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9th International Conference on Higher Education Advances (HEAd'23)

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Preface

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Abstract

This is the preface for the ninth edition of the International Conference on Higher Education Advances (HEAd). HEAd'23 brought together researchers, educators, students, and professionals from around the world to exchange ideas and research findings on student preparation and higher education systems. The conference facilitated thought-provoking discussions, innovative ideas, and collaborative efforts to advance teaching, learning, and the overall higher education landscape. The scientific program, curated by a committee of 188 members from 44 countries, received 326 full paper submissions. Of these, 98 papers were accepted for full-paper presentation, while 40 short papers and 35 posters were also included. The contributions covered diverse topics such as pedagogical approaches, technology integration, student engagement, assessment methods, curriculum design, and educational policies. Additionally, three keynote speeches and three pre-conference workshops enriched the conference experience.

Keywords: *Higher education; innovative materials; educational technology; evaluation and assessment; globalization in education.*

1. Introduction to HEAd'23

This volume contains the selected papers of the Ninth International Conference on Higher Education Advances (HEAd'23), which was held in Valencia, Spain, from 19 to 22 June 2023. HEAd'23 provided a dynamic platform for researchers, educators, students, and professionals from around the world to come together and exchange ideas, experiences, and research results regarding the preparation of students and the organization of higher education systems. The conference served as a catalyst for thought-provoking discussions, innovative ideas, and collaborative endeavors, all aimed at advancing teaching, learning, and the overall higher education landscape.

The selection of the papers for the scientific program was conducted by a team of 188 committee members representing 44 countries on all five continents. Following the call for papers, the conference received 326 full paper submissions with authors from 48 different countries. All the submitted papers were reviewed by at least two program committee members under a double-blind review process. Finally, 98 papers were accepted as full papers for oral presentation during regular sessions, representing an overall full paper acceptance rate of 30%, reflecting the conference's commitment to showcasing the highest-quality work. Additionally, 40 submissions were accepted for short paper presentations and 35 for poster presentations, all of them receiving high review scores, and were published by UPV Press in this volume. The organization committee congratulates all the authors for having their papers accepted in the proceedings of such a competitive conference.

The contents of the program represent a diverse and comprehensive range of topics and research interests in the field of higher education. The selected papers cover various aspects of teaching and learning, including pedagogical approaches, technology integration, student engagement, assessment methods, curriculum design, and educational policies. This rich and varied collection of research contributes to the advancement of knowledge in higher education and offers valuable insights and innovative practices that can inform and enhance teaching and learning experiences worldwide.

The conference program featured three keynotes that overview important and current topics. The first keynote, “Pedagogical Practices in Large Classes in Higher Education: Challenges and Opportunities,” delivered by Anna Logan and Ann Marie Farrell (Dublin City University, Ireland), examined the unique challenges faced by educators in large class settings and explored innovative pedagogical approaches to enhance student engagement and learning outcomes. The second keynote, “What Higher Education can learn from Games – more than fun!” by Martin R. Wolf (FH Aachen University of Applied Science, Germany), highlighted the transformative potential of incorporating game-based learning principles into higher education, emphasizing the benefits of immersive, interactive, and experiential learning environments. Lastly, the keynote titled “The Transformation of the University: Contributing

to Integral Human Development,” presented by Josep Gallifa Roca (Ramon Llull University, Spain), explored the evolving role of universities in fostering holistic development and societal transformation, emphasizing the importance of integrating academic pursuits with social impact and personal growth. These keynotes provided valuable insights and sparked thought-provoking discussions, contributing to the overall richness and impact of HEAd’23.

HEAd’23 also hosted three pre-conference workshops to offer participants the opportunity to explore specific topics relevant to the conference. The workshops included “The future higher education classroom: Introducing new types of learning, executive function processes, and strategies to foster students’ motivation and academic success,” organized by Genny Villa (Université de Montréal, Canada), “Reinventing University: the Digital Challenge in Higher Education,” led by Stefania Capogna (Link Campus University, Italy) and Erika Zuperkiene (Klaipeda University, Lithuania), and “Learning experience design in the age of metaverse,” organized by Eman AbuKhoua (Higher Colleges of Technology, UAE).

The conference was supported and hosted by the Faculty of Business Administration and Management of the Universitat Politècnica de València, which has been recently ranked as the best technical university in Spain by the Academic Ranking of World Universities (ARWU) 2022.

The organizing committee would like to thank all of those who made this year’s HEAd a great success. Specifically, thanks are indebted to the invited speakers, authors, scientific committee members, reviewers, session chairs, presenters, sponsors, supporters, and all the attendees. Our final words of gratitude must go to the Faculty of Business Administration and Management of the Universitat Politècnica de València for supporting, once again, the HEAd conference, making it possible to become a great event.

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Index

Examining university student satisfaction and barriers to taking online remote exams.....	1
<i>Maria Aristeidou, Simon Cross, Klaus-Dieter Rossade, Carlton Wood, Patrizia Paci</i>	
Measuring Student Development Using Points.....	9
<i>Munir Mandviwalla, David Schuff, Laurel Miller, Manoj Chacko</i>	
University sustainability assessment and reporting: Preliminary findings from the Italian context.....	17
<i>Marta Fundoni, Gianfranco Pischredda</i>	
Creating the “Examination Kiosk”: Blended Assessment to Foster Self-Directed Learning in Higher Education.....	27
<i>Anne Jantos, Claudia Albrecht, Sebastian Pannasch, Vincent Zipper</i>	
Pro-f-quiz: increasing the PROductivity of Feedback through activating QUIZZes.....	35
<i>Kris Aerts, Wouter Groeneveld</i>	
Adverse effects of personalized automated feedback.....	45
<i>Jan Riezebos, N. Renting, R. van Ooijen, A.J. van der Vaart</i>	
Authentic Assessment in Higher Education: A Collaborative Approach.....	51
<i>Angela Siobhan Wright</i>	
Mind the Gap: Factors Which Inhibit Supporting Student Teachers to Engage in Action Research While on School Placement.....	59
<i>Maria Moore, Dermot O'Donovan, Pauline Logue</i>	
Ability of Spanish preservice teachers to differentiate between creative and reproductive activities in the classroom.....	67
<i>Eva Izquierdo Sanchis, Joan Josep Solaz Portolés, Antonio Martín Ezpeleta, Yolanda Echegoyen Sanz</i>	

Special Needs Pre-Service Teachers Digital Competencies: An Exploratory Study at the University of Foggia.....	75
<i>Piergiorgio Guarini, Guendalina Peconio</i>	
Advancing Internationalization Agenda Amidst the War in Ukraine: Kindness and Trauma-Informed Teaching Project in Teacher Education	83
<i>Svitlana Anatoliivna Kuzmina, Sue Fan Foo, Olha Vasylivna Matviienko, Tamara Volodymyrivna Glazunova</i>	
How University Teachers Can Support the Linking of Theory and Practice in Lesson Debriefings with Student Teachers	91
<i>Christine Ladehoff, Jan Pfetsch, Diemut Ophardt</i>	
An Empirical Survey of Employment and MTI Competence in China.....	99
<i>Xian Wang, Wenxiang Si, Linxin Ge, Qiuhan Wang</i>	
Intercultural interaction modulating implicit attitudes towards disability and cultural competence in higher education.....	107
<i>Ludmila Tokarskaya Valerievna, Zijun Li</i>	
Developing Supply Chain Competencies Through Experiential Learning and Games.....	113
<i>Sandra Maycotte-Felkel, Heriberto Garcia-Reyes, Elena Isabel Victoria Quijano-Dominguez</i>	
Students' experience of Double Degree programmes: motivations and perceptions of skill acquisition	121
<i>Elena Borsetto, Chiara Saccon</i>	
A Suggested Program for Developing First Year University Students' Agency.....	129
<i>Nevine Mahmoud Fayek El Souefi</i>	
Information skills instruction in Higher Education students using the 4C/ID model.....	137
<i>Consuelo Garcia, Esther Argelagos, Jesús Privado</i>	
A Systematic Review: Foundations for Online Course Design in Higher Education	145
<i>Jacelyn Smallwood Ramos</i>	
E-learning and economics: Knowledge dissemination through social networks.....	153
<i>Roberto Ivan Fuentes Contreras, Moises Librado Gonzalez, Yadira Zulith Flores Anaya</i>	
The digital platform for the Unite! Alliance: the metacampus.....	161
<i>Jesus Alcober, Farnaz Haji Mohammadali</i>	

Nurturing the human connection: Increasing student engagement and personal connection in an asynchronous language course	171
<i>Scott Despain, Jennifer A Despain</i>	
Critical analysis of the potential of social robotics in higher education for the management of illness and bereavement.....	179
<i>Laia Riera, Francisco José Perales, Francisca Negre</i>	
Enhancing Personalization and Experiential Learning in Higher Education through the VR Mobile Application, I'm IN - HKUST.....	185
<i>Kasina Wong</i>	
Student Response Systems: Enabler of active learning in a large class	195
<i>Willie Golden</i>	
A Mixed Reality Laboratory for Developing Competencies in Control Engineering	203
<i>Manuel Navarro-Gutiérrez, Carlos Renato Vázquez, Alejandro Guajardo-Cuellar, Noe Marcelo Yungaicela-Naula</i>	
How Students Manage Peer Feedback Through a Collaborative Activity in a CS1 Course	211
<i>Géraldine Brieven, Laurent Leduc, Benoit Donnet</i>	
Facilitating international transdisciplinary collaboration in a virtual academic exchange project.....	221
<i>Martin Leibinger, Alexandra Regan Toland</i>	
Introducing a collaborative learning strategy in a hybrid and traditional laboratory for undergraduate computer science students.....	229
<i>Sam Ivan O'Neill, Aidan Mooney</i>	
School, University and Community Collaboration for Inclusivity: the Turin Experience with the University Courses “Expert in the Processes of Inclusive Education” and “Expert in Educational and Didactic Processes”	237
<i>Alessandro Monchietto, Paolo Bianchini, Cecilia Marchisio</i>	
Experiential learning using short-term global virtual team projects	245
<i>Stephanie Swartz</i>	
Adopting Learning Circle approaches to equip academic staff for Community Engaged Research and Learning practices	255
<i>Réka Matolay, Linde Moriau, Emma McKenna, Andrea Toarniczky, Judit Gáspár, Márta Frigyik, Brecht Van der Schueren, Sinead McCann, Caroline McGowan, Catherine Bates</i>	

Interdisciplinary Week in Game Design: A Learning Experience	263
<i>Inês Barbedo, Bárbara Barroso</i>	
“Strategy just isn’t like that”. A case study on the use of a cooperative game to experience the strategy roller coaster.	273
<i>Jon Fanning</i>	
Combining computer-based training, virtual, or augmented reality with peer teaching in medical and biotechnological education	279
<i>Christian Hanshans, Moritz Mourice Rick Faust</i>	
They want to fly! – International students attitudes concerning the climate crisis and their air travel behavior.	287
<i>Dimitri Prandner</i>	
A Project-Based Learning Approach For Engaging Undergraduate Students In UN SDGs Using GIS	295
<i>Moustafa Ahmed Baraka</i>	
Take the Challenge: Compute the CO2e emissions of your Programming Course.....	303
<i>Maria Serna, Joaquim Gabarro, Maria Josep Blesa, Amalia Duch</i>	
Investigating Learners Perceptions of Completion and Certification in MOOCs	311
<i>Meghan Perdue</i>	
An Augmentation Framework for Efficiently Extracting Open Educational Resources from Slideshows	321
<i>Balthasar Teuscher, Zhouyi Xiong, Martin Werner</i>	
ChatGPT in Higher Education: The Good, The Bad, and The University	331
<i>Marius Schönberger</i>	
ChatGPT in the Classroom: Friend or Foe?	339
<i>Josep Domenech</i>	
"Building" knowledge by creating manipulatives with the 3D printer: A course for mathematics student teachers	349
<i>Tim Läufer, Matthias Ludwig</i>	
The complexity of grading student work and the reconstruction of the meaning of criterion-referenced assessment	357
<i>Liao Liang</i>	
Reggio Childhood Studies PhD as a learning community	367
<i>Marcella Colacino, Roberta Mineo</i>	

Financial literacy decision tree game: A system development exposé.....	377
<i>Melany Lotter, Chioma Okoro</i>	
Fairness matters in higher education: Student classroom justice perceptions and behavioral responses	385
<i>Rebecca M. Chory</i>	
University graduates enrolled in Higher VET in Spain: An upskilling or reskilling choice?	393
<i>Iván Diego Rodríguez, Juan P. Gamboa</i>	
Quality Management in Italian Universities: A Case Study in the University of Cassino and Southern Lazio	401
<i>Ilenia Colamatteo, Ilenia Bravo, Lucio Cappelli, Patrizia Papetti</i>	
Robust estimation method for the economic subsidies to educational institutions in Chile	411
<i>Valentina Ugalde, Sebastián Dávila-Gálvez, Óscar Vásquez</i>	
Evolution of academic dishonesty in computer science courses	421
<i>Katerina Zdravkova</i>	
Place-based Teaching amidst a Global Pandemic?	429
<i>Barbara Cabezal Bruno, Daniela Bottjer-Wilson, Jennifer Engels</i>	
Surviving and Thriving in COVID.....	437
<i>Mary Jo Parker</i>	
A Post-Covid comparison of students' usage of an online learning platform	447
<i>Robert A. Phillips</i>	
Digital multitasking during academic lectures: Did the Covid-19 lockdown change the students' behavior?.....	455
<i>Rebeca Macedo Mendes, Ana Isabel Veloso</i>	
The role of financial aid in college performance: The importance of class attendance, aid amount and type of aid	465
<i>Isabel de Sivatte, Patricia Gabaldón</i>	
Changing Higher Education Governance in Latin America: The Cases of Chile and Ecuador	475
<i>Mario Alarcón, José Joaquín Brunner</i>	
Resource orchestration and the higher education programme director	483
<i>Hans Frederik</i>	

Non-formal Faculty Development. Conceptual considerations and implementation in practice	491
<i>Birgit Hawelka, Regine Bachmaier</i>	
Teaching olfaction at the time of the 'sensual turn'. The case of Pierre Bénard	499
<i>Sandra Cadiou</i>	
Internal quality assurance systems in Namibian higher education: Stakeholder perceptions and guidelines for enhancing the system	507
<i>Marien Alet Graham, Toini Tuyeimo Ndapewoshali Angolo, Celeste Combrinck</i>	
Lecturer language: EMI students' experiences on first- and second-cycle degrees	517
<i>Jane Helen Johnson, Mariangela Picciuolo</i>	
Learning Analytics Dashboard to Support Instructors: A Literature Review	525
<i>Dhatri Padakanti, Marcia Moraes</i>	
Which career should I choose?. Application of a pre-university vocational guidance platform based on the Ikigai methodology	533
<i>Marta Retamosa, Ángel Millán, Jorge García-Unanue</i>	
Quest-based Gamification In A Software Development Lab Course: A Case Study.....	541
<i>Nuno H. Flores, Rui Pinto</i>	
Retail Design Education. Designing New and Reframed Learning Tools for Experience-based Learning	549
<i>Mariagiovanna Di Iorio, Alessandra Spagnoli</i>	
Analysis of the feasibility of investment projects in real assets with PBL: A very real experience	559
<i>Isabel Abinzano, Harold Bonilla, Pilar Corredor, Cristina Del Río, Elena Ferrer, Ana González, José Manuel Mansilla, Beatriz Martínez, Luis Muga</i>	
A Framework for Developing Mathematical Tasks for Automatic Formative Assessment in Higher Education.....	567
<i>Andreas Körner, Clara Horvath, Lana Medo</i>	
Insights from a transgender student in the EFL classroom: from individual perspective to institutional change	577
<i>Sergio Peñalver-Férez</i>	
English for Engineering: Intercultural formal letter writing.....	587
<i>Begoña Bellés-Fortuño, Adrián Pla-Ángel</i>	

The explicit teaching of vocabulary in French L2: theoretical models, teaching practices and experimental itineraries	595
<i>Silvia Domenica Zollo</i>	
Mathematics in Economic and Business Science: how to reach the top without a pathway	605
<i>Yeray Rodríguez, Ana Munarriz, Maria Isabel Goicoechea, Maria Jesus Campion</i>	
The role of education in fostering entrepreneurial intentions among business students.....	615
<i>Laila Cekule, Andrejs Cekuls, Margarita Dunska</i>	
The learning motives of business students and postponement	623
<i>Merle Küttim, Tarvo Niine, Jelena Hartšenko, Anna Kornijenko, Juhan Loorits</i>	
Online Repository for Facilitating Teaching and Learning of Undergraduate Statistical Modeling Tools	631
<i>Qing Wang, Xizhen Cai</i>	
The MILAGE LEARN+ app on Higher Education.....	639
<i>Mauro Figueiredo, Custódia Fonseca, Paula Ventura, Marielba Zacarias, José Inácio Rodrigues</i>	
Leveraging AI to Instruct Architecture Students on Circular Design Techniques and Life Cycle Assessment	647
<i>Toktam B.Tabrizi, Ozgur Gocer, Arash Sadrieh, Anastasia Globa</i>	
When a test-taking strategy is better? An approach from the paradigm of scheduling under explorable uncertainty.....	657
<i>Cristóbal Alfredo Mauricio, Sebastian Davila-Gálvez, Óscar Carlos Vasquez</i>	
Microcredentials: an opportunity towards the digital transformation	665
<i>Fernando J. P. Caetano, Diogo G. Casanova, Darlinda M. P. Moreira</i>	
Fostering Cooperation Between Lecturers and TLC Staff to Improve Digital Teaching, Experiences with a Pool of Discipline-specific Experts.....	675
<i>Petra Panenka, Ann-Christine Hadam, Hans-Martin Pohl</i>	
(Digitally) transforming education in a large university	683
<i>Iris Peeters, Sylvia Grommen, Hans Tubbax</i>	
Enhancing Online Teaching: Addressing the Challenges Faced by Early-Career Academics at Vietnam National University, Hanoi	691
<i>Le Thi Thuong, Nghiem Xuan Huy, Tran Thi Hoai, Nguyen Thai Ba, Tuan Thu Trang</i>	

Steps towards Enabling Health Professionals through Future Skills.....	701
<i>Yvonne Sedelmaier, Dieter Landes</i>	
“Map ourselves through Digital Storytelling”: Pedagogical tool in the development of self-knowledge skills on Advanced practice psychiatric-mental health nursing.....	709
<i>Carlos Laranjeira, João Gomes, Paula Carvalho, Ana Querido</i>	
Competency-based education advances in Higher Education in Health	717
<i>Pau Martinez-bueso, Olga Velasco-Roldán, Iosune Salinas-Bueno, Inmaculada Riquelme-Agulló, Elisa Bosch-Donate</i>	
Myth-busters at work: Development of engineering identity and employability through student research.....	723
<i>Jeroen Lievens</i>	
Development and piloting of a micro-credential programme in research ethics and integrity leadership – an example from Estonia	733
<i>Anu Tammeleht, Kertu Rajando, Margit Sutrop</i>	
Higher education student work placement and employability	741
<i>Badroonesha Aumjaud, Brinda Ramasawmy, Brigitte Marie Francoise Driver, Deena Ramful-Baboolall</i>	
When Intercultural Education is Problematic: The Case of Russian as a Foreign Language.....	749
<i>Linda Torresin</i>	
Digital Pedagogy for the Present: An Artificial Intelligence Methodology for Curriculum Development.....	757
<i>Michelle Anne Rufrano, Jean-Ezra Yeung</i>	
New Model to Evaluate Values, Beliefs and Assumptions in the Recognition of Prior Learning	765
<i>Phil O'Leary</i>	
Academic rankings as a source of metrics and benchmark tools for continuous improvement at Técnico Lisboa.....	773
<i>Carlos Carvalho Carvalho, João Fernandes</i>	
Undergraduates as researchers in Humanities and Social Sciences courses: Articulating assessment by means of micro and macro cooperative and integrated tasks.....	783
<i>Mireia Trenchs-Parera, Andreana Pastena</i>	

Threshold Tests as a way to encourage long-term, self-regulated learners in Engineering	793
<i>Danica Solina, Chris Wong, Kate Crawford, Elaine Huber</i>	
The PASSt Project: Predictive Analytics and Simulation of Studies aimed at Quality Management and Curriculum Planning.....	801
<i>Gabriel Wurzer, Shabnam Tauböck, Markus Reismann, Christian Marschnigg, Sukrit Sharma, Karl Ledermüller, Julia Spörk, Maria Krakovsky</i>	
An innovative, technology-enhanced instructional approach to address the diverse competencies of STEM students in math classes	809
<i>Andreas Körner, Corinna Modiz</i>	
Development of scientific skills in Higher Education with a flipped classroom-contest approach.....	817
<i>Miguel Garcia-Bosque, Carlos Sánchez-Azqueta, Concepción Aldea, Esther Cascarosa, Santiago Celma</i>	
The essentials of science communication in a course engaging both for students and professionals.....	825
<i>Maurizio Dabbicco, Franco Liuzzi, Sandra Lucente, Massimo Trotta</i>	
Teachers of Natural Sciences: some challenges and perspectives in Brazil.....	835
<i>Cristina Leite</i>	
Designing co-curriculum experiential learning practice in permaculture for studying science classics.....	843
<i>Ming Li</i>	
Relationship between time management and class attendance in university students: clustering techniques for detection of profiles	851
<i>Santiago Porras Alfonso, Julio César Puche Regaliza, Athénaïs Marianne Sauvée, Paula Antón Maraña, Silvia Casado Yusta, Joaquín Antonio Pacheco Bonrostro</i>	
The engagement in university students: Preliminary psychometric analyses of the Spanish version of the Engagement vs. Disaffection with Learning Scale.	861
<i>Alba Aza, Georgina Guilera, Chuen Ann Chai, Juana Gómez-Benito, Estefanía Guerrero, Maite Barrios</i>	
Increasing student engagement with COIL Padlet	871
<i>Barbara Therese Miller, Susan Göldi, Meng Hsien (Jenny) Lin</i>	
Positive effects of mindfulness practices on academic performance and well-being.....	879
<i>Katia G. Karadjova-Kozhuharova, Ruth L. Baker</i>	

Peer coaching in a leadership development program: The role of developmental relationships	887
<i>Laura Cortellazzo, Sara Bonesso, Fabrizio Gerli, Chaima Lazreg</i>	
The current HE classroom: Promoting new types of learning, executive function processes and strategies to foster students' motivation and academic success.	895
<i>Genny Villa</i>	
The value of the teaching quality innovation projects in the universities. The case of Quid Sapienza	909
<i>Barbara Mazza, Elena Valentini, Cristina Sofia</i>	
The search for values as a didactic tool - An interdisciplinary perspective.....	919
<i>Andrea Fenice, Renzo Mocini</i>	
Design and manufacturing of a LIGHTBOARD - Combining the peer-to-peer idea with project based teaching	929
<i>Anja Pfennig</i>	
The impact of technology adoption in teaching and learning within ODeL	937
<i>Thandiwe Bongani Radebe, Ronny Tebeta, Rendani Wilson Maladzhi</i>	
Moodle-based e-learning courses for introduction to critical thinking in a multidisciplinary perspective	947
<i>Jean-François Bodart, Anne-Frédérique Paul-Antoine, Aline Stevenoot, Corinne Vézirian</i>	
Tailoring professional development to postgraduate students: It's not the chicken, it's the egg.....	957
<i>Marianne Elisabeth Savory</i>	
Academic dishonesty, essay mills, and Artificial Intelligence: rethinking assessment strategies.....	965
<i>Simon Sweeney</i>	
Thinking outside the box - Virtual, intercultural labs in engineering education	973
<i>Julia Salzinger, Ika Kurniawati, Lars Abrahamczyk, Rüdiger Höffer</i>	
Students experience of blended teaching formats in pre-calculus courses.....	981
<i>Domenico Brunetto, Giulia Bernardi, Caterina Bassi</i>	
Should we be afraid of open book exams? Our experience.....	989
<i>Antoni Alegre-Martínez, María Isabel Martínez-Martínez, José Luis Alfonso-Sánchez</i>	

Experiencing Third Spaces in between University and Society: Transdisciplinary Learning Experiences in a Shopping Center	997
<i>Thorsten Philipp, Katarina Marej</i>	
Adaptation of the Interprofessional Collaborative Competency Attainment Scale for Usage Across Professions	1005
<i>Simon Schmitt, Monja Pohley, Aldin Strikovic, Eveline Wittmann</i>	
Story/No Story: a narrative design exercise for shared ways of seeing.....	1013
<i>John Stevens</i>	
Collaborative knowledge construction during computational lab activities in Financial Mathematics	1021
<i>Adamaria Perrotta, Alice Barana, Marina Marchisio, Matteo Sacchet</i>	
Learning agroecology through the serious game SEGAE in an online lesson: unveiling its impact on knowledge articulation.....	1029
<i>Mireille De Graeuwe, Lavena Van Cranenbroeck, Rémy Parent, Clément Serdobbel, Yves Brostaux, Kevin Maréchal</i>	
Managing European interuniversity collaboration: A bottom-up approach to identify digital education challenges from below.....	1039
<i>German Varas, Alvaro Pina Stranger, Gaele Mobuchon</i>	
Deep Learning: a Study on Marine Renewable Energy and Sustainability Education in an Irish Context.....	1047
<i>Pauline Anne Logue, Roisin Nash, Michael Walsh, Michael Faney, Dearcán Ó Donnghaile</i>	
Plant and plan, care and grow. A hands-on exercise using the (inner) sustainable development goals to teach research methodology to final year sociology students	1055
<i>Rosalina Pisco Costa</i>	
Community intervention model: social entrepreneurship education as a strategy for a sustainable development	1063
<i>Yadira Zulith Flores Anaya, Martín Arturo Ramírez Urquidy, Roberto Iván Fuentes Contreras</i>	
Exploring second language viewers' use of cognitive strategies in learning Chinese through multimedia learning resources with captions and social annotations.....	1071
<i>Shuzhou Lin, Ting Wang, Wei Wei, Jiahui Yang, Sara Cañizal Sardón</i>	
Diversity in (word) meaning: Reducing the risk of bias in foreign language vocabulary teaching using prototype theory.....	1081
<i>Anna Malena Pichler</i>	

Enhancing Language Self-Efficacy of EFL University Students through Experiential Learning: A Study of the Learning League Project.....	1089
<i>Fiona Sze Han Ho, Nick Wong, Angie Wing Chi Li, Lo Lau</i>	
Data-Driven Project-Based Learning in Specialized Translation Classes – The Case of Comparable Corpora.....	1097
<i>Katrin Herget, Teresa Alegre</i>	
Cultural heritage and its dissemination through linguistic and technical learning in Higher Education	1105
<i>Daniela Gil-Salom, Eliseo Marzal-Calatayud, Damián López-Rodríguez</i>	
Institutional influencers and support for tutoring in a South African higher education institution	1113
<i>Chioma Sylvia Okoro, Nelson Bakali Phiri</i>	
Globalisation vs diversity in national languages in HE context: Case of Estonia.....	1123
<i>Peep Nemvalts, Triin Roosalu, Eve-Liis Roosmaa, Helena Lemendik</i>	
Bottom-up Curriculum Innovation through Grants for Lecturers	1131
<i>Miriam Ossevoort, Robert Inklaar, Jan Riezebos</i>	
Designing a Metaverse for an Immersive Learning Experience	1139
<i>Mark Frydenberg, Shivam Ohri</i>	
Technology-enhanced learning: Cloud Computing to implement cooperation among schools.....	1147
<i>Ilaria Veronesi, Paolo Musmarra, Francesco Saverio Tortoriello</i>	
Inverting the classroom using on-demand lightboard micro lecture films (learning glass)	1155
<i>Anja Pfennig</i>	
Let's Experience Learning in the Metaverse.....	1163
<i>Eman AbuKhoua</i>	
Innovation in Education by Design Thinking	1171
<i>Iris Schmidberger, Sven Wippermann</i>	
Combining integrated curriculum and project-based learning: A short film case study from media and communication students	1179
<i>Hibai Lopez-Gonzalez, Maria-Jose Masanet, Maddalena Fedele, Sandra Rius, Jaume E. Vilaseca, Lydia Sánchez, Sergio Villanueva Baselga, Adrien Faure-Carvalho, Anna Marquès, Jorge Franganillo, María Ángeles García Asensio</i>	

Teamwork and student engagement during practical sessions in laboratories	1187
<i>Chalak Omar, Sarah Plumb</i>	
The Impact of Practical Training on Student Understanding of Plagiarism.....	1197
<i>Mairéad Hogan</i>	
Evolution of a Continuous Assessment and Feedback Concept in a Computer Science 101 Course	1207
<i>Dieter Pawelczak, Antje Neve</i>	
Black Student Achievement Plan Evaluation and Assessment	1215
<i>TrVel Lyons, Mabel Hernandez, Sy Doan, Shafiqah Ahmadi, Darnell Cole</i>	
Reflective Practice ePortfolios: A digital teaching tool to enhance third year BA Culinary and Gastronomic Science students' professional learning experiences.....	1225
<i>Clare Gilsenan, Marie English</i>	
Job Demands and Resources in the Work of University Teachers in Central and Eastern Europe	1233
<i>Klára Kovács, Beáta Dobay, Szabolcs Halasi, Tamás Pinczés</i>	
From training practice in the professional world to university: characterization of Vocational Training students to retain them in university studies	1241
<i>Ana Munarriz, Yeray Rodriguez, Maria Isabel Goicoechea, Maria Jesus Campion</i>	
An Examination of Significant Factors Influencing College Student Employment Cognition.....	1251
<i>Yinggui Qiu, Qiaoguan Ye, Ningjie Wu, Sandy Chen, Hongjie Zhang, Xuan Zhang</i>	
Holey Moley Guacamole! Understanding Foreign Currency Exposure.....	1261
<i>Valeria Martinez</i>	
Creating a Bridge to Post-Traditional Male Student Success at a Community College...	1271
<i>Theresa Marie Dereme</i>	
EPIC in Action, Measuring Entrepreneurial Competencies in Higher Education.....	1279
<i>Connie O'Regan, Neil Ferguson, Michelle Millar, Jenny Mullery, Natalie Walsh, Tony Hall</i>	
The MEM project: 5 years of experiences, challenges, and outcomes of an international double master-level degree	1287
<i>Roberto Montanari, Abdel-Malek Layek, Gino Ferretti, Alessandro Bernazzoli, Eleonora Bottani, Andrea Volpi, Federico Solari, Letizia Tebaldi, Giorgia Casella, Natalya Lysova, Michele Bocelli, Claudio Suppini, Lucia Orlandini, Monia Bertoli, Andrea Pintus</i>	

Multiple-Value Governance in (German) Higher Education: a New Paradigm?	1297
<i>Bernd Kleimann</i>	
Development of the “Complex Project” course in the Transport engineering education	1305
<i>Gábor Horváth</i>	
Digital identity and body identity: the mutation of the university environment in pandemic times.....	1313
<i>Lucia Pallonetto, Rosanna Perrone, Carmen Palumbo</i>	
Reflective practice to bridge the theory-gap practice in Human-Computer interaction classes.....	1321
<i>Moretlo Tlale-Mkhize, Janet Liebenberg</i>	
The use of TAM in evaluating the effectiveness of network simulation tools in Internet Technologies subject.....	1331
<i>Dina Moloja</i>	
Symbiosis between Learning Analytics and digital transformation	1341
<i>Hans Tubbax, Iris Peeters</i>	
Six colours for inclusion: results of an explorative activity in a simplicity approach.....	1349
<i>Alessio Di Paolo, Iolanda Zollo, Michele Domenico Todino, Maurizio Sibilio</i>	
Cybersecurity education in European higher education institutions	1357
<i>Mirva Salminen, Niko Candelin, Kaisa Cullen, Sari Latvanen, Marianne Lindroth, Teemu Matilainen</i>	
The impact of digital platforms enhancement on global virtual teams’ engagement across selected business schools	1365
<i>Emil Velinov, Juergen Bleicher, Vincent Montenero</i>	
Evaluating the Impact of Strategies on Students’ Perceptions of Digital Transformation – A Case Study of a Swedish Higher Education Institution	1375
<i>Henning Brink, Ellen Mårtensson, Carina Ström Hylén, Sven Packmohr</i>	
My First Six Months: Industrial Design Students Perceptions of their First Semester Experience of Learner-Centred Design Studios.....	1383
<i>William Dim, Helen McLean, Soumitri Varadarajan, Caroline Francis</i>	
Student perceptions of a remotely operated motor-driven generator in engineering education	1391
<i>Nicolaas Johannes Luwes, Leanri van Heerden, Walter Commerell</i>	

Ideas on Digitally Supported Individualization of Teaching and Learning for Evolving Competency Requirements	1399
<i>Thomas Fuhrmann, Michael Niemetz</i>	
Using Technology Innovation and Blended Delivery for Student-centred Learning in Large Undergraduate Classes	1407
<i>Dominik Holzer, Alberto Pugnale</i>	
Postgraduate degree program in Social Business as a new knowledge tool in entrepreneurship and social impact	1417
<i>Karina Isabel Salinas Solis, Natanael Ramírez Angulo, German Osorio Novela</i>	
Embeddedness of students with special educational needs in higher education	1425
<i>Anett Hrabéczy, Gabriella Pusztai</i>	
Black Digital Humanities in Interdisciplinary Undergraduate Teaching on Diversity, Gender, and Sexuality	1433
<i>Magdalena J Zaborowska, Juan J Rodríguez Barrera</i>	
Audiovisual and Accessible Translation from a Transdisciplinary Insight: Curriculum Design and Professional Practice for Intercultural Communication	1441
<i>Mercedes Enríquez-Aranda</i>	
Setting Learners up for Success: A Universal Design for Learning Approach to Industry Placement Assessment	1451
<i>Kate Dunne, James Corbett</i>	
The UNIVAC project: Implementing the user journey approach in accessibility research at university.....	1459
<i>Blanca Arias-Badia, Irene Hermosa-Ramírez, Mar Ogea, Mireia Oliver, Daniel Segura, Ana Tamayo, Sergi Torner</i>	
About change: How institutionally aligning online pedagogy, design and technology impacts higher education teachers.....	1467
<i>Paula Charbonneau-Gowdy, Caro Galdames</i>	
Psychometric Properties of the Spanish-Language Version of the Agentic Engagement Scale (AES): A Preliminary Study	1477
<i>Estefania Guerrero, Maite Barrios, Chuen Ann Chai, Juana Gómez-Benito, Alba Aza, Georgina Guilera</i>	
Education 4.0: MiReBooks - Development and Usage of Mixed Reality for Teaching Mining in Higher Education.....	1485
<i>Mariaelena Murphy, Manuel Labrador Ortega, Peter Moser, Susanne Feiel</i>	

Examining university student satisfaction and barriers to taking online remote exams

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Abstract

Recent years have seen a surge in the popularity of online exams at universities, due to the greater convenience and flexibility they offer both students and institutions. Driven by the dearth of empirical data on distance learning students' satisfaction levels and the difficulties they face when taking online exams, a survey with 562 students at The Open University (UK) was conducted to gain insights into their experiences with this type of exam. Satisfaction was reported with the environment and exams, while work commitments and technical difficulties presented the greatest barriers. Gender, race and disability were also associated with different levels of satisfaction and barriers. This study adds to the increasing number of studies into online exams, demonstrating how this type of exam can still have a substantial effect on students experienced in online learning systems and technologies.

Keywords: *Online exams; assessment; universities; Covid-19; online learning.*

1. Introduction

Online exams have become increasingly popular in universities in recent years, as they offer students and institutions greater flexibility and convenience. Despite the growing popularity, there is still limited research that addresses student satisfaction with online exams, and in particular students in distance-learning universities. This paper examines the evidence on student satisfaction and barriers to online exams at universities and explores how students in distance learning universities engage with this new exams model.

Recent studies suggest that students are generally satisfied with online exams, as they allow for more flexibility and convenience. For example, Bashir et al. (2019) found that students are more satisfied with online exams as they are allowed more time to prepare, and the exams were more accessible. However, the increased use of online exams in universities has raised questions about students' potential challenges when taking such tests. Technological issues are a major barrier for many students taking online exams. These include slow internet connection, lack of access to the necessary technology, and lack of technical knowledge (Barrot et al., 2021). In addition to technical challenges, students face psychological difficulties, such as stress and anxiety, when taking online exams. For instance, Almosa (2021) noted that students felt overwhelmed and anxious during online exams due to the lack of face-to-face interaction with the instructor.

Recent studies have shown that online exams are more beneficial to certain student groups than others. Dikmen (2022) examined the effect of online exams on female medical students and found that they were more likely to experience anxiety and lower self-efficacy when taking online exams than their male counterparts. This was because they felt they had less control over the exams and less access to resources. Further, Tai et al. (2022) note that with online exams, disabled students can take the exam in a location of their choosing, adjust the font size and background colour, and have more time to read, write and review answers. However, the literature also highlights some drawbacks of online exams for disabled students, such as feelings of isolation (Tai et al., 2022). This can be particularly problematic for those with disabilities that require more support. Finally, Tran and Reilly (2019) suggest that online exams can create challenges for Black, Asian or Minority Ethnicity (BAME) students due to their lower access to technology, less access to tutoring or other academic supports, and lower levels of comfort and confidence with the technology.

This study explores students' satisfaction and barriers to taking online exams at The Open University (OU), an institution with a long tradition of distance learning and mature student enrolment in the UK. The OU delivers its courses via virtual learning environments, online tutorials and tutor groups. Pre-pandemic, 24% of the OU courses ended with a face-to-face exam, which has now been replaced with mainly remote open book style exams (e.g., multiple choice questionnaires, essays, equations and numerical workings). These exam

interactions range from timed exams (2-4.5 hours) to 7-day submission windows. Motivated by the current lack of an empirical basis for insights into distance learning students' satisfaction and barriers to taking online exams, we explored the following research questions (RQs):

1. To what extent are distance learning students' satisfied with the different elements of online exams?
2. What are distance learning students' barriers to taking online exams?
3. Are there any significant differences among student groups (gender, race, disability) in their satisfaction and barriers to taking online exams?

2. Methods

2.1. Development of survey instruments

The instruments used in this study consist of the 'online exam satisfaction' and 'barriers to taking online exams', hereby mentioned as 'satisfaction' and 'barrier' instruments, respectively. The 'satisfaction' instrument was developed as part of a bigger assessment project by the Student Experience of Feedback, Assessment and Revision (SEFAR) team at the OU (Cross, Whitelock & Mittelmeier, 2016) and was validated through an institutional survey administered in 2015 ($n = 281$) and thirteen interviews. The instrument includes items developed from constructs tested previously by others (e.g., Vattøy, Gamlem & Rogne, 2021) and, in part, composed of newly created items designed to probe additional themes such as anxiety (Falchikov & Boud, 2007) and exam preparedness (Payne & Brown, 2011).

The 'barrier' instrument was developed as part of a Covid-19 evaluation project at the OU (Aristeidou & Cross, 2021). It consists of items identified in the literature as reasons for students' disrupted studies during the pandemic. Some examples of these items include a lack of technical equipment and great demand for devices and the internet in the household (Barrot et al., 2021), childcare and other caring responsibilities (Chirikov et al., 2020). Both instruments were in the form of 5-item Likert scales, ranging from 1 (strongly disagree) to 5 (strongly agree), with an extra 'not applicable' (N/A) option.

2.2. Data collection

Data collected include undergraduate students self-reports on the online exams 'satisfaction' and 'barriers' survey instruments. Demographics and other student characteristics were retrieved from the university database, such as gender (female or male), declared disability (yes/no), and BAME (yes/no). The dataset was anonymised on the 30th of May 2022, prior to initiating the process of data analysis. Ethical approval was obtained from the authors' university ethics committee. The participants provided us with a written consent.

Table 1. Demographics of survey respondents

Background Characteristics	All (<i>n</i> = 562)	With online exams experience (<i>n</i> = 190)
Gender		
Female	336	90
Male	226	100
Declared disability		
No	485	161
Yes	77	29
BAME		
No	485	160
Yes	60	21
Unknown	17	9

2.3. Data analysis

Visualisations of the Likert scales were used to describe students's satisfaction with different aspects of online exams (RQ1) and the barriers to taking online exams (RQ2). Percentages of participants were presented for each frequency selection, and items were presented in order of negative impact on the frequency of agreeing to a particular statement. Data presented in RQ1 include only the students who had an experience of taking online exams ($n = 190$), while data presented in RQ2 includes all survey participants ($n = 562$).

Then, to determine how gender, disability, race, previous qualification and qualification intention relate to each 'satisfaction' or 'barrier' statement (RQ3), chi-square tests were performed. For the tests, dichotomous variables were used for each statement, in which option 1 included all the 'agree' and 'strongly agree' responses to the statement and 0 all the 'disagree' and 'strongly disagree'. N/A and 'neither agree nor disagree' were excluded from the chi-square test analysis. An alpha level of .05 was used for all the analyses.

3. Findings

3.1. Satisfaction with online exams

The survey respondents who had an experience with online exams ($n = 190$) were mainly found to agree that they were able to find a quiet space to take the exam (86%), they were satisfied with the quality of that space (85%), the type of exam allowed them to demonstrate their learning (78%), thought that the exam questions were clear (77%), felt a sense of achievement upon completion of the exam (76%), were satisfied with the mark received (72%), felt prepared just before starting the exam (61%), felt anxious during the exam (58%), thought that the exam was harder than they expected (48%), and enjoyed the exam (31%) (Figure 1).

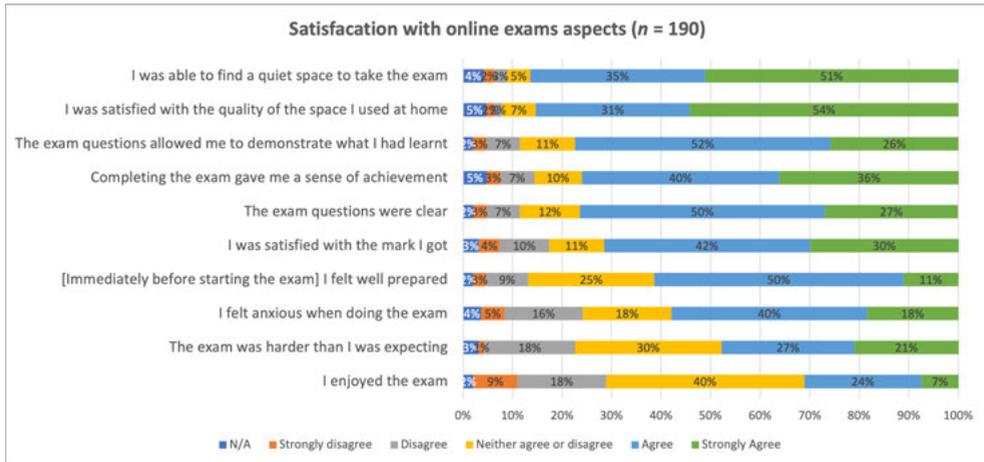


Figure 1. Student satisfaction with different areas of online exams, presented in ascending order of agreement with each statement

Findings from examining student experience during and with the online exams and among students in different groups indicated that BAME students were less likely to feel prepared immediately before starting the exam ($\chi^2 = 4.53$, $df = 1$, $p = 0.03$) than those of a white background. There were also borderline differences between students who declared disability and those who did not ($\chi^2 = 3.74$, $df = 1$, $p = 0.053$). Gender-wise, female students were less likely to report that the exam questions allowed them to demonstrate what they had learnt ($\chi^2 = 4.32$, $df = 1$, $p = 0.04$). Moreover, female students ($\chi^2 = 6.48$, $df = 1$, $p = 0.01$) and students with declared disabilities ($\chi^2 = 5.53$, $df = 1$, $p = 0.02$) were less likely to be satisfied with the mark they received. Further, students with declared disabilities ($\chi^2 = 8.72$, $df = 1$, $p = 0.003$) were less likely to be satisfied with the quality of the home space they used.

There were also no significant differences among different student groups as to whether (a) the exam questions were clear, (b) the exam to be harder than they expected, (c) they felt anxious when doing the exam, (d) they felt a sense of achievement when completing the exam and (e) they were able to find a quiet space to take the exam.

3.2. Barriers to taking online exams

The survey respondents, both those with and without an experience with online exams ($n = 562$), selected employment commitments as the most significant barrier to taking online exams at home – chosen by about one in three students (30%) (Figure 2). This barrier was followed by a lack of confidence in dealing with technical difficulties, expressed by 29% of the survey respondents, when dealing with potential technical difficulties during the online assessment. The third most chosen challenge, selected by 28% of the respondents, was the reliability or quality of the internet connection. Other less selected barriers involved a lack of quiet working space (20%), childcare responsibilities (17%), mental health issues (13%),

confidence in setting up and using technologies (13%), access to an internet connection (10%), and other caring responsibilities (10%).

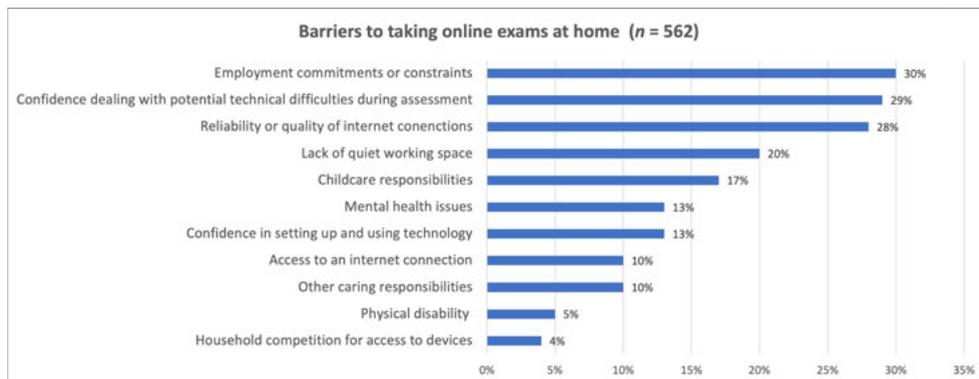


Figure 2. Student barriers to taking online exams, presented in ascending order of agreement with each statement

Findings from examining barriers to taking online exams among students in different groups indicated that female students are more likely to report a lack of confidence in setting up and using technology ($\chi^2 = 10.00$, $df = 1$, $p < 0.01$) and dealing with potential technical difficulties during assessment ($\chi^2 = 11.07$, $df = 1$, $p < 0.01$). In addition, female students ($\chi^2 = 4.51$, $df = 1$, $p = 0.03$) were more likely to choose mental health issues as a barrier to taking online exams at home. Students with declared disabilities ($\chi^2 = 9.01$, $df = 1$, $p < 0.01$) are more likely to choose other caring responsibilities as a barrier to taking online exams at home. Finally, students with declared disabilities ($\chi^2 = 35.32$, $df = 1$, $p < 0.01$) were more likely to choose physical disability as a barrier to taking online exams at home.

There were no differences among student groups in the following statements: employment commitments or constraints, reliability or quality of internet connections, lack of quiet working space, childcare responsibilities, access to an internet connection, and household competition for access to devices. Furthermore, there were no differences between students of different races and faculties.

4. Discussion

Distance learning university students at the OU demonstrated, like traditional university students (e.g., Bashir et al., 2019), high levels of satisfaction with the environment in which they took the exam and the exam procedure, including the type of exams and the clarity of the questions. However, similarly to other studies (e.g., Almossa, 2021), they felt anxious during the exam and thought it was harder than expected. Barriers to taking exams involved various areas, with the most affected being employment commitments –expected in a university with students of a higher average age. Likewise other studies (e.g., Barrot et al.,

2021), technical difficulties also ranked high, with barriers related to dealing with unexpected software and internet issues. Other important barriers related to finding a suitable environment for the exam and arranging childcare – which can relate again to the fact the students have different responsibilities compared to the average university student.

Our findings align well with previous studies wherein online exams are less beneficial for specific student groups than others. In line with Dikmen (2022), female students were found to experience more issues than their male counterparts, including more lack of confidence in technology, and mental health issues. They also thought the type of exam impacted their performance. We have also verified that students with declared disabilities face some drawbacks when taking online exams, including lack of access to assistive technologies or mental health issues (e.g., Tai et al., 2022). However, our results go beyond previous reports, showing how their environment and caring responsibilities may also be barriers. A similar conclusion to Tran and Reilly (2019)'s was reached on BAME's students' confidence with online exams, with findings in the current study concerning their feelings of unpreparedness.

Our work adds to a growing corpus of research on online exams, showing how this type of exam can still impact students familiar with online learning formats and technologies. Overall, the literature and our findings suggest that online exams can offer several advantages over traditional exams. However, it is also important for universities to recognise the potential drawbacks, and carefully consider the needs of students when planning online exams, ensuring they are adapted to meet the different student groups' requirements.

In addition to the greater convenience and flexibility, online exams have also provided a pragmatic and workable solution to challenges as a result from crises such as the recent global pandemic. In this context, online exams can, as indeed they did during 2020 and 2021, provide means to secure academic business continuity and student success. The findings from this and similar studies can give direction to universities about which processes and policies they need to put in place. The barriers to student satisfaction identified here seem, from an institutional perspective, perfectly manageable and do not require unaffordable or not yet existing high tech solutions: acknowledging employment commitments can be addressed through assessment load and scheduling, anxieties about technology can be lowered through training and responsive support services. There is, in fact, little in these findings that could not be implemented at speed: it would therefore all the sooner address the barriers, secure confidence in the robustness of assessment, and offer a better service overall to students.

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Measuring student development using points

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Abstract

While higher education is effective at measuring the acquisition of knowledge, it is less successful in quantifying other types of learning such as learning to know, live together, and to be. This is a problem because it makes it difficult for institutions to implement and sustain student development programs. In this paper, we describe how to measure student development using points. Using data from 623 students over 7.5 years, we show how our points system was used to improve student development over time by focusing on the quantity, variety, quality, and distribution of development activities. Based on our findings, we recommend avenues for additional research.

Keywords: Higher education; student development; measurement.

1. Introduction

Higher education is typically associated with physical, cognitive, and personality development of young adults (Kail and Cavanaugh, 2018). Yet, a major United Nations study concluded that “formal education systems tend to emphasize the acquisition of knowledge to the detriment of other types of learning; but it is vital now to conceive education in a more encompassing fashion” (Delors et al. 1996, p. 37). However, higher education still primarily focuses on one aspect of human development – academics – as measured by GPA.

Delors et al. (1996) place human development at the core of higher education, the principle of which has been widely adopted by universities (Kilpatrick 2019). We interpret this to mean going beyond pedagogy (e.g., teaching tips, GPA), scale (e.g., MOOCs), and reach (e.g., distance learning) to focus on value generation activities that develop students. Student development has always been a major goal of universities (Kilpatrick 2019), and availability of development activities is typically included in institutional assessment (Zilvinskis et al. 2017). Yet, to date there are no systematic and scalable measures of student development. Therefore, our research question is: *How can we measure student development?* This question is important because for student development to become a core activity and move beyond a nice-to-have but difficult-to-attain goal, it must be measurable.

2. Student development

According to Delors et al. (1996), learning can be broadly conceptualized as: *learning to do* - the acquisition of skills and competencies, *learning to know* - the ability to think and integrate new information, *learning to live together* - understanding others, managing conflicts, and *learning to be* - developing one’s personality and judgment. We adopt this broad view of student development. Student development is also related to forming an identity. Chickering and Reisser (1993) conceptualize establishing identity by proposing seven vectors that include competence, emotions, autonomy and interdependence, interpersonal relationships, identity, purpose, and integrity. Student development and identity relate to employability, which Yorke and Knight (2006, p. 8) define as “A set of achievements – skills, understandings, and personal attributes – that make individuals more likely to gain employment and be successful in their chosen occupations, which benefits themselves, the workforce, the community, and the economy.”

Another important stream of research focuses on student involvement (also termed engagement), which is “the amount of physical and psychological energy that the student devotes to the academic experience” (Astin 1984, p. 518). According to Astin (1984), student learning and personal development are a function of the quality and quantity of student involvement. Today, involvement is typically seen as an indicator of institutional excellence as well as the effectiveness of education policy and practice (Axelson and Flick 2011).

Involvement includes traditional academic activities such as studying - learning to do - as well as experiences such as discovery, engagement, and feedback of ideas, cultures, places, and others that relate to Delors et al.'s other forms of learning. Zilvinskis et al. (2017) show that these different forms of student engagement increase the Delors et al. expanded view of learning. While the above research is important for understanding the meaning and importance of student development, it provides little guidance on measuring, implementing, and weighing different forms of development.

Integrating the above literature, we define **student development** as the *achievement of Delors et al. (1996) outcomes of learning to do, know, live together, and be which establish identity and increase employability*. To establish a boundary and to acknowledge its formative and emergent nature, we conceptualize *development as a longitudinal process that involves internal and external activities of varying depth and value, which in turn differentially influence aspects of the above outcomes*.

3. Measuring student development

Engagement, involvement, and development activities are currently measured with survey instruments upon graduation (Astin 1984; Kuh 2001), while others have explored proxy measures such as learning management system (LMS) log files. These are cross-sectional perceptual measures. We instead follow a process view and operationalize student development as a series of activities accomplished at different times measured by points. The point value of each activity is associated with its development value.

Points are common in gamified systems (Liu et al. 2017). They are tangible and provide feedback, which in turn influences motivation by fostering competence, relatedness, and autonomy (Ryan and Deci 2000). Point-based rewards can also produce recurrent behavior (Liu et al. 2017). Points communicate recognition and a sense of accomplishment for activity and task completion, and the quantification enables social comparison and competition. Points are also more objective than the perceptual surveys used in the involvement literature (Astin 1984; Kuh 2001), and related survey measures of acceptance, usage, and satisfaction.

Overall, points work well as an individual measure that can quantify the number and weight of development activities. For example, if a student completes an internship, they might be awarded 300 points, while attending a talk by a speaker might yield only 25 points - reflecting the differential developmental value of each respective activity. The total points that a student has earned per term (points per term) and over the course of their degree program (total points per student) provide a summary of an individual student's development. The average of total points per student provides an aggregate measure of performance, at the academic department (our focus) or institutional university level.

The above measures are important because they focus on the *quantity* of student development activities, but they are not sufficient. Point totals do not address *variety* - the number of different activities (e.g., completing a project and an internship vs. attending two lectures), *quality* – the intrinsic development value of different activities (e.g., leadership vs. attendance activities), and *distribution* (e.g., all the activities in one term vs. spread out across multiple terms). For example, a student earning 500 points may seem very good, but perhaps they earned those points by completing only a few, and potentially similar, high-value activities in their last term before graduation. Addressing variety, quality, and distribution is important to ensure that development is holistic in addressing different aspects of learning (e.g., learning to live together vs. learning to know). Further, our goal is to measure development as a *process*, in which students develop over time by engaging in a variety of high-quality activities.

4. A field experiment in a living lab

We implemented points as a student development measure through a novel web-based self-service technology platform. The platform manages and records the points earned by each student for activities such as experiences (e.g., internships), career awareness (e.g., career fairs), leadership (e.g., officer position in club), enrichment (e.g., study abroad, competitions), communication (e.g., conferences, social activities), team work (e.g., community service, team projects), and workplace readiness (e.g., mentoring, site visits).

The authors' home department served as a living lab to implement and study the use of points as a measure for development. Living labs are a real world test and experimentation environment which enable co-creation of innovation among stakeholders and creators. Living labs offer incremental and visible improvements that reduce fear of failure and co-opt sources of resistance into co-designers (Hyysalo and Hakkarainen 2014; Mandviwalla et al. 2008) by exposing stakeholders to successive prototypes (Mandviwalla 2015). The stakeholders included students, friends and family, faculty, staff, college and university administration, and employers. The stakeholders participated in the development of each iteration of the platform through feedback and use.

The project evolved considerably over a decade of incremental improvements involving more than 7500+ students. To the stakeholders, we positioned student development as a program of learning that *complements but is separate from academics* in which students were expected to gain 1000 points prior to graduation. Over time, we integrated variety, quality, and distribution into the system as follows. *Variety* – we placed restrictions on how many times an activity can be repeated for credit, promoted activities offered across the university and the local community, and adjusted point values so that a student can only meet point expectations by participating in more than a few activities. We also allowed students to

propose new activities. *Quality* - We adjusted the point value of activities to reflect their development potential (e.g., internship receives more points than attending a lecture). *Distribution* - We restricted how many times a student can get credit for an activity (e.g., receive points for attending a lecture only once a term).

5. Results

We collected data from 623 students over a 7.5-year period of using the platform. For each student, we recorded the points they earned for the eight consecutive terms leading up to their graduation as well as the total number of points they earned upon graduation. Table 1 shows the percentage of students attaining point levels in the years following the platform's implementation, in which each year includes the group scheduled to graduate that year (only). As the program was designed for students to achieve 1,000 points before graduation, we chose point cutoffs to designate low, average, above average, advanced, and very advanced achievers. The results show that over time a greater percentage of students achieve higher point levels with 100% achieving the 1000-point expectation by the fifth year. Close to 100% of graduating seniors achieved at least 1,000 points by year 4, compared to a little over 9% in year 1. Over the course of the five years, the percentage above 1,400 points grew from 1.3% to 12.6%.

Table 1. Percentages of students and points levels

Point levels/Year	1	2	3	4	5
<i>Poor (0-300)</i>	76.0%	6.4%	0.0%	2.0%	0.0%
<i>Low (300-999)</i>	14.7%	7.3%	1.1%	0.0%	0.0%
<i>Average (1000-1200)</i>	6.7%	49.1%	59.8%	65.3%	80.0%
<i>Advanced (1201-1400)</i>	1.3%	10.0%	7.6%	8.2%	7.4%
<i>Very Advanced (1400+)</i>	1.3%	27.3%	31.5%	24.5%	12.6%

The results suggest that (a) students will, over time, adopt and embrace new measures of development, and (b) that once you start measuring an activity, perceptions change, and development becomes more frequent. Further, given the structures we put in place, students engaged in a variety of high quality development activities. We measured variety by reviewing the average number of activities. In addition, we adjusted the point values so that to meet expectations students had to participate in high value point activities (quality).

However, it was unclear if the activities were distributed over time or bunched together. Figure 1 shows activity across eight terms (T1 – T8) which is about 2.5 years. The data was standardized to enable comparison so that for a student graduating in any year, T1 is when

they started participating (eight terms in the past). The later years (3, 4, and 5) show more activity with less variance compared to the earlier years. The figure suggests that compared to year 1, year 5 graduates are more developed because they completed more activities each term at a consistent level, reflected by the lower variance.



Figure 1: Development activity

While illuminating, the above analysis requires qualitative interpretation of graphs. We drew inspiration from Shannon’s diversity index (Shannon 1948), which has been used to assess species diversity in biology and ecology (Spellerberg and Fedor 2003). We developed a novel application of the Shannon Diversity Index to measure Development Distribution (DD). DD is expressed as: $-\sum_{i=1}^N p_i \log_2 p_i$, where N is the number of terms and p_i is the proportion of activities completed in a particular term. DD is useful because summing the number of activities only measures what is termed richness, as opposed to diversity, which is the function of the relative frequency of different species (Keylock 2005, p. 203). In our case, DD calculates the activity distribution across terms, i.e., the development process. So that higher DD implies activities are more evenly spread out across more terms. For example, consider six activities completed over five terms. Completing two activities every alternative term across 5 terms (2,0,2,0,2) generates a DD score of 1.585. In contrast completing two activities in the first term and one in each term thereafter (2,1,1,1,1) generates a DD score of 2.251. Another scenario where activities are concentrated in terms 2 through 4 (0,1,4,1,0) generates an DD score of only 1.252. DD is not affected, however, by the total number of activities if the distribution remains the same. Consider a scenario where the distribution of

activities is (3,0,3,0,3). Even though there are now nine activities instead of six, the DD score remains the same (1.585). This means that DD is a more useful measure when combined with total points earned. In sum, DD rewards better distribution, meaning more time to absorb, reflect on, apply, and experience the benefits from each activity as well as apply what was learned to the next activity (e.g., an officer position one term, followed by taking the lead role in a competition in the following term).

Table 2. DD scores over five year period

Year	DD
1	1.57
2	1.84
3	1.97
4	2.09
5	2.18

Table 2 summarizes DD scores of 623 graduates participating in 6,474 activities totaling 617,558 points across five years, in which the minimum possible score is 0 and 4.31 is the theoretical maximum. The gradual increase in DD scores suggests that students were completing activities that were more evenly distributed across terms. This result matches what is observable in figure 1, providing an intuitive validation of the efficacy of the measure.

DD needs to be further improved since it treats all activities as equal, even though it is likely that at different times, for different students, the importance of learning to do, know, live, and be will vary. In addition, we don't know which factors motivate and influence the trajectory of student development. Finally, we also need additional research on how to benchmark points and DD scores at the individual and institutional level.

6. Conclusion

In this study, we show how we developed a measure of student development in a living lab using a technology platform. For student development to move from the nice-to-have to the essential activity conceptualized by Delors et al. (1996), it must be measurable. The results show that points can serve as a measure of student development, including the quantity, variety, quality, and distribution of development activities. Overall, as far as we know, we are the first to measure student development across time using direct rather than perceptual or proxy measures.

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University sustainability assessment and reporting: preliminary findings from the Italian context

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Abstract

With universities playing a key role in creating and promoting sustainable development, they are inevitably called upon to report to stakeholders their active commitment to facing social and environmental issues using comprehensive and clear reporting tools. GRI Standards provide guidelines to help write these reports, yet these can lead universities to prepare heterogeneous documents that are difficult to understand and compare in terms of both information and results. Considering Italian state universities, this paper examines the materiality matrix, a tool used to disclose social, environmental and economic efforts toward the stakeholders. Preliminary results seem to show that somehow universities have misunderstood the GRI 2016 guidelines concerning the materiality matrix. The paper concludes by outlining the limitations of the study and offering suggestions for future research.

Keywords: *Sustainability; reporting; Italian higher education system; GRI standards; materiality matrix.*

1. Introduction

In the last decades, sustainable development has attracted the attention of organisations, both private and public, including educational institutions at all levels. In this context, the relevance of higher education institutions (HEIs) has been widely recognised as meaningful in that they act as drivers of sustainable change (Barth and Rieckmann 2012; Disterheft et al. 2013; Lozano et al. 2013). In particular, universities not only have the duty to teach and transmit knowledge, but they must also act as responsible institutions by advancing research to stimulate sustainable development and change (Barth and Michelsen 2013). Some initiatives to foster universities' sustainable activities have taken hold, such as the new global university rankings aimed at assessing universities for their contribution to sustainable development goals (e.g., The Times Higher Education Impact Rankings). Moreover, some governments have developed sustainability indicators to determine their funding lines to motivate universities to act sustainably. HEIs are thus called upon to improve the dialogue with government and society by reporting and disclosing their sustainable activities and efforts that foster sustainable development. However, the lack of standardised standards has led to the production of different documents across HEIs, making it difficult to clearly disclose or compare information (Fiorani and Di Gerio 2022). Starting from these assumptions, this study attempts to analyse sustainable reports in the Italian higher education system (IHES) by investigating if and how state universities are adopting the so-called materiality matrix and how the standards are being applied. A materiality matrix is a tool that considers key aspects and indicators that reflect an organisation's social, environmental, and economic impacts, or those that influence stakeholder decisions, thereby identifying material issues that deserve to be included in the report (Hsu, Lee, and Chao 2013).

The paper is organised as follows: section 2 presents a brief literature review on sustainability reporting in HEIs; section 3 explains the methodological approach; section 4 describes the findings; and the conclusions are provided in section 5.

2. Literature review

Due to the necessity to act sustainably, HEIs play an essential role in providing and promoting helpful pathways to sustainable action. HEIs, indeed, have a twofold responsibility: delivering trustful results that can help both citizens and firms on the path to sustainability, and being reliable institutions and points of reference when it comes to representing virtuous actions in this sense and stimulating organisational change (Ceulemans, Lozano, and Alonso-Almeida 2015). Especially for the latter, universities should externalise their institutional role by communicating a coherent and reliable image that represents all the virtues expected of them. In this sense, reporting activities, intended as means and measures to collect, process, and present information, help organisations reduce the complexity of information by making

data accessible and understandable in a simplified way for specific target groups and stakeholders. From the sustainability viewpoint, reporting is an accounting practice that aims to communicate all the efforts that an organisation makes in terms of the environment, society, and economy, tracking the impacts and actions related to these aspects, and engaging stakeholders during the investigation process. From a legal perspective, countries are developing numerous directives and laws to provide clear and trustful guidance. It is widely accepted that financial and non-financial information have the same importance and must be subject to regulations, resulting in the double-materiality concept. For example, the European Union recently moved from the NFRD (Non-Financial Reporting Directive) (Directive 2014/95/EU) to the CSRD (Corporate Sustainability Reporting Directive) (Directive (EU) 2022/2464). However, the path to providing clear instructions is long and diversified, and each institution can use one of many available standards (e.g., from the Global Reporting Initiative (GRI) or the International Accounting Standards Board (IASB)) to map its sustainability actions. GRI Standards are the most widely adopted worldwide, but despite their importance, they do not provide specific guidelines for HEIs and more generally for other types of organizations. This might explain why sustainability reporting is still at an early stage in this field (Herzner and Stucken 2020). For this reason, academics questioned whether GRI Standards are adequate when writing sustainability reports for HEIs and proposed alternatives and modifications (Amiano Bonatxea, Gutiérrez-Goiria, Vazquez-De Francisco, & Sianes, 2021; Lozano, 2006), such as the use of a materiality matrix. A materiality matrix is a tool that illustrates which material topics are salient for an organisation based also on the perspectives and opinions of its stakeholders. GRI Standards state that an issue is material when it represents “the organization’s most significant impacts on the economy, environment, and people, including impacts on their human rights” (Global Reporting Initiative, 2021a), whereby material topics are “topics that represent the organization’s most significant impacts on the economy, environment, and people, including impacts on their human rights” (Global Reporting Initiative, 2021b). While an example of a materiality matrix is lacking in the most recent set of standards, one can be found in the GRI Standards published in 2016. This states that a materiality matrix “shows the two dimensions for assessing whether a topic is material; and that a topic can be material based on only one of these dimensions. The use of this exact matrix is not required; however, to apply the Materiality principle, it is required to identify material topics based on these two dimensions.” The topics appear to be relevant according to the two dimensions: if they are reasonably important in reflecting the organisation’s economic, environmental, and social impacts, or in influencing the decisions of stakeholders. However, only the 2016 GRI Standards mention the two dimensions in the report (Global Reporting Initiative, 2016). In the 2021 GRI Standards, the example of the materiality matrix was removed and replaced by more general indications about the process of determining material topics (Global Reporting Initiative, 2021a). This backing down about the materiality matrix between 2016 and 2021

could have been caused by the problematic definition of materiality (herein termed materiality haziness) and by the fact that proposing a materiality matrix became more difficult following the 2016 guidelines. However, even though the materiality matrix is no longer recommended by GRI, it continues to be employed both by companies (De Cristofaro and Raucci 2022) and universities. The GRI 101: Foundation 2016 presents a graphical materiality matrix example, wherein the two previously cited dimensions are respectively associated with the x-axis and y-axis. This inconsistency was already noted by Taubken and Feld (2018), who found that is not so uncommon for the materiality matrix to be subject to misunderstandings and mistakes due to both the materiality haziness and the fact that the matrix is part of a method that is imprecise overall. Problems and misunderstandings, also related to the materiality haziness, moreover seem common in HEIS, to the point that recent literature underlined that HEIs' sustainable reports have a low quality and quantity (Ceulemans, Stough, and Lambrechts 2018) and are mainly limited to the environmental side without properly engaging all stakeholders (Disterheft, Caeiro, Azeiteiro, & Filho, 2015). These issues related to materiality haziness introduce several discrepancies when mapping and identifying key topics for the organisation. The problem of defining when a certain topic is material for a given institution is an object of debate, both for the standards' providers and legislators, to the extent that the definitions of materiality differ slightly in meaning and content, causing several misunderstandings in creating a materiality matrix. The lack of clearness regarding materiality assessment thus has a subjective effect (Bellantuono, Pontrandolfo, and Scozzi 2016; Calabrese et al. 2019). Moreover, assessing the materiality to create a matrix is even more complex. Indeed, materiality must not only determine the relevance of the social, economic and environmental impacts of the institutions but also quantify the influence of these topics on stakeholders in terms of choices and evaluations when making decisions concerning the institution itself.

3. Methodology

Starting from this scenario, and according to the GRI Standards and the GRI's materiality concept, this work aims to investigate if and how Italian state universities incorporate the materiality matrix in their sustainability reports. Although, as seen in the previous section, there is no specific reference to HEIs, this study considers the GRI Standards as the most frequently used within the sustainability reporting of each business area, regardless of the organisation. To address this research topic, and per GRI Standards, this work tries to understand how Italian universities build materiality matrices and if the results thereof are reliable. The methodology used in this paper is content analysis, which is a qualitative research technique used to interpret and evaluate textual material such as sustainability reports (Aggarwal and Singh 2018). The content analysis resulted in a conceptual analysis conducted through Nvivo 12 Plus, aiming to shed light on the concept of materiality along

with the materiality matrix. A list of all Italian public universities was considered to conduct this analysis (N = 67), whereby 19 universities were found to produce sustainability reports, of which only four (University of Brescia, University of Tor Vergata, University of Tuscia, and University of Torino) disclosed a materiality matrix. For each university, only the most recent published report has been considered, regardless of the academic years under consideration. Subsequently, analyses and comparisons of the materiality matrices in the sustainability reports were conducted to detect their peculiarities and characteristics, as well as any inconsistencies with the GRI Standards.

4. Results and Discussion

The analysis showed that of the 19 identified documents, 17 cite the word “materiality”, although only 4 provide a materiality matrix. All 19 reports state that they have been drawn up based on GRI Standards 2016 (see Table 1).

Table 1. Presence of the materiality concept, materiality matrices and GRI Standards.

	Yes	No	Total
Materiality	17	2	19
Materiality Matrix	4	15	19
GRI Standards 2016	19	0	19

The results show a common implementation of the GRI Standards by the entire sample. Yet while the term “materiality” is used in 17 of the 19 reports, only 4 provide a matrix. This could be due to the materiality haziness perceived by the staff in charge of the materiality assessment. Due to the different existing definitions provided by the standards and the legislator, the interpretation of what is material can vary greatly. In any case, even though the definition of materiality is still unclear for academics and regulators, the adoption of the GRI Standards should assume that the organisations that choose to use them automatically share the materiality definition proposed by the GRI. Assuming that it is necessary to follow GRI 2016 instructions when constructing a materiality matrix, and considering that all four universities with a materiality matrix followed GRI Standards 2016, it goes without saying that they embrace the definition of materiality proposed by those standards. Consequently, they should build a matrix based on these. Focusing on the analysis of the four identified materiality matrices, it emerged that there is no alignment between GRI 2016 and the results presented in the graphics produced by these Italian universities. Table 2 shows the discrepancies between the examples of materiality provided by the GRI Standards of 2016 and what is present in the materiality matrices of the Italian universities, demonstrating that what they map slightly differs semantically from what was stated as the basis in the GRI 101 Foundation.

Table 2. Discrepancies between the GRI example and the materiality matrices of four Italian universities.

	Example of a materiality matrix by the GRI Standards (2016)	University of Brescia 2017-2019	University of Tor Vergata 2021	University of Tuscia 2021	University of Torino 2019/2020 - 2020/2021
x-axis	Significance of economic, environmental, & social impacts	Relevance for the University of Brescia	Relevance for the university/ internal stakeholders	Relevance for the university	Relevance for the University of Torino
y-axis	Influence on stakeholder assessments & decisions	Relevance for stakeholders	Relevance for external stakeholders	Relevance for stakeholders	Relevance for the University of Torino's stakeholders

Based on the indications provided by the GRI Standards, the identified materiality matrices did not precisely follow the suggestions provided by the standards. This assumes that the universities did not properly conduct the materiality analysis according to the two dimensions, doing it in terms of tracking the importance of the topics for the institution and its stakeholders. Moreover, the topic prioritizations of the four matrices are not used as guidelines for the sustainability reports. What they missed probably links to the materiality haziness, which can cause an effective misinterpretation of what is important to map, leading to incorrect questions being asked, and consequently influencing the meaning of what is being investigated (Taubken and Feld 2018). This is also the result of a non-mandatory way of conducting the materiality analysis. With the 2016 and 2021 standards, the GRI merely outlined an overall pathway to follow, without forcing the organisations to adhere to a defined methodology, even though the provided path was quite specific and method-oriented. As a result, the materiality analysis is not a materiality analysis conducted based on the recommendations provided by the GRI Standards. These matrices result in tracking the relevance of specific topics from both the university's and the stakeholders' points of view. In other words, the analysed matrices do not seem to provide reliable results according to the recommendations of the GRI Standards, and misunderstandings seem to emerge. The prioritisation of topics is based on an estimation of the relevance from both the internal and external perspectives, i.e. from the points of view of the university and its stakeholders. However, the materiality matrix should prioritise issues based on their influence on stakeholder decisions and on the organisation as well as the impacts that the organisation has in social, environmental, and economic terms – the latter issues are currently neglected.

5. Conclusion

This paper is a preliminary investigation into the coherent use of the materiality matrix in sustainability reports disclosed by HEIs in the context of the IHES. Preliminarily, the results show that those universities that used the matrix deliberately chose to do so based on their free interpretation, thereby producing matrices that, while referring to GRI 2016, bear no relevance from the point of view of the prioritisation of issues. The matrices seem to be based on improper investigations, compared to what was prescribed by the GRI 2016 indications. Moreover, the results prove that the matrix conceived in the 2016 GRI Standards created problems for users and was not easy to put into practice. This is consistent with the retraction by the GRI, which does not further mention the materiality matrix in the new 2021 standards. The difficulties in realising and applying the materiality matrix are also consistent with the notion of materiality haziness. Nevertheless, the matrix, in line with the indications of the materiality analysis, could still be relevant if it is developed using a tailored methodology.

Finally, although the research is still in the preliminary stage, it still presents some limitations, which mainly relate to the sample comprising only Italian state universities that provide a materiality matrix. For this reason, future studies should be extended to the European context or include Italian private universities. This would provide more relevant and comparable information that could help researchers, university managers, and policymakers find the best practices for building the materiality matrix.

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Creating the “examination kiosk”: blended assessment to foster self-directed learning in higher education

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Abstract

The field of higher education is continually evolving; with it, examination strategy must also adapt. Especially self-directed learning will be a focus. We are developing an innovative solution to address the changing needs of university students and their exams. We found current challenges and new requirements for examination strategies based on extensive research analysis of relevant literature in the field and student-based feedback. The solution is a didactical methods in the form of an examination kiosk designed specifically for portfolio examinations. The purpose of the examination kiosk is to promote self-directed learning. It will allow for greater flexibility and individuality in the assessment process. We present the examination kiosk in detail and provide insights into its creation and potential applications.

Keywords: *Portfolio; higher education; self-directed learning; assessment; examination; examination kiosk.*

1. Introduction

Given the constantly changing conditions of the labor market and the development of technology (e.g. Chatgpt), university graduates need a variety of hard and soft skills. Therefore, it is important to adapt the daily routine in university teaching and the associated examination culture to test in a competence-oriented manner (Dede, 2010; Ayaz and Gök, 2020). We pay particular attention to self-direction, which refers to students' ability to set and pursue goals, make decisions, and manage their learning and development, independent of external guidance or direction (Morris, 2019), which graduates will need in future professional careers. Accordingly, the design of a holistic exam strategy is of high relevance.

In the recently established research project „Portfolio Profis“ at the faculty of psychology at Technische Universität Dresden in Germany (TUD), we will design, implement, and evaluate new portfolio strategies for higher education in an iterative process. The search for new solutions became necessary to meet the requirements of the new Psychotherapy Act for the study program in psychology. The conversion of this highly demanded degree program with 120 students each year required the adaptation of the study and examination regulations. Fifteen out of the 16 modules in the study program now have the portfolio as the form of examination. Each of the modules is completed by a graded portfolio based on 30 to 60 hours of work. Portfolio work was chosen as the form of exam to give the teaching staff a high degree of flexibility in designing the exams. It is also intended to reduce the huge amount of feedback and grading required at the end of the semester by assessing performances. It is intended to support students in continuously designing their learning process. However, the basic understanding of portfolio exams at the faculty of psychology differs greatly from that of portfolio work. To improve the quality of teaching, it is necessary to develop and test concepts that combine portfolio work with the requirements of portfolio examinations. However, so far there are no proven concepts for graded portfolio examinations for large groups of students, especially if they aim at a reflective mapping of self-directed learning processes. The current paper, therefore, addresses the following question:

How to develop the concept of portfolio examinations to support self-directed learning processes based on fundamental aspects of portfolio work?

To answer this question, the following sections compare portfolio exams and portfolio work concerning various aspects. Subsequently, a new concept for the implementation of portfolio exams is designed from the comparison and discussed with students of the bachelor's program in psychology at TUD.

2. Comparison of Portfolio Work and Portfolio Examinations

An extensive literature search enabled us to compare portfolio work with portfolio examinations regarding their structure, use, and potential. We focused the search on publications from German-speaking countries to achieve the highest possible fit for synthesis with the portfolio examinations. Additionally, we filtered based on availability online and date of publication after the year 2000. We found many different types and implementations of portfolios, making a single, universally applicable definition difficult (this is described in Knauf, Behrend, & Knutzen (2020) and Keplinger (2014), among others). To answer our research question and to further develop portfolio examinations towards a more reflective design supporting self-directed learning, it does not seem necessary to differentiate the concept of the portfolio work to different criteria but to elaborate on the basic elements. Therefore, the definition by Hornung-Prähauser et al. (2007) serves as the basis for the present description:

A portfolio is "a (digital) collection of "skillfully made works" (=lat. artifacts) of a person who thereby wants to document and illustrate the product (learning outcomes) and the process (learning path/growth) of his/her competence development in a certain time and for certain purposes. The person in question has independently selected the artifacts and organized them about the learning objective. She (he), as the owner, has complete control over who, when, and how much information from the portfolio may be viewed."

Based on this definition, the following section describes aspects of portfolio work and contrasts them with the current conditions of portfolio examinations. The result is a collection of aspects that – as the diversity of portfolio use suggests – are not all addressed in each of the individual publications but are derived from a summative analysis (Barrett, 2011; Bauer & Baumgartner, 2012; Bräuer, 2016).

To contrast portfolio work and portfolio examinations we need also a description of portfolio examinations. In terms of the corresponding examination regulations, portfolio examinations are defined in the examination regulation of the bachelor's program in psychology (Technische Universität Dresden, 2021):

Portfolios serve, using a compilation of similar or dissimilar individual performances, to demonstrate the ability to place the aspects of professional, scientific action determined by the respective task in a larger context. This includes the ability to work in a team if the respective task requires it. Portfolios can include both face-to-face and distant work, and the result is an objective, e.g. written work. The time required for portfolios is specified in each case in the module descriptions and may not exceed 300 hours. Derived from this, the deadline for the submission of individual performances, the duration of individual performances, and the deadline for the submission of the entire portfolio are to be determined within the framework of the respective assignment.

The aspects of portfolio work and portfolio examination are contrasted in Table 1.

Table 1. Comparison of portfolio work and portfolio examinations.

Aspect	Portfolio Work	Portfolio Examination
Objectives	<ul style="list-style-type: none"> · Strengthening the ability to reflect · Support of self-directed learning · Promotion of personal competencies (action competence, self-competence) · new form of performance assessment 	<ul style="list-style-type: none"> · Verification of the achievement of the learning objectives of the module · Flexibility for students and teachers · Relieving the pressure of exams from the end of the semester
Dimensions	Process and product dimension	Product dimension
Content	<ul style="list-style-type: none"> · Documentation of competencies · Mapping of learning process and development · reflection on learning experiences and learning strategies 	<ul style="list-style-type: none"> · processed tasks
Structure	coherent (digital) portfolio, which contains individual artifacts and is created by the students	individual achievements, the results of which are managed by the teachers
Components	"artifacts", e.g. <ul style="list-style-type: none"> · Learning materials · Observation reports · Case studies · Reflections · Learning diary entries · Versions of text contributions 	"subtasks", e.g. <ul style="list-style-type: none"> · Essays · Tests · Excerpt · Literature · Research · Presentation · Poster
Group size	recommended rather for small groups up to approx. 30 students	required also for lectures with 120 students
Supervision effort	high	low
Assessment	Feedback is obligatory, grading only in some scenarios	Grading obligatory points for individual performances and grade
Who decides	Students decide criterion-oriented which components and contents their portfolio contains.	Teachers decide on the content, form, and number of individual performances.
Date of submission	as a rule, the completed portfolio is handed in	each performance is handed in separately

The presentation in Table 1 reveals differences in almost all aspects between the basic ideas of portfolio work and the portfolio examinations as they are currently used. The largest degree of similarity can be found in the list of individual components, which labeled

differently as either artifacts or individual achievements but the components are similar in terms of form and medium.

3. Didactic Development of Portfolio Examinations

Next we will identify the aspects of portfolio examinations that require further adaptation. It is therefore necessary to characterize differences to portfolio work but also to take into account to what extent the conditions given by the examination regulations described above allow for an adaptation. Further developments are required and possible with regard to the following aspects:

Objectives: Fundamental for an improvement of the teaching quality is that the strengthening of the student's ability to reflect and their self-competence as well as the support of self-directed learning are added to the goals of the use of the portfolio examinations. While these are the goals of the Bachelor's program in psychology at TUD they are not yet addressed by the current practice of portfolio examinations.

Who decides: It also appears to be quite essential that students are given a greater opportunity to influence the design of their learning and thus the examination process. In a first step, this can concern the form, content, and/or number of individual performances. Therefore, teaching staff should provide a framework – in accordance with the examination regulations – that provide various opportunities for the students. However, the different opportunities within a portfolio have to be comparable but also the individual and overall workload has to be in line with the examination regulations that are defined for the respective module. In this context, it could become critical that students are overwhelmed with the possibilities to design their learning and examination process.

Dimensions and Content: To strengthen the student's ability to reflect on their own level of knowledge, they need to have opportunities to do so, which also includes to reflect on their learning process, experiences and strategies. Therefore, the portfolio assessment should be expanded to include a process dimension as well as reflective content. However, assessing the reflective component in the context of portfolio exams seems difficult. Therefore, this point should also be discussed with the students during the focus group. To ensure general acceptance for a further developed version of the portfolio examinations also requires to consider the supervision effort on the side of the teaching staff. The higher this effort will be, the lower will be the general acceptance and the willingness for implementation.

Student-based Feedback: To evaluate current portfolio implementations a focus group discussion was conducted with students in the Bachelor psychology program. Eleven students discussed within the framework of a world café suggestions and ideas for the didactic iteration of the portfolio examinations. The following results for further

consideration emerged: Students show dissatisfaction with the current practice of portfolio examinations and expressed the need for a development towards a stronger consideration of self-directed and reflective learning. Students do not see any danger of being overwhelmed or unsettled by greater freedom to design their own learning and examination process. One central idea suggests that the teaching staff provides a selection of portfolio assignments to be completed (e.g., 10 individual assignments) and students select and complete a certain number (e.g., 5 individual assignments). This suggestion was very much appreciated. It is important, that students do not have to specify at the beginning of the semester which tasks they want to complete, so that they have enough flexibility for trial and error. Further, they see the importance of including the process dimension and reflection in the portfolio assessment.

4. Creating the “Examination Kiosk”

The results of the comparison between portfolio work and the current practice of portfolio examinations as well as the information from focus group discussions were used to further develop the concept of portfolio examination. We call the concept the “examination kiosk” and define it as follows:

The examination kiosk is a type of graded portfolio examinations. In this concept, students compose their individual assignment combination and thereby design their learning and examination process. Each student selects their own subtasks from the available options. The sum of all subtasks creates the portfolio examination.

For a successful implementation, a smooth transition seems appropriate, therefore we will describe a "start-up version" of the examination kiosk together with prospects for the further development.

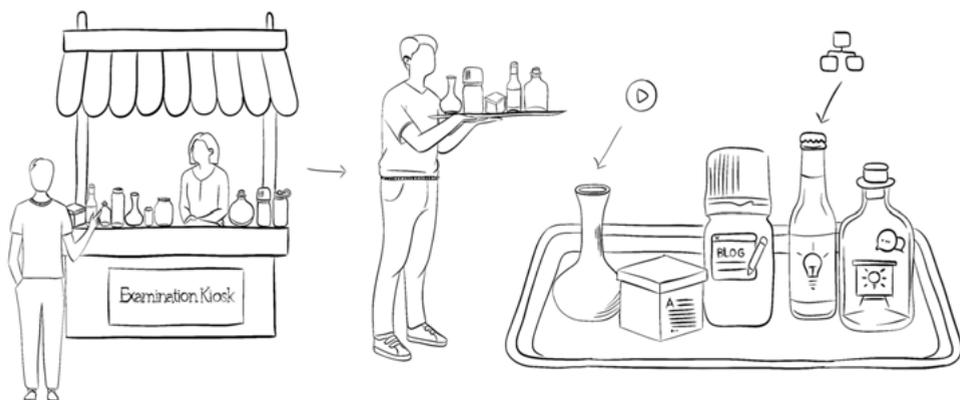


Figure 1. “Examination Kiosk”

Objectives: The examination kiosk is used as a form of examination to check the achievement of the module objectives laid down in the study regulations. It also supports self-directed learning and the promotion of the students' ability to reflect and their self-(learning) and action competence. Lectures and students will benefit from a more equal distribution of examinations across the semester as well as from greater flexibility in the design of the module examination.

Dimensions: The exam kiosk primarily addresses the product dimension, but also considers the process component. This is achieved through an ungraded reflection of the learning process and outcome. In perspective, the reflection may be given bonus points and/or graded.

Structure: At the beginning of the semester, the procedure is transparently presented to students with Video, FAQ, PDF and Miro Board as well as a weekly consultation hour throughout the semester. Thereby, the teaching staff informs the students about the (i) number of available subtasks, (ii) the required number of subtasks that need to be completed by the students, and the scope in work units of each. In order to give students sufficient choice, we recommend that at least six subtasks are offered, of which students may choose four. The content, form, and latest submission date will also be specified by the teaching staff. Students decide during the semester which subtasks they would like to work on and hand in. All submitted individual performances will be evaluated with points. The points will be summed up to a grade at the end of the semester. In an accompanying, ungraded reflection, students answer predetermined questions that address, among other things, the choice of individual performances and the learning process. In the future, students can be given even more decision-making options, e.g. by allowing them to determine the content, number and form of the individual assignments themselves on the basis of their own learning objectives.

Components: The kiosk consists of different subtasks, which are arranged by the students to their personal Portfolio. The concrete tasks for the subtasks and the expected form are specified by the teaching staff. The forms of the subtasks depend on the respective learning objective that is to be examined. For example, tests, one-minute papers, essays, steps of a research project, forum contributions, memes, videos or mind maps can be subtasks. Ideally, these are products that are naturally created by students as part of their learning process.

5. Conclusion

The examination kiosk will be used for the first time in the summer semester of 2023. Its use will be closely accompanied by a scientific study so that the knowledge gained can be incorporated into a continuous development process. By using the examination kiosk, the teaching/learning practice and thus the learning and teaching culture can develop further. In the process, the teaching staff gradually change their role to that of learning facilitator. The students are involved in a participatory way and are trained with regard to their self-learning

competence. Our long-term goal is to raise the quality of university teaching and its assessment strategies and to train learners to become mature, independent and reflective graduates through complex examination systems to create a participatory learning culture. Furthermore, we aim to support teaching staff to implement complex assessment strategies by educating them how to mix assessment formats, for example by using the Blended Assessment Cube (Jantos and Langesee, 2023).

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Pro-f-quiz: increasing the PROductivity of feedback through activating QUIZZes

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Abstract

Feedback beyond the grade is an important part of the learning process. However, because of the large student groups, many teachers in higher education are faced with practicalities such as the limited time to prepare and communicate the feedback to individual students. We have set up an experiment, titled Pro-f-quiz, in which over two years 236 students participated and in which the feedback is communicated through an online quiz that activates the students to reflect upon their solution. The system can be set up in a very limited time compared to booking individual time slots. The results show that approximately 85% of the students appreciate the approach with 60% indicating that they reflect more intensively about their work than when the feedback is transmitted traditionally. Moreover, the grade of the students participating in the project was substantially higher than students not participating.

Keywords: *Grading; feedback; quiz; reflection; student appreciation.*

1. Introduction

Feedback is important in the learning process of students. Providing proper feedback—not overly negative but constructive, enthusing and with a focus on reflection—is of paramount importance but comes with challenges such as tight time constraints and a perceived limited return on investment. Time is a many-faceted problem. First, the teacher’s time: to grade, to formulate and to communicate the feedback. Formulating feedback takes extra time over grading because the match with the evaluation criteria must be made explicit and the required improvement elucidated. Communicating can also take significant time, especially when done orally. The second and often underestimated issue is the student’s time. Fitting the schedule in both the teachers’ and the students’ agenda would imply an extended time span between the first and the last student getting their feedback. In terms of equal treatment this poses a major challenge when the idea of the feedback is to be formative, i.e., helping them in performing better at consecutive tasks.

The limited return on investment is the other problem: Crisp (2007) reports a feeling of wasted time providing feedback, as also confirmed by individual teachers in our environment. Our conjecture is that students, unless triggered otherwise, act as mere receivers of feedback and often prefer to scan the feedback superficially, only searching for the actual grade.

This paper presents **Pro-f-quiz**, a **productive** methodology for giving **feedback** through means of a **quiz**. The quiz consists of concrete, multiple choice questions closely tied to the task at hand. After each question, the student is provided feedback, not only the correct answer but also about the imperfections of the incorrect options. Only after finishing the entire quiz, the students can see their grade and score on each of the questions. We believe this methodology improves the productivity of the feedback process because students are triggered to reflect about their own solution before being able to read the answer, while only requiring a limited time effort for the teacher. The experiment has been performed in the first bachelor year of Engineering Technology for in total 374 students, of which 236 students, divided in 146 project groups, voluntarily participated.

We defined the following research questions to evaluate the productivity of the methodology:

- **RQ1: Do students appreciate the methodology?**
- **RQ2: Does it increase reflection?**
- **RQ3: Is the time needed to set up the feedback system limited in comparison to traditional approaches?**

The remainder of this paper is as follows: Section 2 provides related work; we describe the context and setup of the experiment in Section 3 while presenting the results and the lessons learnt in Section 4. After Section 5, exploring the threats to validity, Section 6 concludes with a summary and suggestions to expand the experiment.

2. Related Work

The use of (automated) assessment and feedback systems to facilitate students' learning has been extensively researched in recent years. Barriocanal et al. (2002) found out that a straightforward application of unit testing, a fully automated feedback mechanism for testing software, does not improve student's engagement. Chatzopoulou (2010) proposes "adaptive assessment", where students with different abilities are served different sets of questions. Matthews et al. (2012) introduced such a system and show that it is especially interesting for a resource-based learning approach that focuses on process assessment. The framework allows for custom comments by instructors. The quantity of feedback and response time was improved, but the quality rates dropped slightly.

Sherman et al. (2013) found out that computer-assisted automated grading systems positively affect student feedback and response time, allowing educators to quickly grade multiple complex assignments while at the same time allowing students to increase their submission per assignment rate. More recently, Thangaraj et al. (2022) compared six recent feedback systems for introductory programming courses in higher education on five different axes. They praise the immediate feedback and the opportunities for the student to initiate the feedback by submitting a work, but also conclude that more development is needed to be more effective in motivating the learning process.

When it comes to the format of feedback, Funk and van Diggelen (2014) claim that although written feedback is still used a lot, students are dissatisfied with the way they are formulated and the quality in general. A two-legged categorical system should be developed to mitigate the fluctuating quality, they conclude. The first category, focusing on the content of learning, should cover task, proces, vision, identity, etc. The second category determines the form of giving feedback: positive-negative, specific-general, limited-elaborate, etc. A quiz-like feedback format as presented in this work avoids most written feedback shortcomings outlined by Funk and van Diggelen.

Online quiz systems have been successfully employed to support educators in providing feedback in large-class courses. Furthermore, most of them allow for multiple attempts, resulting in a significant increase in students' quiz scores. Also, Mendoza and Lapinid (2022) discovered that the positive attitude of students towards feedback increased compared to conventional text-based feedback systems, as it allowed them to better manage their time and help them understand the theoretical material at hand. Although Mendoza and Lapinid did not use the system to effectively grade students, they do note that average results of online quizzes is a good predictor of final exam grades, as also unveiled by Cohen and Sasson (2016) and McDaniel et. al. (2007), who conclude that in the classroom testing can be used to promote learning, not just to evaluate learning. Our approach aims to combine both.

3. Experimental Setup

The experiment took place during two consecutive years in the course *Software design in Java* (4 ECTS) at the joint program ‘Engineering Technology’ at UHasselt and KU Leuven Campus Diepenbeek (Belgium). The course, an “*Objects First*” course (Cooper (2003), Barnes et. al. (2006)), is attended by roughly 200 students yearly. It is situated in the initial general engineering phase of three semesters (1,5 year), after which students choose one of seven options ranging from Chemistry or Construction to Electronics-ICT or Software Systems. All students must pass the course. As students interested in majors outside IT often demonstrate less interest, we use nudging techniques as stimulation. One form used to be an early but non-committal task—no grades, only feedback—that helps them in succeeding in the consecutive assignment (worth 33% of the grade). Because the number of students who took up the challenge gradually decreased to less than 10, we changed the task from non-committal to voluntary, and started grading the tasks, using a bonus system to ensure that students are never punished for performing poorly in the voluntary task. Participation increased to 60-70% but giving individual high-quality feedback would now require a lot of effort.

To minimize the effort and maximize the effect we set up of first version of the experiment in 2021-'22. Instead of directly distributing the feedback and scores, we composed a quiz of 10 multiple-choice questions named the *Pro-f-quiz*. Some questions were basic: “*Did you declare your data members as public?*”; some more introspective: “*Wat representation did you use for the quality of the snow?*”; other questions listed options that could or could not be applicable. Each question was followed by immediate feedback explaining the rationale, e.g. “*A String is not suited because **any** text can be used, not only the values we enumerated.*” We also provided an anonymized Excel-sheet with hashed student names containing personalized feedback and grades. Student can only retrieve their hash by finishing the quiz. We also added an additional question to the quiz “*Did you learn from this feedback quiz?*” Because 87% answered positively, and because we later noticed that the grade of the students who did the voluntary task was 3,63/20 higher than other students, we conducted a second version of the experiment in 2022-'23 with additional questions regarding the feedback mechanism and how much effort they put in the voluntary task. Results were collected through the learning platform Toledo, a derivate of Blackboard and analyzed in Excel.

4. Results and Discussion

Table 1 shows a high overall participation rate of 63% of the students doing the voluntary assignment. The participation rate, counted in number of quizzes completed, increased from 36% to 48,4% in the second year. This implies an average error rate of 7,53% with a confidence level of 95%. If we consider the response as representative for the entire project group, the error rate drops below 6%, thus considering the sample as highly reliable.

Table 1 Participation in the experiment.

Year	Students	Projects	Students with project	Completed quizzes
2021-'22	192	69	127	69
2022-'23	182	77	109	88

On the overall question “*Did you learn from this feedback quiz?*” 87,0% of the students responded positively in the first year and 83,7% in the second, which is consistently good.

Given an expected working time of approx. 4 hours and the responses on question 12 “*How much time did you spend in the task?*”, we divided the population as follows:

- Students working shorter than expected on the task (2 to 3 hours): 14 students
- The group that worked as expected (3,5 to 5 hours): 26 students
- The group that took slightly more time (5,5 to 8 hours): 24 students
- Students who worked a lot more (8,5 up to 20 hours): 20 students

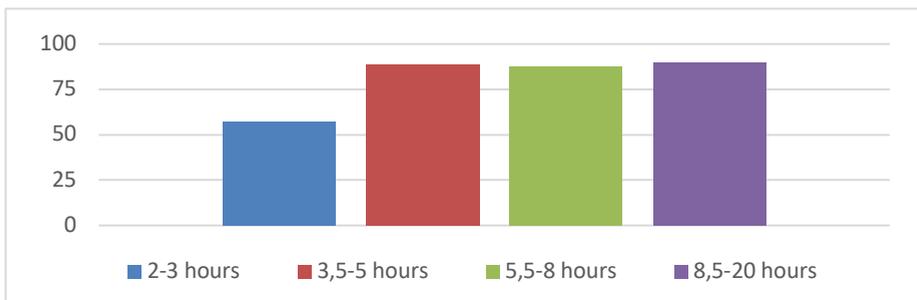


Figure 1 Percentage of students who learnt from the quiz, versus time spent on the task.

Figure 1 shows a distinct difference between the groups that had to work the least versus the most. The first group attributes to 16,7% of the population but contains almost half of the students who did not learn from the feedback: their approval ratio is 57,1% as opposed to 90% in the last group, which is the more important target group. As they had to work much harder to achieve a similar result, they can probably benefit more from high quality feedback. *Figure 2* shows the results classified according to their grade on the task. The percentage of positive responses reaches 100% in the group who performed the least. Together with *Figure 1*, this results in a positive answer on **RQ1** (*Do students appreciate the methodology?*).

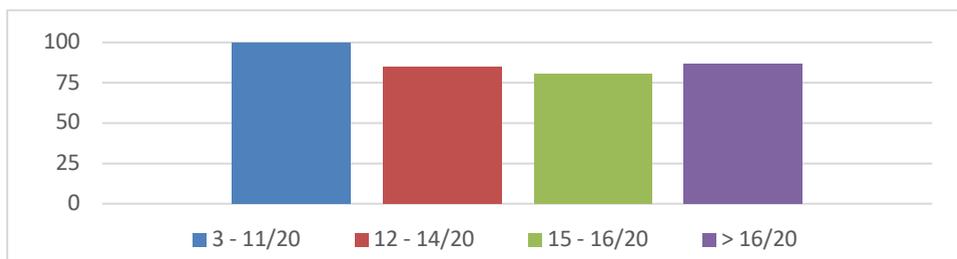


Figure 2 Percentage of students who learned from the quiz, versus grade on the task.

The mere observation that students benefit from the feedback is insufficient to claim that this methodology is superior. Therefore, we explicitly asked the following question: “*To what extent has this way of feedback triggered you to reflect more on the quality of your task?*” **Table 2** shows that 60% of the students is convinced that the approach with the quiz helped them in reflecting more about the quality of their task.

Table 2 Distribution of students reflecting more than when directly given the feedback.

Did you reflect more than when directly given feedback?	Students	Percentage
Very definitely yes	28	32%
Probably yes	24	28%
Undecided	28	32%
Probably not	4	5%
Very definitely not	3	3%

The final two questions look at the attitude of the students. Table 3 shows positive intentions of the students that are not aligned with past observations: 61 students claim that they would make the task irrespective of the promise of a reward, whereas this shrunk to no more than 10 students when there was no reward. Table 4 confirms to a certain degree the presumption put forward in the introduction that many students are only interested in the grade, but on the other hand more than 67% of the students in the sample value the feedback at least equally important as the grade. The effort put in providing is thus highly appreciated by the students.

Table 2 and 4 confirm: RQ2 (Does it increase reflection?): 60% responded that they reflected more than when receiving the feedback traditionally; and 67% point out that feedback is for them at least equally important as the grade.

RQ3 (Is the time needed to set up the feedback system limited in comparison to traditional approaches?) is more difficult to answer firmly, but an estimate is possible. Given 77 project groups and being able to cater 5 sessions per hour would result in almost 16 hours nonstop.

Setting up the feedback quiz took about 2 hours, resulting in an 8-factor reduction. Equally important is the fact that the feedback quiz ensures that all students receive their feedback at the same time. Using oral feedback sessions that would need to be fit in the busy schedule of both teachers and students, it would be nearly impossible to deliver the feedback of the voluntary task to all students in time for the consecutive mandatory assignment.

Table 3 Doing the task without reward.

Would you have done the voluntary task without bonus reward?	Students
Very definitely yes	23
Probably yes	38
Undecided	13
Probably not	10
Very definitely not	3

Finally, Cohen and Sasson (2016) observed that results of online quizzes are a good predictor of final exam grades, but in our case, participation sufficed: students doing the voluntary task scored higher than students who did not, rising from 3,63/20 to 5,22/20 in the second year.

Table 4 Appreciation of feedback.

Feedback versus grade	Students
I only remember the grade.	8
Grade is more important than feedback.	20
Grade & feedback are equally important.	39
I need the grade, but feedback is more important.	16
Grade without feedback is almost worthless.	3

6. Threats to validity

When comparing the grade for the entire course, the control group consisted of students without doing the task nor the quiz, but we had no control group of students who only missed the quiz. Therefore, we couldn't isolate the effects of the feedback quiz from merely executing the task. Next, participation in the experiment was voluntary and not random. This possibly implies a biased sample, consisting of motivated students who would have scored higher in the course regardless of the feedback quiz, and we appreciate feedback more than undermotivated students. Nevertheless, the approach scored consistently high and the effect on the grade was more than substantial, hinting at a significant effect of the methodology.

The reduction in time spent with a factor 8, without sacrificing the quality of the feedback, was a very rough estimate and depends on the size of the group and the time needed to setup the feedback quiz, but it is certainly realistic for large student groups.

7. Conclusion

We have presented an experiment in providing activating feedback to students through a multiple-choice quiz in the context a voluntary assignment that precedes a larger mandatory task. In total 236 students participated. Approx. 85% said they learned from the feedback and 60% reported reflecting more intensively because of the feedback system, with grades on average 5,22/20 higher than who did not participate.

To be able to differentiate in the effect of performing the assignment and of the feedback methodology, additional qualitative research needs to be done to identify the underlying principles and expand their impact. Care should also be taken when composing the feedback quiz to avoid equity issues related to automated feedback systems which is more present in large classes (Xie et al. (2022)) where the time benefits of this approach are the most present.

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Adverse effects of personalized automated feedback

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Abstract

In large classes with hundreds of students, it is rarely feasible to provide students with individual feedback on their performance. Automatically generated personalized feedback on students' performance might help to overcome this issue, but available empirical effect studies are inconclusive due to lack of methodological rigor. This study uses a repetitive randomized control experiment to explore whether automatically generated feedback is effective and for which students. Our results indicate that feedback does not have a positive effect on performance for all students. Some groups benefit from receiving personalized feedback, while others do not perform better than the control group. Students that perform average benefit most from receiving personalized feedback. However, lower-scoring students who received feedback tend to have lower attrition rates and if they participate at the final exam, their performance is not higher than the control group. Therefore, providing automated feedback is not something that should be undertaken mindlessly.

Keywords: *Automated feedback; summative assessment; randomized control experiment; empirical study; adverse effects.*

1. Introduction

Feedback can be one of the most powerful learning tools in education, but it is difficult to use in some higher educational settings (Hattie & Timperley, 2007). Especially in large undergraduate classes with hundreds of students, it is rarely feasible to provide students halfway through the module with individual feedback on their performance and enable them to act upon it when preparing for the final exam. Technological innovation holds the promise to help overcome this issue, as it enables automatically generated personalized feedback on students' performance. Previous studies that have explored the effects of automatically generated feedback on student performance have shown mixed results and often focused only on smaller learning tasks. Moreover, they lack randomized controlled designs (Morris et al., 2021). We provide a rigorous study that explores in greater detail whether automatically generated feedback halfway through the module is effective and for which kind of student.

A commonly deployed technique to provide students with insight on their mastery of the subject is a midterm some weeks before the final exam. This midterm can be formative or low stake summative and poses an important opportunity for personalized feedback, as it generates data on how each student performs on the different learning objectives, while there is still time to improve before the end of the module. We experiment with a feedback system that automatically generates personalized feedback for students on each of the learning objectives of the module that are tested in both the midterm and final exam. The feedback concerns students' current performance, what is expected from them, and how they should proceed from here on. Feedback is formulated for each learning objective at three levels, for students scoring below standard, standard or above standard. Shortly after the midterms, students receive an automatically generated e-mail with their grade and personalized feedback. However, they do not know that the email is automatically generated, as it is sent from the lecturer's account and formulated as a personal message.

We tested this feedback system in three large ($n > 300$ students) first year bachelor modules in business administration. These were all technical modules (Management Science (MS), Supply Chain Operations (SCO), and Statistics (Stat)) that require deep learning strategies as students really need to understand and apply the material rather than recall information. For each module, students were randomly assigned to either the experimental group, receiving an email with their grade and personalized feedback, or the control group, receiving an email with only their grade. Our main outcome measures are attrition rate and performance on the final exam (i.e., not the final grade, as that includes the midterm grade as well). We present effects of receiving automated feedback for low, average and high performing students, for which we used the 33% tertiles as boundaries.

2. Experimental setup

For the field study, we selected three first year modules of a single programme of study. The modules were similar in their assessment plan, as they all included a final exam and a midterm, i.e. an intermediate low stake exam 3-4 weeks before the final exam. All learning objectives tested during the intermediate exam were retested during the final exam. The purpose of the intermediate exams was therefore aimed at informing students on their mastery of the subject and the type of exam they could expect for this module. The midterm is a low stake summative test, as the weight of the midterm is much lower than the weight of the final exam. This allows students to treat it as a kind of formative assessment, since they could make up a bad achievement on the midterm during the final exam. At the start of the year, all 318 freshmen were asked for consent in participating in an experimental study and to give permission in using their outcomes. The students were not informed about the details and purpose of the study to minimize the risk that the outcomes of the experiment are influenced, because the students are aware that they take part in an experiment (Levitt & List, 2009) and could learn from other's individual feedback. In total 88% of the students gave consent to participate in the study. Upon participation in a midterm, we randomly assigned them to either the treatment or control group. Students who did not give consent were left out of the study. Note that not all students who participated in the midterm decided to participate in the exam. Hence, the attrition rates of treatment and control group are of interest, as this decision may have been affected by the treatment. After all three midterms had been offered, a within subjects approach with repeated measurements has been applied to draw conclusions on the effectiveness of the treatment, notwithstanding the differences between the repeated measurements, as the modules are different.

2.1. Personalized automated feedback

The intermediate exams consisted of open (short answer) and/or closed questions (multiple choice). For each graded element of the midterm (i.e., question or sub-question), we asked the lecturers to identify the learning objective that was tested by that (sub)question. Per module, 6-10 learning objectives were tested. As an intermediate exam could consist of 20-40 (sub)questions, each learning objective was measured using on average almost 4 questions.

Students who would not receive feedback for this midterm (due their assignment to the control group or their lack of consent) did receive a personal email with their name and the grade on their exam and some general information (e.g., time left until the final exam). Students in the treatment group were sent a personal email at the same moment as the other students, but in addition to their grade they received information that we denote as personalized feedback. Feedback started positive by denoting all learning objectives that were well-mastered (above standard). Next, the learning objectives that scored standard and might

need some more attention were addressed including suggestions per learning objective, and finally the learning objectives that were below standard and for which substantive improvements were required were addressed, including more extensive suggestions what to do to achieve these improvements.

3. Results

3.1 Descriptive statistics

All students enrolled for the modules were invited to participate, although for this study we were only interested in freshmen students. Their was no random selection from the population involved, but only students that participated in a midterm and the final of a module could be measured. Hence, per module we registered whether the student participated in a midterm and could randomly be assigned to the treatment or control group based on the consent they had provided. For module 2a Supply Chain operations (SCO) and 2b Statistics (Stat), only freshmen who were assigned to a control or treatment group in module 1 Management Science (MS) have been considered, as we use a repeated measurement study design.

Table 1. Partipant flow.

Module	Total population (#freshmen with consent)	Midterm participants (#freshmen with consent)	Treatment group (#final exam)	Control group (#final exam)	No consent or midterm
1. MS	342 (290)	335 (254)	143 (134)	146 (141)	53
2a. SCO	305 (255)	286	128 (118)	158 (147)	19
2b. Stat	319 (231)	270	128 (118)	142 (137)	49

3.2 Attrition effects

Table 1 shows percentage of freshmen with consent that participated in the midterm (i.e., assigned to either the treatment or control group) and attrited for the final exam. The attrition differences that we found show a much larger attrition in the treatment group. Further examination revelead that these differences cannot be attributed to confounding variables, such as age, gender, high school GPA, et cetera. However, for students that scored low on the midterm (lowest 33%) AND received feedback we found a significant effect in the last

Table 2. Attrition effect of feedback after midterm for each module.

Module	Attrition in control group	Attrition in treatment group
1. MS	3.7%	6.1%
2a. SCO	5.6%	8.9%
2b. Stat	3.7%	8.1%

two modules. Students with a similar low score who did not receive feedback had a higher participation in the exam. Hence, feedback to lower scoring students has a significant attrition effect, resulting in higher attrition as a result of personalized specific feedback.

The results are graphically depicted in the upper part of Figure 1, which shows differences with the control group. If the boxplot crosses the 0-line, there is no significance treatment effect at 0.05 level.

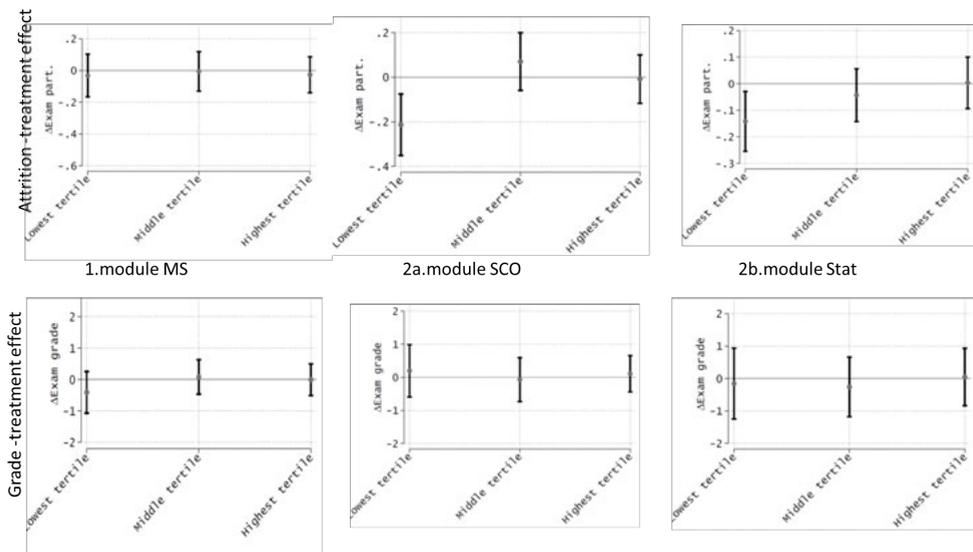


Figure 1 Treatment effects on Attrition level (upper part) and Grade of final exam (lower part).

3.3 Grade performance effects

We did not find significant effects of providing personalized feedback (treatment) on the final exam grades in a module. The average grade received by students in the control group was similar to the grade of students in the treatment group. We had expected that the group of students who could benefit most from feedback, i.e. who received suggestions for improvement for only a few learning objectives and hence scored average in the midterm, would show a significant effect of the feedback received. But our data did not confirm this hypothesis, for neither of the modules. Moreover, we did not found a significant performance difference between the lower scoring treatment group students and their control-group counterparts, notwithstanding the higher attrition rates in the treatment group. We denote this as an adverse effect of feedback, as personalized feedback has had no clear impact on performance, only on attrition rate.

4. Discussion and Conclusions

The randomized controlled experiment that we performed leads us to two conclusions. First, we have not been able to demonstrate a positive or negative effect of personalized feedback on the grade performance of the first year students. Next, we have been able to identify an adverse effect of personalized feedback in terms of attrition level in two of the three modules, both located after the students had already taken the first module in their study program.

These conclusions ask for discussion and reflection, as theory suggests mainly positive effects of personalized feedback. Has the experiment correctly been designed? We believe it is, as we followed a similar setup as has been used in other repeated measurements field studies (Levitt & List, 2009). Has the treatment, i.e. the formulation of the feedback, been provided correctly? We followed guidelines of Hattie & Timperley (2007) and Núñez-Peña et al. (2015), but we made the choice to provide feedback based on the achievement of module learning objectives, not on the detailed level of the question itself. Or did we identify an adverse effect of feedback that should lead us to reconsider the power of feedback?

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Authentic assessment in higher education: a collaborative approach

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Abstract

This research explores a collaborative learning experience using Authentic Assessment between businesses in a European City and a Higher Education (HE) Institution. Using the umbrella of Authentic Assessment, MBA students solve a problem through Problem Based Learning (PBL) while working with businesses and City Hall. Students explore the concepts of 'best practice' in service delivery in the City.

A mixed methods research methodology was applied to gather the primary data. The aim was to examine this collaborative approach to PBL using Authentic Assessment for the students while enhancing their overall learning experience and to gather their feedback and that of participating businesses.

The outcome resulted in the development of a Service Charter for the City, through an interactive student assessment strategy. Further recommendations for training business owners on how to deliver 'best practice' for service delivery are also proposed.

Authentic Assessment through collaborative learning works and has many benefits.

Keywords: *Authentic assessment; collaborative learning; problem based learning; experiential learning; city service charter.*

1. Introduction and Research Context

Authentic Assessment (AA) is an engaging approach to assessment where students use and apply knowledge in real-life settings. Many consider it the best approach to assessment for reasons such as its authenticity, student engagement benefits, opportunities to work with industries, prospect of observing ‘best practice’ in action, and, from an educator perspective, it reduces the opportunities for contract cheating. Authentic Assessment in higher education is concerned with working in conjunction with external organisations where students at all levels are given the opportunity to explore real life and real world issues. Ultimately, the emphasis is on better ways to assess work (McArthur, 2023). The Authentic Assessment examined here is the work of an MBA cohort as they look for new ways to improve service delivery and are tasked with writing a ‘Service Charter’ for a City.

1.1. Background to the Study: Developing a Service Delivery Experience through AA

A collective excellence in ‘service delivery’ creates an experience for the consumer which is memorable, affirming, and, most importantly from the commercial perspective, it makes the consumer eager to repeat it. While each business operation has its own style, personality, and particular environment, there are certain constants in the provider-consumer interchange which will, when taken all together in a city, paint a picture of either satisfaction or dislike, contentment or discomfort, efficiency or sloppiness. Using Authentic Assessment and collaborative learning while working with businesses to improve this service experience in a City is the context here. The Collaborative learning process centred on a group of 22 MBA students while they interacted with 20 businesses in a European City to research, develop and write a Service Charter. Details of the development of the charter per se are not dealt with in this paper, just the experience of its development by the students and business alike while being authentically assessed.

Finding novel ways to assess third level students is always a challenge for Higher Education Institutions; hence the value of placement at the fulcrum of learning and business development through a collaborative learning challenge and experiential learning. An experimental approach was afforded to MBA students when they were tasked with writing a ‘Service Charter’, while, in parallel, being assessed through ‘problem solving’ for 5 ECTS credits with the third level partner. The dual aspect of learning between businesses and college began when students, using Authentic Assessment, sought to solve a problem for City businesses and present a solution, and the second, when a recommendation came from the research that the businesses needed to undertake further training in order to implement the plan of the Service Charter. Addressing inconsistencies in the service model and synchronising efforts to grow commercial activity is best addressed through cooperation in the competitive space, an approach known as ‘co-opetition’, coined in 1913 by the Sealship Oyster System in the USA (Jansen van Nieuwenhuizen, 2016) to describe the idea of

cooperative competition, or cooperating with competitors. Its principles are that in cooperating with one another you are creating more business, you are in ‘coopetition’ not competition, working together to common advantage (Jansen van Nieuwenhuizen, 2016). Co-opetition is a perspective on business relationships which highlights the ambivalence of competition and cooperation (Stein, 2010). The City business community at the core of this paper is now leading the way, joining together to establish a coordinated approach to the quality of service in their City. Also, for educators there is a need to move beyond the conceptualisation of education as a simple acquisition of knowledge to one which nurtures and assesses innovation and expertise in the utilisation and application of knowledge, (Boland, 2010), achieved here through Authentic Assessment.

1.2. The Taks: Develop A City Service Charter Using Authentic Assessment

A relatively new concept and not widely embraced (limited literature), the purpose of a Service Charter is to outline and detail the standards a customer/visitor/client can expect when engaging with service providers in a City. A City Service Charter is a collective commitment by all those engaged in the daily service life of the City to focus on the needs and preferences of their customers, motivated by values such as respect, integrity and excellence. Among an extensive set of aspirations, some of the following desirable ones are: 1. Commitment to cooperation by all sectors of service providers in instilling a sense of ‘pride of place’ and service excellence; 2. Enhancing the customer experience by being attentive to all aspects of City life; 3. Constantly monitoring and communicating; 4. Ensuring staff are trained to be thoughtful, courteous, motivated. When writing a Service Charter, it is necessary to define the purpose, scope and standards of your business’s commitment to customer service so that employees and customers know what to expect (smallbusiness.chron.com).

2. Literature

This section briefly examines some of the terms in the context of the literature that were applied in this investigation; assessing in Higher Education; starting with Authentic Assessment the main assessment approach that encompasses, Problem Based, Experiential & Collaborative Learning.

2.1. Authentic Assessment, Problem Based, Experiential & Collaborative Learning

Authentic Assessment concerns students in higher level institutions deeply examining issues in a real-life setting that are relevant to their field of study (Ashford-Rowe et al., 2014; McArthur, 2023). This type of assessment allows the students to become immersed in the real-life problem, transferring later to the future graduate’s skills that they bring to the workplace (McArthur, 2023). Problem Based Learning (PBL) an element of Authentic Assessment began in the the medical and health sciences, progressing into mainframe Higher

Education. A learner-centered approach, PBL is where students engage with a real-life problem (Savery, 2006). PBL is complex in nature and not simply a teaching technique, but a total educational strategy (Barrett, 2005). PBL is a very specific approach to education learning and it affords students space and time to define their own learning and to be creative (Barrett, 2005; Kahn & O'Rourke, 2005). Students are tasked with developing novel solutions which facilitates interactivity with businesses and each other to enhance learning (Barrett, 2005). Experiential learning also enhances student learning in higher education and (Kolb & Kolb, 2107) developed a model of learning based on the notion that the best learning is achieved through involvement, reflection, and action, placing action into the management learning model.

Looking at collaboration, Roschelle & Teasley (1995) found it to be a coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem. Dillenbourg (1999) found that it is challenging to agree on what collaborative learning is and, in its broadest context, means that learning happens together. Learning can involve two or more people, groups, or communities learning together, and at all levels. Dillenbourg (1999) suggests that collaborative learning is an activity of joint problem solving, and learning is expected to occur as a side-effect of problem-solving, measured by the elicitation of new knowledge or by the improvement of problem-solving performance. The pedagogical sense is prescriptive; one asks two or more people to collaborate because it is expected that they will thereby learn efficiently. The psychological sense is descriptive: one observes what two or more people have learned, and collaboration is viewed as the mechanism which caused learning (Dillenbourg, 1999).

3. Methodology

The study explores Authentic Assessment practices and seeks to understand if there is a benefit using this assessment strategy in collaborative learning experiences using PBL. Twenty-two MBA students and 20 businesses were involved in this research as well as one member from City Hall. A mixed methods approach was applied and both sets of data were triangulated (Patton, 2012). To examine the experience of the learning of the students a positivistic research methodology was applied as quantitative facts can be directive and informative (Harvey, 1998). A quantitative survey instrument using a Likert scale was developed after the learning, and in conjunction with colleagues involved in department programme development. The questionnaire was tested to eliminate any errors and cleansed prior to execution. All 22 MBA students were asked to fill out the survey in person in a class setting to ensure 100% participation. The survey was completely confidential so that private contributions and negative experiences where they arose could be provided in confidence (Harvey, 1998). All ethical concerns were addressed including informed consent, withdrawal, data used and storage in line with GDPR. Students were given the freedom to

make genuine comments about their experiences. Comment boxes were also included to gather deeper insights and opinions which are informative. For the second element of the research, the business participants were asked in person about their experience with working with the students and their implementation of the Service Charter. A qualitative methodology was applied as it was believed that a post-positivistic approach (Patton, 2012) would gather in-depth answers from participants about their experiences. In all, 20 City centre businesses participated in the interviews. An interview guide consisting of 10 questions which focused on their overall experience, learnings, and suggestions for the future. The City Hall contact was also asked to participate in the research to add to the data. A pilot interview was conducted, and all cleansing and ethical considerations were applied. Due to the importance of this Service Charter and the future of the project, all the businesses who participated in the project completed the interview along with the City Hall; 21 participants in total gave their full consent.

4. Findings & Discussion

This section sets out some of the pertinent findings; however, the restriction of the paper limits the presentation of all findings.

4.1. AA Student Experience

Authentic Assessment, examining PBL at MBA level was found by the students to be appealing and stimulating. Of the 22 students, 87% stated that it was a positive experience. Stress was mentioned by 5% who maintained that it was a taxing experience overall. When asked about solving problems together as a group to come up with a plan, 66% stated that working in a class group was enjoyable overall. In terms of personal development, 39% stated that it improved their professional development skills, with 30% stating that the process will benefit their interpersonal and employability skills in the future due to the specific nature of the task of dealing with City businesses and City Hall.

From a negative stance, students outlined that the real-life challenge was stressful as they were tasked with delivering a working document that was to be implemented by City Hall and participating businesses. 25% of the students worried initially that they may not be “up to the task”, or, “the standard required”, as the work was of the level of a “professional consultancy”. “I was gravely concerned initially; what if it all ‘fell flat’ and was not of the standard expected by City Hall, and also, how could this impact on my overall MBA results?” Another student stated that they were “worried that they may not be able to deliver the required document in the given term time”.

Other positive encouraging comments included; “I felt excitement, joy and happiness when we met the deadline and the City representatives loved our Service Charter”. Another student

stated that “I cannot explain the sheer delight at seeing the final colour version of our plan in beautiful red, the colour of our City”. “It was such an honour to complete this work for City Hall”. The final statistic showed that the students were very satisfied with this Authentic Assessment for MBA level; 90% stated that they would love more collaborative learning with industry in the future for other modules.

4.2. Experience of the City Businesses

Findings from the City businesses were extremely positive. They enjoyed working with the students on developing the Charter. Positive comments included, “I enjoyed working with younger people to determine how they viewed our City and our service delivery”. Another participant said it “was a novel experience and I learned so much more about overall service delivery”. The next retailer said, “we have to be competitive as a City and this project focused our minds on how to be more competitive!”. Two contributors mentioned that businesses need to work more closely together and not to dwell on competitiveness”. This of course is the whole ethos behind co-opetition. “The three new principles for the City developed by the MBA students from their research of ‘Service, Customer, and City Principles’ are something that we can now strive to achieve as businesses and in a wider context as a City”. Other participants greatly appreciated the training offered to learn how to implement the charter that the students devised. “It was exciting returning to further training”. “We learned so much from it”.

Some negative comments included, “the timing was bad for my business”. For me, “the induction day was too long as I had to find staff cover”. Timing will always be an issue for us. We are retailers always on the go”, but the “summertime was definitely the wrong time due to staffing issues”. City Hall stated that one of the learnings was to run the training just before the summer as many shops get temporary staff in over the summertime, so the mystery shopper audits can be affected. For the next roll out, we will run it in February. The next challenge will be to move beyond the 20 businesses that participated and to have a City-wide implementation of the new City Service Charter.

The following *Figure 1* outlines the cycle of learning from the process:

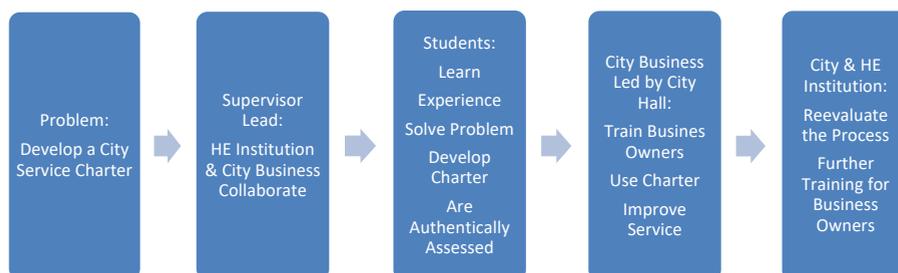


Figure 1. AA - Collaborative Educational Experiential Learning Cycle

5. Conclusion

Authentic Assessment is a challenging process for students and lecturer alike; however, to be challenged is to learn and to learn one must be challenged. Setting a real problem through AA and encouraging enquiry, is a perfect way to assess students in Higher Education settings (Biggs, 1999). The findings of this research are very positive in the context of AA using PBL and collaborative learning with a HE institution and local businesses. Theorists provide much debate around the ideas & philosophies for the use of PBL and advocates of collaborative and PBL provide compelling benefits in the literature for their use. This has been reflected in this current research. Using AA and collaborating through problem solving can provide original and exciting challenges for instructors and students. The benefits of this type of learning experience and assessment for the students especially at MBA level are all-encompassing as MBA students need and deserve to be challenged. PBL means the students can become part of a 'real life' collaborative team in an organizational setting; in this case a City scape setting. Authentic Assessment provides relevant student engagement and although it is a more challenging process for lecturers to oversee, the realities are that it helps to counteract any opportunities for contract cheating, now real concerns for Education. Overall, solving the problem, developing the charter in this case and the continuation of the learning was a very positive experience for all. The MBA students helped decipher the mindset of the City business community by conducting surveys among regular shoppers, tourists, occasional visitors and residents, and consulting broadly with many interested contributors. Students became richly engaged in the process. The end of this AA resulted in a valuable Service charter which will guide the consumer experience in the City into the future and set a precedent for similar charters throughout Europe. The operationalization of this charter continued the cycle of learning, as all the 20 service providers who signed up to the charter undertook a short training courses to facilitate its implementation. This training will be ongoing, with protagonists engaging with those who experience the City routinely. The Service Charter, guided by values such as pride of place, integrity, accountability, respect and excellence, will lead to improved service delivery, customer service and, ultimately, increased profits in a positive cooperative community, while the benefits to the HE community can be reassurance as to the reliability of this assessment approach that avoids opportunities for assessment deception by students.

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Mind the gap: factors which inhibit supporting student teachers to engage in action research while on school placement

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Abstract

In the Irish context, there is an expectation for research to be embedded across the continuum of the teaching profession, including initial teacher education. The Teaching Council has set out the requirement for student teachers to engage in research on their own practice, while on school placement, which links learning in their higher education institutions and the host school. This paper aims to examine some of the factors which inhibit support for student teachers to engage in action research while on school placement. This case study uses a constructivist and interpretivist philosophy. The design and analysis are underpinned by the triangulation of qualitative data collection through questionnaires, focus groups, group interviews and semi-structured interviews. Themes are developed using thematic analysis. Key findings include challenges encountered in supporting student teachers to engage in action research, not least conducting research ethically, and the power dynamics at play in school placement.

Keywords: *Initial teacher education; action research; student teachers; school placement.*

1. Introduction

Increasingly, knowledge-based societies require a consistent supply of quality teachers who are equipped with the skills to actively engage in ongoing professional development and to conduct school-based research to develop a culture of professional learning and sharing in school settings (Darling-Hammond, 2017). A teaching practicum, or school placement is a mandatory part of the preparation for teaching in most jurisdictions (OECD, 2022) and is regarded by the Irish Teaching Council as the ‘fulcrum’ of teacher education (Teaching Council, 2020, p. 9). By integrating new pedagogical knowledge and skills into initial teacher education (ITE) and working in partnership with schools to develop reflective practice, student teachers are facilitated to incorporate theory and practice (Hall et al., 2018; OECD, 2019).

The Department of Creative Education in Atlantic Technological University (ATU) undertook funded¹ research to develop a framework model to support student teachers of technological subjects engage in action research while on school placement. This paper aims to present initial findings that identify some of the challenges which inhibit student teachers from engaging in action research on school placement. This paper contributes to the growing field of study relating to teacher education in Ireland, with a specific focus on technical education. It begins by examining literature pertinent to school placement and follows with a description of the methodology employed to gather data. Findings from the research are discussed and the paper concludes with some recommendations. The term ‘co-operating teacher’ is used to describe a teacher who provides support for a student teacher on school placement. Teaching Council documentation refers to this person as a *Treoraí*, the Irish word for ‘guide’.

2. Literature

The quality of an education system depends on the high standards of its educators (OECD, 2019). Reflective practice and research-informed teaching are recognized internationally as supporting quality teaching (Darling-Hammond, 2021). Significant developments have been made in ITE in Ireland in the last 30 years, in response to changing social and economic demands, as well as in response to a proliferation of academic research in this area (Hall et al., 2018). Among these changes was the establishment of the Teaching Council in 2006, which is tasked with establishing and increasing high standards for teaching and teachers (Teaching Council, 2020). The Teaching Council aim to reconfigure ITE to meet the ever-changing demands of society and learners in the 21st century. Their *Research Strategy* sets out three pillars “Research, Reflective Practice and Relationships” to support research-

¹ This study was funded by a Research & Innovation Strategic Endowment (RISE) Scholarship from ATU.

informed teaching (Teaching Council, 2016, p.1). As well as informing policy and decision making in the Teaching Council itself, the strategy also aims to develop a “vibrant research culture within the profession, whereby teachers as reflective practitioners and enquiry-oriented learners are actively engaging in and with research” (Teaching Council, 2016, pp.1-4). This strategy aligns with findings from international studies of high functioning education systems, where there is a focus on research in teacher education, and where graduate teachers are equipped to use research critically and reflectively (Sahlberg et al., 2012).

Of relevance to this paper is a requirement by the Teaching Council for student teachers on school placement to “engage in research on their own practice”, that makes connections between their learning in higher education institutions and practice in school (Teaching Council, 2020, p. 13). Internationally, practitioner research is viewed as being particularly suitable for student teachers in ITE (Cochran-Smith et al., 2009). It is premised on the belief that they can develop professionally by examining and reflecting on their own learning, as well as their teaching and learning (Qing-li et al., 2019). Action research is one approach. It is based on a cyclical process of self and critical reflection, evidence gathering, planning, implementation and review (Mc Niff, 2017).

3. Methodology

Using a constructivist and interpretivist philosophy, the research design for this case study facilitates triangulation of qualitative data collection, through questionnaires, focus groups, group interviews and semi-structured interviews. It has a single specific area of focus, which is to gain an insight into some of the factors which inhibit support for student teachers to engage in action research while on school placement. This gives a holistic view of the issues from the perspectives of different stakeholders (Denscombe, 2017). Reflexive thematic analysis was used to develop themes from the qualitative data (Braun & Clarke, 2006, 2019). Ethical approval was obtained from the Research Ethics sub-committee of ATU, and this study abided by the ethical standards set out in the ATU research ethics policy.

Participants were selected strategically, based on their expertise in the field of education and their subject specialist knowledge. The population represented four groups of education stakeholders. Group one consisted of post-primary school principals (n=15), and group two of post-primary subject specialist teachers of Design and Communication Graphics and Construction Studies (n=10). For these groups, stratified random sampling was used to create a sampling frame and schools were selected proportionally from the Department of Education’s online database of schools in Ireland (Department of Education, 2021). Group three comprised of school placement tutors (n=6) from ATU, reflecting a mix of genders and experience levels, who participated in a focus group. Group four consisted of education experts (n=3), identified based on their own field of study in ITE, who took part in semi-

structured interviews with the researcher. While this paper focusses on the stakeholders pertinent to school placement, due to time constraints, the scope of this study excluded student teachers, their pupils, and the parents/guardians of pupils.

4. Findings

In the online questionnaire and interviews, participants were asked to consider from their perspective, “What challenges might there be for student teachers to engage in action research?” Power dynamics and the challenges of meeting requirements to research ethically were identified as potential inhibiting factors, which are discussed further below. Participants were anonymized using the following key: principal in questionnaire (PQ 1-15), subject specialist in questionnaire (SSQ 1-10), principal in group interview (PGI, 1-3), subject specialist in group interview (SSGI), school placement tutor (SPT 1-6), subject specialists (SS1-3) and education experts (EE 1-3) in semi-structured interviews.

4.1. Power Dynamics

That tensions in professional relationships exist in schools between principals, teachers, and student teachers, emerged during the analysis of data. Participants suggested that power dynamics could negatively impact on the student teacher’s ability to fully engage in action research while on school placement. An aspect of this was the predicament which might exist if student teachers were pressurized by school management to engage in supervision of classes, or other school activities, at the expense of time allocated for college attendance or research practices. EE3 described how, in their experience, student teachers are faced with the dilemma of “wanting to do the work for the principal, for financial reasons, but also to keep the principal happy, but...they’re trying to also do their thesis.” EE1 suggested that the solution was in empowering student teachers to advocate for themselves, to enable them to address the power dynamic and to withstand the pressures which might be exerted on them in schools. However, EE1 also acknowledged that the ad hoc nature of school placement impeded structured supports: “we help the students advocate for themselves, but in practice because of that lack of formalised structure, and the power dynamic...some students just do not get the support for a range of reasons.”

Another aspect of the power dynamic related to the role of the co-operating teacher. Teaching Council documentation states that “the student teacher shall discuss their research plans with the Treoraí [co-operating teacher], as they have overall responsibility for the class” (Teaching Council, 2020, p. 19). However, EE1 noted that in Ireland “teachers aren’t chosen for their skills as co-operating teachers, they are chosen because they are the class teacher... so the age-old issue is that co-operating teachers are not trained or recognized [as co-operating teachers]”. This perception suggests that there may be a reticence, reluctance or even a lack of skill, on the part of the teacher, in their role as co-operating teacher and researcher. This

reticence was evident in the online questionnaire from both principals and subject specialists, who were asked to outline the challenges there might be for student teachers to engage in action research. SSQ5 suggested that there may be a “reluctance of schools and staff to participate”, while PQ8 intimated an “unwillingness of others to engage”. PQ6 implied that there might be a challenge of “getting the co-operation from other staff who might be willing but not see it as a priority”. A different aspect of the power dynamic was articulated by PQ5 who expressed this as “(how) to explain what is involved to students and how to ensure teachers don't feel vulnerable”. This alludes to a consciousness on the part of teachers around deficiencies in their knowledge about action research, which may challenge their own perceptions of being an expert. For some, this may result in them feeling exposed professionally. These and similar comments, allude to challenges for student teachers who are required to engage in research, yet may face a lack of support from staff in schools.

4.2. The Challenges of Researching Ethically

Researching ethically is based on the principles of honesty, reliability, respect, and accountability (All European Academies, 2017). A range of challenges to researching ethically emerged in the analysis of the research data. PQ3 identified the principle of informed consent: “I think it is important that all involved know the research is taking place”. However, there did not appear to be alignment between respondents as to how this should be achieved. PG11 was prepared for student teachers to use the school's consent policy, however, they would be constrained by this and “you'd have to be very clear with the students that they obviously are bound by the school policies and have to work within those parameters”. This differed from PQ9 who wrote, “I would be happy that parents and students are aware and that parents can sign for their students not to participate only”. While PQ8 noted that “without signed permission the school could find itself it a trick[y] situation.” Others held differing views. SSQ9 felt that “depending on the nature of research and assuming student work is anonymous, I don't see the need for informing parents/students”. These comments highlight both the varied understanding of the ethical requirements for consent and the range of differing approaches in place in schools.

Another aspect relating to informed consent emerged, that of problems which the requirement for consent from participants might pose for the student teacher undertaking research. As EE1 put it:

One of the other issues was parental consent...the age-old issue of handing out these letters and getting them back in. You know that they were never coming back in. So, it's... caused issues with the data collection...What do we do with kids who can't be involved?

There are a range of potential challenges raised, including when data collection can begin and how to navigate lack of permission with pupils in the class. Other concerns were raised

by SS3 who suggested that the refusal of parental consent might single a pupil out in class “(t)he student themselves might feel excluded...everybody else in the classroom is handed out a questionnaire and...they're not allowed to ... take part in it”. This could result in classroom management issues for student teachers, as they navigate how to deal sensitively with the situation. The literature suggests that where consent is not obtained, the researcher “should decide whether this was an active refusal of consent, in which case they would need to respect this and find a practical solution.” (BERA, 2018, p. 12). As these are real issues, a policy might be devised to support student teachers in dealing with these scenarios.

Another area on which there was significant consensus, was on the issues raised by the General Data Protection Regulation (GDPR). Enacted in 2018, there is a high awareness of this legislation in schools. Among the respondents in the online questionnaire this knowledge was in evidence, as articulated by PQ1 “(t)he whole area of GDPR needs to be respected by and complied with by everyone concerned”. However, there were few specifics as to what this might include, apart from the legal requirements involved and here seemed to be some confusion between GDPR and informed consent, as indicated by SS3 “GDPR would be another issue...and you would find that...could be one of the most difficult parts of the work, is actually getting permission from parents...whether it be a signed document or ...getting them to respond to an email.” EE1 summed up the impact of these difficulties “I think it's getting more and more difficult involving the pupils in the schools”. However, once there is an awareness of the issues, it may be possible to put measure in place to address them. In relation to gathering informed consent, SSG11 proposed that it might be of use “if there was some sort of...a consent form, with...the header from [name of TU]” Therefore, a generic form could be designed, and adapted for use by student teachers, to be shared with research participants in schools.

5. Conclusions

The findings presented in this paper suggests the requirement for a national policy on informed consent, which could be developed by the Teaching Council as part of their strategic plan for 2022-27. Their goal for developing collaborative professional communities for sustainability, includes developing greater collaboration between stakeholders in education (Teaching Council, 2021). However, this is a complex issue, as the Teaching Council, while responsible for developing effective policies, regulation, and research in relation to education, are not responsible for the dissemination of this at a local level in schools. The recommendations of the *School Placement Working Group*, in relation to the training of co-operating teachers, awaits implementation (Teaching Council, 2019).

The aim of this paper was to examine some of the factors which inhibit support for student teachers to engage in action research while on school placement. Pressure on student teachers

to engage in supervision and substitution of classes in schools, issues around effective support from co-operating teachers, who may feel professionally vulnerable, a lack of consensus on informed consent and difficulties posed by GDPR, have been identified as potential inhibitors. In the absence of a national policy, one recommendation of this paper is that the Department of Creative Education in ATU develop documentation and resources which support action research, informed consent and GDPR for student teachers engaging in action research while on school placement.

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Ability of Spanish preservice teachers to differentiate between creative and reproductive activities in the classroom

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Abstract

Creativity is a key competency for the 21st century society and the development of certain scientific aspects related to creativity should constitute a priority in education. But to do so, teachers need to have the skills, confidence and pedagogical knowledge necessary. This paper investigates the ability of 190 Spanish future teachers to differentiate between creative and reproductive activities in the science classroom. Using the instrument prepared by Newton and Newton (2010) they were asked to rate a set of activities according to their capacity to develop scientific creativity. The results show that both the field of knowledge and the scientific topic influenced their responses, although they were able to differentiate between creative and reproductive incidents, with statistically significant differences in both topics studied.

Keywords: *Scientific creativity; classroom activities; preservice teachers.*

1. Introduction

The importance of creativity and creative thinking is recognized in the OECD reports and it has been included in the last PISA tests in 2022 (OECD, 2019). It is also considered a key competence for the 21st century (Henriksen et al., 2016). Consequently, there are references to creativity in the syllabus of many countries (Patston et al., 2021) and the recent Spanish Educational Law states that “[...] artistic creation, audiovisual communication, digital competence, the promotion of creativity and the scientific spirit will be worked on in all areas of Primary Education” (LOMLOE, 2020, p. 122873).

Thus, creativity should be present in all school disciplines and teachers will be responsible to training students with creative skills and competencies (Soh, 2017). However, the difficulty in defining creativity and the poor teacher training regarding creativity causes hesitation and doubts in its implementation (Mullet et al., 2016). Early childhood and primary teachers have stated that they feel unprepared to effectively promote student creativity in the classroom (Cheng, 2010). The study of Bereczki & Kárpáti (2018) show that inservice teachers, despite holding positive beliefs towards creativity, did not propose activities that foster creativity in their teaching practices. Recent studies with Spanish preservice teachers (Echegoyen & Martín-Ezpeleta, 2021; Martín-Ezpeleta et al., 2022) show that, despite their creative self-perception, their real creativity demonstrated in different academic works is not sufficient to promote creativity in the classroom.

With respect to science, there is an international consensus that it is intrinsically creative, and that the development of certain scientific aspects related to creativity should constitute a priority objective of education (Hetherington et al., 2020). There are different factors that can influence scientific creativity such as convergent and divergent thinking, general creativity and domain specific creativity, inquiry skills, or knowledge about science, among others. Newton and Newton (2010) proposed three types of activities to enhance scientific creativity in the classroom: a) through the speculative description of situations with tentative, hypothetical explanations and their possible alternatives; b) gathering knowledge and assessing ideas (such as proposing a method to gather reliable and descriptive information or an empirical test that allows contrasting a hypothesis); and c) applying scientific knowledge to solve a daily problem.

There are, however, different studies that point out to a lack of teacher preparation to adequately implement creativity in the science classroom (Ramnarain, 2018), despite its importance. Newton and Newton (2010) found difficulties in some primary education teachers to distinguish between creative and reproductive activities in the science classroom. Cruz et al. (2020) found that primary preservice teachers were not completely able to pose questions related to the primary education curricula for the development of scientific research activities. Another study (Izquierdo & Solaz-Portolés, 2022) shows that the inquiry skills of

Spanish primary preservice teachers are low. In this context, this study aims to evaluate the ability of Spanish preservice teachers to differentiate those science classroom activities able to promote creative thinking from others that were just reproductive activities where no creative thinking was involved.

2. Methodology

An *ex post facto* descriptive design was used to analyze the ability of Spanish preservice teachers to differentiate between creative and reproductive activities in the science classroom.

2.1. Participants

Participants were 190 students in their sophomore year of the Early Childhood Education Teaching and Primary Education Teaching degrees of a large Spanish university. This was a convenience sample pertaining to 6 different natural groups. 163 (85.8%) were female and 27 (14.2%) were male, which corresponds to the population of study.

2.2. Instrument

The proposed classroom activities were selected from the instrument developed by Newton and Newton (2010). Originally this instrument was comprised of 36 short classroom incidents in three dissimilar science topics: “Earth, Space and Gravity”; “Electricity”; and “Plants and Animals”. For the present study only 20 incidents related to the first two topics were used to not overload the participants. There were eight incidents favouring creative thought in science and eight incidents biased towards reproductive thought in science (four related with descriptive science and four with explanatory science). These 16 items corresponded to Field 1 (constructing notional scientific knowledge such as speculative descriptions of situations, tentative explanations, hypothesis, etc.) and Field 2 (constructing empirical ways of gathering knowledge and evaluating ideas). Four additional items were related to incidents in Field 3 (applying scientific knowledge to solve a practical problem). The various categories of items (descriptive-creative, descriptive-reproductive, explanatory-creative, explanatory-reproductive, problem solving-creative, problem solving-reproductive) appeared equally for each of the two topics. The degree of stimulation of creativity in each situation is asked to be rated using a 5-level Likert scale, where the lowest level means “no opportunity to develop scientific creativity” and the highest-level means “a very good or great opportunity to develop scientific creativity”.

2.3. Data analysis

Descriptive statistical analysis was done using SPSS software version 28. Particularly mean and standard deviation was calculated for each of the variables. To check the normality of the distributions Kolmogorov-Smirnov test for one sample was used. Although not all of

them presented normal distributions, the fact that mean and median values were similar and the analysis of Q-Q plots showed little deviations of normality (in the distribution tails) suggested the use of parametric tests. Thus, Students' t test for paired samples was used to compare the ability to differentiate between creative and reproductive activities. The significance level was set at .05.

3. Results

The mean scores (standard deviations in brackets) for each type of activity in topic 1 “Earth, Space and Gravity” and topic 2 “Electricity” are shown in Tables 1 and 2, respectively. They show that the creative activities in Fields 1 and 3 are generally scored higher than the reproductive ones. They have more difficulties in Field 2 (empirical ways of gathering knowledge) since the scores are similar between creative and reproductive activities in this field and even they give a higher score to the reproductive explanatory activity in field 2 in topic 1 (M = 3.64) than to the creative one (M = 3.58). It is worth pointing out that the items in fields 2 and 3 tended to obtain higher scores than those in field 1, independently of their nature. This indicates that these preservice teachers consider that practical and problem-solving activities have a higher capacity to foster creative thinking in science than the non-practical ones.

Table 1. Main scores awarded to the incidents in the different fields for topic 1: “Earth, Space and Gravity”. (The higher the score, the greater the perceived opportunity for creativity).

Field	Reproductive activities			Creative activities		
	Descript	Explanat	Problem_solv	Descript	Explanat	Problem_solv
1	3.11 (1.13)	2.57 (1.07)		3.64 (.94)	3.90 (.91)	
2	3.69 (.97)	3.64 (.99)		4.23 (.87)	3.58 (.93)	
3			3.56 (1.08)			3.83 (.96)

Comparing our results to those obtained by Newton and Newton (2010) with in-service teachers, it is apparent that the difference in the scores obtained by creative and reproductive activities is much lower in the case of preservice teachers. The mean scores also tend to be higher in the case of preservice teachers: in the study of Newton and Newton (2010), the highest score of 3.04 was awarded to descriptive creative incidents in field 1 in the topic “Electricity”, while in our study there were mean values above 4 points in four cases, one in the topic “Earth, space and gravity” and three in the topic “Electricity”. In this last topic a mean score above 4 was awarded even to descriptive reproductive activities in field 2. This could be due to the fact that the sample in this study is composed of preservice teachers at their sophomore year, so they might not have yet assimilated what it means to be “creative in a science classroom”.

Table 2. Main scores awarded to the incidents in the different fields for topic 2: “Electricity”. (The higher the score, the greater the perceived opportunity for creativity).

Field	Reproductive activities			Creative activities		
	Descript	Explanat	Problem_solv	Descript	Explanat	Problem_solv
1	2.71 (1.06)	2.82 (1.11)		3.74 (.94)	3.65 (.84)	
2	4.27 (.94)	3.95 (1.06)		4.27 (.70)	3.93 (.87)	
3			3.57 (1.11)			4.10 (0.87)

A more general view of the results can be found in Table 3, where the scores of all creative and reproductive activities are grouped by topic. It is apparent that in all cases, the scores awarded to creative incidents are higher than those awarded to reproductive incidents for both topics. To assess if those differences were statistically significant, Students’ t test for paired samples was carried out. The results (see Table 3) showed that it was statistically significant in all cases, with a large size effect in both of them as considered by Cohen (1988) for behavioral sciences.

Table 3. Descriptive statistics and results of the t test for paired samples for the scores awarded to creative and reproductive incidents in both topics.

	Min	Max	Mean	SD	t	p	d
Creat topic 1	2.67	5.00	3.79	.52	12.202	<.001	1.05
Repr topic 1	1.75	5.00	3.25	.68			
Creat topic 2	2.60	5.00	3.94	.51	8.587	<.001	.78
Repr topic 2	1.20	5.00	3.47	.75			

It is also worth pointing out that this group of preservice teachers gave higher scores for both reproductive and creative activities in topic 2 than in topic 1. This can be due to the fact that, as Jarvis and Pell (2004) stated, most primary teachers (and also preservice teachers) are not science specialists and their knowledge in the different topics may differ, which will make more difficult to assess the ability to promote creativity in one topic than the other. It is also worth noting that some students gave high scores (even the maximum score of 5 points) to reproductive activities in both topics, and that the mean score of reproductive activities was also high, which might indicate that they do not understand what creativity in science is and how to foster it.

4. Conclusions

The results of this study show that Spanish preservice teachers are in general capable of differentiate between reproductive and creative activities in the science classroom. However, the results are not completely satisfactory. The set of items considered creative obtained similar results to those obtained in previous studies (Newton & Newton, 2010), so there was

a clear recognition of those activities as opportunities to develop creativity in students. On the other hand, most of the participants also valued reproductive-type activities as good opportunities to develop the creativity of the students, contrary to what was expected. This could be related to the type of training received at the faculty of teacher training, with little disciplinary specialization (in this case, in science) and a lot of general and transversal didactic training, being both parts of the pedagogical content knowledge (Gudmundsdottir & Shulman, 1987).

Didactic training received by these preservice teachers is generally based on preparing activities whose value seems to be given to the procedure and materials (what is done and how), but not always to its content (what must be learned). Therefore, when they are presented with activities involving manipulation or involving innovative materials, they tend to think that there is also an opportunity to develop creativity even if those activities are of a reproductive type.

Thus, there is a need to improve the training of teachers in the development of creativity in the scientific field for which a supportive learning environment encouraging curiosity, inquiry and innovation is key. Teachers need to consider the learning objectives, level of student engagement and autonomy, complexity, and assessment method, which focus is different in creative and reproductive activities. By doing so, they can design activities that promote creativity and critical thinking, and help students to apply their knowledge in new and innovative ways.

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Special needs pre-service teachers digital competencies: an exploratory study at the University of Foggia

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Abstract

In Italy, K-12 teachers and school institutions' digital competencies were under the average in the OECD Countries (Talis Survey, 2018), and they struggled during the lockdowns due to the Covid-19 pandemic, which has forever changed the way in which the didactic is provided.

The University of Foggia Learning Science hub (LSh), in Italy, works on designing and planning new methodologies to teach digital skills to pre-service teachers (especially special needs teachers), in order to enhance their knowledge and use of digital skills in planning and providing interventions, lessons and courses.

To guide the designing and planning activities, we have administered the DigComp 2.2, the newest version of the self-report questionnaire of the Digital Competence Framework for Citizens created by the European Commission, to 338 teachers attending a specialization course to become special needs teachers at the University of Foggia in the current Academic Year (2022/2023).

In the present study, the collected results of the survey will be analyzed and discussed, becoming the cornerstone of LSh research in this field. At the end of the specialization course, the survey will be proposed again, to compare teachers' digital skills at the beginning and the end of the course.

Keywords: *Digital competencies; pre-service teachers; DigComp 2.2; teaching methodology.*

1. Introduction

In recent years, especially after the Covid-19 pandemic, educational research has mainly focused on understanding how to improve the digital skills of K-12 teachers. Not only “operational” skills, such as how to use a videocall software, but also a new knowledge about the possibilities offered by the didactic digital software and tools in designing and planning a lesson or a whole study course.

Even though the importance of implementing digital tools in didactic environments, from digital softwares, personal computers and devices (e.g. smartphone or tablet) to the implementation of digital methodologies and environments (e.g. Digital Game-Based Learning, Gamification and Serious Games) has been enhanced by the Covid-19 pandemic, teachers and researchers can’t ignore the impact that the “digital world” has had and is having on the students (Nazempour et al., 2022).

The Digital Natives use technologies and digital tools everyday in every aspect of their lives (Coggi & Emanuel, 2022). All the actors in the school environment – from pedagogists and academics, who research everyday new methods and methodologies in order to help teachers and students, to the teachers themselves, the ones who provide the didactic content and knowledge to students – can no longer continue in providing didactic and pedagogical contents in a tradition and formal way, expecting students to be happy, motivated and committed in the teaching and learning processes.

The University of Foggia and the Learning Science hub (LSH), strongly believe in innovative digital didactic methodologies. For these reasons, the LSH is involved in researching new and more effective ways to teach innovative digital methodologies and technologies to pre-service teachers, like the ones already mentioned: Game and Digital Game-Base Learning, Gamification processes, Serious Games (of which the University of Foggia is also producer) (Di Fuccio et al., 2021), Hybrid and Blended Learning Environments etc.

Nevertheless, improving teachers’ digital competencies and the ways in which those competencies are provided can’t take place without the opinions, thoughts and needs of teachers themselves: the LSH involves pre-service teachers constantly asking for opinions and needs they feel in order to plan new methodologies that can teach digital competencies answering to the teachers’ needs.

2. The context and the sample

The University of Foggia holds the “Tirocinio Formativo Attivo” (active training internship, abbreviated as TFA), a one-year university course aimed at qualifying to teach special needs students in Italian schools. The Italian Ministry of Education plans the course and then it is provided by the single Universities. The course is open to K-12 teachers, and they are divided

into groups according to the school grade they are entitled to teach in. They are divided into *Infanzia* (Kindergarten, 3 to 5 years old), *Primaria* (Primary School, 6 to 10 years old), *Scuola Secondaria di Primo Grado* (Middle School, from 11 to 13 years old) and *Scuola Secondaria di Secondo Grado* (High School, from 14 to 18 years old).

The LSh teachers hold several courses about Psychology and Pedagogy. Among them, there is the Information and Communication Technologies (ICT) course, which is a 150-hours course that aims to provide digital competencies, knowledges and tools to train the teachers in the use of technologies for didactic purposes.

The lectures of the course are provided mostly online. The University of Foggia wants to be an example of good practice about Hybrid and Blended Learning, not only theoretically but practically: even though the lockdowns of the Covid-19 pandemic are over, this doesn't mean that we have to come back to the usual frontal and formal lessons, giving the possibility to attend the course even to people who have not the possibility to travel during holidays (lectures are provided from Friday afternoon to Sunday afternoon, so working people can have the possibility to attend the course as well).

The lessons are structured to be 8 hours long, from 9 am to 2 pm and then from 3 pm to 6 pm; the structure of the single lesson is:

- a first part shaped like a formal lesson, in which the Professor gives theory references and knowledge to the participants (1 hour and 30 minutes);
- a second part in which an innovative didactic methodology, software or tool is presented (30-45 minutes);
- a third part in which the participants must work individually and in groups. In this way, they can not only listen about the digital methodologies, tools, software etc., but they can act like students, doing practical activities with the tools provided (individual exercise and feedback, 2 hours and 30 minutes; group exercise and feedback, 2 hours and 30 minutes);
- in the last part, participants deliver their work to the teaching staff, and there is a moment of immediate feedback: some groups present their work in order to share it with their colleagues and show it to the teaching staff. In this way, there can be a dialogue and a debate among the teaching staff and the teachers attending the course, providing feedback on the methodology of the course itself.

In this edition of the TFA, the ICT course is focused on presenting to the participants innovative digital didactic methodologies. Every group attends to 7 lessons, which topics are:

1. Gamification
2. Serious Games
3. Differences between Gamification and Serious Games

4. Digital Game-Based Learning
5. Hybrid and Blended Learning
6. Elements of Instructional Design
7. Exam and Final Feedback

The macro goal of the ICT course in the framework of the TFA is to provide digital knowledge and competencies to the training pre-service special needs teachers. In order to understand and evaluate the efficacy of the course, the participants have been asked to answer a questionnaire before and after the course. The questionnaire provided before the course and data collection will be shown in the next paragraph.

3. The survey

In the first lesson, participants will be asked to answer a self-assessment questionnaire about digital competencies. The same questionnaire will be administered during the last class, in order to compare the results of the participants and detect if there are any changes in their perceived levels of digital competencies.

3.1. The DigComp 2.2

The survey used in this study is the DigComp 2.2: The Digital Competence Framework for Citizens, also known as DigComp. It provides a common language to identify and describe the key areas of digital competence. It is an EU-wide tool to improve citizens' digital competencies, helping policy-makers to formulate policies that support digital competence building and planning education and training initiatives to improve the digital competence of specific target groups (Carretero et al., 2017). Digital competence is one of the key Competencies for Lifelong Learning, and it was first defined in 2006 (Ala-Mutka et al., 2008). The European Digital Framework (DigComp) was originally developed by the Joint Research Centre, European Commission, in 2013 to identify and define the digital competence that is relevant for all citizens who live and work in Europe today (Clifford et al., 2020); with the 2.2 update in 2022, the aims of the Joint Research Centre are to include the latest discoveries in the technology field, like Artificial Intelligence, Virtual and Augmented Reality and Internet of Things and to keep the DigComp relevant in the learning field (among other) (Vuorikari et al., 2022).

The DigComp is structured in five main areas, each one divided into competencies (Figure 1).

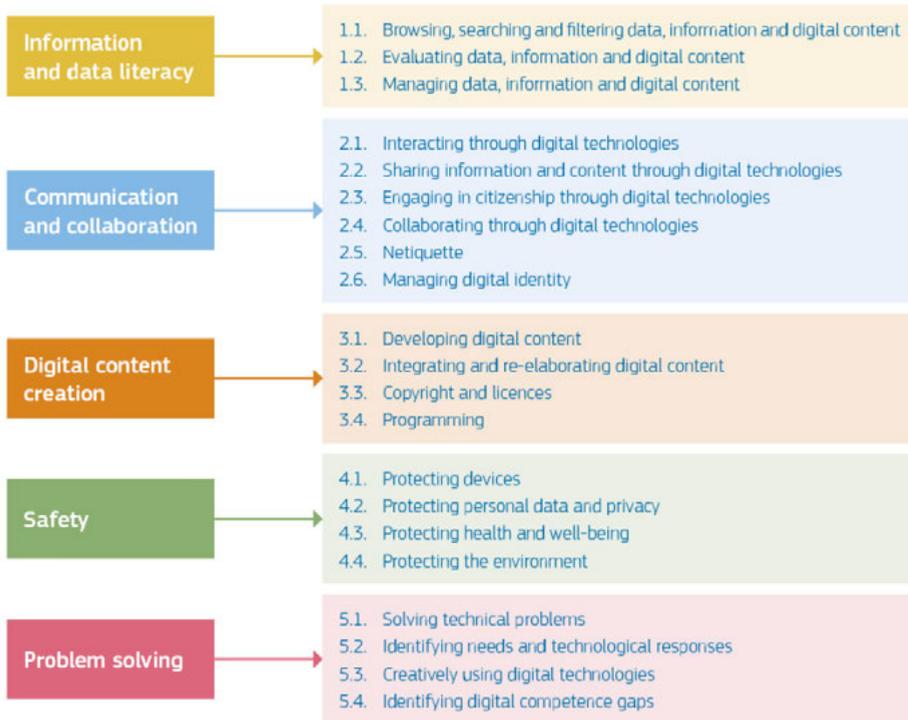


Figure 1. The DigComp conceptual reference model. Source DigComp 2.2, *The Digital Competence Framework for Citizens* (2022).

Every competence is composed by 4 items, except for competencies 4.3 and 5.3, that are composed by 3 items, for a total of 82 items. Every item is measured on a 4-point Likert scale. Total scores that participants can obtain are: Low, Foundation, Intermediate, Advanced.

3.2. Platform and data collection procedure

The participants were asked to answer the Italian version of the DigComp 2.2 on the “mydigiskills” platform (<https://mydigiskills.eu/it/>). They obtain a .pdf file with their results by email. Results showed to participants the total scores that they obtained for every competence, and in every aggregate area. The results are graphic, as shown in Figure 2.

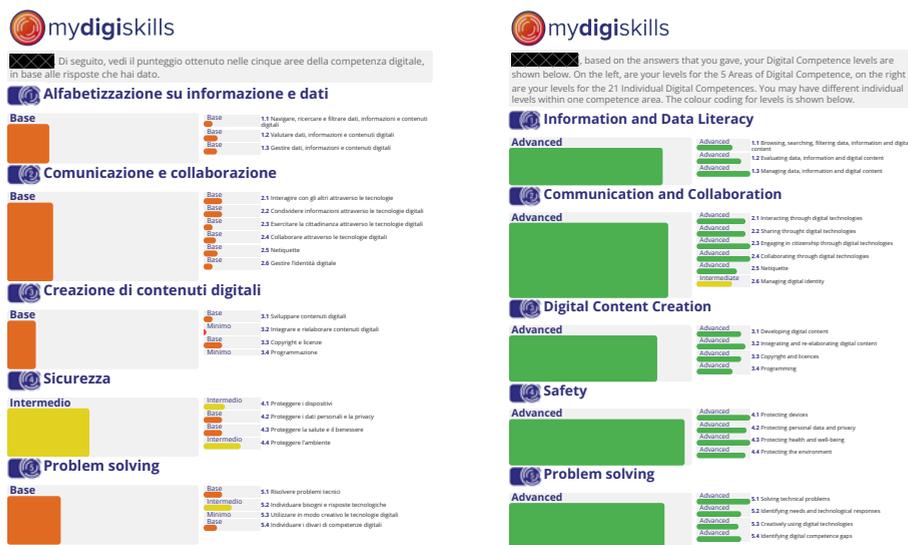


Figure 2. Two DigComp 2.2 results received from the on mydigiskill platform (Italian and English).

Participants were then asked to upload anonymously the .pdf file of their results in a dedicated Google Form. All participants signed informed consent, and they were secured about voluntary participation and anonymity. This study was accepted by the Ethics Committee of the University of Foggia, Italy, and conducted in line with the Declaration of Helsinki.

In the Google Form were uploaded 397 questionnaires. The final sample was composed by 338 teachers (after deleting duplicates). The total scores when then recoded as numbers in order to create an ordinal variable: Low = 0; Foundation = 1; Intermediate = 2; Advanced = 3.

Concerning data analysis, descriptive statistics in terms of means, frequencies and percentages were performed using SPSS 27 (IB Corp., 2020)

4. Results

This work focuses on the results of the area 3, Digital Content Creation. The reason of this decision is that the competencies of area 3 (Figure 1) are those that relate most to teachers' use of digital skills.

Table 1. Results for area 3, mean and standard deviation. N=338, range = 0-3

Item	M	SD
3.1 Developing digital content	2.15	0.78
3.2 Integrating and re-elaborating digital content	1.71	0.79
3.3 Copyright and licenses	1.75	0.69
3.4 Programming	1.37	0.59
TOTAL	1.74	0.59

5. Discussion and Conclusions

As Table 1 shows, in the area 3, Digital Content Creation, pre-service teachers don't feel very much confident. If item 3.1 "Developing Digital Content" has $M=2.15$, which is quite a good result on a 0-3 range, the item 3.4, "Programming" with $M=1.37$ is actually very low. Nevertheless, the item 3.4 result is not unexpected, since it refers to advanced digital competencies. Looking at the answer for every competence, the highest percentage detected certify the generally average result:

- 3.3 Copyright and licence, Intermediate (53.9%);
- 3.4 Programming, Foundation (49.7%);
- 3.2 Integrating and re-elaborating digital content, Intermediate (44.9%).

These results are showing that pre-service Italian special needs teachers should develop more their digital competencies regarding digital content creation, a competence that can really help in planning and design teaching and learning processes for Digital Natives.

There must be said that these results refers to *Infanzia, Primaria and Secondaria di Primo Grado* schoolgrade: the study is currently going on with schoolgrade *Secondaria di Secondo Grado* (High School). This survey will be developed in the next months, in order to collect a wide overview about Italian special needs pre-service teachers. At the end fo the TFA course, the DigComp 2.2 will be administered again, during the last lesson for every schoolgrade, in order to analyze if there will be any changes in special needs pre-service teachers digital competencies self-assessment, thanks to the ICT course. After the analysis, it will be clear if the structure and topics of the ICT course were useful and efficient in enhancing pre-servicespecial needs teachers digital competencie.

In conclusion, there can be not mentioned that in previous surveys about Italian pre-service teachers digital competencies, Italian pre-service teachers rate their skills higher than other European colleagues, while "they receive slightly lower scores on tests of knowledge about the possibility of using ICT in teaching processes and knowledge" (Tomczyk et al., 2022).

The results of this investigation will be used to reflect and develop new ways to provide ICT and digital competencies courses to Italian teachers and pre-service teachers, in order to allow them to develop and enhance their digital competencies in the educational field.

Further help to this research will be brought by the next OSCE Teaching and Learning International Survey (TALIS), which will be performed during 2023. In the 2018 edition Italian teachers and school institutions digital competencies were rated under the average of the OSCE Countries. The very goal of this research is to provide new methodologies to enhance Italian pre-service teachers digital competencies.

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Advancing internationalization agenda amidst the war in Ukraine: kindness and trauma-informed teaching project in teacher education

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Abstract

The paper aims to describe and analyze graduate students' collaborative online learning project between Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University, Vinnytsia [VSPU] Ukraine, and Worcester State University [WSU], Massachusetts, USA, as one of the outcomes of the internationalization agenda in Ukraine. Since the war in Ukraine and the increased acts of violence in the U.S. require immediate action, the "Kindness and Trauma-Informed Teaching" project is essential. Based on a one-semester interaction for the case study, research, and project work, it is a novel practice at both educational institutions. Graduate students engaged in asynchronous and synchronous activities utilizing Zoom, Google Classroom, and Google Documents. The project was carried out under the auspices of Education USA, the American Council in Ukraine, and SUNY COIL Foundation in the USA. The findings highlight the significance of such partnerships and persuade that this project promotes further collaborative research in teacher education.

Keywords: *Collaborative online international learning; international project; internationalization agenda; kindness and trauma-informed teaching; Ukrainian and American universities; graduate students.*

1. Introduction

The traditional understanding of the internationalization of education is associated with concepts such as globalization, cross-cultural awareness, mutual understanding, research integration, and student /faculty mobility (de Wit, 2019, p. 12; Ge, 2022, p. 229; Gromov, 2022, p. 58; Kuzmina & Glazunova, 2018, p. 294; Lisnychenko et al., 2022, p. 430; Malcolm, 2021, p. 4; Matvienko et al., 2022, p. 344). By definition, these terms entail a significant increase in scope, novelty, change, and challenge. Nevertheless, internationalization is primarily viewed as positive, where evident benefits outweigh shortcomings, although some apprehensions might also arise (Kuzmina & Glazunova, 2018, p. 295). Projecting internationalization on Ukrainian education makes this process a “necessary condition” for higher educational establishments' competitiveness and financial security (Gromov et al., 2022, p. 57; Matvienko et al., 2021, p. 142). Due to global developments, Ukrainian higher education has committed to robust international collaboration in line with the country's political aspirations aimed at European integration (Gromov, 2022, p. 56; Tripses et al., 2018, p. 214). Therefore, Ukraine's internationalization agenda has confidently and steadily become an integral part of higher education policies. Importantly, collaboration has got more versatile, including joining international non-governmental educational organizations as their affiliates, signing partnership agreements with universities, ensuring dual-degree education, guest-lecturing, developing curricula and courses with co-teaching opportunities, and writing research papers (Powell et al., 2014, p. 34; Gromov et al., 2022, p. 59; Lisnychenko et al., 2022, p. 430; Tripses et al., 2018, p.216). Similarly, international collaboration is viewed positively for student motivation to learn foreign languages, intercultural and values awareness (Lisnychenko et al., 2022; p. 440; Matvienko et al., 2022, p. 344)

However, the war in Ukraine endangered the sustainability of Ukrainian education. The air raids, shelling, internally and internationally displaced students and scholars, destroyed infrastructure, and power outages became severe obstacles to educational services. The regular academic communication and interaction paradigms were ruined and seemed irreparable. Nevertheless, progress in technology integration in Ukrainian higher education as a response to the COVID-19 pandemic (Matvienko et al., 2021, p. 141) and advances in the internationalization agenda achieved before the war helped resume schooling and internationalization agenda pursuits.

2. Methodology

The research describes the collaborative online learning of kindness and trauma-informed teaching by American and Ukrainian graduate students. The authors intended to design the project first, to provide students with an understanding of the significance of teaching kindness, trauma, and stress responsiveness in educational practices because of the war in

Ukraine and increasing violence in the USA. Second, to promote international collaboration in teacher education.

The project was integrated into the Traditions of Academic Collaboration: International Experience class offered at VSPU graduate school in the fall semester (October – December 2022) and the Trauma-Informed Learning class taught to WSU graduate students. This empirical research examines graduate students' behavioral patterns and attitudes to designated activities, consisting of F2F lectures, thematic scientific reading interventions, weekly assigned tasks on the materials, and discussions in international groups in real time. The commitment to online collaboration resulted in a welcoming environment for the three interaction modes: case study, research, and project work in asynchronous and synchronous formats. The Google Classroom platform, Google Documents, and Zoom were employed to unite forty-three students (17 American and 26 Ukrainian). Google Forms were used to survey students' experiences. The authors applied descriptive, qualitative, and quantitative methods to explore opinions about online international collaborative learning and the relevance of kindness and trauma-informed teaching. The literature under review is scientific papers about views on and internationalization experiences (de Wit, 2019; Ge, 2022; Gromov et al., 2022; Kuzmina & Glazunova, 2018; Powell et al., 2014; Tripses et al., 2018).

3. Collaborative Online International Learning

3.1. Internationalization Leadership Academy and SUNY COIL initiatives

The Internationalization Leadership Academy [ILA] All-Ukrainian program was launched in January 2022 by Education USA and the American Council in Ukraine in partnership with the State University of New York Collaborative Online International Learning Foundation [SUNY COIL] to foster leadership in internationalization. The SUNY COIL Foundation has been “empowering” leadership in collaborative learning since 2000 (SUNY COIL, n.d.). The selection criteria prioritized candidates' professional and personal skills and competencies for international collaboration: a desire to step out of the box, have prior experience in international cooperation, and the ability to connect with a U.S. partner-in-education and develop a joint project for integrating it in the class of the home university. The Education USA and SUNY COIL initiative resulted in fourteen international educational tandems from Ukrainian and American universities, engaging more than 250 students in collaborative learning in the fall semester of 2022-2023 (Education USA, n.d.). A three-week training for American and Ukrainian professors-collaborators gave good insight into planning/designing and involving students-collaborators in discussions and projects (Figure 1).

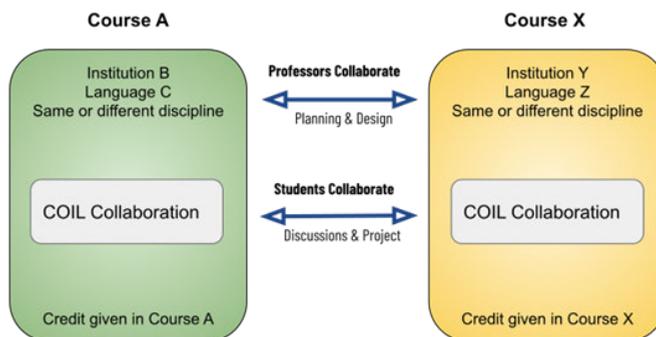


Figure 1. The layout of student/professor engagement in the COIL. (Source: website <https://coil.suny.edu/>).

3.2. The Kindness and Trauma-Informed Teaching Project

The Kindness and Trauma-Informed Teaching Project was preconditioned by the war in Ukraine and increased violence in America (Statista, n.d.). Besides, the authors collaborated on kindness as NGO Global Community Uniting for Equity members. The project design required students to develop teacher competencies in the case study on kindness, research and analyze presidential speeches, and develop project work on the effect of stress and emotional trauma on a child's brain development. Guided by the central questions about how to make acts of kindness universal and the primary focus for teaching relationships, students considered the case study through group skills, pro-social attitudes, and influencing societal values positively. In conclusion, a plan was created to create a culture of kindness in the classroom. Resulting in ranking the importance of teaching kindness as *important* by 20,5% of students and *very important* by 82,1%, as the survey shows (Figure 2).

How would you rank the importance of the topic 'Teaching Kindness' in school curriculum.

39 відповідей

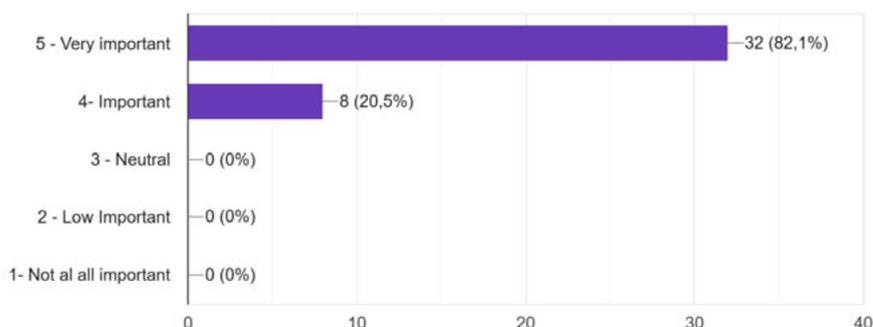


Figure 2. Display of ranking the importance of teaching kindness.

The “Presidential Speeches and Their Effect” research was performed in international teams in joint Google Docs. Such leaders’ speeches as President Obama, Bush, Zelensky, Trump, and Reagan were considered powerful for positive or adverse impact. Interestingly, both American and Ukrainian students noted that the emotional tone, choice of vocabulary, and stylistic figures are essential. The five created teams identified 33 to 53 words of kindness, 42 to 46 of their opposites, and 10-15 phrases of positive or negative character in the speeches under scrutiny. The identified common themes in the studied addresses are “elements of kindness,” “confronting barriers,” and “threats to unity.” Relating the speeches to the events that generated public appeals proved the political context to be impactful. The “Stress and Trauma Effect on Child’s Brain Development” project work addressed adverse childhood experiences resulting in apathy to learning and behavioral disruptions. Students identified the types of trauma and mechanisms of impact on a child’s brain development by analyzing scientific papers, YOUTUBE materials and reflecting on lectures delivered to project participants. Based on the acquired knowledge, 87,2% of students think trauma-informed learning is *very important*, and 12,8 % agree it is *important* (Figure 3), admitting practical recommendations on handling trauma in the classroom are timely provided and a valuable tool under current circumstances.

How would you rank the importance of the topic 'Trauma Informed Teaching/Care' in school curriculum.
39 відповідей

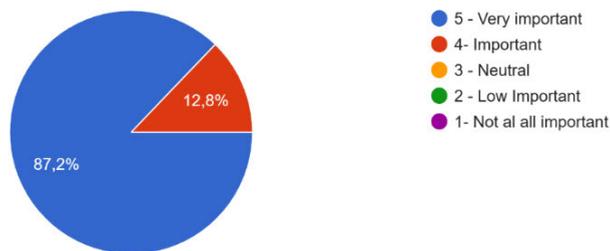


Figure 3. Display of opinions of trauma-informed teaching importance.

While students were reflecting on integrating kindness and trauma-informed teaching into professional activity, 82,1% of students confirmed the attitude as *I will undoubtedly*, 10,3%-*if they have like-minded colleagues; if my students are interested* – 5,1%, and only 2,6% - *I don't know* (Figure 4).

Do you think you will integrate these practices in your work as an educator?

39 відповідей

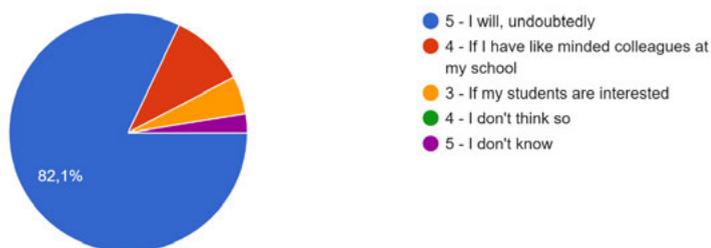


Figure 4. Commitment to integrating into work.

Interestingly, the synchronous discussions in ZOOM breakout rooms and the presentations of the teamwork outcomes at a general session concluded case study, research, and project work with the most desirable interaction format: live communication and vibrant cultural exchange. Decidedly, those F2F meetings became crucial for ruining stereotypes, developing mutual respect, and professional and personal exchange.

4. Professional and Personal Gains for Practical Applications

Since the authors were genuinely interested in student attitudes to and benefits of the project, they completed the work with the questionnaire. The Google Forms surveyed the graduate students' experience in kindness and trauma-informed teaching. The responders' emphasized the project's relevance and value for practical application and successful career pursuit. The highlighted benefits can be distinguished as professional (87%), personal (55%), or both – (45%). Concerning the professional gains from the project, students highlighted: *helpful in creating a toolbox to have as teachers; giving new perspectives for professional development; learning how to be a professional and kind person; getting an insight into what it is to teach in wartime; learning approaches to teaching kindness in the classroom; pursuing a successful career in education; solving similar problems in education; learning about trauma-informed teaching in an applicable way, learning to feel as an educator when students are stressed and how students may respond to the stress of war; a new experience I am eager to implement in my work; kindness can be developed in every person; we need more of such teaching for schools; exploring aspects Ukrainian education is lacking and adopting them.*

Considering personal gains, the students singled out: *learning new myself; the most important learning is to be kind and communicate with people of different cultures; taking such classes refreshes your passion for teaching; it was inspirational and emotional; a humbling*

experience to meet colleagues whose country is at war; learning the power of human spirit and connection; eye-opening experience for me; helping see things from other perspectives; learning kindness is vital to the well-being.

In addition, student feedback contained opinions of the benefits of English proficiency (15%), cross-cultural awareness (86%), live interaction (88%), character traits relating to national identity (17%), and evident intention to keep in touch (29%). The emotional component is high (96%) and expressed as *a once-in-life experience; I learned for this project more than during all years of study; complete fun of interactive collaboration; fantastic, inspirational, amazing experience; incredible exchange of ideas, cultures, and experience; like no other experience.* Concerning the drawbacks, American and Ukrainian graduate students are unanimous here: *there is not enough time for f2f sessions*, forwarding suggestions to organize more international collaborative projects.

5. Conclusions

The authors conclude that despite the war, Ukrainian higher education is determined to foster the internationalization agenda in teacher education, considering it a professional and personal enrichment resource and a powerful way to stay connected to educators worldwide for solving common problems. Reflecting on the VSPU and WSU graduates' feedback, we assume that international collaboration on kindness and trauma-informed teaching is essential for Ukrainian and American teacher education to help the traumatized and the stressed. It is evident that kindness and trauma-informed learning is fundamental due to the current situation and should be included in the teacher training curriculum in Ukraine to cope with the aftermath of war. More emphasis on kindness and trauma-informed responsiveness should be made in American schools to stop the violence eventually. In parallel, the research findings testify that estimates of the significance of intercultural exchange and collaborative research in teacher education are high. This paper's researchers fully agree with a student's opinion that "it is essential to build a community of kindness in the classroom, school, and, consequently, in society in general, and changing society means to change thinking." When young minds generate such ideas, there appears to be a conviction that creating a world of kindness is existential and achievable, signifying education's focal role in this endeavor.

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How university teachers can support the linking of theory and practice in lesson debriefings with student teachers

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Abstract

Considering professionalism as a paradigm of higher education in university settings, it seems crucial to establish supportive spaces in which reflection, regarded as a mediating process between theory and practice, can be initiated. Within the conceptual framework of UntAdFoKo supervision, developed and tested in pre-service teacher education, N=10 lesson debriefings of university teachers and student teachers in the practical semester of teacher training were qualitatively analyzed to find out how and to what extent reflection can be initiated by connecting practical teaching situations with theory-based principles of learning-effectiveness and dimensions of teaching quality. First results indicate that in lesson debriefings using the conceptual UntAdFoKo supervision, linking of theory and practice occurred more as twice as often as the description of teaching situations and that university teachers are the main initiators of the linking process. These findings give insights into the effect of conceptually linking theory and practice on reflection processes.

Keywords: *Linking theory and practice; reflective practice; teacher education; lesson debriefings; practical semester; teacher training.*

1. Theoretical Framework

1.1. The Paradigm of Professional Development in Higher Education

Higher education faces the challenge that faculty members “typically have been trained in their subject matter but not in pedagogy” (Pesce, 2015, p. 1). However, assuming that tertiary education pursues the objective of professionalism, the development of a “critical reflective professional practice” (Davis & Moon, 2015, p. 30) seems inevitable to pursue a professional development among university teachers. The call for professionalism is considered as a university paradigm in the context of a “discourse of excellence” (Readings, 1996), but this, on the other hand, is also a “challenge of excellence” (Light & Roy, 2001, p. 8). In order to comply with the idea of excellence as a predominant feature of higher education (Light & Roy, 2001), the call for conceptual frameworks in a time of supercomplexity (Barnett, 2000) seems reasonable. The expectations set on higher education have a particular impact on the university-based learning support of student teachers as well. What is the purpose of university-based practice phases in teacher training? These university-based practice phases are not about conveying teaching routines, but rather about bringing together theoretical-conceptual analysis and practice (Baumert et al., 2007, p. 8), always having in mind the ideal of the “reflective practitioner” (Schön, 1983). However, if universities want to train student teachers to become reflective practitioners, ways must be found to make university teachers “reflective professionals” (Light & Roy, 2001, p. 13 ff.) in the first place. Based on the assumption that the ability to reflect is a way to support the development of a professional teaching role (Korthagen, 2001, p. 53), this paper presents a concept on university-based learning support for practical semester students in teacher training and empirical data on the connection of theoretical dimensions of teaching quality to concrete teaching behavior and lesson situations.

1.2. Lesson Debriefings as a Learning Opportunity for Student Teachers

First of all, it is important to specify that practical phases in university-based teacher training cannot claim to implement a high degree of teaching experience, but should rather be considered as an opportunity to learn how to reflect, thus to connect practical teaching situations with scientific knowledge in the sense of reflexive knowledge (Herzog et al., 2001, p. 19f.). The question, then, is how university teachers can design their lesson debriefings in a way so that they become a space for initiating reflexive knowledge in student teachers in order to pave their way for professional development in their future practice. In a German study from 2005, the author concludes that “postconference feedback hardly ever lives up to its frequent qualification as an ‘interface between theory and practice’” (Schüpbach, 2007). Important learning processes in teacher education seem to take place uncontrolled and unconsciously, leaving essential aspects of professional development to chance (Hascher, 2006, p. 145f.). But why is reflection of high relevance in the setting of lesson debriefings?

Reflection is not only significant to justify pedagogical action but also to deal with the discrepancy between theory and practice or between knowledge and skill (Neuweg, 2011, p. 33ff.). Considering reflection as a mediating process between theory and practice (Leonhard & Rihm, 2011), it seems crucial to create spaces in which reflective practice can be habitualized (cf. Helsper, 2001, p. 13). The UntAdFoKo concept presented here, aims to explicitly connect specific teaching situations to educational knowledge and thereby create reflective spaces within university-based learning settings.

1.3. UntAdFoKo – A Concept for Lesson Debriefings to Foster Learning-Effectiveness

UntAdFoKo, i.e., lesson debriefings - adaptive, focused, criteria-oriented, is a comprehensive, interdisciplinary concept for lesson debriefings between university teachers and student teachers in the practical semester of teacher training. It has been used and pilot tested in teacher training programs at the Technische Universität Berlin since 2018 in the project "Digitalization in Vocational Teacher Education " (DiBeLe¹) with the aim of increasing the learning-effectiveness of lesson debriefings. In the following, the embedded tools included in the UntAdFoKo concept are outlined: The process script (1) helps the university teacher mentally plan and structure the course of the lesson debriefing, the reflection sheet (2) is used by both university teacher and student to prepare and document the debriefing session in a written form and it also helps to support the process of establishing links between specific teaching situations to 17 basic principles of learning-effectiveness that originate from the psychology of teaching and learning and are listed in the criteria tool (3). The principles of learning-effectiveness are based on the three basic dimensions of teaching quality (Gärtner et al., 2021) that can be defined as superordinate categories:

- *Support of acquisition of competencies* (includes principles such as: learning activities aim clearly at a specific acquisition of skills; cognitive activation that was achieved; task(s) adequately fit the performance level of school students)
- *Motivation* (includes principles such as: learning activities were suitable for promoting self-efficacy; pupils had a scope of autonomy; learning activities aroused interest)
- *Classroom management* (includes principles such as: clear program of action in class; flow of instruction was well managed; all pupils actively involved in learning activities)

Based on the outlined theory and former research, the current study addresses the following research question: How and to what extent can university teachers initiate reflection

¹ <https://projekt.dibele.tu-berlin.de/wiki/doku.php?id=en:start>

processes by conceptually linking theoretical principles of learning-effectiveness to practical teaching situations in lesson debriefings with student teachers?

2. Methods

$N = 10$ lesson debriefings were audio recorded in the practical semester 2020/21 with a total quantity of 3 university teachers and their assigned student teachers studying Prevocational Education or vocational disciplines. The analysis focuses on a section of the debriefing session in which successful and less successful teaching situations were named, explained and each to be linked to one of the above mentioned theoretical basic dimensions of teaching quality or to one of the principles of learning-effectiveness, and eventually associated with an alternative course of action for the less successful situation. The conversations were verbatim transcribed, deductively coded in Atlas.ti using qualitative content analysis (Mayring, 2014). For the purpose of qualitative analysis, all the material was divided into speaker turns (Sacks et al., 1974), each of which was identified on the basis of speaker change. Based on the assumption about the above mentioned importance of habitualizing a reflexive practice (Helsper, 2001, p. 13), the material was first examined to determine which levels of reflection, according to a model by Fund et al. (2002), occur in the lesson debriefings. The authors present a two-dimensional framework that contains the dimension of *content* and also the dimension of *form* (Fund et al., 2002). Their evaluative tool is developed on the basis of Hatton and Smith's work on levels of reflection (Hatton & Smith, 1995). Four categories are focussed: Description, Personal Opinion, Linking and Critical Bridging (Fund et al., 2002, S. 490) that are used to assess student teachers' reflective abilities. Using the tool by Fund et al. (2002) seemed reasonable to better evaluate the gradation of reflection in "lower-level reflection" (referring to a specific lesson) and "higher-level reflection" (going beyond a specific situation) (Fund et al., 2002, S. 491). Furthermore, the reflection level "linking" seems particularly suitable as a category, not only to be able to make statements about whether a connection between practical teaching situations and theory-based principles of learning-effectiveness came about, but also to find out to which of the theory-based basic principles a connection was made, i.e., which objects or contents within the theoretical framework were addressed. Overall, the levels of reflection according to Fund et al. (2002) - Description, Personal Opinion, Linking and Critical Bridging - were coded and additionally, within the category *linking*, the 17 theory-based principles of learning-effectiveness and the 3 basic dimensions of teaching quality from the criteria tool were deductively coded as well. Although the basic dimensions function as a superordinate category for the principles of learning-effectiveness, the distinction between both was made in the coding system. This is because there are students who refer to both, the basic dimension and the identified principle. In each case, the basic dimension was coded separately when explicitly mentioned by the student teacher or the university teacher and was not coded

implicitly as a superordinate category of the mentioned principle(s). If one and the same principle of learning-effectiveness or one and the same basic dimension of teaching quality occurred twice within the same speaker turn, the corresponding code was only assigned once.

3. Findings

In the lesson debriefings that were conducted within the UntAdFoKo framework, the percentage of the category *Description* (“what” and “how”) was only 7%, while the *Linking* category that comprises the connection of practical teaching situations to theory-based principles of learning-effectiveness and basic dimensions of teaching quality accounted for 17%. This means that *Linking*, considered as higher-level reflection (Fund et al., 2002, p. 491), occurred more than twice as often as the *Description* of teaching situations, considered as lower-level reflection (ibid.). The results indicate that the majority of linking impulses was given by university teachers, namely 61% (79 out of 129 times), while the linking impulses given by students were only at a percentage of 39% (50 out of 129 times). The results can be interpreted in a way that university teachers seem to play a key role in linking practical teaching situations to theory-based principles of learning-effectiveness. Giving these linking impulses does not seem to be a matter of course that happens automatically but should rather be structurally supported on the part of the university teacher. On the other hand, the percentage of linking impulses initiated by students (39% or 50 out of 129 times) shows that applying the UntAdFoKo tools also seems to help students initiating linking processes by themselves. Considering the percentage of linking impulses on both sides, students and university teachers, the structural approach and the embedded tools within the UntAdFoKo framework seem to promote the connection of practical teaching situations with theory-based principles of learning-effectiveness instead of mainly describing teaching situations, which can be considered as an increase in levels of reflection. The category *Personal Opinion* (Fund et al., 2002, p. 492) accounted for the largest percentage of the lesson debriefings at 46%, in which personal concerns of the “what” or “how”, relying on feelings or intuitions (ibid.) about a lesson situation that is perceived as functional or dysfunctional, are expressed. Although the *Personal Opinion* category can be considered as “lower-level reflection” (Fund et al., 2002, S. 491), it still represents an increase within the levels of reflection on the side of the students by moving from mere description to a student’s standpoint (Fund et al., 2002, S. 490) which, in addition to describing, includes the reflection on “reservations, hesitation or agreement of the student, in connection with the subjects in the first dimension” (ibid.). The *Critical Bridging* category, in which there is a critical analysis of the “what” or “how” and where the student “generalizes; reaches general conclusions [...]. Suggesting alternatives with explanations and reasons” (ibid.), only occurs at 0.53%. Looking at the contents of reflection, it can be stated that almost half (49%) of the total amount of basic dimensions relate to the dimension of *motivation*. The other half is distributed almost equally between

classroom management (27%) and *support of acquisition of competencies* (24%). *Motivation* was the basic dimension favored by both student teachers and university teachers alike. There are both overlaps and differences between the university teachers and the student teachers in the frequency of the mentioned principles of learning-effectiveness. The 3 most frequently mentioned principles of learning-effectiveness by university teachers are: Presence of a clear program of action (11 codes); connection to prior knowledge (10 codes); cognitive activation (10 codes). The 3 most frequently mentioned principles of learning-effectiveness by student teachers are: students' sense of autonomy (7 codes); clear action program (7 codes); cognitive activation of students (5 codes). The results indicate that university teachers can support the linking of practical teaching situations to theory-based principles of learning-effectiveness and basic dimensions of teaching quality by dialogically inviting students to establish this connection by means of embedded tools within a conceptual framework. Knowing which objects or contents are generally most common in the reflection process within the UntAdFoKo framework, makes it possible for university teachers to adjust the selection of contents so that the student teacher's learning outcomes can be increased. However, the results suggest that on the one hand the use of a concept seems helpful in establishing the link between theory and practice, but on the other hand the role of the university teacher seems to be a crucial for supporting the linking and thereby reflection processes. Overall, the findings indicate that by preparing, structuring, and conducting the lesson debriefing by means of the process script, reflection sheet and criteria tool, the university teacher is able to provide a conceptual framework for student teachers within a higher level of reflection through linking theory and practice can be achieved.

4. Discussion

Following Beckmann and Ehmke (2020), the findings of the current study suggest that the conscious connection of theoretical knowledge and practical teaching situations seems to be useful for student teachers' learning. The concept presented here can contribute to counteracting the many variants of structural implementation of lesson debriefings (Brack, 2019) by having university teachers follow a conceptually structured procedure for lesson debriefings with the help of conceptually embedded tools. In addition to lesson debriefings as a verbal and joint form of reflection (Christof et al., 2018), it would be interesting to find out if theory-based frameworks such as the UntAdFoKo concept can also be applied in other settings of higher education reflection. These could for example be e-portfolio work or practical semester reports as a written matter of reflection or reflective talks among colleagues as another verbal form of reflection (ibid.). The further application of a conceptual framework like UntAdFoKo, which combines theory and practice, would need to be adapted to the particular form of reflection and cannot be adopted unchanged. However, the tools presented here could be a starting point to develop suitable tools for further reflection-promoting settings within higher education. In order to draw conclusions about the learning

efficacy of lesson debriefings, it would be useful to conduct a contrastive comparison in which the rather small sample of $N=10$ is expanded by analyzing lesson debriefings of a comparison group of student teachers without UntAdFoKo concept supervision presented here. This would help to gain insights into whether the establishment of theory references occurs primarily through the application of the UntAdFoKo tools or whether the embedding of theory references also occurs independently regardless of the use of conceptual tools. The individual behavior of both, university teacher and students, should be taken into consideration in order to be able to make statements about the establishment of linking processes regardless of reflection-promoting concepts. In this case, it could be investigated whether the embedding of theory references is basically individually dependent on the university teacher or whether the conceptual embedding is causal and decisive for the production of theory references made by student teachers. For further research, it would also be helpful to analyze the extent to which students teachers' individual dispositions, such as self-efficacy or learning-goal orientation, influence the linking of theory and practice in lesson debriefings. With regard to the university teacher, it would also be conceivable to include his or her conversational role by using the MERID model (Crasborn et al., 2011) in order to be able to assess the extent to which the university teacher's role in the mentoring dialogue (active or reactive, directive or non-directive) contributes to the establishment of theory references.

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An empirical survey of employment and MTI competence in China

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Abstract

The Master of Translation and Interpreting (MTI) of China is controversial as less than 10% of graduates take translation as their job, in contrast to over 89% employment rate. The striking disparity poses a question: why MTI graduates are popular with the employment market? This research, uses questionnaires and comparative empirical research to explore the impact of employment requirement on MTI competence from the perspective of 'professionalism'. We find that that a cluster of technology applications have entered the employment requirement and becomes integral to the MTI competence, framing a new type of professionalism that focus on information acquisition and language conversion. Employment recruitment also put emphasis on sector practice. The MTI education may improve the employment rate via these enhancement measures relating to professionalism.

Keywords: *MTI; employment; professionalism; translation technology cluster; sector practice.*

1. Introduction

From 2007 to 2022, China Higher Education approved 316 educational organizations to run a major called Master of translation and interpreting (MTI) which aims to cultivate talents with professional competences in translation and interpreting and meet the growing needs of foreign exchange in terms of language. Over these years, some researchers claim that, in terms of employment fulfillment, MTI is self-evidenced by the tremendous expansion in scale (Zhang & Wang, 2020). Data show that the employment rate of MTI graduates has reached 87.85% on average, indicating that cultivation in this regard can meet the needs of employment (Zhang & Wang, 2020). Cui (2017) has conducted a series of survey on the MTI major, finding that MTI competence is ‘strong’ adaptable to employment, considering the fact that less than 30% of MTI graduates are engaged in translation and interpreting-related jobs. However, previous research rarely discussed the adaption of MTI to the employment in terms of competence. This present research explores the feature of the ‘strong’ adaptability of MTI to jobs in light of recruitment requirements, using MTI graduates as empirical samples.

In the context of relationship between employment and MTI education, we make contribution to the literature in that with translation technology as the strong influencing factor, MTI is newly labeled as being more adaptable to employment.

2. Study Design

In this study, a sample survey and information retrieval method was used to collect 70 questionnaires from 170 graduates from the grades 2018 and 2019 of Shanghai Maritime University (Wang & Wang, 2020). The recovery rate of questionnaires was 41.3%. The valid questionnaires were 70 with a 100% questionnaire efficiency rate. We distributed the questionnaire to collect the data by means of the Questionnaire Star, Wechat and other network channels. The questionnaires included (1) the employment satisfaction, industries engaged, income status, and career development of MTI graduates; (2) the opinions of MTI graduates on the curriculum after working for some time.

The questionnaire focused on the translation competence of MTI graduates, which mainly includes: students’ initial goal of applying for MTI degree program, expected occupation, and actual occupation, working industry, employment channels, factors affecting their employment competence, employment satisfaction, salary, expected translation competence, etc. Considering the validity, the questionnaire contains 18 questions, among which questions 1-5 involve basic questions such as students’ name, gender, working industry, age, and income; questions 6-18 include expected employment, expected industry, expected curriculum of employers, demand for practical courses of employers, etc. In addition, there

are 3 multiple-choice questions and 8 questions with fill-in-the-blank options within those 18 questions.

From the perspective of the market, we download 72 pieces of job information related to translators from mainstream recruitment websites, such as Zhaopin, Liepin, HunterOn, Qiankun Headhunting, and Sunsharer Headhunting. Those job requirements involve translation competence, industry, major, salary, communication ability, and job scope, which are similar to the design and content of the questionnaire, thus facilitating further comparison, analysis, and categorization. The questionnaires collected and the job advertisements are comparable for their number are the same.

3. Results and Discussion

3.1 Employment and Engagement of MTI

Enhancing competence in translation and interpreting is an important teaching goal for the MTI major. Translation competence is essential for MTI students (Liu, 2011; Han, 2020). Zhu (2019) equates professional knowledge with professionalism from the original purpose of MTI training. Based on this, one prevailing view is that the specialization of polytechnics be combined with specialized courses of each university (Li, 2020), and allocate more training requirements to practice of translation for special purposes (Liu, 2017). Li (2020) and Sun (2015) claim that the Higher Education Steering Committee stresses on professionalism but ignores the necessity of practice in special fields. In summary, professionalism needs to be oriented at employment. Professionalism is affected by employment requirements (Yao, 2020) but is not detailed.

In the questionnaire of this research, we designed question 2 “What is your expected occupation before employment?” and question 3 “What is your current occupation?” to compare the employment expectation and actual engagement (See Table 1).

Table 1. Expected Employment and Actual Engagement of MTI Students.

Occupation	Expected Employment	Actual Employment	Standard Deviation (SD)
Translators	36.3%	9.1%	0.19
Teachers	39.4%	33.3%	0.04
No expectations	6.1%	9.1%	0.02
Others	18.2%	48.5%	0.21

It can be seen the characteristics of the expected and actual engagement of MTI students. 1) the gap between expected employment and actual engagement in being a translator is huge. The expected proportion (36.3%) is much larger than the actual employment (9.1%). And the Standard Deviation (SD=0.19) shows that expecting to be a translator, in the eyes of pre-training students, is not sufficient for employment. 2) In terms of the occupation as a teacher, the percentages of expected (39.4%) and actual employment (33.3%) are nearly the same while the SD (0.04) is comparatively small, indicating that the language skills of MTI students are still an important component for employment. 3) In the choice of “others”, the expected percentage (18.2%) is lower than the actual percentage (48.5%), with SD at 0.21, indicating that MTI students are employment ready with other competencies.

The above characteristics suggest that the actual demand for MTI students is hooked to the basic language skills and new competencies (Hu & Tian, 2020).

3.2 The New MTI Competence Under Employment

The employment requirement for MTI job market post challenge to MTI education. Li (2019) pointed out, the MTI curriculum should not only include basic language courses, but also cultivate professional skills. So what professional competence required for job markets do MTI students have?

Question 12 of the questionnaire is a multiple-choice question “Which aspects of the specialized courses offered by the MTI program have contributed most to the development of your professional competence?” The options include translation technology, translation theory, economic and trade translation, science and technology translation, literary translation, and others. We searched “translator and interpreter” on the job page and randomly selected the job advertisements listed. After manual screening to remove duplicate and invalid job offers, we obtained 72 job offers from mainstream headhunters and job sites. Then, we sorted them by high-frequency words, removed words unrelated to competence, and obtained keywords such as Computer-Aided Translation, Translation Certificate, English Competence, Translation Practice, and Relevant Industry Experience. And the ratio of demand was calculated based on the word frequency. The integration of student questionnaires and job recruitment is shown in Figure 1.

From Figure 1 we can see that, first of all, the demands from employers (12%) and students (55%) both focus on translation skills despite various percentages. Secondly, the demand for industry experience (32%) of employers is greater than the maximum percentage of any individual industry (18%) in translation from students’ viewpoint. These findings indicate that students and markets both agree that translation technology is a distinctive feature that distinguishes MTI majors from other foreign language majors. Therefore, we believe that translation technology and industry experience should act as part of professional competence in MTI job market.

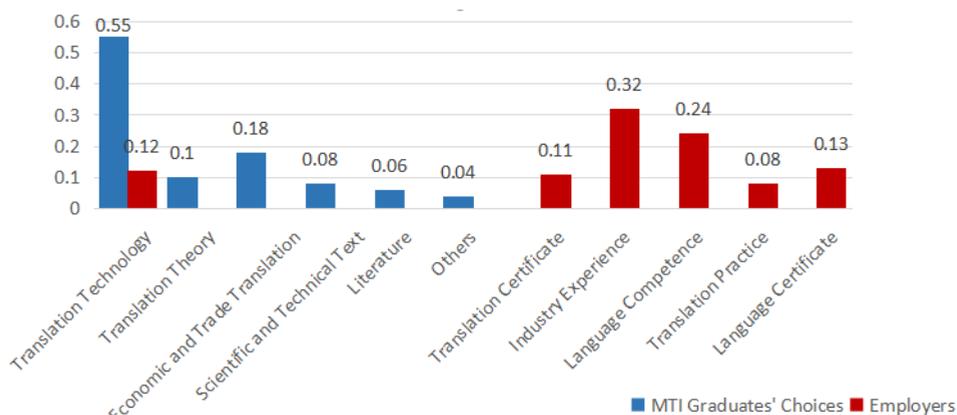


Figure 1. Comparison of competence between MTI graduates' expectations and employers' demands.

3.3 Translation Technology as New Competence

In 2014, the World Translation Conference on Man vs. Machine? The Future of Translators, Interpreters, and Terminologists was held in Dublin, highlighting the shift in translation studies towards technology. Translation talents with technical ability can meet the needs of the market (Miao & Wang, 2010; Yao, 2013). But what is translation technology? Does translation technology promote employment?

According to the international standard for translation service ISO17100:2015, translation technology contains three levels: technical tools, management, and communication. Technical tools involve alignment software such as ABBYY Aligner, translation software such as MemoQ and Trados, self-built terminology database, OCR recognition, format conversion, and other over twenty technologies. Translation project management includes complex missions such as forming teams, formulating programs, arranging schedules, and assigning tasks. Communication includes instant messaging software such as Facebook, QQ, WeChat, and email. Although Wang (2020) did not divide translation technologies into three categories, his classification also mainly covers the first two parts. With a total number of nearly thirty, all these diverse technologies involve translation corpus, format conversion, and project management. Therefore, MTI students need to spend a lot of time learning as many as 30 types of technology. And Fu (2015) points out that “relevant skills must be acquired with special training”(p.81), which also illustrates the difficulty of translation technology learning. In this regard, we believe that translation technologies are unique to MTI students with the competence that effectively runs through the whole process of translation.

3.4 Industry Experience in Specialized Field

The division of labor in the translation industry is becoming more and more detailed. In the job market, MTI students should have much practice experience, so they can be competent in different fields of translation work (Zhao & Yang, 2021). We analyzed 72 pieces of job advertisements for translation positions that contained industry experience statements, selected their high-frequency words about translation experience, and made them classified. See Figure 2.

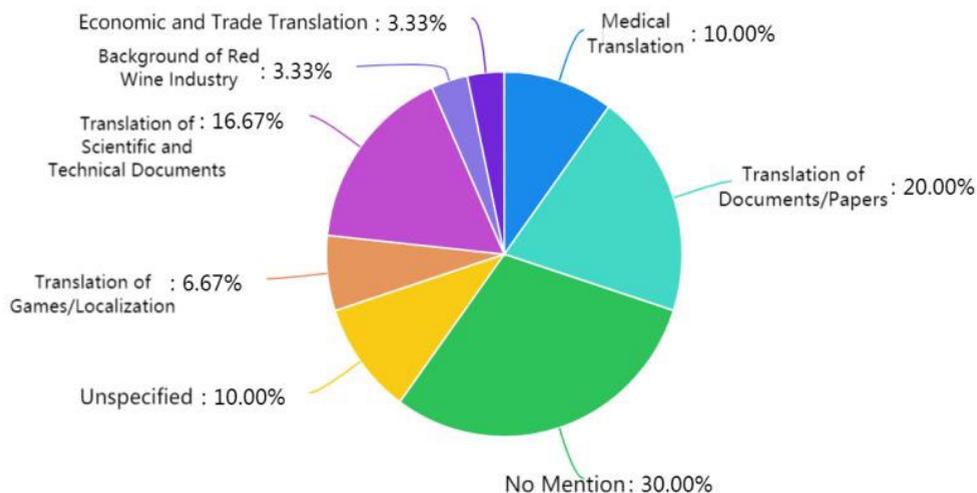


Figure 2. Industry experience for employers' consideration.

It is shown that most employers (70%) require industry experience for MTI graduates, while 30% do not specify their industry requirements. To make it clear, the translation of documents or papers accounts for 20%, the translation of scientific and technical documents accounts for 16.67%, and the translation of economic and trade documents accounts for 3.33%, revealing the proportion of employers' demand for industry/profession. It can be seen that employers measure the professionalism of translators by their experience and practice in different translation industries. Professionalism should be reflected through industry practice. As Xu (2010) pointed out that MTI education must be classified considering the market factors, such as engineering, medicine, law, economy and trade, literature, and so on.

4. Conclusion

Against the background of technology trends such as CAT, intelligent translation, and deep learning, the MTI competence represented by professionalism is insufficiently studied. This may be caused by the traditional translation model based on basic language skills and translation skills, has rooted in education as absolute soundness. But translation has entered

the machine translation age, thus simply focusing on students' basic language skills and translation skills, and ignoring such translation technologies as computational linguistics and corpus linguistics will "obviously fail to meet the demand for talents in the society of language intelligence development" (Hu & Tian, 2020).

Based on the questionnaires of MTI graduates from Shanghai Maritime University and the feedback from employers, we can find that the employment market has redefined the MTI competence by highlighting the role of translation technology. Such technology cluster used in the translation process, in terms of the type of technology and the length of learning time, has essentially distinguished MTI majors, and should be viewed as a key component of the professionalism of MTI.

From the perspective of the teaching program, MTI curriculum should pay attention to the training of translation technology in order to meet the needs of the market and improve the efficiency of the translation. As Wang (2012) pointed out, the MTI course setting should consider the market demand and the content should emphasize the combination of theory and practice. So we propose that the curriculum design of MTI should open courses focusing on translation technology (cluster) and translation professional practice to ensure the effectiveness and employment rate, and further meet the market demand for translating practitioners.

This study has some limitations. Participants in this survey from the same university may result in homogenization. Also how translation technology can be included in the curriculum remains to be designed. Therefore, a larger sample nationwide may present a deeper understanding of the role of translation technology to employment in MTI education.

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Intercultural interaction modulating implicit attitudes towards disability and cultural competence in higher education

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Abstract

People with disabilities (PWD) are increasingly recognized as one of the most overlooked potentials in the labor market. More and more disability inclusion strategies appear and evolve in the workplaces. Nevertheless, employees with disabilities in the work environment are still faced challenges of explicit and implicit biases. Especially, comparison with positive explicit attitude due to social expectation, implicit attitudes towards disability tend to be negatively tied with charity, inability and distrust. This present article originally proposes intercultural interaction as the solution to modulate implicit and emotional attitudes towards disability. Besides, this article highlights that intercultural interactions between people with and without disabilities could promote individual cultural knowledge. It is underlined the importance to involve schemes of cultural competences and intercultural interactions into higher education to facilitate more inclusive work environment.

Keywords: *Implicit attitudes; people with disability; intercultural interaction; cultural competence; higher education.*

1. Introduction

According to the World Report on Disability (World Health Organization, 2022), more than 16% of global population live with disability and majority of people with disability (PWD) potentially function effectively as workforce. Disability inclusion in workplace has been growingly highlighted by government policies and organizational initiatives in the last decade. However, stereotype and biases towards disability remaining as formidable obstacles which hinder the effective cooperation and interaction between employees with and without disabilities in the workplace (Bonaccio, Connelly and colleagues, 2019).

Explicit and implicit attitudes and towards disability predict the willingness and effectiveness of intercultural interactions between these two social groups. Explicit attitudes refer to more deliberative or intended response which vastly rely on motivationally and cognitively controlled factors. Comparatively, implicit attitudes can be characterized as the automatic association which individuals hold between an object/event with evaluation and it coincide with automatic emotional attitudes (Rudman, 2004) . Implicit attitudes better than explicit attitudes dominantly foretell individual behaviors, especially when it comes to the immoral issues like the attitudes towards disability. Comparison with universally positive explicit attitude towards disability, implicit attitudes towards employee with disabilities tend to be negatively tied with charity, inability and distrust. Empirical evidence has presented that traditional implicit attitudes towards disability negatively comprise pity, dependence and marginalization and hinder the appropriate treatment and rehabilitation for people with disabilities. This effectively explains the phenomenon that non-disabled employees feel stressed and discomfort when actually interacting with disabled employees, even though they identify not to discriminate against disabled employees. Extant study in Russia underlined that in spite of three-quarters of the respondents holding positive attitudes towards disability, only one quarter feel ready to interact with individuals with disabilities, and lack of interactive experience as the main reason raises fear to cooperate (Volosnikovaa & Efimovab, 2016). It is crucial for scholars and practitioners to further investigate individual implicit attitudes towards disability and its potential solutions.

It has been widely addressed that implicit attitudes primarily stem from affective experience and cultural biases. For instance, pleasant interactive experience with partners with disabilities leads to positive implicit attitudes towards disability. Evidence has emphasized the two-way correlation between affective experience with implicit attitudes (Songa, Slabbinck, Vermeir & Russo, 2019). Moreover, cultural milieu and biases towards individuals from different cultural background are highly related to implicit attitudes. The influence of cultural milieu on implicit attitudes offers the possibility that intercultural interaction experience may foster the positive implicit attitudes towards another sub-culture and culture. Besides, it has been shown that training regarding knowledge of disabilities significantly promote the positive attitudes towards disability (Packer, Iwasiw and

colleagues, 2000). Cultural knowledge refers to the knowledge which could allow a better grasp of the internal logic and modal behavior of the other culture, and the basic understanding for the behavior. This type of knowledge helps for adapting to the new culture (Thomas and colleagues, 2008). Cultural intelligence serves as the cognition facet of cultural intelligence, which is considered as the crucial competence for adapting and functioning in intercultural situations. It is reasonable to consider that individual with more cultural knowledge will be more adaptive and tolerant with other cultures and diverse contexts.

Therefore, this article hypothesizes:

1. 2. Interaction with people with disabilities correlates with individual implicit attitudes towards disability.
2. Intercultural interaction with people with disability correlates tot cultural knowledge about disability.
3. Individual cultural knowledge about disability correlates to implicit attitudes towards disability.

2. Method

It is arduous to collect implicit attitudes of individual by subjective self-report. Building on literature, Implicit Association Test (IAT) have been applied to investigate implicit attitudes. This article conducted the online survey via Google form among 112 university students (19-27 y, 50 male, 62 female, all physically able) from Ural Federal University (Yekaterinburg, Russia) and Institute of International Economic Relations (Moscow, Russia) in November and December, 2022. The survey totally comprises 4 questions about intercultural interactions, 6 questions about cultural knowledge and some questions about individual demographics of participants such as age, gander, education, work experience and position. 4 questions about intercultural interactions embodying 1) “do you have abroad experience”; 2) “do you speak second language”; 3) “frequency of cross-cultural interaction”; 4) “frequency of interaction with people with disabilities”. Questions about cultural knowledge are based on Cultural Intelligence Scale (CQS) (Ang, Van Dyne and colleagues, 2007) with seven-dimensional Likert form, including 1) “I know the legal and economic system of the other cultures”; 2) “I know the rules (e.g., vocabulary, grammar) of other languages”; 3) “I know the cultural values and religious beliefs of other cultures”; 4) “I know the marriage systems of other cultures”; 5) “I know the arts and crafts of other cultures”; 6) “I know the rules for expressing nonverbal behaviors in other cultures”. Furthermore, this article applied Harvard Implicit Association Test about Disability and collected results of every participants.

3. Result

Through analysis via IBM SPSS Statistics 26, this article lists the correlations among intercultural interaction, cultural knowledge and implicit attitudes toward disability in the Table 1 as follows. Results support hypotheses of the article, intercultural interactions with people with disability positively correlate with implicit attitudes towards disability, as well, individual cultural knowledge about disability positively correlates to implicit attitude towards disability.

Table 1. Correlations among Intercultural interaction, cultural knowledge and implicit attitude.

Coefficient	Intercultural interaction	Cultural knowledge	Implicit attitude
Intercultural interaction	-	0.518*(0.031)	0.619**(0.007)
Cultural knowledge	0.518*(0.031)	-	0.213*(0.046)
Implicit attitude	0.619**(0.007)	0.213*(0.046)	-

Note: * indicates significance at 0.05 level; ** indicates significance at 0.01 level.

4. Discussion

According to results, negative implicit attitudes towards disability still commonly exist. While, this article proposes the new solution that intercultural interactions with disabled people and cultural knowledge about disability could improve implicit attitudes towards disability among students in the universities. The stereotypes towards people with disabilities represent the misunderstanding between different social and cultural groups. People with and without disabilities could be considered as two different cultural groups, which are provided with distinct traits and behavioral patterns. Thus, effective interaction between these two groups requires cultural competence. Both practical intercultural interaction and theoretical cultural knowledge could mitigate the stereotype and bias towards people with disabilities, and hold more positive attitudes towards the disabled in the daily study and work. The positive attitudes will let individuals more recognize and appreciate competencies of people with disabilities, which will lead real disability inclusion and productive cooperation between these two groups.

Current findings suggest the inclusion of cultural competencies into higher education. It has been highlighted that interactions with people with disabilities could ease negative implicit attitudes of individuals. In the university, it is crucial to provide opportunities of inclusive programs or events to enhance interactions between people with and without disabilities. As well, cultural competency-based schemes and programs should also be paid more attention

to develop students' cultural knowledge of disability and accordingly foster the better cooperation between employees with and without disabilities in the later work environment. More future research are needed to investigate detailed interculturally interactive and cultural competency-based schemes in the higher education.

Furthermore, this present study proposes the professional training program about cultural knowledge into inclusive employment, which will help the two cultural groups understand better about each other and ready for co-work. Except training program, events or activities involving intercultural interactions could also be concerned as the method for inclusive employment. Different kinds of interactions like work-related interaction and social interaction could be offered by workplaces in the way of training, regular workshop, team game, group travel, amusement event and so on. But it may be influenced by types of disabilities and degree of disabilities of individuals. For instance, for employees with blindness, organizational weekly reading day could be considered to involve employees without disabilities to learn books for the blind. More additional studies are needed to investigate the effective invention method for inclusive employment and education.

Lastly, this present article has several limitations. First, small sample has been collected by this article. Investigations for larger sample are required. Second, the implicit association test- attitudes towards disability is not adapted enough in Russia. More future studies are needed for checking its adaptation in Russia and with different social groups. Third, the questionnaire for intercultural interaction are self-developed, and it may be with more risks for reliability than standard scales. Forth, this study did not conduct the correlation with demographics factors, such as gender, education and work experience. These factors may impact for the correlations among intercultural interactions, cultural knowledge and individual implicit attitudes towards disabilities.

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Developing supply chain competencies through experiential learning and games

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Abstract

The Supply Chain Management field has a shortage of talent to deal with the complex problems organizations face nowadays. Higher education institutions have worked to close the gap in knowledge and competencies with various results. This paper presents the results of implementing a Supply Chain Management course, which includes experiential learning, gaming, and industry-academia collaboration to develop four competencies in this field. The main results show how the relevance of hands-on learning, the variety of learning environments -such as virtual, simulated, and real- and tutoring from both practitioners and professors from different disciplines become key elements in developing the required skills to perform a role in a Supply Chain related position.

Keywords: *Experiential learning; role-playing game; learning environments; supply chain competencies; competencies development.*

1. Introduction

Nowadays, market trends' dynamics are affecting the organizations' configuration and operation of supply chains. Constant and ever-faster changes in markets, economy, finance, and technology encourage supply chain evolution in collaboration, configurations, and management. Moreover, including Internet of Things (IoT) technologies or adopting cyber-physical systems has accelerated the innovation in supply chain operations to meet customer needs (Garay-Rondero *et al.*, 2020). Similarly, globalization has changed how the industry competes due to global sourcing, cultural challenges, the interactions among and between nations, and how all these factors affect the production of goods and services (Fernando and Wulansari, 2021).

On the other hand, graduates that enter a related supply chain position in the industry have been showing gaps between academic training and the industry requirements. For these people, the required skillset includes the capability of dealing with uncertainty, dealing with non-routine situations, adapting to rapid changes in the work environment, flexibility, and adapting to dynamic work requirements, among others (Al-Shammari, 2022). Additionally, companies face significant challenges in recruitment, retention, and succession of the few able talents, mainly due to the combination of competencies required and the level of interaction needed within and across the organization to create value for all the stakeholders (Flöthmann *et al.*, 2018).

Considering this scenario, this paper presents the findings after implementing a supply chain management (SCM) course involving active learning didactic strategies, information technology aids, and dual learning to develop SCM competencies at the undergraduate level. The remaining of the paper is as follows: section two briefly presents a theoretical background on supply chain talent requirements and current teaching innovations; section three describes the methodology followed to develop supply chain competencies in the students; section four shows the results obtained during the implementation of the course; section five includes the discussion results, and section six summarizes the conclusions and recommendations for future work.

2. Theoretical Background

Developing supply chain competencies has been relevant for over twenty years. However, the supply chain operations' complexity emanating from a changing business environment, globalization, and technological advances has raised hurdles in meeting the industry requirement for SCM professionals, who additionally need to develop skills to perform planning and strategic functions and not just carry on transactional or office tasks (Prajogo and Sohal, 2013). Recent studies indicate a factor of one to six between the SCM professionals supplied by higher education institutions and industry needs. This proportion

does not consider the effectiveness of the training nor its alignment with the competencies required for current SCM-related positions (Birou *et al.*, 2022). Furthermore, supply chain professionals have become a source of competitive advantage to organizations, so a lack of talent is considered a relevant cause of supply chain risk (Dubey and Gunasekaran, 2015). Thus, focusing on developing SCM competencies at the undergraduate level becomes critical for an organization. The following subsections briefly describe previous research on the need for SCM competencies in the current related positions and preceding academic efforts to develop them.

2.1. Supply Chain Competencies

There is no unique classification or consensus about the skills required for SCM professionals. For instance, Sun and Song (2018) recognized that the SCM field is continuously evolving, such that it is becoming more interdisciplinary as the business environment is more complex every day. After a thorough literature review, they classified the SCM skills required by the professional field. They included technical knowledge and soft skills requirements such as communication and teamwork, self-management and improvement, and social responsibility. Conversely, Birou *et al.* (2022), based on a review of 109 courses, found 120 related topics, of which 18% appeared once throughout these courses, concluding that there is no clear consensus about the SCM field coverage. Finally, Sweeney *et al.* (2010) remark on preparing future professionals to use sophisticated SCM software to deal with problem complexity, efficiently use the information, and support the decision-making processes. This broad scope makes it difficult to define a clear set of skills to be covered in a course. Moreover, the contents may change between an engineering program course and a business course.

2.2. Academic Efforts in Developing SCM Competencies.

Regarding academic efforts to provide an adequate environment for developing supply chain competencies, the literature shows a variety of scopes. For instance, Pepper and Clements (2008) used a role-playing approach to provide the “learner” with a structured methodology, allowing individual learning outcomes to be accomplished through scenario-based activities. The applied simulation exercise provided an environment for experiential learning and problem-solving at a pace defined by the learner. Results showed benefits related to complexity understanding, communication, and adaptation to changing scenarios. Similarly, Sweeney *et al.* (2010) used specialized software to provide experiential learning in a more realistic and significant context for understanding key management concepts. The authors highlighted the benefits and challenges of designing courses based on specialized supply chain software. Likewise, Gámez-Pérez *et al.* (2020) proposed a collaboration model to develop supply chain competencies through experiential learning, international experiences, and collaboration between two universities in different countries and industries. Their

findings include the need to promote closer collaboration between academics and practitioners to generate an understanding of the needs, competencies, and skills required in the future SCM workforce.

3. Methodology

As presented, the previous literature review emphasizes the importance of collaboration between industry and universities in identifying, assessing, and developing relevant SCM competencies in students. Regardless of the difficulty in identifying the key SCM competencies to be developed in a course based on industry requirements, extant literature shows some SCM competencies commonly identified as critical, presented here in Table 1.

Table 1. SCM competencies commonly identified as critical.

Competency	Description	Source
SC Diagnosis	the ability to define and understand supply chain complex problems	Birou <i>et al.</i> , 2022; Gámez-Pérez <i>et al.</i> , 2020; Prajogo and Sohal, 2013; Dubey and Gunasekaran, 2015
Technology Adoption	the ability to be flexible and capable of adapting to new and changing situations, including the use of technology to support SCM operations	Al-Shammari, 2022; Fernando & Wulansari, 2021; Flöthmann <i>et al.</i> , 2018; Gámez-Pérez <i>et al.</i> , 2020
Data analysis and communication	the ability to understand the business context and effectively communicate findings	Al-Shammari, 2022; Birou <i>et al.</i> , 2022; Flöthmann <i>et al.</i> , 2018
Improvement proposals	the ability to solve complex problems, proposing improvements or innovations based on creating value for all the stakeholders	Prajogo and Sohal, 2013; Gámez-Pérez <i>et al.</i> , 2020; Flöthmann <i>et al.</i> , 2018

Source: Authors' compilation based on references.

Even though more competencies appear in the literature, the authors selected these four to be evaluated during their SCM course. A series of formative evaluations were conducted, which led to a summative assessment of each of the competencies, considering an intervention process from diagnosis to improvement proposals for the supply chain of the collaborating industry partners. In addressing the gap between academic training and industry requirements, the authors included experiential learning, role-play gaming activities, and industry-academia collaboration to enhance the development of the selected competencies.

Seeking to enhance the students' experiential learning, the authors implemented a project-oriented learning didactic strategy via the challenges posed by the collaborating organizations. Industry professionals were involved before the start of the semester in designing the challenge posed to the students and throughout it in assessing the presented proposals. In addition, intending to provide different points of view to analyze the problems and define feasible solutions, SCM experts from other industries and industrial chambers were invited to share their experiences and opinions on current disruptions and challenges.

Also, a LEGO supply chain scenario simulator was applied twice in the semester to enhance the students' learning experience, helping them to understand key SCM concepts, identify opportunities, and propose improvement actions. The first simulation was run at the beginning of the course to clarify SCM concepts and provide a systemic scope and a role-play gaming learning environment. The second one was run previously to elaborating the improvement proposals.

Being sensitive to the increasing interdisciplinarity of the SCM field in the constantly changing business environment, the authors considered that offering an integral approach from different disciplines will add value to the student's learning experience. Therefore, the professors implementing the course pertained to various fields -industrial engineering and international business- providing a multidisciplinary approach.

Concerning industry-academia collaboration, the organizations presented a specific problem that required using the selected competencies and assigned a mentor for each. Each mentor defined the number of follow-up meetings, whether in situ or virtual, the feedback procedure, and provided the information needed. In addition, sessions required by the professors in charge of tutoring the students complimented the students' learning experience. The chosen problems involved students analyzing and proposing improvements for previously defined supply chain operations. The industry partners were a Mexican-based organization in the meat industry during the Spring 2022 semester and a US-based organization in the heavy agricultural machinery industry during the Fall 2022 semester. Both organizations have worldwide operations and similar operative challenges. The results of the implementations are shown in the next section.

4. Results

The pilot implementation for the Spring 2022 semester was successful in that students, professors, and industry partners did perceive the development of the specified SCM competencies. Nevertheless, the professors and industry partners evaluating the student performance in such competencies detected room for refinement, particularly in the competence related to the improvement proposal. Even though the industry partner received the submitted proposals well, several issues were detected regarding the time scope limitation

confined to one semester, which limited the implementation and benefit measurement of the proposed improvement proposals.

Under such conditions, students cannot learn about the consequences of their decisions, and submissions remain at the proposal level. Therefore, the authors decided to implement The Fresh Connection™ (TFC) simulator during the Fall 2022 semester, in addition to the previously described conditions implemented during the Spring 2022 semester. The authors intended to overcome some of the mentioned shortcomings since TFC requires analysis and decision-making processes from participants, assuming the perspective of various roles. TFC simulates the students' decisions during six rounds in a SC scenario, each representing six months, allowing the participants to face the consequences of their improvement decisions and acknowledge their errors for three years. The following figure compares the average grades obtained by students on the individual submissions designed to demonstrate the development of the specified four SC competencies.

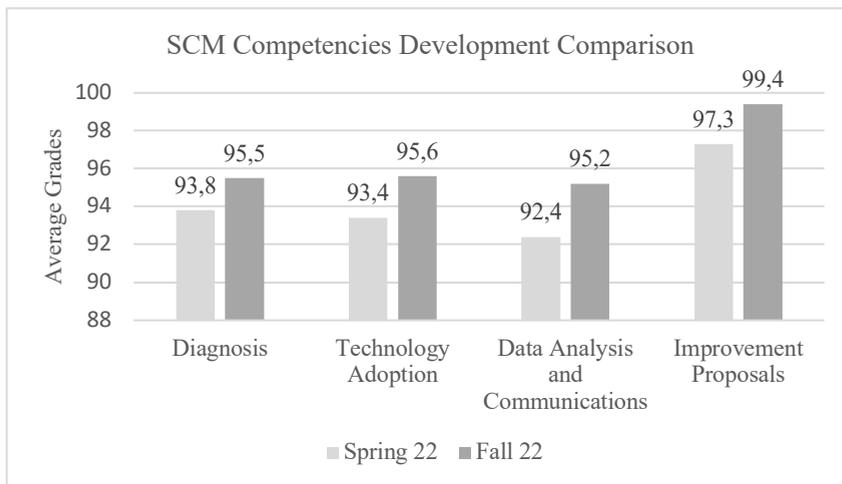


Figure 1. Average grading comparison of individual student deliverables on competencies development.

Even though the average grades increased during the Fall 2022 semester, the main concern was identifying the benefit of a physical role-playing simulation using LEGOs and the specialized SC software TFC to refine the students' deliverables. In this regard, a Student's t-test analysis was conducted to compare the grades of the student proposals presented during both implementations. The null hypothesis assuming group similarity was rejected, demonstrating a significant upgrade of the improvement proposal competency in students after experiencing TFC simulator in combination with various learning environments. The grading process includes the comments from the mentors and the professors' assessment of the competence based on a rubric. Results are shown in Table 2.

Table 2. T-Test two samples assuming equal variance.

	<i>Spring 2022</i>	<i>Fall 2022</i>
Mean	97.3529412	99.3333333
Variance	10.9625668	0.91954023
Observations	34	30
Pooled Variance	6.26502214	
Hypothesized Mean Difference	0	
df	62	
t Stat	-3.158639	
P(T<=t) one-tail	0.00122485	
t Critical one-tail	1.66980416	
P(T<=t) two-tail	0.00244971	
t Critical two-tail	1.99897152	

5. Discussion

A combination of learning didactic strategies, information technology aids, and dual learning during the implementation of a SCM course enhances the development of the professional competencies required to thrive in a changing business environment. However, there are limitations to developing SCM competencies in the classroom, even when innovative learning techniques are implemented, as was detailed in the literature review. The authors tested a combination of several learning environments and were able to compare the results from two consecutive implementations under similar conditions. There are limitations to the development of competencies in students confined to one semester in the classroom. Hence, it is necessary to provide experiential learning as close as possible to real-life challenges to overcome such shortcomings and strengthen the development of the much-sought SCM competencies, which have become a competitive advantage for organizations. Although the inclusion of several learning environments, such as the physical LEGO simulator and the use of TFC created a positive benefit in terms of competency development, this was only possible in combination with the guidance and tutoring of professors, the interaction with industry experts, a multidisciplinary approach, and a hands-on experience.

6. Conclusion and Future Work

After two implementations of the course, the SCM competencies were developed satisfactorily, based on evaluations of the students' deliverables by the industrial partner and the team of professors. The multidisciplinary work, the simulators, the organizations' supply chain problems, and the evaluation from industry experts and professors allowed the students to experience similar real-life challenges. Finally, designing a SCM course is a dynamic, iterative process if it is to be aligned with the changing environment and disruptions faced

by supply chains nowadays. Hence, this course's didactic design and improvement processes must be continuously adapted to current and future disruptions influencing a supply chain, the industry's needs, and other collaboration schemes.

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Students' experience of Double Degree programmes: motivations and perceptions of skill acquisition

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Abstract

The implementation of collaborative and double degree programmes has been promoted in higher education since the 1970s as an internationalisation strategy for networking between universities. The value of the Double Degree experience is unanimously recognised by European and international institutions, but data on the evaluation of this experience from the students' perspective, their motivation to take part in these programmes and the perceived skills that can be acquired through this experience seem to be scarce. Through a pilot questionnaire designed to collect quantitative and qualitative data, this study aims to investigate these aspects - students' motivations and perceptions of the skills acquired - in relation to their participation in a Double Degree programme. The results of this survey can contribute to increasing students' and stakeholders' awareness of the benefits of Double Degrees and to improving the quality of teaching and services in these programmes.

Keywords: *Internationalisation; higher education; Double Degree programmes; mobility experience; employability skills; soft skills.*

1. Introduction

Higher education institutions are among the main actors involved in the internationalisation process, as they determine strategies and activities to promote their international dimension not only locally, but also globally, thanks to globalisation dynamics. At the regional and national level, collaborative programmes are seen as means to contribute to an increase in a country's status, competitiveness, and capacity building (cf. Knight, 2008). The implementation of collaborative and double degree programmes has been promoted in higher education since the 1970's as an internationalisation strategy for networking among European universities in the EHEA (European Higher Education Area) and transatlantic relations between Europe and USA. Double degrees can bring a number of benefits, not only because they foster student mobility and institutional networking, but also because the knowledge transfer created by partner institutions becomes a bridge between different content materials, teaching methods, and ultimately, different cultures.

From an institutional perspective, universities can enhance their reputation through partnerships with other renowned institutions. For students participating in this experience, one of the perceived benefits of these programmes is the acquisition of a range of skills that can make graduates more likely to be employed in the future (Jones, 2014). Double degree programmes also represent an investment in terms of time and funds for the institutions involved in the process, and a challenge for students who have to change their learning environment and step out of their comfort zone. The value of the double degree experience is unanimously recognised by European and international organisations (cf. European Commission 2022), but data on the evaluation of this experience from the students' point of view, their motivation to participate in these programmes and the perceived skills that can be acquired through this experience seem to be scarce. With a view to improving the quality of the teaching and services provided in a Double Degree programme, this study aims to investigate these aspects – students' motivations and perceptions of skills acquisition – in relation to their participation in such a programme, through a pilot questionnaire designed to collect both quantitative and qualitative data. The results of this survey may contribute to improving the students' and practitioners' awareness of the existing programmes, and better inform other stakeholders about the benefits of double degrees.

2. Literature review

The first double degree programmes in Europe were launched in the late 1970s and probably originated from the pre-Erasmus Joint Study Programme, which ran from 1976 to 1984 (European Commission, 2020). Initially, double degrees were developed to open labour markets in other countries to graduates (European Commission, 2020). According to the literature, the terminology used to define double degrees is similar, but not always

unanimous. In Knight's book on higher education, joint and double degrees are given the same definition: "An arrangement whereby providers in different countries collaborate to offer a program for which a student receives a qualification from each provider or a joint award from the collaborating providers" (2008, p. 105). In a later publication, the scholar differentiates the two types of programmes, indicating that a double degree programme awards "two individual qualifications of an equivalent level upon completion of the collaborative programme requirements established by the two partner institutions" (Knight, 2011, p. 301). Whereas, in a joint degree programme, a joint diploma is conferred upon completion of the collaborative programme requirements set by the partner institutions (Knight, 2011, p. 300). International double degrees are offered by two higher education institutions, located in different countries, which have collaborated to develop an integrated curriculum where students' credits are recognised in the administrative system of both institutions. Students attend classes and study at the two (or more) partner institutions (i.e. 1 home institution + 1 institution abroad). At the end of the study programme, each of the institutions issues a degree certificate to the students.

The opinions of the main stakeholders involved in double degree programmes were analysed in a couple of cross-countries studies (Culver et al. 2011, 2012). Culver et al. (2011) examined the strengths and weaknesses of a sample of dual- and joint-degree programmes at the graduate level in the United States, Sweden, Italy, and Germany. Their findings suggest that the primary reasons for implementing such programmes are the possible benefits for both students and their institutions: while students can add an international element to their education through direct exposure to another culture and educational system, their institution can increase its visibility and reputation through partnerships with other universities. In a follow-up study (Culver et al. 2012), four different stakeholder groups provided insights into their own perceptions of double-degree experience. According to the students and alumni interviewed, the double degree could make them more employable, representing a way of widening their pool of job opportunities, in both the countries in which they studied, and as proof of their proactiveness and willingness to do more than their peers. In contrast, the group of teachers was less convinced that the double degree could improve students' employability.

In another study (Wiers-Jenssen, 2012) on the employability of students who have had a mobility experience compared to those who have not, it was pointed out that a degree obtained abroad is neither an advantage nor a major disadvantage. "This also indicates that the 'added value' of a full degree abroad is not fully convertible to a domestic setting and that some employers may be sceptical toward foreign education" (Wiers-Jenssen, 2012, p. 485). From the students' perspective, double degrees present the advantages of boosting their career opportunities, having international study and life experience, and the impression of receiving "two degrees for one", as the workload and tuition fees may be lower than in a traditional degree (Knight, 2013).

3. Method and data collection

The data collection technique used in this pilot study was an exploratory questionnaire (cf. Creswell, 2014), as it was the most suitable tool to investigate the opinions of Double Degree students. The main research questions that guided the study were meant to uncover students' motivations for participating in a Double Degree programme, and their perceptions of the value of the experience, in terms of the acquisition of mobility skills. Of these, the present paper will consider the following questions:

RQ: What are the main motivations for students to enrol in a Double Degree programme?

RQ: What are the students' perceptions of the employability and mobility skills they developed the most during this experience?

The questionnaire consisted of both open and closed questions, and was structured in a series of sections based on the main aspects to be explored. The first section started with an open-ended question on the students' motivations to enrol in the Double Degree programme. This required students to state the reasons for their choice, with no predetermined category from which to choose. Another section of the questionnaire aimed at discovering students' perceptions of the skills that can be developed during a Double Degree programme. The available literature on employability and mobility skills – conceived as a mix of soft skills and intercultural competence – was helpful in formulating the close-ended questions. The list of items was adapted from a European study on the skills that students should gain through mobility. The study is the result of an Erasmus+ Programme co-funded project called 'Erasmus Skill Project', which took place between 2018 and 2020, with the aim "to prepare students before their mobility abroad for pursuing their studies under the Erasmus+ Exchange Program and to help them assess their learning curve before, during and after this mobility experience as well as to better understand the skills developed from this experience".¹ Participants were asked to rate a list of items according to a Likert-type scale from 1 to 5, where 1 was 'not important' and 5 was 'highly important'.

The anonymous, Internet-based questionnaire was first sent at the end of March 2022 to students currently enrolled in Double Degree programmes at four selected universities in Italy, Germany and France, which have established such programmes among themselves. A total of 90 e-mails with the questionnaire invitation were sent to the students' institutional addresses, using the e-mail address received when they enrolled in the programmes. Of these

¹ Intellectual Output 2 of the Erasmus Skills Project (2018-2020). ERASMUS + Project number: 2018-1-ES01-KA203-050439. Erasmus+ Key Action 203 - Cooperation for innovation and the Exchange of good practices; Strategic Partnerships for higher Education. Retrieved from: https://www.erasmuskills.eu/eskills/tools/self-assessment-questionnaires/_intro/ES_IO2_Final_Report.pdf

e-mails, 20 were returned by the system because the e-mail addresses were no longer valid, resulting in 70 e-mails actually delivered to the students. To ensure that all students received the invitation, a second set of 42 e-mails was also sent to the e-mail addresses used at the home institution, of which 7 were returned by the system and 35 were valid. After a few weeks, a reminder message was sent to complete the survey. Thirty-five students, who were either in the outgoing or incoming mobility phase at the time, answered the questionnaire. The respondents were 20 males (57.1%) and 15 females (42.9%), the majority of whom were between 23 and 25 years old (26 students), 6 between 26 and 28 years old and 3 between 20 and 22 years old. Some students attended their Double Degree programme between the 2020-22 academic years, so they were close to the end of the programme when they filled out the questionnaire, while others enrolled in the 2021-22 academic year and will conclude it in the 2022-23 academic year, thus providing very up-to-date answers about their experience. Below, the analysis of the results presents the students' views.

4. Results

One of the initial sections of the questionnaire aimed to discover why students are motivated to participate in double degree programmes, through an open-ended question. The students' responses were analysed through content analysis (Schreier, 2012) and classified according to thematic labels, and the main motivations that emerged were: "living abroad and seeing other cultures" (11 answers), "increasing employability and career opportunities" (9), "enriching the curriculum vitae" (6). These themes can be associated both with intrinsic motivation, such as curiosity and the challenge of discovering another country and another culture, and with extrinsic motivation, given by external rewards (cf. Ryan & Deci, 2000).

Other themes found were related to the type of extrinsic motivation, driven by the acquisition of skills or the conscious improvement of an activity: "to broaden and improve my knowledge" (5 answers), "to acquire new skills" (5) and "for the structure of the programme" (5). Others were related to the benefits and final results of the programme (extrinsic motivation), such as "to gain international experience" (4 answers), "to obtain a double degree" (4), "to network (meet new people)" (4). Other extrinsic motivations cited less often were "reputation of the business school" (2), "to improve English proficiency" (2), "the opportunity to work in the host university's country" (1); while the fact that "it was the only available double degree programme to choose from" (1) shows an amotivation (cf. Ryan & Deci, 2000). The students' responses seem to indicate a mix of intrinsic motivations, such as experience abroad and the acquisition of skills and knowledge, and extrinsic motivations, such as future career opportunities and the attractiveness of one's CV if one holds two degrees from different universities. In the study, these views were confirmed by a subsequent close-ended question, in which students were asked to rate the importance of these motivations in their decision to participate in a Double Degree programme.

One of the closed-ended questions on students' perceptions of skill acquisition contained a set of seven items adapted from the 'Erasmus Skills Project' (cf. par. 3): intercultural awareness, global citizenship, resilience, openness and curiosity, empathy and tolerance, creativity (i.e. thinking outside the box), and academic knowledge. Students were asked to evaluate which competences they felt could be most acquired in a mobility experience, answering the question: "Which of these 'mobility skills' can be developed during a Double Degree experience?". The large majority of the respondents (77%) indicated that 'intercultural awareness and knowledge' can be highly developed, while the possibility of developing 'global citizenship' was rated as 'highly' by 23 students (66%) and as 'very' by 10 (28,6%). The students also expressed similar ratings for 'resilience', which 66% rated as 'highly' and 28,5% as 'very' likely to be developed, followed by 'openness and curiosity' (62% as 'highly' and 26% as 'very' likely). Other skills, instead, received mixed ratings as 'empathy and tolerance' was rated as 'highly' likely to be developed by 51% of respondents, while 23% rated it as 'very' and 20% 'moderately' likely. The acquisition of creative skills, meant as a way of 'thinking outside the box', was considered as 'highly' likely developed by 16 students (46%), and 'very' and 'moderately' by 8 students each. Finally, only 43% of the students felt that 'academic knowledge' could be 'highly' developed, while 7 'fairly' and 12 'moderately', making it the competence least associated with mobility, in the list provided to the students. The results of their responses can be seen in the figure below (Figure 1).

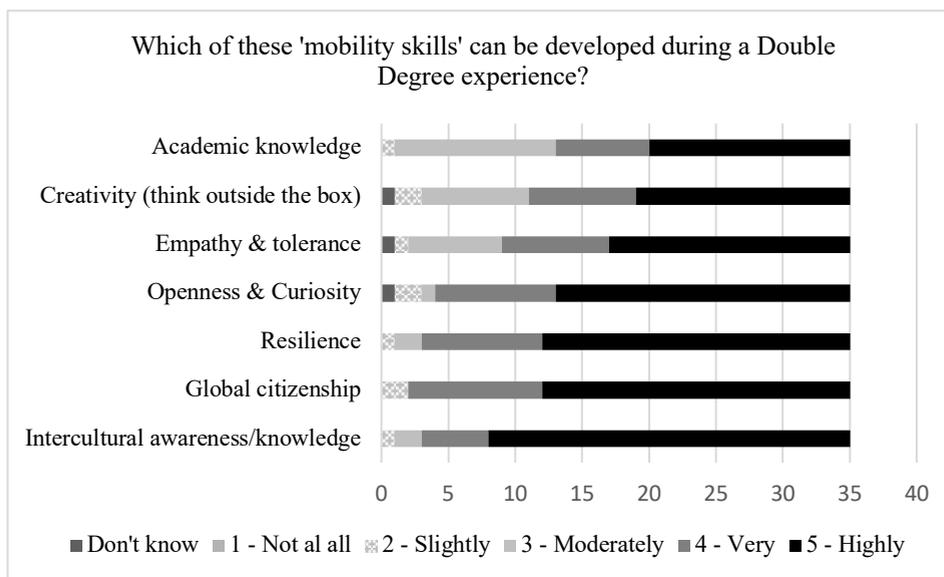


Figure 1. Students' perception of the acquisition of 'mobility skill' during a Double Degree programme.

The analysis of the findings, part of which has been presented here, revealed a number of aspects related to the double degree experience that open the way for further reflection on the impact of these programmes for the students and institutions involved.

5. Discussion

As the results from this study show, students are motivated to participate in Double Degree programmes because they feel that they can acquire both knowledge and skills, as well as intercultural and soft skills, considered as ‘highly important’ by half of the participants. Their responses are in line with research that states that exposing students to different cultural contexts through mobility experiences can help them question their identities, values and beliefs, and help them improve their personal growth and self-efficacy, along with their intercultural competence (Jones, 2014).

It is not unexpected that students who enrol in international mobility programmes are motivated by the possible acquisition of these skills, as it is equally true that these programmes attract students who already possess such skills and are drawn to mobility as a way to further develop them (Jones, 2013, p. 102). In fact, it has been shown that mobile degree students constitute a select group in terms of their prior exposure to international experiences, because they are more likely to have lived abroad and to have parents who have lived abroad (Wiers-Jenssen, 2012). Furthermore, it appears that the skills acquired through students’ international mobility initiatives are the type of general employability skills sought by employers (Jones, 2013). To support students in becoming more aware of their skills, it might be beneficial to involve them in some preparatory activities before their departure for their mobility, and after their return. An example of such activities is provided in the ‘Erasmus Skills Project’ mentioned before (cf. par. 3), where pre and post self-assessment questionnaires were created to help students assess how and which mobility skills they improved during their experience abroad. A similar assessment activity could be created to meet the needs of Double Degree students, who should be able to emphasise the value of their international experience, and make their CV’s stand out not only because of the presence of two degrees awarded, but also because it indicates a goal-oriented, highly motivated and competent candidate.

To bridge the gap between the skills sought by employers and those acquired by students, it is crucial to raise awareness among the main stakeholders involved in the process – i.e. students, universities, graduates and employers – so as to reflect on the pathway leading to the development of students’ employability skills, and to better understand employers’ expectations (Succi & Canovi, 2020). This is especially important when students have participated in an international mobility programme, because graduates need to be able to adequately present the broad range of their competences, through relevant examples from

their own experience, during the recruiting phase, and then be able to convert their skills into observable and value-adding behaviour once they are hired.

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A suggested program for developing first-year university Students' agency

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Abstract

Students joining universities sometimes lack the agency to lead their lives and succeed in higher education. In the educational context, agency refers to the more empowered positioning of students to be active agents in their own learning lives. Enhancing life skills/competencies can facilitate students' agency when they instill positive set beliefs and personal competencies, creating agentic capacity. Action Learning is one of the methods used to enhance life skills/competencies by engaging students in real life problems, taking action, and continuously reflecting on their actions. This paper presents a suggested program for building first-year university students' agency through a balanced approach of Competency-based Learning, Action Learning, and Reflective Learning.

Keywords: *Action learning; agency; competency-based learning; reflective learning; university students.*

1. Introduction

Student agency refers to the quality of students' self-reflective and intentional actions and interactions with their environment. "It encompasses variable notions of agentic possibility ("power") and agentic orientation ("will")" (Klemenčič, 2015, p.11). Bandura (2006) identified four core properties of human agency; intentionality, forethought (set themselves goals and anticipate likely outcomes of prospective actions to guide and motivate their efforts), self-reactiveness (self-regulation), and self-reflectiveness (metacognitive capabilities). According to Heckman and Kautz (2013), skills give agency to people to shape their lives in the present and to create future skills. Murphy-Graham and Cohen (2022) offered a general definition of life skills. For them, life skills are skills "to be able to do life well" (p. 37), opening the answer to be 'it depends' (Schmidt, 2022, p.268). Research has informed various intervention programs to enhance youth life skills according to the context where they are applied. Due to life skills nature vary according to the culture and the environment (UNICEF, 2003), each program differs in its goals and approaches (Bender, 2002).

One of the goals of teaching life skills is to support students' transition from one educational level to the other, raising their awareness (Akfirat & Kezer, 2016). The program suggested was designed for first-year university students in Egypt to enhance students' agency. The program uses three approaches to learning to enhance students' agency; Concept-based Learning, Active Learning, and Reflective Learning. This program was implemented with twenty first-year university students from different disciplines. There were clear signs of skills/competencies development and agency enhancement in the final presentation, students' reflections, and mentors' notes.

2. The Suggested Program

The program used the backward design model (Wiggins & McTighe, 2005) to plan the curriculum design sequence. The following are the details of the program under the three aspects of the backward design; identifying desired outcomes, determining acceptable evidence, and planning learning experiences.

2.1. Identifying Desired Outcomes

The first step is articulating desired outcomes needed for first-year university students. In this step, Competency-based Learning was used to identify and define precise measurable descriptions of knowledge, skills, and behaviors students will possess at the end of the program. The Competency-based curriculum emphasizes life skills and evaluates mastery of skills necessary for an individual to function proficiently in a given society (Savage, 1993).

The following are the four main competencies, each with sub-indicators that sets curriculum skills focus and objectives.

Table 1: The Program Desired Outcomes of Main Competencies and Skills Indicators.

Main Competencies	Skills indicators By the end of the course, participants will be able to
<p>Reliability On one self</p> <p><i>the quality of being trustworthy of oneself performing consistently well.</i></p>	<p>S-1-1: Self-awareness S-1-1-a: identify the values and indicators of self-awareness S-1-1-b: analyze preferences and style S-1-1-c: develop self-awareness</p> <p>S-1-3: Self-reflectiveness S-1-3-a: explore past experiences in detail S-1-3-b: point out reasons behind preferable and unpreferable actions S-1-3-c: reconsider alternatives and identify the next steps S-1-3-d: take reflective actions and develop new skills and strategies</p> <p>S-1-4: Self-regulation S-1-4-a: practice self-control and resilience strategies S-1-4-b: practice self-motivation and positive thinking S-1-4-c: practice strategies of mental focus and concentration S-1-4-d: practice strategies to manage negative feelings</p>
<p>Connectability With others</p> <p><i>the quality of being able to connect with different people for different purposes</i></p>	<p>S-2-1: Communication S-2-1-a: interpret received non-verbal messages and give appropriate answers S-2-1-b: use a variety of speaking and writing techniques to communicate with a variety of audiences S-2-1-c: read critically from a variety of sources and understand the hidden meaning</p> <p>S-2-2: Social presence S-2-2-a: collaborate with others to accomplish tasks S-2-2-b: build meaningful relationships and avoid negative peer influence S-2-2-c: accept and understand others' differences</p> <p>S-2-4: Civic engagement and leadership S-2-4-a: recognize the relationship between community challenges and personal skills and contributions S-2-4-b: manage peoples' skills and monitor achievements S-2-4-c: adopt passionate ideas and use influence strategy to form team motivation</p>
<p>Ingenuity In life roles</p> <p><i>the quality of being clever, original, and inventive.</i></p>	<p>S-3-1: Intentionality S-3-1-a: practice self-direction and clear vision S-3-1-b: initiate and resume actions to reach desired results</p> <p>S-3-2: Forethought S-3-2-a: set clear, challenging, and realistic long-term and short-term goals S-3-2-b: plan specific actions to achieve goals S-3-2-c: follow-through with plans taking corrective actions throughout</p> <p>S-3-3: Creativity S-3-3-a: find, interpret, judge, and create information S-3-3-b: process and analyze information by sifting, sorting, comparing, verifying, and trying out different ways to make sense of the information S-3-3-c: practice observing, gathering, organizing, and testing information to formulate and support critical arguments S-3-3-d: consider multiple alternatives and create novel and innovative ideas</p>
<p>Main Competencies</p>	<p>Skills indicators By the end of the course, participants to be able to</p>
	<p>S-4-1: Agility</p>

<p>Adaptability To one's environment</p> <p><i>the quality of being able to adjust to new conditions</i></p>	<p>S-4-1-a: think and draw conclusions using intellectual acuity S-4-1-b: react quickly to precarious situations with clear priority measures</p> <p>S-4-2: Decision-making and problem-solving S-4-2-a: combine knowledge, understanding, and skills to create solutions S-4-2-b: consider unlikely or impossible alternatives S-4-2-c: examine alternatives from different perspectives</p> <p>S-4-3: Coping with unexpected situations S-4-3-a: practice flexible thinking by developing multiple opposing, contradictory, and complementary arguments S-4-3-b: apply skills and knowledge in unfamiliar situations S-4-3-c: manage change by adopting alternation and practicing adaptive skills</p>
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2.2. Determining Acceptable Evidence

According to Mkonongwa (2018), competencies can be used as criteria for assessing the competency attainment level required for success. The program uses the competencies set as criteria of assessment through the program. Mentors keep track to produce their final judgment of each sub-skills level for each student (skills are scored in four levels).

2.2.1. Students Journals

Students keep a journal throughout the program that they must use daily to record all actions or problems encountered.

2.2.2. Ongoing Observations

Mentors write anecdotal notes for each group member after each reflective session describing how they reacted and any significant signs showing the competencies.

2.2.3. Final Presentation

At the end of the program, every group presents the project journey, and each member mentions their perspective of competencies enhanced in this project.

2.3. Planning Strategies for Implementation

2.3.1. Planned Interactive Workshops

As much as identifying which skills to teach in a program, how to teach them is more important (Schmidt, 2022). The program starts with some interactive workshops on basic competencies/skills. The interactive workshops through the implementation of the project clarify some concepts students need at this specific phase/step of the project. Reflective tasks through the implementation of the project are designed to consolidate students' self-discoveries and support skills' development.

Table 2: Alignment of Project Steps/Phases with Action Learning process, Interactive Workshops, and Reflective Tasks.

Project Steps/Phases	Action Learning Process	Interactive Skills Workshops	Reflective Tasks
Before introducing the project		<ul style="list-style-type: none"> - Know about yourself - The growth mindset 	Task 1: Individual self-assessment of competencies using program outcomes before the beginning of the project and putting individual aims.
a. Explore their community.	- Present challenge/problem/issue/question	<ul style="list-style-type: none"> - Communication skills - Self-motivation 	Task 2: Individual Reflective questionnaires focusing on self-discoveries and setting the next steps.
b. Creating an idea to develop their community.	- Insight? New ideas and understanding, perceptions and assumptions.	<ul style="list-style-type: none"> - Collaboration skills - Designing an action plan 	Task 3: Group reflective questionnaire of how the idea was developed. Task 4: Individual Reflective questionnaires focusing on self-discoveries and setting the next steps.
c. Implement this idea.	<ul style="list-style-type: none"> - Test actions in the workplace - Bring results back to set. What worked, what did not work 	<ul style="list-style-type: none"> - Time management - Self-management - Perseverance 	Task 5: Regular group reflective sessions supported by the mentor. Task 6: Individual Reflective questionnaires focusing on self-discoveries and setting the next steps.
d. Collect evidence of learning.	- Drawing conclusions and marking learning		Task 7: Review of self-assessment in Task 1
e. Present the outcomes.			Task 8: Individual Reflective journal of what was learned in the program.

2.3.2. Designing the Project Procedures

The most effective learning is based on the need to solve problems (Welskop, 2013). Action Learning is a structured method that enables small groups to engage in real-life problems, take action, and learn as individuals and as a team while doing so (Serrat, 2017). Revans (1983), the originator of Action Learning, believes that people must be aware of their

shortage of knowledge to be motivated to complete it. They then start to ask questions and collaborate with others to find solutions, try them out, reflect again, and so on. In the process of reflection, experience theory is transformed into knowledge, which undoubtedly increases learning effectiveness (Welskop, 2013). Figure 1 clarifies the Action Learning Process. In this process, they develop agency components of; intentionality, forethought, self-regulation, and self-reflectiveness.

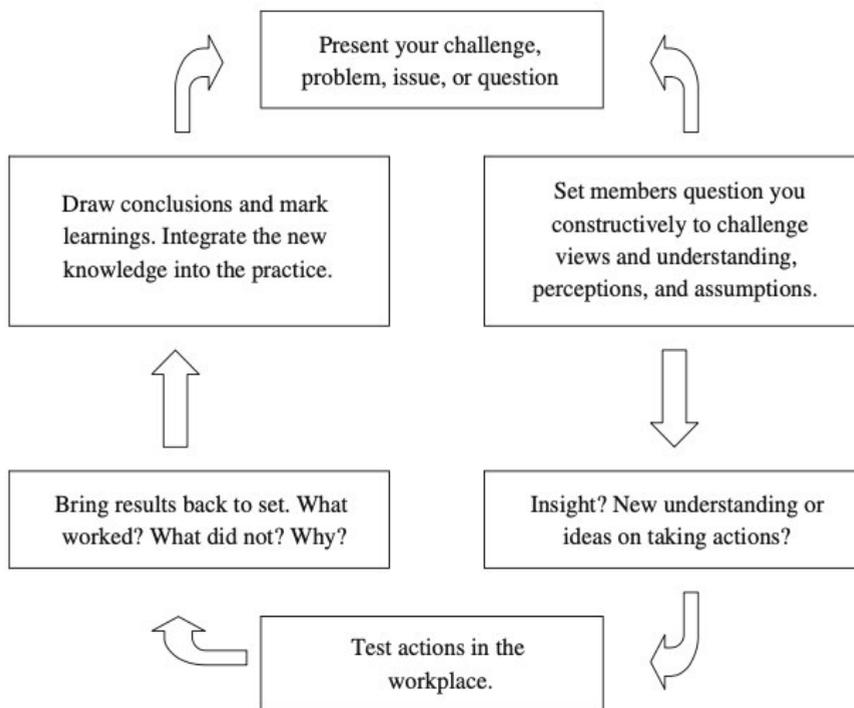


Figure 1. The Action Learning Process (Serrat, 2017).

The project takes students into different phases to implement an idea they create. The project goes through the following steps in groups of five supported by a mentor:

- a. Explore their community.
- b. Creating an idea to develop their community.
- c. Implement this idea.
- d. Collect evidence of learning.
- e. Present the outcomes.

2.3.3. The Reflective Spiral

According to Powell (2004), "Reflective practice is a hallmark of quality instruction" (P.2). Moon (2005) mentions that "reflective learning emphasizes the intention to learn from current or prior experience" (p.80). For Kember et al. (2008), "Reflection operates through a

careful re-examination and evaluation of experience, beliefs and knowledge" (p. 370). There are different kinds of reflective approaches, for example, the use of journals and group discussions following practicum experiences that are not directed to a solution of a specific problem. Reaching the competencies set in the outcomes are achieved by students frequently reflecting throughout the project. They go through the following: (see Table 2)

- a. Individual self-assessment of competencies using program outcomes before the beginning of the project and putting individual aims.
- b. Individual Reflective questionnaires focusing on self-discoveries and setting the next steps.
- c. Group reflective questionnaire of how the idea was developed.
- d. Regular group reflective sessions supported by the mentor.
- e. Individual Reflective journal of what was learned in the program.

Frequent reflection helps them create their own cycle of plan, do, reflect, plan, do, reflect, and so on. With the support of a mentor, this cycle consolidates the sources of agency of intentionality, forethought, self-reactiveness, and self-reflectiveness.

3. Conclusion

The knowledge students learn from reading books about different theories and concepts is important but insufficient (Weshop, 2013). Learning skills through action focuses on application, giving students opportunities to try and refine skills. The accumulation of skills/competencies learned through action and reflection build students' agency and enhance their ability to lead their lives. The program suggested takes students into a cyclic process of learning, applying, and reflecting, then learning and applying again. It carefully identifies what competencies first-year university students need and develops a path of application and reflection supported by mentors to monitor and assess learning.

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Information skills instruction in higher education students using the 4C/ID model

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Abstract

Information skills instruction continues to be a pending subject among university students despite the fact that they handle the Internet with ease, since the ability to define what is needed, to be strategic when deciding where to search and how, to select the information most appropriate and relevant and to use it properly is not routinely taught. The purpose of this article is to show how the 4C/ID model is applied to the design of this skill, the challenges encountered in its adaptation and the improvement in self-perceived efficacy by students. The results show that the model is successful and the students felt more prepared to face this type of tasks in the future.

Keywords: *4C/ID model; information skills instruction; online; higher education.*

1. Introduction

University students regularly use the Internet to find information for their academic work. Traditional libraries have been largely replaced by massive scientific databases and academic search engines to provide the information that students require in their work at the University. However, many students lack the ability to find the information they need and use it competently in their academic texts (Zhou & Lam, 2019). Although many students claim to be digital natives, using the Internet for academic purposes is not the same as using it for leisure purposes (Hinchliffe et al., 2018). This deficiency in their informational skills implies a great effort for their teachers, who must invest a lot of time and resources in training the students (Lanning & Mallek, 2017). And although this training has traditionally fallen on librarians and information management specialists, the information skill required is increasingly specific (Taylor, 2012) and less generic, so many professionals from other academic fields (engineering, medicine, law) are nowadays responsible for working on this skill with their students.

This complex cognitive skill is often referred to as information literacy (IL) or information problem solving (IPS) and has been widely explained by different theoretical perspectives and approaches (ACRL, 2016; Brand-Gruwel et al., 2005; Brand-Gruwel et al., 2009; Catts & Lau, 2008). IL involves much more than just searching the Internet. It is a complex process that always points to a specific goal (Garcia & Badia, 2017). It begins with the ability to clearly identify what you want to search for (the definition phase), the selection of the best ways to search for information (which tools to use, which search engines, databases), the strategic application of searches (use of Booleans, keywords, key authors), the selection and organization of the information from the results (what to choose, for what purpose) obtained and the integration of that information in a coherent and orderly manner with the personal texts of the students. It is a more complex process than it seems at first sight and it cannot be resolved simply by browsing the Internet or using social networks (Argelagós & Pifarré, 2016). To carry out this process properly, instruction and a critical attitude are needed (Frerejean et al., 2019).

The 4C/ID model is an instructional approach whose primary objective is to help to teach complex skills or professional competencies (Van Merriënboer et al., 2002). It is a task-centred instructional model (Francom, 2016) that aims to avoid the fragmentation of knowledge in favour of a flexible and interconnected integration of knowledge, skills and attitudes (Van Merriënboer & Kirschner, 2018). It is based on four main components: (1) learning tasks, (2) supportive information, (3) procedural information, and (4) part-task practice.

1. Learning tasks are the backbone of the educational program, as, for instance, cases, projects, professional tasks, problems, or assignments that students work on.

Learning tasks encourage inductive learning: students learn by doing and confronting particular experiences. The learning tasks in the 4C/ID model must meet a series of characteristics: their variability, that is, they must be different so that they represent all the dimensions that are found in the professional environment, and also the level of complexity of the tasks must be different and progressive, like the support received from the instructor, which should be decreased gradually by the process known as ‘scaffolding’. Finally, upon completion of the last tasks, the student should be able to perform them correctly on his own.

2. The second component of the model is the supportive information (sometimes called “theoretical information”), which helps students to perform the non-routine aspects of learning tasks, which often require problem solving, reasoning, and/or decision making. Supporting information provides the link between what students already know (i.e. prior knowledge) and what they need to know in order to perform the learning tasks.
3. The procedural information helps students to execute routine aspects of the learning tasks, that is, those aspects that are always performed the same way. This information must be presented the first time the student performs that aspect as part of a learning task. For subsequent tasks, the presentation of the procedural information has to be gradually removed since its need decreases as the student gradually masters the routine.
4. Part-task practice aims at strengthening cognitive rules through extensive repetitive practice. It is important to begin the practice of a part of the task within a fruitful cognitive context, that is, after students have faced the routine aspect as part of a complete and meaningful learning task. Then, students will understand that practice can help them improve their performance in all tasks.

The objective of this article is to show the adaptation process of the 4C/ID model for information skills instruction of university students in a completely online environment. The reason for selecting the 4C/ID model to train this skill is precisely that it is a complex cognitive skill, which is usually taught following classical instructional methods or its design focuses only on part of the skill, on the search for information (Koufogiannakis & Wiebe, 2006). As well, we wanted to find out if students felt more prepared to this type of task after completing a 4C/ID course on information skills.

2. Methodology

2.1. Context of the study

The context of the study was the Faculty of Education of a Spanish university whose academic model is completely online. Both 4-year degrees and one-year university master's

degrees are studied at this Faculty. At the end of their academic programme, students have to present a final study manuscript (between 40 and 80 pages) that always incorporates a theoretical framework and that requires the application of information skills by the students. The students who were going to be part of the voluntary instructional process belonged to the degree in early childhood education and in primary education, the master's degree in special education, in neuropsychology and education, and in psych pedagogy.

2.2. Design process

Since students belonged to a virtual university, it was decided to generate an instruction that combined synchrony (adobe connect) and asynchrony (pdf, videos and mind maps) tools. So, for the instruction, we decided to land the 4 components of the 4C/ID model (see figure 1):

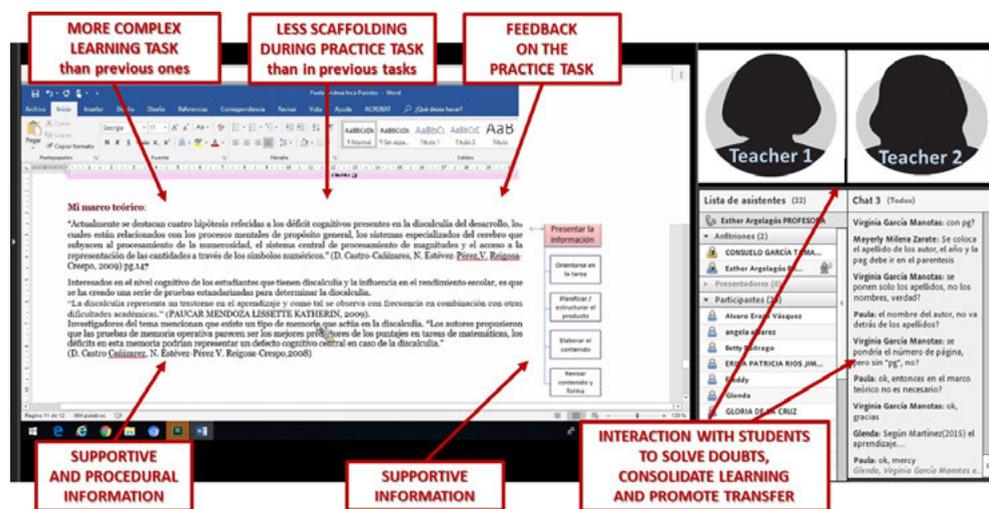


Figure 1. Example of synchronous session. Source: own

- Learning Tasks. They had to be relevant for the student's real life and also had to have different levels of complexity so that the students could feel comfortable and gain more confidence in themselves. We chose the following topics: (1) gamification and learning, (2) cyberbullying and childhood, (3) metacognitive strategies in primary education, (4) cooperative learning and (5) personal choice of each student.
- Supportive information. A pdf content was elaborated to explain the student the main components of the instructional model, which help them to understand and follow step by step the complete process to write the contents needed for a theoretical framework of an academic text, based on the results obtained.
- Procedural information. Modelling examples video recorded were key to show students how to proceed to apply the instruction by themselves. Having an expert

doing and reflecting on what to do, even incorporating mistakes and failures was fundamental to include the routine aspects of the information process.

- Part-task practice. This was approached in two ways: firstly, the teachers taught in synchronous classes how each part of the information process was applied, and secondly, the students practiced that part of the process autonomously but with the support of the written and audio-visual material. In such a way that at the beginning the students received a lot of guidance from their teachers, but in the end, the task had to be carried out completely autonomously.

2.3. Course instruction

In order to carry out the complete instructional process, it was decided to structure the course contents, the modelling examples and the synchronous classes according to the step-by-step model (see figure 2) designed by Brand-Gruwel et al., (2005).

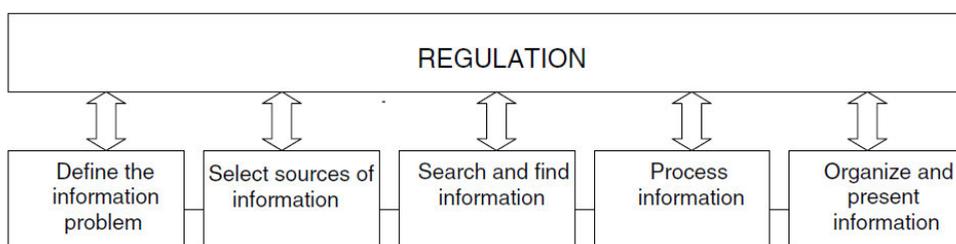


Figure 2. Descriptive model for information problem solving. Source: Brand-Gruwel et al., (2005).

First, the ability to define research questions was deployed by the teachers, explaining all the steps involved in the development of this ability: topic analysis, activation of prior knowledge, how to specify a topic and how to establish research questions. Secondly, the focus was on the selection of academic sources and search strategies, how to carry them out through google scholar and the databases of the university, how to use the thesaurus, keywords and Booleans within search engines or metasearch engines and how to carry out an initial evaluation of the results based on a checklist to control the reliability, veracity and timeliness of the source. In the third place, the analysis of the results, the selection and the summary of the publications found for its later consultation was worked. And, eventually, the teachers showed how to analyse and extract the relevant information from the relevant sources and how to integrate the information. Subsequently, the last section of contents was oriented to how to organize and present the information, plan the text and the fundamentals to paraphrase, quote and correctly incorporate the information found in the content itself.

At the beginning of the course, the students received the following action guideline (which was repeated in each phase of the instructional process):

1. Read the .pdf that explains the step to be carried out.

2. *Watch the video (as many times as necessary) about the step to be taken.*
3. *Run the task (see the video while it is being done).*
4. *Reflect on the results.*
5. *Share doubts with the teacher in the Connect session*
6. *Attend the next class.*
7. *Perform the following task.*
8. *Start with step 1 again.*

The resolution of the task allows to reflect on the results and problems encountered. During the connect session with the teacher, you will see the results that you should have obtained and the teachers will explain in detail the steps that should have followed, and they will resolve the doubts that you may have in relation to the phase worked on. To begin with, remember to watch the first video that explains all the steps to carry out the search and use of the information needed to write a theoretical framework.

In task 1 the complete instruction of the process was shown and shaped by the teachers. In tasks 2 and 3 the part-task practice was applied so that the students internalized the routines supported by the procedural information. In task 4 the students carried out the activity autonomously with prompts and occasional help from the teachers. Finally, the students performed the last task without help. The course lasted two months, the first four tasks were developed during 3 weeks, and the last task (autonomous) was done one month after the instruction.

2.4. Participants

The call for the voluntary course and subsequent research was made to 120 students, and 80 (28.8 % female, 36.86 average age) accepted to participate. Finally, 25 completed the entire course and 55 did not. The Self-Efficacy Scale for Information Searching Behaviour (SES-IB-16; Rosman et al., 2015) is a questionnaire to measure self-reported information literacy. It was used to measure students' assessment about their possibilities of successfully approaching the task of preparing the theoretical framework of their final project. It was filled out by the students before and after completing the course.

2.5. Data analysis

Improvement in students' self-perceived efficacy was analysed by means of a mixed analysis of variance (ANOVA) using group (experimental and control) as an intergroup factor, and the pre-test and post-test results of the SES-IB-16 as an intragroup factor, applying SPSS v18.

3. Results and conclusions

The application of 4C/ID model to information skills instruction was successful. On the one hand, the main challenges we had to address in the adaptation were of a different nature. The first was to start from a global vision of the entire training process from an expert perspective, in order to break it down into its parts. The conceptual framework of the IPS skills by Brand-Gruwel et al., (2005) was of great help, when comparing the skill breakdown of the model with the steps carried out by the expert. Secondly, we had to decide what each task would consist of, not only the different content but also their different level of complexity. And how to scaffold during the instruction period was another of the issues we faced, since the objective was for students to internalize the most routine mechanisms to address more complex aspects, as they progressed in their training. Another challenge was deciding the timing of the classes to give students time to complete the parts of the tasks, attend classes, share the results and reflect on their mistakes and successes. We made the decision to leave a long period of time (one month) between the instruction and the delivery of the last task (free theme developed autonomously) so that the students had time to reflect on everything they practiced and learned.

On the other hand, from the teachers' point of view, the process was enriching when observing how the students progressively not only understood what they had to do to solve the tasks, but also became more and more autonomous in the process of defining, searching, selecting and elaborating the information for the theoretical frameworks of their academic thesis. It was a little more difficult to personally manage each student during the synchronous classes, but the decision to expose the "best" results and share the most common mistakes was very helpful for the students.

Finally, on the part of the students, the feeling of self-efficacy of the group that took the course was significantly higher than the group that did not take it. In the case of the self-efficacy expectations measured by SES-IB-16, we observe that there is an intra-subject effect [$F_{1,78} = 25.27, p < .001, \eta^2_{partial} = .245$] and interaction between this factor and the group [$F_{1,78} = 16.08, p < .001, \eta^2_{partial} = .171$] with a high effect size, so the training was considered very effective. So, we consider the task centred approach of the 4C/ID model, based on an integration of knowledge, skills and attitudes (Van Merriënboer & Kirschner, 2018) helpful for information skills instruction and to increase students's sense of future success concerning their academic challenge at the end of their university studies.

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A systematic review: foundations for online course design in higher education

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Abstract

The purpose of this study was to select specific best practice indicators for improving online course design based on the recent research findings shared during and post COVID-19 pandemic. PRISMA guidelines were used during the search process to identify qualifying studies. EbscoHost, Academic Search Ultimate, Educational Research Information Center (ERIC), Google Scholar and JSTOR were the six databases searched for selecting articles that met the following criteria: a) written in Spanish or English, b) peer-reviewed studies and indexed journals c) higher education level and d) online courses design best practices. The database searches identified a total of fifteen relevant studies. The findings of this study demonstrate four core indicators of online course design: planning course alignment, using templates for framework design, developing articulated connections and continuous cyclical review. These essential indicators are critical for online course planning as they have shown to be vital to student achievement, retention, and satisfaction.

Keywords: *Online course; course design; best practices; higher education.*

1. Introduction

Trends in higher education suggest that distance learning is the most rapidly growing sector, in great part due to the COVID-19 pandemic. For this reason, online course design is a topic of growing importance since inefficient online course design has been shown to result in poor student achievement, low retention rates, and dissatisfied students (McMahon, 2021, Joosten & Cusatis, 2019). While online course models are not a new phenomenon (Abdous, 2020), the growth of online teaching experience over the past three years has broadened the amount of research regarding effective online courses and positive student outcomes around the world; therefore, creating a need for an updated review of the literature.

Distance education refers to learning where the participants are not required to be in the same location but are dependent on either technology to engage in educational activities synchronously or asynchronously (Traboulsi, 2008). Online course design is fundamental to student success as it is the framework that connects the student at a distance to course materials, recorded lectures, assignments, assessments, and collaboration with the instructor and classmates (Fischer, et al., 2022). For this reason, educators creating online courses are tasked to approach online course design from a different paradigm than traditional pedagogy. The purpose of this study was to select specific best practice indicators for improving online course design based on the recent research findings shared during and post-pandemic.

2. Methodology

PRISMA guidelines include a 27-item checklist to facilitate the clarity of systematic reviews (UNC University Libraries, 2020). Following the PRISMA guidelines, six databases were selected in this study. These databases were chosen because of their international scope and alignment with topics in education and technology to answer the research question of what current best practices in online course design are as identified during and after the pandemic. Different keywords with combinations including higher education and online courses, best practices, and distance learning were used during the search process.

Articles were selected using the following criteria: a) written in Spanish or English, b) peer-reviewed studies and indexed journals c) higher education level and d) online courses design best practices. The initial search yielded 928 matches. Through the identification process 274 studies were duplicated and therefore eliminated, 539 studies were ineligible due to not meeting eligibility criteria, 67 studies were removed for other reasons such as not being a research article. This resulted in 28 studies that were screened for eligibility, resulting in a total of 15 international studies that met the selection criteria. Articles were initially categorized according to the following dimensions: country of origin, purpose of the study, data collection methodology and key findings. Studies referenced in the journal articles used qualitative, quantitative, or mixed methods research methodology. This international sample

helps to minimize bias, as the results are not likely to be attributed to a specific geographic location. The applied searches and results from each database are shown in Figure 1.

3. Results

Participating studies included asynchronous, synchronous learning and/or hybrid model courses. Journal articles were chosen internationally and included Spain, Malaysia, Taiwan, India, USA, Turkey, Jordan, and Sri Lanka. Eligible studies focused on the challenges with transitioning from face to face learning to distance education, online course design characteristics, online course instructional practices, student and faculty experiences and perceptions of the online experience. The results revealed that effective online course design frameworks are the principle requisite for positive student learning outcomes, which also encouraged improved concentration and independence.

An emergent theme from this study has been the articulation that the shift to online learning in higher education has been uncertain due to the lack of adequate design, planning & development (Adedoyin & Soykan, 2020; Oliviera, et al. 2021). These deficiencies were attributed to a lack of clear institutional policies that clearly address their vision of the online classroom (Haider & Al-Salman, 2020). Without a structure to follow, courses within the same institution could be presented in a variety of organization patterns leading to confusion among students. Student frustration with course design was correlated with poor learning outcomes, and perceived lack of course quality, both of which lead to the reduction in course effectiveness (Nambia, 2020; Bradley & Vigma, 2016).

Online course design is the organization of course content so that it aligns with student learning outcomes resulting in effective learning. (Ceballos, 2018; McMahan, 2021; Sanga, 2019, Sandanayake, et al., 2021; Tamilarasan, et al., 2021). The contribution of this study is to inform institutional policies, positively affecting future online course creation and providing clearer guidelines for course creators to follow.

The first essential indicator in best practices for online course design was planning. Planning begins with a needs analysis to choose a delivery model (synchronous, asynchronous, or blended) suited to the content of the course & to the audience. Once established, the determination of learning objectives can take place, which are then aligned with assessments (McMahan, 2021). Objectives are defined to mark specific learning goals to be met as the course progresses; course articulation refers to the transparency regarding the relationship these individual objectives have among them and how they contribute to achievement of the learning outcomes expressed at the onset of the course. LaForge (2022) found that improving course organization, transparency, objective-assignment alignment and developing instructor feedback opportunities, resulted in improved student retention, better learning outcomes and higher student satisfaction. Providing clearly stated learning objectives and their

interrelationship, facilitates students' understanding of what they should be learning is often overlooked.

The lack of articulated course was another emergent theme uncovered within the literature. The benefits of course articulation is that it results in manageable targets for students to achieve (Hsu, et al., 2017). Nave (2020) found that student effort to persevere is aided by dividing longer-term goals into short-term objectives. When class content is presented in logical chunks of information, it promotes greater student concentration (Bao, 2020). Using themes, lessons or modules presents learning outcomes by segmenting or chunking course content, which aids in the next foundational indicator: course framework design.

Course framework design has been defined as the organization and presentation of course materials. This type of organization requires the course structure to be clear and consistent (Fischer, et al. 2022). At the institutional level, having a model further supports students' abilities to navigate in different courses due to the use of a uniform model (Garcia-Penalvo, 2021, p.12; Oliveira, et al., 2021). Consistency can be implemented using a standard framework in the form of module templates (Ralston-Berg & Braatz, 2021). Module templates would support lesson structure transparency by having a clear and logical sequence that is student friendly, consistent and intuitive for each module that is repeated throughout the course. For example, each module would begin with the presentation of the objective and how it fits within the course objectives, followed by required content materials, videos, texts, practice activities, assignments, and end with a module evaluation. Intuitive design supports the learner by predicting potential problems or needs a learner may encounter and designing solutions to minimize these problems. In a study conducted by Fischer, et al. (2022), they found course transparency in organization had significant positive effects on students' independence, which is a required skill for student success in online courses.

Once planning and a design framework are in place, instructors should articulate content connections to facilitate students' recognition of the importance of that unit or module in meeting course objectives (Martin, et al, 2019). The connections between objectives and learning outcomes should be explicitly expressed to students as a means of facilitating the big picture image that students are creating as they progress (Sandanyake, et al, 2021; Kharagpur, 2016). Nave (2020) found that students were more engaged when they understood why they were learning the content, understanding its relevance in real-life contexts. This was a motivator of efficient learning which reduced course abandonment rates. Development of methods & materials will direct the student from the course objectives to learning necessary content to achieve learning outcomes. Learner-content interaction, learner-learner interaction and learner-teacher interactions are three areas of interaction to be considered when developing course materials (Moore, 1989). Course materials can be in the form of videos [screencasts & lecture recordings], audios, texts, animations, drawings & graphics and more as new platforms and interactive technologies are being developed to

support interaction with the content, instructor, and classmates. In distance education, environments ideally there would be a balance among tasks that are done independently and those that encourage collaborative learning for greater student interaction and persistence in the course (Bilgiç, et al., 2020; García-Peñalvo, 2021).

Formative assessments can support students' self-reflection by acting as checkpoints for the students' understanding of their progress. In the study conducted by Holzmann-Littig, et al. (2023), students expressed that assessments motivated them to monitor their understanding and maintain focus on the material. In terms of summative evaluations, rubrics provided ahead of time add clarity of the instructors' expectations. Additionally, Lorente-Ruiz, et al. (2021) recommend identifying standard feedback strategies to increase student-teacher communication that may increase participation. Students that receive frequent and specific feedback tend to stay connected to the course (Nave, 2020). Communication, despite distance, is facilitated when communication channels are explicitly expressed for students to initiate contact with the instructor (LaForge, 2022; Hsu, Baldwin, & Ching, 2017).

Course review in its entirety is the final indicator found in the research for best practices in online course design. During this stage, best practice includes identifying opportunities for student feedback, guides for self-reflection and evaluation of the course after completion (Nave, 2020). McMahon (2021) recommends creating a framework for self-assessment as well as peer review processes to continue refining course quality. Once student and instructor feedback have been reviewed, the instructor would return to the planning stage to enhance identified areas of improvement. Ralston-Berg & Bratz (2021) recommend refining design and course structure after each completion of the course. Prior experience has been the greatest predictor of positive online teaching experience, thus supporting the importance of a cycle of continuous improvement and growth (Marek, Chu & Wu, 2021). This final indicator is crucial to the instructor's professional development in online course design. Ongoing evaluation and reflection could also inform institutional policies regarding the production of quality online courses.

4. Conclusion

This systematic literature review has identified four essential indicators to improve online course design, rooted in recent research of best practices in distance education. The following indicators are (1) to plan aligned course objectives, (2) use module templates to facilitate consistency and transparency within the design framework, (3) develop articulated connections within the course to share with students regarding how the material is connected within the course and its relevance to their future and (4) conduct continuous cyclical reviews of the course after each completion to include feedback from the instructor and students. By including these indicators, students are more likely to navigate efficiently for effective

learning, participate in activities, and successfully complete the course thereby improving student retention rates. However, if not included in online course design potential consequences are lack of achievement of learning outcomes, disengagement, and course desertion. Institutions and educators can use these findings to inform formal policies regarding online course design. Based on each institution's particular needs, resulting policies could in turn provide direction for relevant professional development topics for online course instructors. While the focus of this study was on higher education online course design, further research may consider differences in public versus private institutions. An online course design model is crucial to student success, and by incorporating these fundamental indicators, instructors are better equipped to support student achievement at a distance. This study provides evidence to support standard indicators to be included in online course design models and in decision-making relating to online course policies.

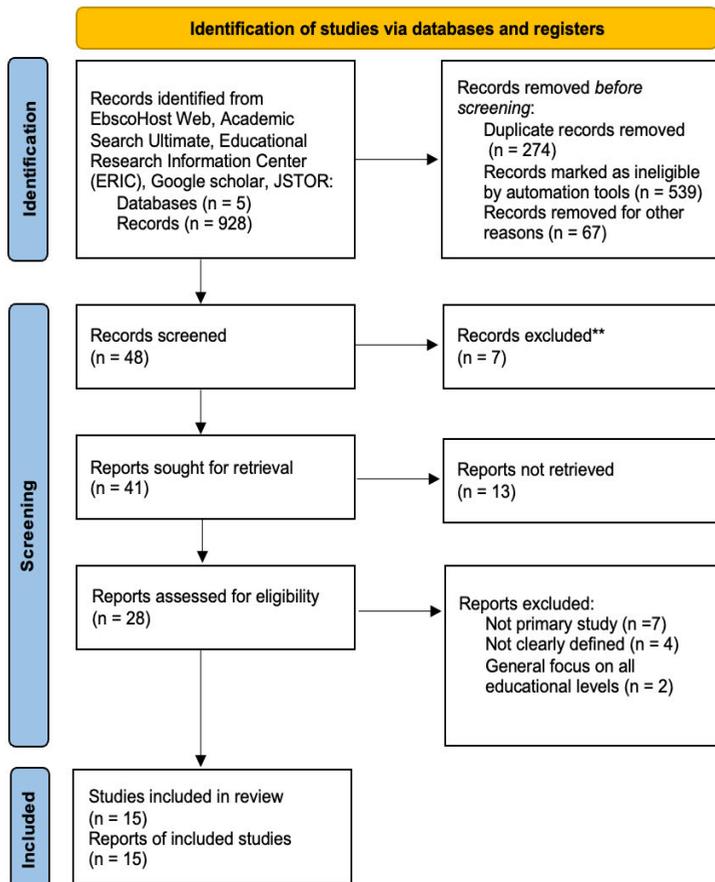


Figure 1. Details of selection of studies for review.

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E-learning and economics: knowledge dissemination through social networks

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Abstract

Increasing digitalization has led to a shift from learning and knowledge transfer based on reading texts, books and/or journals, to the use of virtual platforms. These changes represent future challenges for the acquisition, appropriation, and dissemination of knowledge. According to the Availability and Use of Information Technologies in Households National Survey (ENDUTIH, 2021), in Mexico there are just over 88 million Internet users and more than 91 million cell phone users. This survey also shows that more than 94% of users use social networks. The objective of this work is to measure the reach that the publication of infographics with scientific content through social networks has had. Using an analysis of variance (ANOVA) and controlling for characteristics of the publications, it was possible to estimate statistical differences between groups. The results indicate that the classification by control groups: people reached, and interactions; show differences in means between groups and years of publication, demonstrating positive results for the dissemination and acquisition of scientific knowledge through infographics.

Keywords: *Social networks; knowledge dissemination; infographics in education.*

1. Introduction

In recent years changes in the learning process have encouraged many students to complement their own process in the classroom with digital tools. These learning media represent an opportunity for students to access knowledge faster and with better results. Much of the change in the digitization process boomed during the COVID-19 pandemic. According to the National Survey on Availability and Use of Information Technologies in Households (ENDUTIH) 2021, in Mexico, just over 55.3% of homes with young people had internet access, representing more than 11.8 million people. The same survey found that more than 24 million young people searched the internet for information on education, research, and homework. Regarding internet use, just over three million people between 25 and 29 years of age use this medium for training. Among the most used social networks are: WhatsApp, Facebook, Instagram, Messenger, and YouTube.

The digitization process has given rise to new means of disseminating and spreading knowledge. Significant changes have been observed in students, teachers, researchers and all Internet users. However, a positive acceptance has been found in infographics, whose main feature is to summarize extensive information in a template that can be consumed through social networks. Infographics are considered part of information visualization. It is a field of research that focuses on patterns and trends in abstract data sets and can help design content with maximum effect (Naparín and Saad, 2017). In this sense, infographics become an attractive medium to disseminate knowledge, becoming an ideal method of dissemination and knowledge transfer for all audiences. This is the reason why infographics have greater acceptance when they meet visualization requirements, such as colors, images and text.

In the understanding that didactic and fast learning strengthens soft and hard skills in university students. The development and dissemination of infographics can reduce knowledge gaps in adults and young users of social networks. The dissemination of knowledge through digital media can contribute to the Sustainable Development Goals of the United Nations 2030 Agenda, whose goal is to "leave no one behind"; and in goal 4, quality education, efforts are sought to ensure inclusive, equitable and quality education that provides opportunities for all.

With this philosophy of bringing knowledge to all, in 2019, through a call for professional social service, a research project on Financial Inclusion for Development is created, this initiative consists of participatory action research to promote financial education. The project in addition to having a research agenda, consists of a professional social service program where students put into practice their communication skills, design and dissemination of science through infographics in a project called "Econographic". With the intention of analyzing the reach and reactions that the infographics published during the period 2019-

2022 have had. This document aims to measure the effect that the publication of infographics with scientific content has had through the social networks of the "Econographic" project.

2. New ways of learning

Studies show that the use of modern technologies in the classroom offers them the opportunity to learn faster, with better results and with greater satisfaction. The appeal of infographics seems to be inherent in their nature, as users are attracted to visualization, colors and images. An infographic can transfer knowledge about a subject quickly and massively, however, this condition depends on the quality and presentation of the infographic.

The use of this medium to transfer knowledge has become increasingly popular among the academic community, however, the speed of learning depends on multiple factors. The process of acceptance, assimilation, appropriation and absorption of knowledge is heterogeneous in each individual. Returning to the theoretical contributions on learning, from Piaget's cognitive theory (1969), also known as evolutionary, learning focuses on a gradual and progressive process, i.e., it is directly related to the individual's biological process and the environment in which he/she develops, however, much of learning depends on adaptation.

On the other hand, from the approach of *Watson's behaviorism* (1913), the learning process is obtained from behavior, in this sense, the observable and measurable behavior of an individual is analyzed until it becomes repetitive. In this sense, the individual can, through adaptation, generate his own learning. This is undoubtedly closely related to the theoretical approach of *cognitivism or Information Processing Theory*, where one of its authors Neisser (1967) states that the observation of new patterns of behavior leads to the construction of new learning. This learning includes how information is interpreted, processed and stored in memory. Furthermore, this approach is based on the philosophy that the human differential processes information through symbols, logical rules and external reality that is perceived and processed by individuals.

In addition, as mentioned by Stoyanova and Kommers (2002), the cognitivist approach states that information is stored in memory through a pattern of nodes that creates a network, in which the nodes are connected to each other through relationships. This process is nothing but an interconnected learning process, in this sense, recently e-learning developers adopt the *constructivist approach*, where knowledge is interpreted through individual perceptions (Pange and Pange, 2011).

However, the learning process has been adjusting to the needs of users. Much of this new approach alludes to the intensive use of the Internet. The concept of *e-learning*, beyond. One of the main approaches that enable a teaching and learning process is *Active Learning*. According to Bonwell and Eison (1991), it consists of an educational strategy that involves

students in the learning process. In this sense, this method requires the active participation of individuals in the construction of learning, i.e., *learning by doing*.

However, the learning process has been adjusting to the needs of users. Much of this new approach alludes to the intensive use of the Internet. The concept of *e-learning*, beyond focusing on the individual's learning process, is focused on the means used to achieve that learning. This approach is based on the intensive use of information and communication technologies (ICT) to disseminate knowledge. In addition, learning design using digital media, such as the use of infographics, can encompass the theoretical approaches mentioned above.

3. Transferring knowledge through "Econographic"

Infographics assist people to make informed and quick decisions about a specific topic. Using the constructivist approach and active learning, where university students can build and disseminate knowledge, in 2019, a project was created to produce and disseminate infographics on economic, social, political, and cultural topics regarding the Mexican context. "Econographic" is a project devised by students and supervised by teachers of Faculty of Economics and International Relations of the Autonomous University of Baja California.

The main objective of this project is to disseminate scientific knowledge concerning social sciences. The process of knowledge transfer is massive and fast. The project uses social networks to publish infographics, the platforms used are Facebook, Twitter, and Instagram. Regarding the reach of the infographics depends on multiple factors, such as the type of social network where it is published, the time of publication of the infographic, the number of followers, and the quality and visualization of the infographic.

In theory, an infographic is considered a means of visualizing information. It is a medium used by research to connect patterns and trends in abstract data sets and can help design templates for greater effect (Naparín and Saad, 2017). An infographic is considered a collection of information (Krauss, 2012), this data is interconnected into a representation or a set of ideas (Polman and Gebre, 2015). In this sense an infographic is integrated by a set of texts, drawings, paintings, graphics and images (Taspolat, Kaya, Sapanca, Beheshti, and Ozdamli, 2017). The use given to infographics is diverse, depending on the intended purpose.

The "Econographic" project is based on the 5E instructional model, which is based on the cognitive principle. In this phase, the student engages in a topic of their own interest, followed by an exploration stage of the different explanations and relationships that interact with the topic, then explains a complex process in a synthesis process with which they

elaborate an original iconography. Finally, this effort is evaluated directly by the teacher, and the success of the dissemination objective is measured through the number of people reached.

4. Methodology and results

The methodology used was chosen to analyze the following variables the reach of the infographics published and to identify whether there are significant differences in the results when controlling for the characteristics of the publications. For the first objective, a graphical analysis was performed, and for the second objective, the analysis of variance technique (ANOVA) was used to estimate whether the group averages were similar or statistically different.

As a variable to approximate the dissemination of content, two metrics published by the social network were used: interactions and people reached by each of the publications. Interactions are understood as the actions that people perform with the publication, which include reactions, comments, sharing the content, clicking on the photo or link. On the other hand, the people reached are defined as those who see the publication, either because they are followers or because a user shared the content. The difference between both metrics lies in the fact that an interaction requires some type of participation by the users of the social network to be counted that's not the case to count a person reached. In the period analyzed, 210 infographics were published, 169,588 people were reached and obtained 14,786 reactions.

The variables of dissemination were grouped into three categories: lexicon, topic, and year of publication. The lexicon of the publications was subdivided into positive, neutral, or negative, iconographies with a positive approach are those that address content associated with entrepreneurship, economic recovery or technological advances, the negative approach focuses on phenomena related to the loss of welfare or natural disasters and the neutral approach only presents information without the intention of generating a judgment on it. The groups and categories were constructed after the publication of the content.

Table 1. Divulcation variables, all categories.

Topic	Year		Lexic		
Economy	76	2019	33	Negative	62
Politics	88	2020	39	Neutral	100
Other	34	2021	103	Positive	48
Entrepreneurship	12	2022	35		
n	210		210		210

When comparing the evolution by year, an increase in the number of people reached is identified, but an opposite trend in interactions. This indicates the relationship between the frequency of publication and the increase in average reach, even though users tend to interact

less with the publications. Graphically, no different average is identified when grouped by type of lexicon or topic. The outliers observed are found in both criteria of disclosure classification and all the groups constructed.

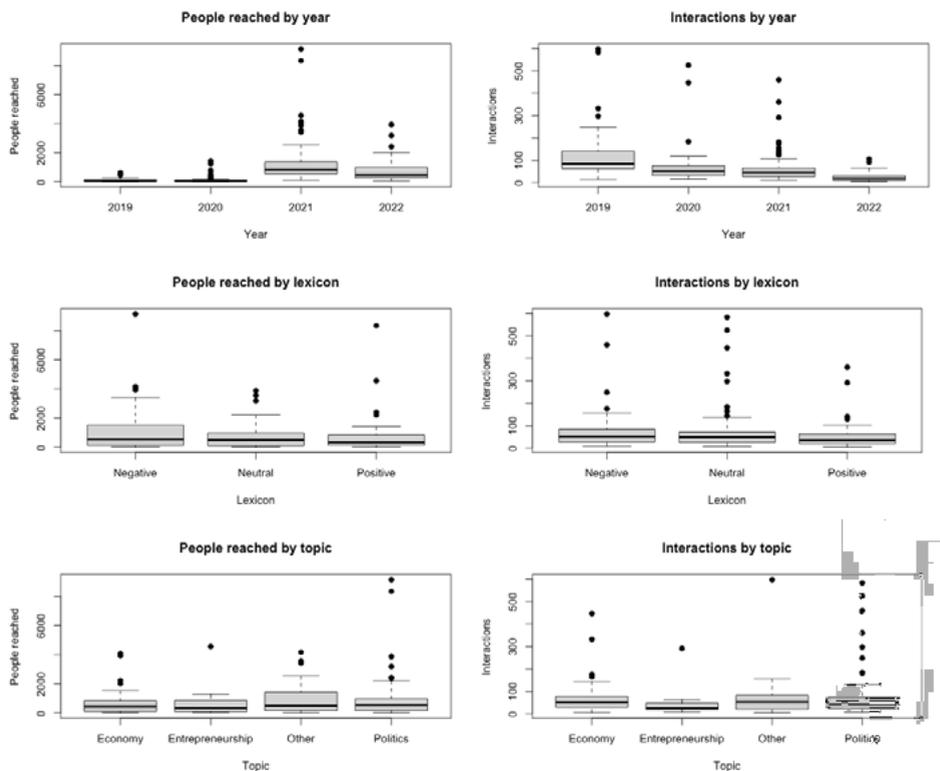


Figure 1. People reached and interaction by topic, lexicon and year. Source: Own elaboration.

The null hypothesis (H_0) of the ANOVA is that there is no difference in the means, and the alternative hypothesis (H_1) is that the means are different from each other. Table 2 shows that the differences between the means are significant when grouped by year of publication for both individuals reached and interactions, something that was apparent from the graphical analysis. When comparing the means of the 6 groups constructed using the criteria topic and lexicon, statistically significant differences were also identified with 95% confidence.

The ANOVA technique identifies whether there are differences between group means, but not the magnitude of the differences. A Tukey's Honestly Significant Difference (Tukey's HSD) post-hoc test was performed to identify the difference between the groups. Table 3 shows that the average number of people reached in 2021 was higher than 2020 and 2019, and the 2022 average was higher than 2020 and 2019. When performing Tukey's HSD using

interactions as the dependent variable and the between the subject and lexical categories with no significant differences found.

Table 2. Divuligation variables, all categories.

Variables	# of Groups	Df	People Reach		Interactions	
			F value	Pr(>F)	F value	Pr(>F)
Topic	4	3	1.206	0.309	0.268	0.849
Year	4	3	13.967	3.32e-08*	10.08	3.65e-06*
Lexicon	3	2	2.283	0.105	0.609	0.545
Topic and Year	9	8	4.49E-01	0.89	1.026	0.418
Topic and Lexicon	6	5	1.946	0.0891**	1.526	0.184
Year and Lexicon	7	6	1.48	0.1874	1.188	0.315
Topic, Year and Lexicon	8	7	0.396	0.9041	0.754	0.626
Residuals			175			

*Significativo al 99%, **Significativo al 95%

Table 3. Tukey's Honestly Significant Difference.

Comparisson	People Reach				Interactions			
	diff	lwr	upr	p	diff	lwr	upr	p
2020-2019	41	-590.08	672.13	0.99	-54.79	-106.43	-3.159	0.03*
2021-2019	1099.6	565.9	1633.3	0.000*	-70.90	-114.57	-27.24	0.000*
2022-2019	710.4	63	1357.8	0.02*	-106.8	-159.86	-53.92	0.000*
2021-2020	1058.6	556.9	1560.3	0.000*	-16.11	-57.15	24.93	0.73
2022-2020	669.4	48.1	1290.6	0.029*	-52.09	-102.93	-1.26	0.04*
2022-2021	-389.2	-911.2	132.8	0.21	-35.9	-78.70	6.72	0.13

* Statistically significant

Graphical analysis and ANOVA were performed, eliminating the data of persons reached and interactions above the upper interval defined as third interquartile +(1.5 *interquartile range), without modifying any of the results.

5. Conclusions

The results show that the "Econografico" social service project has fulfilled its objective of popularizing science. Students designed and published 210 infographics, reached 169,588 people and obtained 14,786 reactions. Positive and significant differences were identified in the average number of people reached in 2021 compared to 2019 and 2020. Negative and

significant differences were identified in the average number of interactions for 2022, 2021 and 2020 publications compared to 2019. No differences in average person reach or average interactions per publication were identified if grouped by topic or lexicon.

Future analyses should consider as grouping factors a more specific time element, the profile of the users reached or some approximation of the context to identify the elements that allow publications to be more successful in their outreach objective.

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The digital platform for the Unite! Alliance: The Metacampus

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Abstract

Nine European technology universities constitute the Unite! alliance, a network that creates a new model for a virtual and physical European inter-university campus through close cooperation, physical and virtual mobility of members, joint programmes, communities that support teaching innovation, and open and entrepreneurial innovation networks. The Metacampus virtual campus platform is an important aspect of this framework. All participants in the Unite! community can join at the Metacampus, which coexists alongside other universities' virtual campuses. It must become a valuable and useful tool for a wide range of users who are used to very different tools and processes, which is only one of the many difficulties it faces. The Moodle platform was chosen as the base for the work, and it was decided to maximise its features while minimising the amount of new innovations required to achieve the goals. After four years, the number of users who have registered and taken part in the activities that have been suggested enables us to draw the conclusion that the path is the right one for handling a challenge like the design and execution of a multi-university virtual campus.

Keywords: Education; virtual campus; interuniversity network; e-learning; engineering education.

1. Introduction

Currently, one of the 42 European Universities in Europe is Unite! (University Network for Innovation, Technology, and Engineering)¹. It was chosen for the 2019 Erasmus+ call, which had a three-year funding cycle that ended in 2022. It was chosen again for the 2022 Erasmus+ call as a European University. It is a network of universities from nine different countries that creates a novel framework for a digital and physical inter-university campus in Europe. The partners collectively have 280,000 students and 77,300 graduates each year. They already work closely together on more than 80 EU initiatives, including ones involving blended learning (Valderrama et al, 2018), and they have exchanged more than 2,000 students in the previous five years. The nine universities considerably span Europe, as shown in Fig 1. Northern Europe has KTH Royal Institute of Technology, Aalto University, on the one hand. Western Europe, on the other hand, is home to the universities of Wroclaw Tech, Technical University of Darmstadt, Grenoble INP-UGA, and Graz University of Technology. The Universidade de Lisboa, Universitat Politècnica de Catalunya, and Politecnico Di Torino are the last three institutions in Southern Europe. This close cooperation is made possible by, among other things, communities of innovation in education, virtual and physical mobility for all students and staff, an academy for teachers to create cutting-edge models and pedagogies, and, ultimately, an entrepreneurial open innovation network. The Metacampus², an inter university virtual campus that allows for digital mobility, virtual spaces, and online resources, is necessary for this entire network. All of this while coexisting with the member universities' virtual campuses and highlighting their complementary nature.

Four fundamental principles must be followed while creating a learning ecosystem (Tiwana, 2014), such as simplicity, resilience, sustainability and the ability to evolve. The integration, interoperability, and evolution of its components must also be taken into account when establishing a framework for technological ecosystems, in addition to a proper characterization of the architecture that underpins it (García-Peñalvo, 2016). We satisfy these demands as well as those of the nine partner universities by using Moodle as a platform and reduced customised developments.

An interdisciplinary team from the Universitat Politècnica de Catalunya (UPC) created the Metacampus under the lead of the Institute of Education Sciences (ICE), in collaboration with the ICT Services Area and the company UPCnet, which provides IT services to UPC. The team has substantial expertise with the UPC institutional virtual campus (Atenea), which is built on the Moodle learning management system, and they have previous experience with

¹ <https://www.unite-university.eu/>

² <https://metacampus.unite-university.eu/>

Campus Digital, an earlier version of it that was based on Lotus Notes, and that was used up to 2007 (Alcober, 2000).

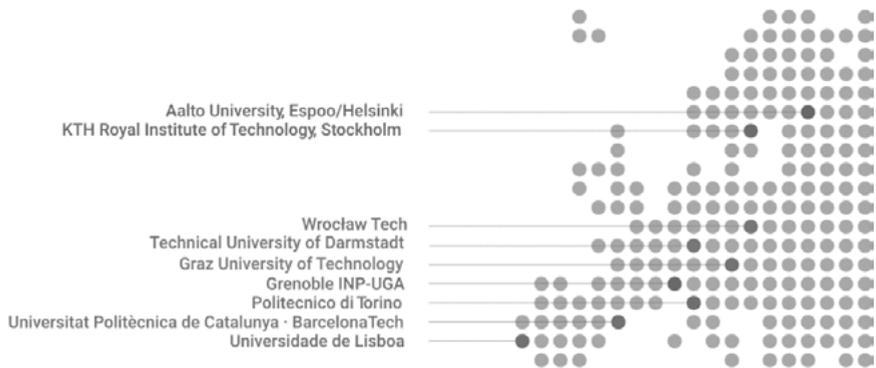


Figure 1. Partners of Unite! alliance. Source: Unite! website (2022).

The validation of the Metacampus platform's best practices is described in this study. The goals of the project are discussed in section 2, and the approach is presented in section 3. The activities that were undertaken and their results are described in Section 4. And lastly, section 5 presents the conclusions and finally section 6 is acknowledgment.

2. Objectives

One of the goals of the Metacampus is to serve as a meeting point for all those involved in the Unite! community, which includes the nine member universities' administrative and support staff as well as students and faculty. On the other hand, this portal aims to achieve the goals of the Unite! project, which include achieving high levels of collaboration in teaching innovation, the field of mobility, in communities, and in joint programmes. These goals were mentioned in the introduction section. As a result, the Metacampus must address demands, be effective and efficient, as well as long-lasting and with benefits that are transferable outside of the specific setting in which they emerged (García-Peñalvo, 2016).

3. Methodology

The methods used involves a number of time-ordered steps. The initial stage was to compile the needs as seen from the user's perspective. The users were community members from Unite! who contributed to a shared document that was divided into sections for the various work packages. After completing this compilation, the Metacampus team and UPCnet gathered, assessed, and prioritised a set of roughly 70 needs, forming the four pillars mentioned in Section 4. The third step involved the work package participants, academics as well as staff, suggesting additional project activities that allowed the Metacampus to

demonstrate its potential. The fourth phase involved validating the findings using various measures, such as the quantity of users who had signed up and the volume of visitors to the Metacampus website. In addition to the number of visits to the Metacampus website, this last metric, which is displayed in subsection 4.6, should also include the average session length, in order to measure the engagement of the user.

There were two working initiatives that deserve mention. On the one hand, there was a set of requirements with a specified development, such as enabling information sharing between universities and the Metacampus, allowing for the creation of a course catalogue, as well as the integration of a search engine and Learning Tools Interoperability (LTI)³ technology, which allows lecturers to offer courses in Metacampus from their home learning management system, without the need of replicating contents in other systems. While the other task groups worked together to analyse these needs and how the platform would be able to deliver a solution, the utilisation of the Moodle functionalities was prioritised. The deployment of corporate information systems (Parthasarathy, 2018), which suggests organisations adapt to these reliable information systems rather than customising these information systems to conform to the way businesses work, served as inspiration for the second line. This creates a learning ecosystem with the characteristics indicated earlier.

4. Results

The projects completed within the two lines of work previously described are outlined in this section, including the integrated search engine, the LTI integration, the course catalogue, eduGAIN, and the Moodle functions. Finally, it is explained how these results were validated.

4.1. Integrated search engine

The ability to search and find information from the nine universities is one of the key features that makes the Metacampus an entry portal for users of the Unite! ecosystem. Setting up a Google search within the nine colleges' domains is an easy fix. The idea goes one step further and enables results to be filtered by a collection of information, for example, the university of that result, one of the nine languages, or the type of result, such as a course, a person, or even a thesis proposal. This search engine's initial iteration, which is based on the Apache Solr search server, is currently being finished (Smiley et al, 2015).

4.2. LTI Integration

LTI integration is a crucial feature that the team has experience with (Alier et al, 2021). This technology enables students to access courses through Metacampus that are actually hosted

³ https://en.wikipedia.org/wiki/Learning_Tools_Interoperability

in the university where the professors are currently employed. As a result, the professors can carry out their normal duties on their virtual campus of origin without having to duplicate their materials in a different system. Using an upgraded version of Moodle (v.3.8 at least), the development of a plugin by UPCnet, and the assistance of the University of Grenoble INP-UGA. There have been issues with user management and security that have been analysed and require further research to be implemented in the exploitation systems.

4.3. Course catalogue

The course catalogue is a feature that needs data to be shared across universities. Since all institutions are actively upgrading their procedures for the Erasmus without Papers⁴ (EWP) project, it was decided to use the API (Application Programming Interface) standards of the courses. The course catalogue will not be implemented until an updated version of the API is made available.

4.4. eduGAIN

A functionality that was considered important is the possibility to prevent users of the Unite! ecosystem to register again in the Metacampus. On paper the right solution is to use eduGAIN (Michael, 2019), although there have been technical difficulties. A temporary interim solution has been chosen, and that has been that users with institutional mail from any of the nine universities could register temporarily, pending the resolution of the technical obstacles.

Instead of re-registering in the Metacampus, users of the Unite community were able to access using their home credentials, which was a feature that was much valued. The best choice seems to be to use eduGAIN (Michael, 2019). As a result, the platform is aware of the user's role within the home university and can take appropriate action, such as hiding things that are not meant for that user.

4.5. Moodle functionalities

Another line of work attempted to maximise the use of Moodle functionalities to suit the needs of the work packages in parallel with the creation of the aforementioned functionalities. As a result, the Metacampus adheres to the General Data Protection Regulation (GDPR) (Amo et al., 2019) and follows the web content accessibility guidelines, Web Content Accessibility Guidelines (WCAG) 2.1, with an AA level (White, 2019). By combining the Atto Multilanguage plugin with the MultiLanguage Content filter plugin, users can upload content in any of the nine languages (Mangiatordi et al, 2019). The platform users must upload accessible material in a variety of languages in order for the platform to be in compliance with accessibility requirements or multilingualism. The outcome would not be

⁴ <https://erasmus-plus.ec.europa.eu/european-student-card-initiative/ewp>

accomplished without the users' active participation. It has been suggested that one of the essential elements for achieving the platform's objectives is training.

In addition to English being the primary language of instruction, partner institutions' native tongues and cultures are also included thanks to multilingualism. English is used for any interuniversity course even if none of the nine universities in Unite! have it as their primary language because it is the common language that all of them accept. Since Moodle has proven to be useful for multilingual teaching (Qin et al., 2022), Metacampus team has installed the nine various languages using the respective language packs.

Communities have been formed using the Moodle overflow plugin, which permits behaviour similar to StackOverflow in addition to the qualities stated above (Vasilescu et al, 2013). Additionally, OpenBadge credentialed course functionality (Myllymäki, 2014) has been used to deliver courses as a standard concept to students, faculty, and administration staff. Asynchronous collaboration spaces, such as project events (Boot Camp and Dialogue), or student co-creation initiatives, have also been used. The publication of Master's thesis proposals, which has been made available through the Moodle database activity, is one example of how Moodle functionality can satisfy a necessity that seems out of reach.

4.6. Validation of the results

The number of spaces developed by the Metacampus last year 2022 was 55, with 3 spaces having more than 150 people and 5 spaces having more than 50, in addition to 23 spaces with more than 20 attendees, according to the activities of the Metacampus. These areas included the Multicultural and Multilingual Training Center, the Teaching and Learning Academy, the Hackathon (H@ckyour-COVID), and Student Co-Creation Unite! Future and Joint Initiatives. The nine Unite member universities currently (April 23) have 5,450 registered users on Metacampus. It should be noted that the average session length (Fig. 2) and user count (Fig. 3) both demonstrate that there were 5200 users during this time and that the average engagement time was 3 minutes and 28 seconds. Additionally, it was discovered that 21% of users used mobile devices to visit the website, while 78% used desktop computers. The reason probably is because there is no specific mobile app to access the Metacampus.



Figure 2. Session duration time Source: Metacampus Google Analytics (2022).

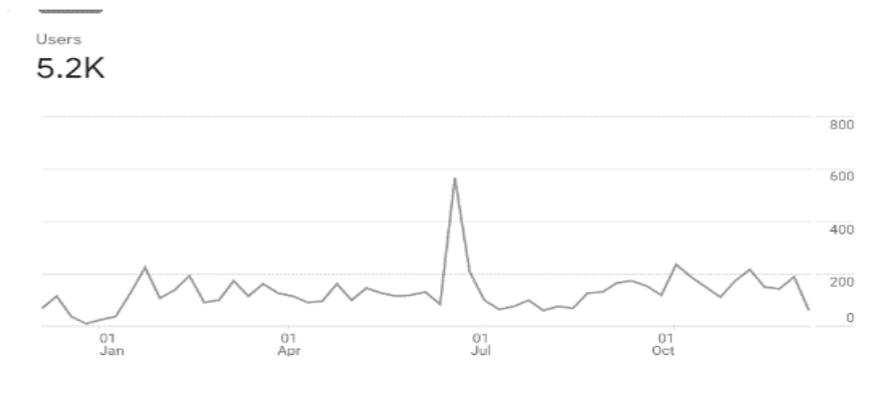


Figure 3. Number of users Source: Metacampus Google Analytics (2022).

5. Conclusions and Discussion

Due to the uniqueness of the alliance's member universities, with their various dynamics and expectations, and the engagement of distributed groups of people from each service, designing and launching a virtual campus like the Metacampus for Unite! Is a challenging endeavour. In the end, the platform must be beneficial to users and include educational tools that enable participants to grow their abilities. As a result of the variety, virtue, knowledge, and conviction that the project's criteria and objectives have finally been achieved, Unite! has become, in our opinion, a model for other European alliances with comparable goals that have been founded in Europe.

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Nurturing the human connection: increasing student engagement and personal connection in an asynchronous language course

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Abstract

Based on course evaluations, student needs and expectations regarding asynchronous courses have changed during and after the COVID pandemic. With the goal of meeting, understanding and responding to the needs of the post-COVID student, intentional modifications were made to an online, asynchronous course to ensure attention to the student as a whole. While respecting the need for asynchronous offerings, designing increased opportunities for human face-to-face interaction in the form of guided personal and language goal setting sessions, orientation sessions, chapter check-ins and exam preparation sessions were all implemented. Initial feedback results show a positive shift and satisfaction in learning, resilience and growth not only for students, but also for instructors.

Keywords: *Asynchronous; engagement; F2F interaction; goal-setting; needs assessment; online.*

1. Introduction

The recent worldwide pandemic forced a shift to online learning in higher education for a significant period of time. While instructors and students retooled courses and transformed learning, it has been through experience in recent months that we acknowledge the need for increased human connection not only within face-to-face courses, but also in traditionally asynchronous online courses. During the fall 2022 semester, our university family suffered an increased number of student deaths. This sparked additional, increased focus on student and faculty psychological well-being, which led administrators to expand, at an accelerated rate, access to mental health care, to initiate wellness days, as well as assess and adjust associated administrative and crisis-response policies. As instructors, we have observed that the post-COVID student population, while more adept at technology than ever before, has a greater need for one-on-one, meaningful human engagement to facilitate success in life and learning. As noted by Booker et al. (2022), the pandemic has been an “enduring, thoroughly disruptive, and as yet unresolved, phenomenon—impacting social life, academic and employment opportunities and demands, physical and mental health, and financial standing for many young adults, their families, and their communities” (p. 1946).

2. Course Modifications

Having offered distance and online courses over the past 24 years, we recognize that gone are the days of plug and play, grade and graduate. Over the years, our introductory Spanish course has gone through many technological and instructional transformations. In this most recent iteration, through months of assessment, trial and discovery, we have reassembled our asynchronous course with several key features to enhance and celebrate the teacher-student connection. Incorporating a needs assessment, increasing student choice through gamification and meeting the needs of each student through one-on-one personal check-ins with an instructor on a regular basis has led to a student/teacher relationship that is not only beneficial to overall positive student outlook and personalized learning, but has also increased instructor job satisfaction.

Regular and intentional modifications to the online course have been a constant in response to a world of ever-changing needs and technological progress. The course was originally taught by one instructor, streamed live, recorded for later access and testing was conducted on campus, in person with the instructor (Despain, 2003). Full-class-length videos were later replaced with brief video segments, the coursemate element was modified, testing became remote or in-person at local testing centers, an additional instructor was added, graduate student support was incorporated, language-engagement projects were added and removed. Keeping delivery technologically up-to-date, relevant and generationally current has been a characteristic of our course. While some may argue that the answer to increasing student

engagement is to limit asynchronous course offerings, registration statistics at our institution show that students seeking higher education degrees have a continued interest and need for online asynchronous courses.

3. Needs Analysis

Our most recent modifications have been based on results of an informal needs assessment conducted through a course format survey. This survey has been pivotal in being able to ensure that students who truly need a face-to-face course are directed to that format well in advance of the start of the semester. Acknowledging that students may not fully understand the value of face-to-face versus a virtual language learning experience, we have outlined the benefits and challenges of virtual language courses in a very transparent manner. Another informal needs assessment that we employ comes in the form of one of the most foundational connections we make with students--the mandatory orientation. Not only is this gathering the first time students meet instructors, students meet their potential coursemates as well. After a few minutes of welcome and informal introduction, instructors guide students through each element of the course, answering any questions posed along the way. This interaction gives all in attendance an opportunity to connect on a personal level and helps make sure that the course format placement is accurate. Instructors guide students through the technological aspects of the course to ensure that technology will not be a hindrance to their language learning. The orientation also provides the opportunity for instructors to be extremely clear about the expectations of the course.

One of the first assignments for students is designed to activate students' background knowledge of language learning as well as to introduce them to the world of second language acquisition along with researched learning strategies so that they might understand that language learning can and should be personalized. Students then use this knowledge to develop three SMART goals (goals which are specific, measurable, attainable, relevant and time-based). In many ways, what we see in our classes is not unlike what we might see in society at large. We have students who are, as Carroll et al. (2013) describe as being, "delinquent" in not fully participating in the class or meeting student learning outcomes, as well as students who are "at-risk" of not learning the material or passing the course, and we have students who are "not at risk". According to Carroll et al. (2013) intervention programs should focus on assisting students to "develop clear self-set achievable goals and support them through the process of attaining them, particularly if the trajectory towards delinquency is to be addressed" (p. 431). Obviously, we are especially concerned for students who are challenged or at-risk of not meeting the learning standards set for the course. Research suggests that students who engage in active goal setting and self regulated learning and who receive guidance from others in achieving their goals, tend to belong to the not at-risk group (Carroll et al., 2013). Committing students to evaluate their purpose for taking the course,

personally designing action items and periodically reporting their progress is another effort at assessing and reassessing students' needs on a regular basis.

4. Student Needs

Identifying students' needs is pivotal in offering course content in a personalized way. Respecting and offering student choice within a course is another significant element of engaging students. As Wang et al. (2015) note, student choice in learning leads to increased motivation to learn. Recognizing the connection that exists between student choice and motivation, elements of gamification were added to the course to increase student interest and involvement. Offering meaningful yet optional language application and culture experiences with a reward upon completion, adds an element of friendly competition that resonates with a significant number of students. With the successful completion of each activity, students earn badges or “chapas” which have the potential to positively impact their overall score by deleting low participation, homework or recording scores. Including this element of fun, freedom and competition within a framework of discovery, target language application and student choice has led to a positive shift in engagement.

Expanding on the concept and practice of respecting students and their choices, as well as rededicating ourselves to student success as modeled by student affairs professional James C. Hurst's (personal communication, March 10, 2020) mantra, *Each Student – A Person*, we were led to develop increased opportunities for instructor/student interaction, while maintaining the asynchronous model. In previous years we had offered TA Café sessions - essentially drop-in online office hours, during various times of the day, where students were welcome to visit, practice their new language skills, ask questions or review performance with the graduate teacher assistant. While modestly attended, the Café did not engage students on a level that was making a positive difference for the majority of students. Consequently, we retooled and developed the Chapter Check-in. During the Chapter Check-in, a graded element of the course, students have the opportunity to visit one-on-one with an instructor on a regular basis (roughly once every three weeks) throughout the semester. In coordination with the chapter conversation project, the student signs up for an appointment slot with an instructor and is prepared to ask and answer questions regarding their performance in the course. The session begins with simple yet personal questions. How are YOU doing? What is working for you as you study and learn Spanish? What are you finding challenging? Students then take the initiative to evaluate their progress with their three SMART goals, their progress in the course and they are guided as they review and modify their language goals as well as their process of learning. Time is then designated for a student Q&A about current content and then the instructor leads a look-ahead which briefly introduces upcoming themes, grammar structures and associated vocabulary. The Chapter Check-in culminates in a five-minute conversation wherein the student initiates a

conversation with the instructor in the target language, demonstrating their acquired and practiced skills in the learned concepts and structures according to preassigned academic parameters.

5. Student/Instructor Engagement

As Zhou (2020) asserts in research regarding online courses during the COVID pandemic, online instructors should “communicate with students through multiple channels and ways” (p. 1488). To encourage increased student/instructor engagement, use of the target language, and to support recently learned concepts, we established virtual F2F exam preparation sessions. Students benefit from attending the student-led sessions that last no longer than 1 hour. Time is spent on addressing student generated questions about course content, but more importantly instructors have the opportunity to listen to students’ general feedback about the course or life experiences. While this interaction is couched in the framework of language learning, the extended and likely most important benefit is offering another human connection with mentors who are working to guide, support, and foster resilience. This ensures both personal and academic success on the challenging path of learning and growth.

Lastly, while the recent adjustments that were made in the course were initiated to address the student learning experience, one of the unexpected benefits resulted in greater job satisfaction for the instructors. Having taught an online, asynchronous course for decades we were used to the rather impersonal nature of the format. As an instructor, while it was natural to recognize a name and to be able to recall the academic challenges or progress of a current student, having an opportunity to connect with students on a more personal level has resulted in deeper and more meaningful relationships. A legitimate partnership has been forged in the asynchronous realm. Early feedback to these course modifications indicate that both students and instructors benefited from increased interaction and the resulting personal connection. Results from a student survey administered at the end of the semester are included in the next section.

6. Survey Results

An attitude survey regarding the Chapter Check-ins was conducted following the final Check-in session of the course. Nineteen students were enrolled and 13 responded to the brief, anonymous, volunteer survey (68% return rate). Quantitative results of the survey are found in Table 1. A majority of students looked forward to the Chapter Check-ins and they felt both seen and heard by their instructors. They also found it helpful to review upcoming content during the Chapter Check-in. A majority also indicated that having regular check-ins helped them feel connected and that the check-ins motivated them to be more engaged in the asynchronous class. Students were asked to self-report their predicted final grade, with 69%

predicting a grade of A or B, 15% predicting a grade of C and 15% predicting a grade of D or F.

Table 1. Student Survey Results.

Question	Agree or Strongly Agree	Disagree or Strongly Disagree
I looked forward to having a one-on-one personal conversation with my instructors during the Chapter Check-ins.	62%	38%
Creating and regularly revising my 3 SMART goals had a positive impact on my success in FLS 101-601.	46%	54%
I felt seen and heard - knowing that my instructors would be asking about how I was doing, about my SMART goals and if I had any questions.	85%	15%
I found it helpful to review the content of the upcoming chapter	77%	23%
Having regular Chapter Check-ins helped me feel more connected with my instructors	69%	31%
Having the regular Chapter Check-in motivated me to be more engaged in this online asynchronous class.	69%	31%
When scheduling the Chapter Check-in, I could easily find a day/time that met my needs.	62%	38%

Regarding the SMART goals a slight majority of the students felt that the creation and regular revision of goals did not positively impact their success in the course. Positive student comments included, "very helpful," "great way to maintain progress," "helped me hold myself accountable," "a good idea," "a helpful tool." Ambivalent or negative comments were, "had no impact on my experience," "I didn't find them very helpful," and "weren't as helpful as the projects." Student responses to the open-ended prompt, the best thing about the chapter check-ins included, "seeing and being able to ask questions directly," "talking to an instructor about my progress throughout the class," "being able to practice verbal skills," "interpersonal interaction with my instructors," "encouraged interaction," "I can talk to my instructors and that helps me feel more comfortable," "checki[n]g in with your instructor is nice," and "getting to know the professor." To the open-ended prompt of other thoughts or feedback regarding the chapter check-ins, student comments included, "very informative if you are confused," "the chapter check-ins did not make me feel any better about the exams," "keep them going," "asking about mental health each time may be good, considering all that has

happened this past semester," "I have missed [some] chapter check ins because I have anxiety."

7. Conclusion

Based on student feedback and instructor experience, we will continue to incorporate a regular needs assessment, student choice through gamification and goal setting and chapter check-ins within our asynchronous online language course. We have found that striking an appropriate balance between the convenience of asynchronous online learning, and developing and nurturing the human connection between student and instructor can be achieved by responding to a thorough needs assessment and ensuring proper placement both in proficiency level as well as course format. Additionally, thoughtfully crafted student-driven goals facilitate the student's responsibility and accountability for the learning process. Furthermore, providing options for student choice in learning not only communicates respect for the student as a unique individual but also engages student motivation and customizes learning. And finally, for many learners early and regular student/instructor synergistic interaction solidifies success on the scaffold of learning.

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Appendix

Student Survey

Thank you for being awesome students! We are interested in your feedback regarding the new addition of the Chapter Check-in and its components (life check-in, 3 SMART goals, class content review) for this semester. Usernames and emails are not being collected as part of this survey. Your responses are anonymous.

1. I looked forward to having a one-on-one personal conversation with my instructors during the Chapter Check-ins. (1-4, Strongly disagree ... Strongly Agree)
2. Creating and regularly revising my 3 SMART goals had a positive impact on my success in FLS 101-601. (1-4, No impact ... Positive impact)
3. I felt seen and heard - knowing that my instructors would be asking about how I was doing, about my SMART goals and if I had any questions. (1-4, Ignored ... Seen and Heard)
4. Feedback or thoughts on 3 SMART goals (Open-ended)
5. I found it helpful to review the content of the upcoming chapter. (1-4, Strongly disagree ... Strongly Agree)
6. Having regular Chapter Check-ins helped me feel more connected with my instructors. (1-4, Disconnected ... Very Connected)
7. Having the regular Chapter Check-in motivated me to be more engaged in this online, asynchronous class. (1-4, Strongly disagree ... Strongly Agree)
8. When scheduling the Chapter Check-in, I could easily find a day/time that met my needs. (1-4, Strongly disagree ... Strongly Agree)
9. The best thing about the Chapter Check-ins...(Open-ended)
10. Any other thoughts or feedback about the Chapter Check-ins? (Open-ended)
11. What grade do you expect to earn in this course? (A or B | C | D or F)

Critical analysis of the potential of social robotics in higher education for the management of illness and bereavement

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Abstract

Social robotics and the use of information and communication technologies have a significant impact on education. This approach combines robotics and artificial intelligence with a social and emotional perspective to improve the quality of education while providing psychoeducational and emotional support to students. This critical analysis aims to discern whether these technologies, together with inclusive and quality teaching strategies and organisational strategies adapted to each centre and classroom, can enable the presence in class during periods of hospitalisation and/or convalescence of seriously ill students, and facilitate their participation and progress, as well as allow for better accompaniment during the bereavement of the class if this colleague dies. The advantages of these technologies are highlighted as tools of great value in the inclusion and integration of these students during higher education, although it is true that it is essential to carefully assess the advantages and disadvantages before implementing them.

Keywords: *Benefits; drawback; artificial intelligence; telepresence; teacher; classmate.*

1. Introduction

Social robotics and the use of information and communication technologies (ICT) in higher education are of great importance in the field of education. This approach combines robotics and artificial intelligence (AI) with a social and emotional perspective to improve the quality of education and support students (Belpaeme et al., 2018). In particular, for students facing limiting illnesses, social robotics and ICT can be valuable tools to help them stay connected and participate in their education effectively (Belpaeme & Tanaka, 2021).

According to Johal (2020), social robotics can enhance student engagement and learning in higher education by offering a more personalised and enriching experience. Furthermore, the combination of ICT with social robotics allows students to access online learning resources and materials in real time and from anywhere (MAarell-Olsson et al., 2021). According to the authors, these resources provide a unique opportunity to enhance education and provide support for students with limiting illness, allowing them to remain present in the classroom without being physically there. It is not just a computer screen, but the social robot gives a physical and corporeal presence to the student who for health reasons cannot be in the classroom. This innovative and emotional approach can help students stay connected and actively engaged in their education, despite any challenges they may face. This research aims to discern from already published contributions whether these technologies, accompanied by inclusive and quality didactic strategies together with organisational strategies adapted to the characteristics of each centre and classroom, can make possible the presence in classes during periods of hospitalisation and/or convalescence, as well as facilitating the participation and progress of students with serious health problems.

The use of social robotics in higher education for students with limiting illnesses and difficulties in attending face-to-face classes is justified by its ability to enable classroom presence, improve accessibility, encourage participation and, ultimately, provide an inclusive context for students with serious health problems. In addition, in the case of a palliative illness and possible death, the robot allows classmates to say a final farewell with an appropriate farewell. The acceptance and gradual farewell of fellow students with the student in a palliative illness situation through the presence in the classroom of the figure of the student who no longer exists avoids the empty chair syndrome by peers and normalises the end of life, eliminating taboos and associated fears (Riera & Ruiz, 2021). However, it is necessary to evaluate all the elements involved in the use of this particular type of technology in a classroom. To this end, a critical analysis article is carried out in order to evaluate and analyse the existing contributions on the subject. The resulting research question is: What are the uses, advantages and disadvantages of digital technologies and social bots in higher education for students with a limiting illness?

2. Literature review

With the great advances in technology, social robots have become a useful tool to help these students overcome physical barriers and participate in school activities (Newhart & Olson, 2017). Social robots are electro-mechanical devices programmed to interact with people and help them meet their needs. In the case of students with limiting conditions, social robots can be used to provide a presence in the classroom and keep them connected to their peers and teachers (MAarell-Olsson et al., 2021), which has positive implications in terms of accessibility and inclusion (Belpaeme et al., 2018). For example, social robots can be programmed to deliver classroom presentations, participate in group discussions and activities, and provide ill students with the opportunity to interact with peers and teachers in real time (MAarell-Olsson et al., 2021). In addition, social bots can also help students with limiting illnesses to keep up with their school work and receive instructions and feedback from their teachers. Not only do they provide educational advantages, but social robots can also provide emotional support to students with limiting illnesses (Newhart & Olson, 2017).

However, it is important to note that the use of social bots in education should be a complement to and not a substitute for the care and support of teachers and other educational professionals (Belpaeme & Tanaka, 2021). The use of this technology for students with limiting illnesses that prevent them from attending face-to-face classes can be a valuable tool to help them overcome physical barriers and stay connected to their peers and teachers, although there are a number of legal and ethical issues to consider (Powell et al., 2021). Telepresence robots can also improve efficiency in classroom management, enabling better coordination and communication between students and teachers. This can result in a better learning experience for all students, not just those who are limited by health problems.

In addition, there are also some negative practical implications to consider, such as classroom and home privacy (Wadley et al., 2014), data protection (Pusztahly & Stefán, 2022), the possibility of technology malfunctioning or connection disruptions, and the high cost associated with implementing and maintaining telepresence bots (Khaksar et al., 2020). Some of the utilities through practical examples of the use of social bots and ICT in the classroom for other purposes are as follows, although the use of these technologies continues to grow in higher education:

1. Pedagogical robots: pedagogical robots, such as the NAO robot, are used to enhance learning in the classroom (Robaczewski et al., 2021). The literature shows the use of up to 26 types of robots (Dawe et al., 2019).
2. Virtual and augmented reality: Virtual and augmented reality is used to enhance the learning experience in the classroom (Boyles, 2017).
3. Educational games: Educational games are an effective way to enhance learning in the classroom (Amanatiadis et al., 2017).

In the case of students with a limiting illness with frequent hospitalisations or absences, this technology improves collaboration between school and home and allows the student to learn independently while maintaining social relationships (Zhu & Van Winkel, 2015). In this sense, the potential of social robots for bereavement support arises in the event of the death of a partner with a limiting or complex illness. Although there is no literature on the subject, it is estimated that they allow the class to say a gradual and preventive farewell to the sick classmate, which will result in a better emotional management of grief. It should be noted that this is a first approach to the subject in the form of an analysis of possibilities, without claiming to be a systematic review of the literature.

In summary, social robots can have both positive and negative implications for university learning. However, the implications for accessibility and inclusion of health-limited students and bereavement management for their peers, while improving the efficiency and quality of education in general, need to be analysed.

3. Critical argument and conclusion

The use of social robotics and ICT in higher education appears to have the potential to improve the quality of teaching and support for students with limiting illnesses. However, it is important to keep in mind that social robotics and ICT are complementary tools and not a single, definitive solution to all the challenges that students with limiting illnesses may face.

One criticism of social robotics in the educational context is that, while it can provide a physical presence for students with limiting illnesses, it cannot replace human interaction and the face-to-face teaching experience. Social robotics and ICT can improve accessibility and participation, but cannot provide the same experience as a face-to-face classroom and interaction with peers and the teacher. In addition, it is important to consider equity and accessibility in the use of social robotics and ICT in education. Not all students have access to the same technological resources and, in some cases, social robotics and ICT may exacerbate inequalities rather than reduce them.

There is as yet no evidence of their usefulness and effectiveness in emotionally managing the grief of peers who are left behind, although it is thought that they may be a useful resource for dealing with empty chair syndrome in the classroom. The figure of the robot in the classroom allows for a remembrance of the departed peer, while the teacher guides a gradual farewell to the departed peer. Finally, it is important to highlight the need for proper and ethical regulation in the use of social robotics and ICT in education. There is a need to ensure the privacy and security of student data, as well as to consider the possible social and ethical implications of the use of social robots in the classroom.

In conclusion, although social robotics and ICT can be valuable tools to support students with limiting conditions in higher education, it is important to carefully evaluate the uses, advantages and disadvantages before implementing them. A balanced and critical approach is required to ensure that these technologies are used ethically and effectively to enhance education and, above all, further research is needed on the potential of using this technology beyond distance learning.

Based on the above, the following recommendations are made for future research on the use of social robotics and ICT in higher education:

1. Detailed evaluation of the effectiveness of social robotics and ICT in improving the quality of teaching and support for students with a limiting illness.
2. Comparative studies between the experience of students with illness in a face-to-face classroom and a virtual classroom using social robotics and ICT.
3. Research on equity and accessibility in the use of social robotics and ICT in education, including analysis of barriers to accessing the technology and the possible exacerbation of inequalities.
4. Studies on ethical regulation in the use of social robotics and ICT in education, including privacy and security of student data, as well as the social and ethical impacts of their use in the classroom.
5. Cost-benefit analysis of the implementation of social robotics and ICT in education, including teacher training and the infrastructure required for its use.
6. Studies on the training needs of teaching teams so that they can make appropriate use of these technologies in the Teaching-Learning processes.
7. Analysis of the pedagogical, organisational and technological needs of educational centres to adequately integrate social robotics in the classroom.

These recommendations can help future research to gain a more complete and critical understanding of the use of social robotics and ICT in higher education and to make informed decisions about their implementation. What is undeniable is that technology is the future of education, so it is our responsibility to adapt and adapt this technology in the service of educational quality.

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Enhancing personalization and experiential learning in higher education through the VR mobile application, *I'm IN-HKUST*

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Abstract

The present project aims to break the physical limitation of job interview practices for students in LABU2060 Effective Communication in Business, the last required CLE course of the Business School's program at the Hong Kong University of Science and Technology (HKUST). The pandemic has intensified the need for incorporating emerging technologies, e.g., virtual reality (VR), in Higher Education. A VR job interview mobile application was implemented in LABU2060 in 2022. Surveys, field observations and focus group interviews were conducted within HKUST. It was found most students were satisfied with the usability and their learning experience gained through using the application in the 2D mode. Students participated in the field tests, utilizing the application in the VR mode (N=17). The findings revealed that the VR job interview application successfully helped students practice and prepare for their job interviews. Students preferred the VR mode to the 2D mode thanks to the immersiveness and authenticity of the VR job interview practices.

Keywords: *Virtual reality; job interview application; business communication; higher education; personalization; experiential learning.*

1. Introduction

This project was developed to meet the needs of business students in the LABU2060 Effective Communication in Business course, as part of the language requirement for the Business School's program at the Hong Kong University of Science and Technology. The course, beginning with job-seeking, utilizes a simulation approach, but only one online lesson on job interview practices is not sufficient for students. Finding partners to practice outside of class has proved futile (with or without the pandemic), and teachers are unable to provide additional support. To address this, the project team employed Virtual Reality technology as a solution to provide an authentic and immersive learning experience for students. The VR job interview trainer, enhancing learning effectiveness and administrative efficiency (Fabrisa, Rathnera, Fonga, & Sevigny, 2019), was designed to fill the gap in teaching and learning of business communication in a job interview setting. It allows learners to actively engage with the application at their own pace and time without added stress, such as the presence of a teacher or assessments. Through this process, learners are able to reflect on their experience and partake in a meaningful learning process. There are a few online VR training courses for job interview skills in the market. However, these commercial solutions are not without costs. The free job interview software in the market might not be satisfactory while some provide training contradicting what we is taught in our Business Communication course. One existing job interview mobile application in higher education in Hong Kong does not seem to be in full operation due to the limitations presented. Our VR job interview practice application, *I'm IN–HKUST*, in the mobile application market (Play Store and Apple Store) has served to offer comprehensive training for HKUST student users to improve their communication and job interview skills.

2. Literature

The project is based on the principles of experiential learning and the learning model that accounts for how the brain processes and registers information.

2.1. Experiential Learning Theory (ELT)

The creation of meaning is achieved through personal experiences. Kolb's (1984) experiential learning cycle consists of four steps that occur repeatedly during every experience: Experience, Reflect, Think, and Act. The cycle begins with a tandem, a concrete experience followed by reflection on that experience, leading to abstract thinking and deriving conclusions – “learning [is] a function of experience” (Moore 1999, as cited in Moore 2010, p.4). According to ELT (Kolb, 1984; Kolb & Kolb, 2005; Kolb & Kolb, 2009), learning is best facilitated by a process that draws out the students' beliefs and ideas about a topic so that they can be examined, tested and integrated with new, more refined ideas. Furthermore, ELT sees a holistic process as pivotal to learning that involves the integrated

functioning of the whole person, including thinking, feeling, perceiving and behaving. ELT proposes that learning results from synergetic transactions between the learner and the environment. Moreover, ELT views learning as the process of creating knowledge, as opposed to the model which is based on the transmission of prescribed fixed ideas. The experiential learning process is rooted in the process of brain functioning (sensing, integrating and motor) (Zull, 2002). The two sets of experiential learning and brain-based learning principles intersect and are juxtaposed (e.g., Duman, 2010). Learning naturally involves the brain, and learning could be deeper if more parts of the brain are involved.

2.2. Brain-based Teaching and Learning

The Brain-based teaching and learning (BBTL) approach, based on research in cognitive science and neuroscience, aims to align with the brain's natural operations to promote full understanding and memory retention. There are 12 principles established by Caine & Caine (1990) which cover topics such as the brain as a computer, the importance of meaning and experience in learning, which coincide with ELT, and the effects of emotions, attention, and memory. One principle states that people understand and remember best when facts and skills are embedded in natural, spatial memory, i.e., experience, in short. This approach emphasizes a holistic approach to learning and uses the three instructional methods of Orchestrated Immersion (OI), Relaxed Alertness (RA), and Active Processing (AP) to create a highly engaging and meaningful learning experience. The mental model developed through the three instructional techniques (Gülpinar, 2005) is particularly interesting in how BBTL and ELT work together in a learning environment that could maximize the benefits for the learners. Shifting from rote memorization to meaningful learning is essential in BBTL.

3. Project Description

The primary aim of the project was to enhance students' practice opportunities for job interviews and their awareness of their communication skills when answering interview questions. The project objectives were successfully met within the 1.5-year time frame. A VR job interview application with instructional content on job seeking was implemented in a course at HKUST in Spring and Fall 2022 and was made available in the mobile application market. The VR app is linked to a website with a user menu and a database for storing users' performance recordings. The immersive learning experience incorporated virtual reality, personalization, reflective elements, and gamification. Unique features of the project include a VR and 2D mode option, 3 different practice time frames and 3 challenge levels, a collection of job interview questions for a suite of 15 most sought-after jobs among HKUST students, and a replay of interview questions and a skip option during practice sessions. Students can receive verbal feedback from the VR trainer based on their self-assessed performance levels, and training resources, i.e., mini-lessons in the form of videos, are

provided. The mini-lessons feature input from HR directors and managers in the industry as well as instructors of the course.

4. Methodology

Two Qualtrics surveys were conducted in the Fall of 2021 and Spring of 2022 to gather feedback on the VR app. The surveys received positive feedback on the app's usability and the learning experience provided, along with useful suggestions. However, the response rate for both surveys was low, possibly due to the timing of the VR app's launch. Additionally, many respondents used the 2D mode instead of the VR mode, likely because of the pandemic and the difficulty accessing the HKUST library to borrow VR headsets. Hence, the project team invited students from different disciplines to evaluate the project and assess the effectiveness of the VR features in Summer 2022.

HKUST students were invited to partake in a field observation study from 15 June to 16 July 2022. A total of 17 students provided valid responses. The study consisted of three parts: (1) **VR app experience** with short evaluations, where students were asked to use VR goggles provided by the project team and practice an interview in the VR mode, (2) **individual interviews**, and (3) **focus group interviews**. During the field tests, students were given a 15-minute interview practice at a designated difficulty level, but were able to choose any industry and job they were familiar with. After the practice interview, students completed a short self-evaluation on the App and received feedback from the VR app based on their self-evaluation. They were also asked to provide written ratings of their performance and an observer also made notes on their performances. In the final part of the study, students were asked to watch a mini-lesson (out of 13 in total), a 5-10 minute video in the VR mode with any topic of their choosing.

An individual interview was held to gather information about students' experience with the VR app and their engagement during the interview practice. The purpose of the interview was to assess the usefulness and ease of use of the VR app. Afterwards, students participated in a focus group discussion to explore potential uses for the VR app, such as job interview training. The groups were composed of 2-3 students from the same field of study, for example, students enrolled in the LABU2060 class were placed in the same group. The breakdown of participants is listed in Table 1 below.

Table 1: Disciplines of student subjects.

Disciplines	Number of groups	Number of students
Business	4	10
Engineering	2	4
Science	1	3
Total	7	17

5. Findings

The results of the study on the users' experience with the interview practice are presented below, including their level of engagement, level of stress, effectiveness of the VR practices, and effectiveness of the feedback received.

5.1. Level of Engagement

The students' level of engagement during the interview practice was evaluated using a 3-point Likert scale, with results indicating that the students were able to actively participate (average score of 2.29 and a standard deviation of 0.686). The observations made by the teachers also suggest that the students were able to fully engage in the interview practice (average score of 2.47 and a standard deviation of 0.624). These results are presented in Table 2 below. The majority of students were reported to have engaged in the practice and interacted with the VR app. One student was reported to have been initially nervous but eventually became more comfortable as the practice progressed. Students felt more engaged in the VR mode as compared to practising in 2D, as it allowed them to be fully immersed and not distracted by their surroundings.

Table 2: Students' engagement levels as reported by the students and the observers.

Engagement Level	N	Min	Max	Median	Mean	Std. Deviation
Students	17	1	3	2	2.29	0.686
Teacher-observers	17	1	3	3	2.47	0.624

Note: A 3-point Likert scale

5.2. Level of Stress

According to the students' feedback, the majority of them felt low stress levels during the interview practice. They attributed this to app's ability to repeat any questions and the fact that the interviewer was not a real person and would not have any facial expressions affecting their performances. They also highlighted that they felt they were practicing, as the VR interviewer would "go easy on you", and "mistakes are allowed".

5.3. Effectiveness of the VR Practices

The VR interview practice was found to be effective in improving communication and interview skills. The flexibility and convenience of the app, as well as the immersive experience provided by the VR goggles, were cited as factors by students that contributed to its effectiveness. They reported that they were able to engage more fully in the practice and felt more prepared for real job interviews as a result. Additionally, the app provided an authentic experience that was close to a real job interview and helped students focus better and practice more effectively. A student claimed they would "try to use it again, especially

when I'm having a job interview soon. I can listen to some questions from the interviewers. I will be able to practise more and also get more well prepared before the real job interview.” Another student indicated they “would like to try 100% (perform at their best)” in the VR interview. Students reported it was really difficult to have a job interview practice partner in real life. Some students were able to make subsequent improvements based on the self-reflections through the VR app. In contrast, students who had used a 2D version of the app reported being easily distracted and abandoning the practice quickly.

5.4. Effectiveness of the Feedback

To assess the effectiveness of the feedback provided, students were asked to rate their own and teachers the students' performances using the same 3-point scale during the interview practices with the VR app. The results showed that the teachers' ratings were slightly higher than the students' self-evaluations (see Table 3). Related Sample Wilcoxon Signed Rank Test ("Wilcoxon-signed-Rank test," n.d.) was conducted to determine if significant differences between the median scores of the teachers' and students' evaluations were presented. The results showed that there were no significant differences in task fulfillment, fluency, stress and pausing, and energy and enthusiasm level. However, there was a significant difference in the use of language, with the teachers' ratings being higher than the students' self-evaluations, indicating that the students' language use was more proficient than what they reported and the feedback by the VR trainer might have been more critical than what the students should receive in the end.

Students were further asked to provide their thoughts on the feedback they received. The majority of students stated that the feedback provided by the VR app was useful, providing specific and accurate suggestions. One student said the feedback on the VR app was very close to the teacher comments on her job interview performances before.

Table 3: Related Sample Wilcoxon Signed Rank Test on the Observation.

Observer - Students	N	Median		Positive Differences	Negative Differences	p-value (2-tailed)
		Observers	Students			
Task Fulfilment	17	3	2	10	3	0.052
Use of Language	17	2	2	9	2	0.029 [^]
Fluency, Stress and Pausing	17	2	2	6	2	0.132
Energy and Enthusiasm Level	17	2	2	4	3	0.380

Notes: A 3-point Likert scale. [^] Lower than significant level 0.05

6. Discussion

The purpose of the paper was to analyse the findings in regard to the perspective of personalization and experiential learning conceived through the VR app. The results will be analyzed to explore the benefits of using VR technology and self-reflections in learning.

6.1. Personalization through VR Technology

Students' need for more learning practices is often neglected. The VR job interview program is based on the idea of continuous learning which was not feasible in a classroom setting due to administrative and resource concerns and the curriculum design. It is not up to the students if they hope to have practices on a given topic in the capacity and frequency each individual would prefer to have. In reality, solely one lesson was assigned for students to practice the communication skills they have acquired in teachers' preferred format (in pairs or groups) in class. The students in the study found that repeating the same tasks in the VR environment helped them improve their responses, and they felt that this repetition helped them answer job interview questions in a more organized way. In addition, the communication skills they developed would be pivotal not only to the job interview assessments that will shortly be conducted but also to real-life job or internship interviews that might occur at a much later time. With the VR app, job interview practices are personalized – it has become a viable option according to the time and space as needed by students.

6.2. Experiential Learning through VR Technology

The main focus of the study is to understand the effectiveness of using a virtual reality (VR) job interview speaking program, in the form of a mobile application. The research specifically examines the experiences of the student users and the benefits of using VR technology for this type of communication skills training (see Table 2). The results suggest that students preferred the VR mode as it provides an authentic, immersive and interactive

experience, which leads to better performance during the interview. The VR environment creates a sense of presence and eliminates distractions, contributing to the overall effectiveness of the program. All of these coincide with the intended pedagogy behind the program which is based on Experiential Learning Theory and Brain-based Teaching and Learning, focusing on the “integrated functioning of the whole person—thinking, feeling, perceiving, and behaving.” Student users are engaged in a learning environment that fully engages their many communication skills (OI), allowing them to process learning materials by actively practicing them (AP) while removing the unnecessary fear (RA). The VR job interview application aims to provide a safe and secure learning environment that promotes meaning-making and counters ‘downshifting’ (when learners retreat to a defensive mode being less flexible and open to new information). The study's findings indicate that the VR app is a superior platform for experiential learning, which was not initially expected by the researcher.

7. Conclusion

The VR job interview training environment creates a sense of presence, eliminates distractions, and contributes to the overall effectiveness of the program. The VR app was designed in a manner to allow students to reflect on their own learning and take charge of their own development by providing personalized options (in terms of the length of practices, challenge levels, industry and job, replaying or skipping any interview questions during the practice) and flexibility (with reference to time and space), in line with the principles of experiential learning theory (ELT). ELT posits that learning is most effective when it is an active process, where students learn by doing and reflecting on their experiences. The study's findings support the effectiveness of using VR technology for communication skills training, yielding the benefits of personalization and meaningful learning experience.

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Student response systems: enabler of active learning in a large class

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Abstract

This paper presents students opinions on the benefits they gained from using Vevox – a student response system (SRS), in a 2022-23 Semester I, final-year undergraduate module with 56 students in an Irish University. The students were surveyed to assess what benefits, if any, they believed they had obtained from using the SRS in the module. The key benefit identified by 41% of the students was that using the SRS contributed to them engaging with the lectures – both in terms of the material being taught and with their classmates. The second most important benefit identified was that the questions posed via the SRS enabled the students to reflect on their learning while in the lecture. The research contributes to the literature by showing that posing open-ended questions via SRS leads to active engagement and learning by students.

Keywords: *Student response system; audience response system; active learning; large class teaching; Vevox.*

1. Introduction

The ability to use computer technology to enable students to ‘vote’ emerged in 2005 when physical clicking devices in the possession of students could be connected via a radio-frequency to a receiver. These devices normally had 4 buttons from which students could choose to answer a multiple-choice question posed by the lecturer. Even with such limited capabilities research found that using them resulted in significantly increased student engagement and improved satisfaction with their learning experience (Chou, Chang, & Lin, 2017; Nikou & Economides, 2016; Pimmer, Mateescu, & Gröhbiel, 2016).

In recent years, such ‘clickers’ have been replaced by mobile phone apps that allow student responses. There are currently 80+ such app systems, with the most popular being Kahoot, Polleverywhere, Vevox, QuestionMark and TurningPoint. These new student response systems have significantly improved functionality – allowing different question types, including open questions where the response is a typed answer. In addition, because they run on mobile phones – which are ubiquitous among the student population – and can communicate via either wifi or mobile network, they can be used by all students easily and do not suffer the technical connection issues that was common among radio-frequency clicker systems. (Bogdanović, Barać, Jovanić, Popović, & Radenković, 2014).

The general availability of these technically reliable student response systems (SRS) which are now available for purchase via Institutional software site licences, provides the possibility of widespread adoption. In addition, these systems now facilitate various assessment functionality via the variety of question formats that they allow. Which, makes them an ideal technology to enable technologically based assessment as part of the live teaching environment. While traditionally such assessments in the live teaching environment would have used pen and paper, in large classes this was not practical due to the time required to gather such paper-based responses alongside the need to manually match the individual student responses against a class list. With SRS, the assessment questions are available to all students at the same time and for an equal duration. Student responses are available immediately electronically and the student response system has functionality to amalgamate answers which can immediately be displayed to students – such immediate feedback has consistently been demonstrated to improve learning. From an administrative point of view each students answer is available in the system against their name – so marks awarded are easily recorded.

Research to date on SRS has been predominantly on enabling student participation and enhancing their learning, but little research has focused on using them as an assessment method – even though they have been identified as a technology that could enhance formative assessment in the 21st century (Spector et al., 2016). An early systematic review on student response systems undertaken by (Kay & LeSage, 2009) suggested that research need to be

carried out with respect to the impact of specific types of questions in enabling improved learning environments. A recent systematic review on SRS (Wood & Shirazi, 2020) and the student experience found that the most widely discussed theme within the articles identified was student engagement. Echoing the research call of (Kay & LeSage, 2009) who also identified the area of assessment – specifically ‘question design’ as a critical element in the use of SRS, and acknowledge that it is an area that requires further study, and more specifically the use of SRS to pose open-ended questions to students. This research seeks to answer this call for research.

2. Case Study

The SRS, Vevox, was used in the final year University under-graduate module: Business Intelligence & Analytics in Semester I, 2022-23 by the author in the University of Galway. 117 students took the module. Vevox was used in each of the eleven 2-hour lectures to ask open-ended questions which together were worth 15% of the overall assessment marks for the module. Forty questions were asked over the duration of the module. The decision to partake in some or all of the 40 questions was a decision each student had to make and importantly they were not deducted marks for not partaking, instead any marks not availed of through answering the in-class questions were instead awarded for their final written exam.

2.1. Data Collection method

At the last lecture in the module, students were asked 3 questions via Vevox, about their experience of using Vevox. In advance of putting up the questions, the lecturer made it clear that these questions would not form part of their in-class assessment mark and so it was entirely voluntary if they wanted to answer them. Also, they were assured that at no stage would the answers they gave be attributed to them individually – i.e. their anonymity was assured. There were 61 students present at the last lecture and 56 of those chose to answer the questions about Vevox. This means that 47% of the students registered for the module partook in the survey. This would have been higher had attendance at the final lecture been higher.

A central part of the pedagogy for using in-class assignments in this module was to ask open-ended questions that required students to think and provide their own answers based on their own individual learning. This ethos was also used in the phrasing of the questions on their experience of using Vevox.

The three questions asked were.

1. What benefits (if any) do you believe you have gotten from using Vevox polling software in this module?

2. In what ways (if any) do you think using Vevox polling in this module has helped your learning?
3. Write down your questions/suggestions as to how the lecturer could use Vevox Polling to better improve your learning?

3. Findings

The answers given for each of the questions were analysed and categorised at the individual question level and additionally also across the three questions.

Given that submitting the answers via Vevox was the means through which the 15% available for in-class assessment was facilitated, it might reasonably have been expected that this was a benefit that students would self-identify from using the Vevox software. To assess this, the answers across all three questions were analysed. Across the three questions, only 6 students (10% of respondents) mentioned anything about obtaining marks for their answers to questions each week and 3 of these were with respect to suggestions on how to improve things.

The lack of responses that even mentioned the availability of continuous assessment marks, is surprising, especially given this module is a final-year module and as such the marks from the module contribute to the calculation of each students overall degree result.

3.1. Benefits of using the student response system

The key benefit identified by 41% of the students was that using the SRS contributed to them engaging with the lectures (Table 1) – both in terms of the material being taught and with their classmates. Examples of responses identifying engagement, were:

- “Engagement in class and improving participation/attendance. Helped me stay focussed. Feel like opinion listened to.”
- “From being forced to be engaged (at the beginning), to really getting engaged into this module, serious thinking, etc.”
- “It has led to me being much more engaged with the lecture as it is more interactive. Without any sort of engagement in lectures I tend to stop paying attention, so I have really enjoyed engaging with the content in real time rather than just in assignments”

Table 1. Benefits of using student response system.

Benefits identified by students from using Vevox?	Responses	% of Responses
Engagement in lectures	23	41.07%
Learning Reflection during lectures	16	28.57%
Anonymity	6	10.71%
Critical Thinking	3	5.36%
Active Participation	3	5.36%
Answer Comparison	3	5.36%
Class Participation Marks	2	3.57%
Total	56	100.00%

The second most important benefit identified was that the questions posed enabled the students to reflect on their learning while in the lecture. Some of the answered classified under this benefit are below:

- “It got me to think more deeply during the lectures, it helped me to start a discussion in my own head and listening to other student’s mental models afterwards for me to think differently”
- “It helped me to actually think about the lecture material rather than just listen. So, I do think this type of engagement helped me learn because the info sticks better.”

Six of the respondents identified that the anonymity of the system – the fact that who gave the answer was never identified when answers were shown on-screen in class – was an important benefit for them. One example of a response that specifically cited the benefit of anonymity was:

- “I enjoyed using Vevox, it allowed students to answer questions freely and without having to shout out answers in class which many people would be uncomfortable with.”

A benefit that was identified by 3 students was that the use of SRS to pose questions enabled them to think critically, one example of a response is: “As explained by the lecturer, several polls were given to challenge our thinking and critically discuss several topics.” Three students stated that the SRS enabled them to actively participate in the lectures, e.g. of a response: “It has allowed for active participation and has given me the opportunity to share my views on various topics.” The capability of the system to immediately show on screen other students answers to the question was a benefit directly identified by 3 students. Text of one such response is: “The ability to get an insight into other students’ thoughts & opinions

and to allow me to critically think about certain questions that I would not have thought about before.”

Looking at the totality of the responses from students with respect to the benefits they believed they obtained from the SRS, it should be noted that none answered that they had received no benefit – even though this was allowed for in the question as it started with the words: “What benefits (if any).” The overall picture of what emerges from an overview of the answers is that the students benefited from the system as it enabled them to actively engage in and contribute to their learning while in the lecture and they could do this in a way that respected their answers by maintaining their anonymity.

3.2. Benefits to students learning

The second question asked, was more specific – asking students to reflect on how they believed the system had helped their learning. The answers given were very similar in opinion and focus to the responses to the first question on overall benefits. The similarity of the answers to the two questions strengthens the argument that the students saw the SRS as facilitating and enabling their learning, rather than just something that only had the functional purpose of recording their attendance and assessing them, or just being entertaining.

The categorised responses are shown in Table 2 below. Looking at the responses collectively, what emerges is that the students believed the SRS helped their learning by facilitating them in being active, engaged and reflective learners while being in the lecture hall. The benefit of obtaining continuous assessment marks because of answering the questions posed was only identified by 5% of the students as a way the system had helped their learning.

Table 2. How students believed the SRS helped their learning.

How helped Learning?	Responses	% of Responses
Active Learning in lectures	18	34.62%
Active Reflection in lectures	13	25.00%
Engaged learning	9	17.31%
Critical Thinking	6	11.54%
Class Participation Marks	3	5.77%
Other Answers	3	5.77%
Grand Total	52	100.00%

3.3. Students suggestions for improvement

The extant literature on the use of SRS talks a lot about the importance of the questions asked in terms of the benefits obtained by students. The third question asked sought to ascertain what ideas the students might have in terms of questions and/or suggestions that would better improve their learning. The categorisation of the answers given is shown in Table 3 below. During the module, the students answered 40 questions, yet none of them suggested a way to improve things was to ask fewer questions, instead 21% suggested asking more questions. A lot of the suggestions for improvement was on better question construction – with some wanting more focused questions – such as multiple choice questions, but others looking for more open ended questions which might be posed at the end of one lecture to be answered at the start of the following weeks lecture.

10% of the respondents would have liked to see more discussion in class on the answers provided. This was done on a few occasions during the module, but the suggestion indicates that students found benefit in this and allowing for more of this is likely to further increase the sense of engagement and active learning experienced by the students. One of the features within Vevox is that the answer to a question can be displayed as a word cloud. To enable the word cloud to be displayed effectively, Vevox limits each individual answer to 20 characters. This character limit on answers was cited by 3 students as something that they suggested might be usefully removed to allow a more complete answer.

Table 3. Suggestions for improvement.

Suggestions for improvement	Responses	% of Responses
No Suggestions	13	25.49%
Improved Question Construction	13	25.49%
More Questions	11	21.57%
More discussion in class on answers provided	5	9.80%
No Character Limit on Answer	3	5.88%
More Time to Answer	3	5.88%
Use for Assessment	2	3.92%
Vevox Software Capability Improvement	1	1.96%
Total	51	100.00%

4. Conclusion

The use of a student response system consisting of open-ended questions to enable in-class interaction with students in a large lecture is something that is highly regarded by the students as being beneficial to their learning experience. The answers given by students via the SRS were graded and could account for up to 15% of their final grade, yet this benefit from the system was only cited as a benefit by less than 10% of the students. Instead, the key self-selected benefits that students identified were active engagement, active participation and real-time feedback on their answers relative to their peers. This case study clearly shows that used in the correct way asking open-ended questions via a SRS enable simultaneous individual student engagement and learning in a large classroom setting.

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A mixed reality laboratory for developing competencies in control engineering

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Abstract

This work presents a novel mixed reality laboratory for the development of competences in control engineering. This laboratory simulates various control systems that may interact with different control devices. The mixed reality lab has three components: (i) a virtual environment, (ii) a virtual-electronic interface, and (iii) a control unit. The virtual environment displays a virtual representation of the system under control. The electronic interface uses a microcontroller to solve the differential equations that models the simulated system. The values solved by this interface are sent to the virtual environment for driving its animation. Moreover, input and output signals are connected to the control unit for the implementation of a control law. The functionality of the proposed mixed reality laboratory is showcased by modeling and controlling a Planar Vertical Take-off and Landing (PVTOL) system. Furthermore, the motivation of a group of students, after experimenting with the laboratory, is reported.

Keywords: *Mixed reality labs; virtual systems; educational innovation; higher education.*

1. Introduction

In the engineering education community, there is a consensus that laboratory experiences are fundamental to learning processes. Through these experiences, students develop relevant procedural and disciplinary competences since they offer an interactive learning strategy. In recent years, universities worldwide seek innovative solutions to reconfigure or succeed traditional laboratories. The area of control and automation engineering has been an essential field for the implementation of innovative solutions to overcome the limitations of conventional laboratories. In general, control and automation theory is abstract and difficult to understand, since it consists mainly of theoretical models. Although traditional hands-on laboratories allow students to associate theoretical concepts with physical phenomena, they have some limitations (Hernández-de-Menéndez et al., 2019). The most common limitations are: (1) equipment for control engineering experiments is often expensive; (2) equipment needs to be shared by students in groups; (3) both laboratory opening hours and space are limited; (4) experimental sessions are always detached from theoretical courses; and (5) experimentation with real systems could be risky.

The rise of virtual and remote laboratories is removing the limitations of traditional hands-on laboratories (Li et al., 2020; Macías García et al., 2020; Morales-Menendez et al., 2019; Tejado et al., 2021). Among these laboratories, those that use mixed reality and augmented reality laboratories have demonstrated several advantages over others because they combine the benefits of physical and virtual components (Liang & Liu, 2018; Zata et al., 2017). In particular, mixed reality laboratories have been successfully applied to train technicians in different fields, such as medical procedures (Aebersold et al., 2018; Barsom et al., 2016), industrial maintenance and assembly (Gavish et al., 2015), among others. Regarding control engineering, mixed reality laboratories have shown significantly improves for learning specific concepts (Frank & Kapila, 2017).

This work presents a mixed reality laboratory that aims to develop the procedural and disciplinary competences of engineering students taking control engineering courses. Engineering competencies are important skills and abilities required to solve modern challenges (Guajardo-Cuéllar et al., 2020, 2022). Control engineering is not exempt from these modern challenges. The proposed laboratory has three elements: (i) a virtual environment that simulates the system to be controlled, (ii) a control unit that uses a physical electronic device to control the simulated system, and (iii) an electronic interface that communicates the virtual environment and the control unit. A Planar Vertical Take-Off and Landing (PVTOL) system is used to showcase the functionality of the proposed laboratory. Furthermore, seventeen students from the Tecnológico de Monterrey used the laboratory and reported their experience in a survey. The students found the mixed reality laboratory very useful, easy to use, and realistic.

2. Virtual Environment

This section describes the virtual environment. Electro-mechanical systems are designed using a CAD software, then they are imported to a game engine for creating the virtual environment.

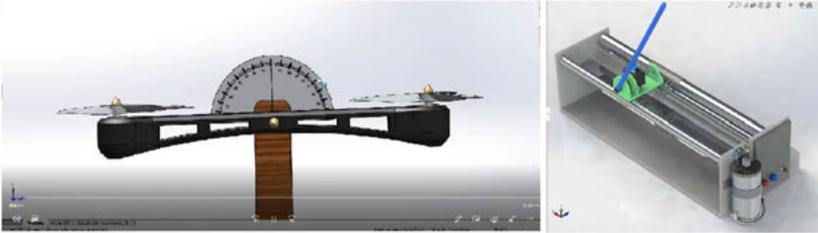


Figure 1 Two systems designed with a CAD software.

For the development, the systems must be firstly designed using a CAD software. Two examples are shown in Figure 1: (left) a Planar Vertical Take-Off and Landing (PVTOL) system and (right) an inverted pendulum. The PVTOL system consists of a beam that rotates about its central axis, whose movement is induced by the thrust generated by the rotors located at both ends of the beam. This system is a simplified version of a quad-rotor, in which engineering students can apply control concepts. The second system is an inverted pendulum on a cart driven by a direct current (DC) motor. The center of mass of the pendulum is above the pivot point. Therefore, the pendulum is unstable without a control algorithm. Through this system, engineering students can understand and apply stability concepts that arise in applications such as rocket guidance.

The CAD models of the two systems are then exported to Unity, a well-known game engine, where they are integrated with different assets in a virtual environment. Afterward, Unity generates an application containing the virtual environment, which can be executed in a personal computer, tablet, or smartphone (a link to a video is provided in the next section).

3. Electronic Interface

This section shows how the differential equations of a system can be implemented using a microcontroller. A numerical method for solving the equations of the system is codified on an Arduino board. It is enabled for sending the data to the application via serial communication, it also writes these values on the electrical outputs of the microcontroller.

3.1. Mathematical model implementation

The system's dynamics is solved in the electronic interface. In detail, the model of the PVTOL system is:

$$J \frac{d^2\theta(t)}{dt^2} = l(f_1(t) - f_2(t)) - C \frac{d\theta}{dt} \quad (1)$$

where θ is the angle of the beam, C is the viscous friction coefficient, l is the distance from the center of the beam to the rotors, J is moment of inertia of the system, and f_1 and f_2 are forces on both ends of the beam. f_1 and f_2 depend on the rotor speeds as follows:

$$f_i = \alpha u_i^2$$

where u_i is the speed of the i -th rotor, and α is a proportional constant that relates the force and speed of the motor. Equation (1) is solved and implemented in an Arduino Mega board that is included in the electronic interface.

3.2. Connection with the virtual environment

In order to animate the simulated system, it is necessary to send the system variables computed by the microcontroller to the virtual environment.

The virtual environment was programmed for receiving the data via serial communication and display it. Moreover, the values are used to animate the simulated system. In the case of the PVTOL, the application obtains the values of aforementioned variables: θ , ω , u_1 , and u_2 . Moreover, the virtual beam is rotated according to the angle θ , received by the application.

3.3. Connection with the control unit

In order to interact with electronic controllers, the interface microcontroller must read input signals from certain analog inputs, and it must provide output signals through analog outputs.

For the inputs, the microcontroller reads ports attached to Analog to Digital Converters (ADCs), obtaining signals in the range from 0 to 5 Volts. The input signals can be provided by a control unit (microcontrollers, PLCs, DSPs, FPGAs, etc.) or other electronic devices, such as potentiometers and operational amplifiers.

On the other hand, the interface provides analog signals representing values of state variables (e.g., angles, velocities and forces). These values are provided by the microcontroller as pulse width modulation (PWM) signals. Then, an electronic circuit transforms the PWM signals into analog ones, by using Resistor-Capacitor (RC) filters. Thus, these electrical signals can be read by the control unit, emulating electronic sensors.

3.4. Mixed reality lab demonstration

The following link opens a video about a simple simulation of the PVTOL system using the virtual environment and potentiometers as external signals: <https://youtu.be/RNu05f1YITs>

The video shows the application running in a personal computer. First, the application is initialized and the “Balancín” option is selected to open the virtual classroom containing the

PVTOL system. Then, the user walks around the classroom using the keys ‘a’, ‘s’, ‘d’, ‘w’, and the mouse. Later, the serial port “COM14” of the computer is connected with the application, this is the port where the Arduino board is also connected. At this moment, the sound of two propellers starts because the application is now receiving the data corresponding to the rotor speeds from the microcontroller. These rotor speeds are defined by the value of two potentiometers that can be observed in the second screen (displayed at the bottom right of the video). Then the value of left potentiometer (left rotor) is increased, this produces a negative torque on the beam, and consequently it rotates until it reaches -45° (this is a limit value imposed in the code). After that, the value of the right potentiometer (right rotor) is increased. When it overpasses the left potentiometer value, it produces a positive torque on the beam, and consequently the beam rotates until it reaches 45° . Finally, the user tries to balance the beam by regulating the speed of the right rotor; however, this is a very difficult task for a human being because the system is unstable and the user fails to balance the beam.

The virtual environment and the electronic interface comprise the Mixed Reality Labs proposed in this work. The former provides two significant advantages: it is possible to design and simulate several engineering systems, and it provides a visualization of the system behavior. The latter allows to interact physically with the simulated system, which can be controlled using a wide variety of control devices.

4. Control Unit

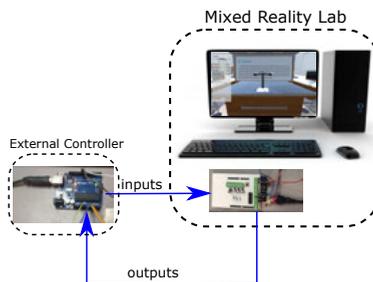


Figure 2: Scheme for connecting the Mixed Reality Lab to a control unit.

Figure 2 shows a scheme with the connections between the mixed reality lab and an external microcontroller, which in this particular case is an Arduino Uno board. For the PVTOL system, the outputs are the beam angle θ and its velocity ω , their electrical signals are sent from the mixed reality lab to the external controller. In the same way, the inputs of the PVTOL system are the rotor speeds u_1 and u_2 , which are driven by the electrical signals received from the external microcontroller.

The output variables of the system are used by a Proportional-Integral-Derivative (PID) control algorithm for computing an actuator signal effort, necessary for maintaining a

required reference value. This signal is provided as an input to the system. The PID algorithm is running in an Arduino Uno board, for maintaining the angle of the beam at a required value. The following link is a video showing an implementation of this controller, it maintains the beam angle in different required positions: <https://youtu.be/WDKJmbDNWWM>

First, the user opens the application and connects the Arduino Mega that simulates the PVTOL. Then, the user uploads the PID controller code in an Arduino Uno board and launches a plotter for visualizing the required angle and the current angle of the PVTOL system. During the experiment, the video shows the virtual environment and the plotter at the same time. In the plotter, the red line represents the required angle for the beam, the values are -20° , -10° , 0° , and 10° . The blue line represents the current angle of the PVTOL system. This behavior can be appreciated in the virtual environment, where the angle of the PVTOL system is maintained. The main characteristic of the control unit that commands the behavior of the virtual system is its versatility.

5. Implementation with students

The mixed reality laboratory was used in a group of undergraduate engineering students from the Tecnológico de Monterrey, in order to assess their motivation when working with this platform. The group included seventeen students of the Mechatronics Engineering program. This project has the approval of the experimental protocol submitted in December 2022 and approved in January 2023. It is important to note that the sample used for this study previously signed an informed consent. After the experimentation with the mixed reality laboratory, a survey was applied to the students to measure their motivation regarding this laboratory. The formulation of the survey questionnaire was based on similar work on remote control laboratories (Achuthan et al., 2021; Liang & Liu, 2018; Tejado et al., 2021). The reliability of the questionnaire used was validated in previous studies (Achuthan et al., 2021), using the Cronbach's Alpha method and the instrument was found to be reliable ($\alpha > 0.79$). The survey questionnaire consisted of eleven positive claims, regarding the impact of the laboratory in three aspects: (1) learning motivation; (2) comprehension without supervision; and (3) realistic experimentation. Seventeen students answered the survey, Figure 3 shows the scores averages grouped by aspects.

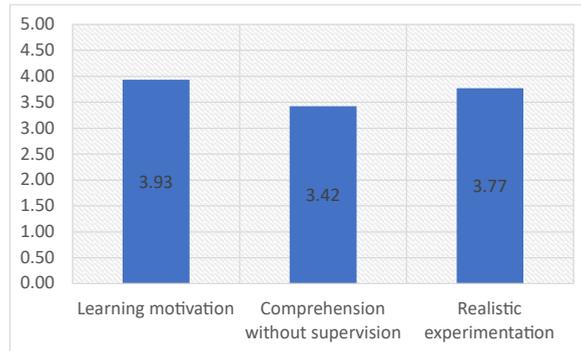


Figure 3: Score averages of the survey claims grouped by the aspects.

The results of the survey demonstrated that, through the use of the mixed reality laboratory, the students were motivated to learn about the implementation of control strategies on hardware.

6. Conclusions

A mixed reality laboratory for control engineering courses was described in this work, which combines simulations of control systems in a virtual environment and an electronic device that functions as interface with external control units. This scheme allows students to practice the implementation of any kind of controller, in any kind of electronic device. Moreover, the motivation of students working with the laboratory was assessed. The measurement of competencies development, regarding control engineering, is left as future work.

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How students manage peer feedback through a collaborative activity in a CS1 course

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Abstract

In order to boost students' motivation in practicing their problem-solving skills and give them opportunities to get feedback, we broke our CS1 course routine with a disruptive cross-skilling activity. It relies on collaboration between teams of students where peer feedback (using rubric) stands as the cornerstone to design and build a solution responding to a given problem.

This paper aims at formally assessing the peer feedback process across three activity sessions. It also highlights the different success factors supporting peer feedback in that context through a cause and effect diagram. We show that peer feedback fosters primary problem-solving foundations. We also discuss its limitations, namely due to an insufficient granularity in the provided checklist as well as a lack of transversal skills from students, making them less comfortable with peer feedback. Although, by repeating the activity, students could manage it better and better and take more advantage of peer feedback.

Keywords: *Peer feedback; team-based learning; checklist; problem-solving; CS1.*

1. Introduction

In a Introduction to Programming Course (CS1) dedicated to First Year students, a particular importance is given in teaching a problem-solving method as the resulting skills are crucial in the long run to be able to handle new challenges (Choudhar et al., 2022). Although, in practice, students often lack motivation during traditional programming exercise sessions, taking lots of time to solve a given exercise and missing feedback (Sharmin et al., 2020).

To overcome that issue, the Collaborative Design and Build (CDB) activity (Brieven et al., 2022) was deployed in our CS1 course. That activity implements Assembly Line Learning (Rosario et al., 2020) and Team-Based Learning (Burgess et al., 2021) where peer feedback is drawn on a checklist. To motivate that process, CDB was designed such as the reviewers need to give a feedback as clear and as precise as possible since they will have to rely on the productions they have reviewed to progress the solution. Previous work (Brieven et al., 2022) has shown that students feel motivated in taking part to CDB, due to its social dimension and its authentic aspect. CDB also appeared to boost students' enhancement in solving problems.

This paper addresses the particular focus of peer feedback, aiming to assess it and identify how it could be optimized. This is tackled through two research questions: (RQ1) How relevant is peer feedback in the context of CDB in a CS1 course? (RQ2) Which prerequisites influence the feedback process in that context? Answering those questions, this paper shows that students provide correct feedback based on a given checklist (RQ1) while their capacity to integrate it is moderate (RQ1). To explain that gap, we namely point out a lack of accuracy of the checklist criteria and students' difficulty in communicating. This diagnosis is corroborated through a cause and effect diagram depicting the feedback process in CDB in relation with other dimensions emerging from the discussion related to RQ1, such as students' skills (not only disciplinary) or the activity parameters (like the checklist) (RQ2).

2. CDB Activity

The CDB activity (Brieven et al., 2022) is made up of two phases: the Design (solution design) and the *Building phase* (solution implementation). Fig. 1 shows how CDB is setup.

The right side of Fig. 1 ("Classroom Configuration") illustrates that, for N participants, the CDB activity relies on G Groups of students, each Group being split in T Teams (each Team comprising S students, with $S \geq 2$). The goal of each Group is to solve T problems in a limited amount of time. The left part of Fig. 1 draws how the T problems are getting progressively solved, in parallel, over time, following the T steps required to frame a problem-solving process. This conception is inspired by real professional life as, in large-scale development projects, the different steps in solving a problem are performed by different teams.

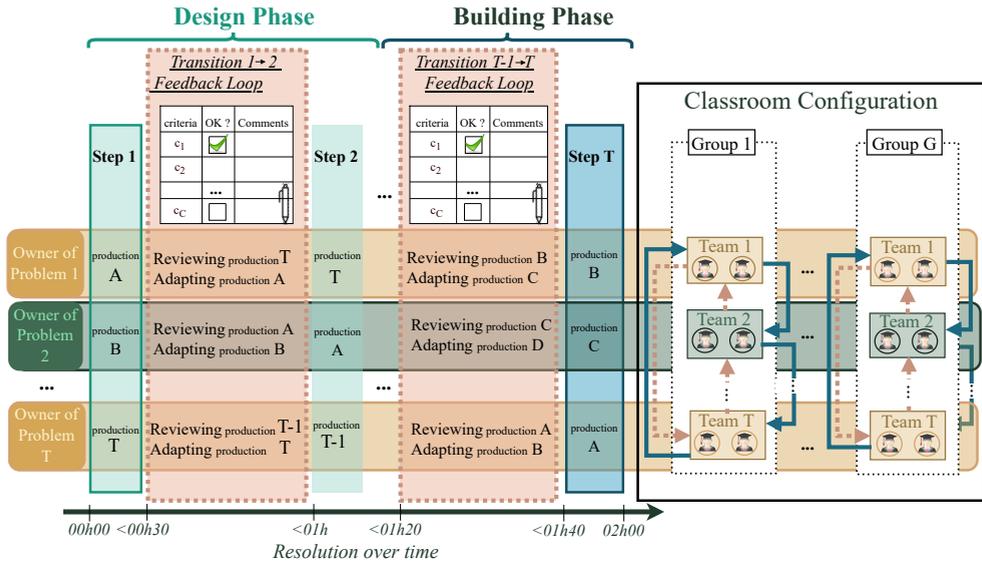


Figure 1. CDB generic set-up in the particular instance of two students per Team ($S=2$).

Going into more detail, at the beginning, each Team receives and gets responsible for one problem. For a given problem, the T steps are sequentially addressed, each Team being busy, turn-by-turn, with a specific one. At the end of each step, each Team work moves to the next Team, clockwise, similarly in each Group, as depicted by the plain arrows (Fig. 1, right part).

Then, a transition period is dedicated to allow each Team (*reviewers*) to report a feedback about the production provided by the previous Team (*submitters*). During that period, every Team holds two roles in parallel. For instance, Team 2 is reviewer of Team 1 (as expressed through the dashed arrow (Fig. 1, right part) linking the reviewers to the submitters) while it is submitter of Team 3. Note that the motivation behind that feedback loop is to limit the impact of a “poor quality work” on the next productions that are based on the previous ones.

Criteria supporting step 1	OK?	Comments (referred by tags if needed)
Input(s)	<input type="checkbox"/>	
Output	<input type="checkbox"/>	
Objects that are used :		
- have a relevant name	<input type="checkbox"/>	
- have a type that exists in C	<input type="checkbox"/>	
- have a purpose that is clearly expressed	<input type="checkbox"/>	
SP :		
- is generic (i.e., doesn't restrict to an example)	<input type="checkbox"/>	
- has a clear description	<input type="checkbox"/>	
- has a functional description	<input type="checkbox"/>	

Figure 2. Checklist related to the first step.

Next, each reviewers' checklist (reflecting the feedback) (see Fig. 2) was assessed. Fig. 3 depicts that process through a matrix in which the first column lists the *C* criteria related to a given step (each one being labeled *c_i*). The next column contains the boxes selected by the reviewers. Those are compared to the ones checked by the teacher (referred by the column "B2") used as benchmark to derive the *Feedback Correctness Rate* (FCR). Finally, the last column represents the checklist filled from the refined solution. It allows to compute the *Improvement rate* (IR), measuring how much the reviewers' feedback conducted submitters in meeting the unchecked criteria. For both rates, closer to 1 the better, closer to 0 the worst.

4. Results and Discussion

Fig. 4 exposes a cause and effect diagram where peer feedback is evaluated in CDB (RQ1). Then, the factors a successful feedback loop relies on are distilled (based on inferences emerging from RQ1 and the surveys' outcomes), classified, measured (on the grounds of students' views, at each session), and put in relation with each others (RQ2). Those links are quantified through the Pearson coefficient and its corresponding p-value.

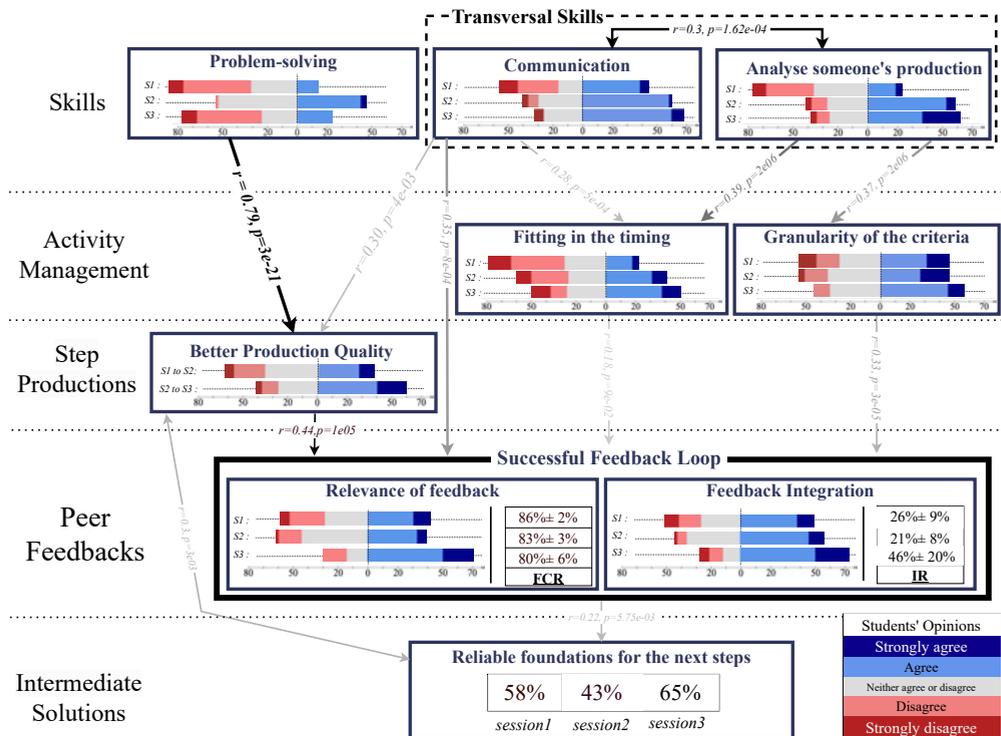


Figure 4. Cause and effect diagram depicting the feedback process in CDB.

4.1. (RQ1) How relevant is peer feedback in the context of CDB in a CSI course ?

Considering the main frame of Fig. 4 (“Peer Feedbacks”), first, it shows that students seem quite mitigated about the relevance of the feedbacks they received during the first sessions. However, from the second to the last one, 30% of students found it richer, which is consistent to how comfortable they felt in integrating the feedback, rising from 49% to 72%. To further corroborate students’ perception, it was put in perspective with results derived from their own productions and feedbacks. There, in contrast to students’ opinion, a constant high FCR was computed. That overestimation with respect to students’ opinion may be due to the fact that students missed tags in their production and comments as more accurate guidance. Those two feedback components were not involved in the FCR computation while they were taken into account in students’ view. This explanation gets confirmed by noting that, over all the filled checklists, only 10% of criteria had a comment on the side. That may have prevented students from clearly identifying and fixing their gaps, especially those related to more complex criteria. Finally, the distribution of students behind each FCR mean is provided in Fig. 5a.

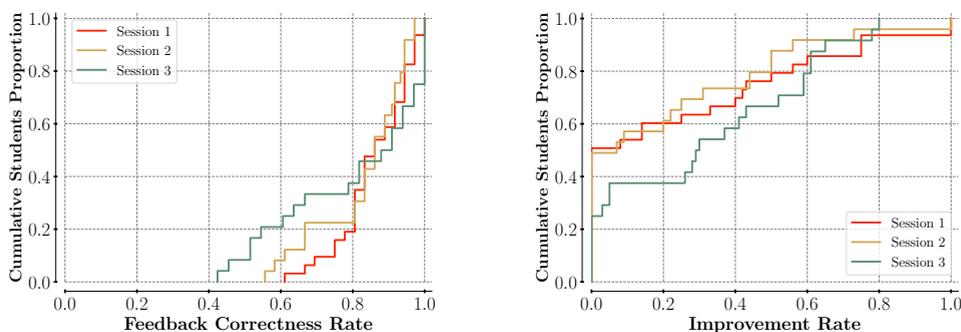


Figure 5. Cumulative distribution of students (a) emitting a correct feedback and (b) improving from a given feedback.

It namely shows that, for the three sessions, 60% of reviewers checked at least 80% of the criteria correctly. It substantiates the gap between how submitters perceive the feedback and the actual feedback correctness in terms of checked boxes. In response to that, the list of criteria could be refined to tight better the expected solution (although it should not disclose it) and the reviewers should develop their feedback further too (through more comments typically). Next to this, Fig. 3 illustrates that the average IR remained limited (less than 30%) across the two first sessions but got better in the last one (reaching 46% ($\pm 20\%$)). However, the large confidence interval related to that last result reflects the heterogeneity of submitters’ perception in adapting to the feedback. That heterogeneity is distilled through Fig. 6b depicting that 25% of students did not improve at all, 35% improved on 50% to 80% of the criteria that were not inially met and the rest of the submitters stood in between. More generally, considering the three sessions, it can be noticed that submitters are likely to enhance from the feedback, but remaining gaps are persisting. Possibly, some students were

missing time in tailoring their solution. Those results get consolidated seeing the proportions of reliable refreshed production being above the average. However, they do not reach top values, which confirms that further refinements are still needed and suggests that students may lack problem-solving skills. It also converges to previous findings stating that feedback intervention shifts the attention away from the task itself and closer to the self (referring to, e.g., motivation, critical-thinking, communication) (Kluger and DeNisi (1996)), which is also partially highlighted through RQ2. From an evolution point of view, the proportion of reliable productions rises from 58% to 65% over the sessions despite the last session proposed harder statements, which emphasizes the production quality improvement over the CDB sessions.

4.2. (RQ2) Which prerequisites influence the feedback process in the context of CDB?

Let us now strengthen the inferences stated in Sec. 5.1 by studying the factors assumed as influencing peer feedback. They are grouped in categories defined upon “Peer Feedbacks” in Fig. 5, and ordered based on how they impact on each others. Typically, students’ “Skills” influence the way students handle the activity parameters (included in “Activity Management”). Then, student’s ability to build and digest a feedback depends on the quality of the submission as well as how comfortable they are in managing the activity and mobilizing their skills.

In practice, all the components belonging to the three upper floors follow a similar trend than the feedback dimensions, getting better and better managed by students across the sessions, except the problem-solving skills. It is likely due to the nature of the problems that had to be tackled with a more formal angle students were not used to yet in the last session. Although, thanks to better transversal skills (Borova et al., 2021), students could counterbalance that difficulty by dealing better with the activity itself. More precisely, first, 80% of the students were initially struggling in fitting to the timing and, eventually, 50% were still facing that issue. That last proportion partially explains why the IR remains under the average : likely, besides some misunderstanding of the feedback submitters received, they lacked of time to analyze and integrate it. Next, the criteria of the checklist sounded missing accuracy for about half of the submitters (although their perception got more moderate), which comforts the idea that criteria should be refined. Finally, prior to that, students improved in collaborating with each others by communicating better and feeling more comfortable in analyzing the submitters’ production, allowing them to deal better with the activity itself and, eventually, manage peer feedback, as underpinned through the positive correlation between those factors.

5. Perspective and Conclusion

To wrap up, CDB implements peer feedback embedded in a real-life scenario where students get responsible for sequential tasks on successive problems. To solve them, they need to give

their best contributions, by providing valuable feedback and by shaping their outputs using feedbacks they receive in order to consolidate their ground and the ones of their reviewers.

In practice, in the context of CDB, students are quite good at identifying gaps in submitters' productions by relying on a checklist. However, digesting a feedback from reviewers appears more difficult (as also raised and deepened in other studies (Carless & Boud, 2018)). This paper explains that gap through three main reasons. First, students have difficulties in managing the limited time allocated to peer feedback. To overcome that, one could split the feedback loop period in two subparts to make sure students do not spend the whole period in building the feedback. Next, some criteria of the checklist lack of accuracy. Finally, most of the reviewers do not spontaneously distill them through further explanation, they only check boxes. In response to that, on the one hand, some criteria could be detailed and, on the other hand, students could improve their transversal skills that play a key role in peer feedback at both sides. Over the three CDB sessions, students felt more comfortable with respect to those last factors, which got reflected on the feedback process itself and the final productions quality. It confirms that CDB stands as an essential building block in our teaching methods, giving to students the opportunity to train transversal skills and learn from peer feedback.

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Facilitating international transdisciplinary collaboration in a virtual academic exchange project

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Abstract

What challenges does virtual collaboration pose to fundamental conditions of collaborative work such as building relationships and trust and establishing balanced participation? We approached this question in a virtual seminar in transdisciplinary Public Art across six international universities, with funding from the German Academic Exchange Service (DAAD) International Virtual Academic Collaboration (IVAC) program. Together with our partner institutions and accompanied by an intercultural facilitator, we established a collaborative methodology for teaching and learning. As means of participation and relationship building, we developed a two-step method for matching student teams and used collaborative tools such as playful exercises and open agenda meetings. We conducted a qualitative study to monitor the collaborative process throughout the course. We held semi structured one-on-one interviews with fifteen students and analyzed their written reports. The results illustrate how our methodology supported the students' collaborative creative practices. Additionally, we describe challenges and consider possible solutions.

Keywords: *Online teaching; collaboration; public art; art education; relationship building; collaborative methodology; academic exchange.*

1. Introduction

Since the outset of the COVID-19 pandemic, online teaching has gained substantial importance in higher education. While technical tools and solutions have quickly developed and improved (García-Morales, 2021; Carruana Martín et al., 2022), scholars have worked to retain the social importance of relationships, trust and care in online teaching environments. As Burke and Larmar (2021) review, students in online courses are more likely to experience isolation and loss of a sense of identity and personal engagement with other students and teachers than they are in face-to-face classes. In online education, opportunities for casual encounters, personal exchange and spontaneous feedback are reduced. Recent studies suggest that an environment for collaboration should be purposefully designed and facilitated (Herrera-Pavo, 2021; Uukkivi et. al. 2022). Herrera-Pavo (2021) reviewed studies on social and educational factors as a basis of virtual collaboration in higher education and proposed that teachers assume not only the role of educators but also of mediators.

We designed a virtual teaching collaboration, with a focus on social qualities. In the realm of interdisciplinary creative practice, our aim was to create an environment for participation and free experimentation. We followed the extracurricular aim of forming a community of practice in socially engaged public art. In the spring and summer of 2022, six international universities co-developed and realized the joint seminar called “Public Arts Garage”, integrating perspectives from artistic research, performative art, architecture, anthropology and literature and language. The partnering universities included Bauhaus-Universität Weimar, Concordia University Montreal, Rennes 2 University, Queen’s University Belfast, University College Cork and University of Barcelona. The project served as a prototype within a newly founded international graduate school on creative approaches to public space (GS-CAPS). Students were matched across different countries and disciplines to develop artistic projects in virtual exchanges that took place in public spaces in the respective locations. Due to different academic schedules, the seminar was divided into two cohorts – one with five and one with three partner universities – that followed the same basic methodology. We followed an idea of deep collaboration, guided by our intercultural facilitator Susanne Wille, who accompanied the entire process including course design and moderation during the sessions. Her approach was informed by a relational understanding of cultural complexity (Baumann Montecinos and Grünfelder, 2022) and focused on the quality of attention and intention (Scharmer, 2016). With her support and with participation of all partner institutions, we established a collaborative methodology, consisting of a two-step process for matching student groups and collaborative tools like playful exercises and weekly open-agenda meetings. In this qualitative study, we investigated what drove the collaborative processes in the student groups, how our methodology supported these processes and what challenges emerged in virtual group work.

2. Methods

The data collection was undertaken as a means of evaluation and as part of the lead author's doctoral thesis. The qualitative study focused on results that describe social qualities and pedagogical methods as a basis for virtual student group work. The data consists of interview transcripts, fieldnotes and written reports produced by the students. Semi-structured, one-on-one interviews were held (Brinkmann and Kvale, 2018), lasting between 45 min and one hour. An interview guide was designed using open-ended questions about the participants' experience during the course. Follow-up questions were used to delve deeper into relevant aspects (Flick, 2007). The data were analyzed with an inductive approach, allowing findings to arise from the data through initial and focused coding (Charmaz, 2014; Saldaña, 2015).

Fifteen students participated in the study with informed consent. Participation comprised of an interview and analysis of reflective reports produced during the seminar. A request for participation was sent to all 51 students. Additionally, individual requests were sent to participants who had the most relevant experience in the subject (Flick, 2007). The final selection included students with particularly positive or negative experiences in their group, students who dropped out and students who had experienced both cohorts of the seminar.

The authors were at the same time initiators, coordinators and co-teachers in the seminar. Being involved in multiple roles provided profound insights, while it could be seen as a limitation of bias in the study. The researchers were sensitive to potential conflicts of interest.

3. Results

The interviews revealed how students connected to their groups and how they collaboratively developed projects. We could confirm that our methodology was able to support group formation in a way that students felt connected and could develop creative work through virtual exchange. Additionally, we identified challenges that emerged and considered how these could be met in future collaborative projects.

3.1. Matching method to build positive group relationships

Our matching method supported the formation of teams that were able to develop positive dynamics and more or less equal commitment to collaboration. Positive experiences were reported in groups where students found commonalities such as similar personalities, interests and cultural backgrounds.

Most of the students had not met before even if they were enrolled at the same institution. For supporting the formation of groups across the international partner universities, we developed a two-step matching process consisting of a kick-off workshop and a survey. The

kick-off workshop was held in a virtual¹ meeting space. Students worked on creative tasks in small groups in different constellations. They brainstormed about connecting features in public spaces, such as bodies of water or public monuments, between their home countries. The results were then presented to the whole cohort. The aim was to foster curiosity and interaction as an alternative to customary introductory rounds, which often promote self-presentation. In the second step, the participants filled out a survey as a basis for the teachers to build groups of two to four students for the seminar project work. The participants were asked to name preferences for potential team members. Furthermore, they were asked open questions about their expectations and skills they would like to share, followed by ranking questions about experience in creative collaborations and digital exchange. Finally, questions about expected time commitments and learning styles were included. In the selection, priority was given to the choice of potential group members, followed by the other questions in the order as listed above. All groups were mixed across institutions and disciplines. 60 percent were mixed across academic levels of MA and Ph.D. based on our survey, at least one student in each group was experienced in collaborative work and virtual exchange, so that other group members could benefit from this experience. Our intercultural facilitator helped design the matching method and moderated the kick-off workshop. As non-subject-specific teacher, she was in a neutral role and could thus fully focus on the aspect of building relationships.

Through initial coding, we recognized that most participants highlighted positive experiences regarding their relationships in the groups. With focused coding, we determined what made the experience positive. Eight participants of both cohorts emphasized a sense of openness for equal participation. For example, they felt that there was “room for change” to bring in ideas and that the group members would “listen” which made it “easier to share”. Two of those students remarked team spirit, describing that they were “tied together as a team” and experienced “some sort of synergy that you can't really organize or assume from the beginning”. Others mentioned “trust”. Importantly, in many cases positive experiences of group constellations in both cohorts were reported as mostly being related to commonalities that the participants identified in their team-mates. One participant depicted that their group had similar “personalities”, others told that they shared a similar “*worldview*” and “that we think about the same things at the moment.”². Four of the students from three different groups emphasized cultural background as a connecting factor. For example, a student from Germany suggested that their group worked well together “*maybe because of culturally being congruent, being kind of from the same place*”. This group consisted of three partners who lived in Germany, Canada and Brazil, while sharing a Latin American heritage. They were able to use this commonality to co-develop a performance for different public spaces. They

¹ An exemption were the students from Canada in the second cohort, who met in a hybrid setting in a room.

² Original quote in German: “dass wir uns gerade um die gleichen Dinge Gedanken machen.” (Translation by the lead author)

chose the topic of sharing dreams, because the group could relate to the topic from their own cultural backgrounds. They were “*feeling very close culturally to the importance of the dream space*” and were “*very aware of what this means to indigenous communities, to indigenous cultures in Latin America.*”

The interdisciplinary seminar across six international universities offered multiple ways for students to benefit from differences like different disciplinary backgrounds, academic levels and cultural environments. At the same time, differences were accompanied by challenges, like working across different time zones and learning cultures. While collaboration entailed embracing differences and learning from each other’s diverse experiences, ideas and approaches, our data show that fruitful creative group work was essentially supported by elements of commonality. Herrera-Pavo (2021), has argued that virtual group work is more likely to succeed if the group shares common interests. Our results confirm this finding while our case additionally involved the factors of personality and cultural commonalities. The two-phase matching process was a helpful instrument. Even limited to virtual meetings, participants were able to find fellow students with whom they felt connected. The findings offer a way to refine this method, by more consciously addressing important commonalities.

3.2. Collaborative tools for developing creative group work

One of the most rewarding outcomes of the collaboration was reported when the group work led to new and surprising results. Next, we consider how the collaborative tools of “playful exercises” and “Maker’s Lounge” meetings supported this outcome.

Throughout the seminar, playfulness was used to encourage curiosity, leaving known paths and creating new ideas together with others. In the first cohort of the seminar, Maruška Svašek, a partnering professor from Queen’s University Belfast, developed a game that the student groups were asked to play. They explored public spaces based on an experiment of playful ethnography (Svašek, 2019). In the second cohort, students were encouraged to design their own playful exercises in reference to “unlearning exercises” used in a collaborative course (in-person) at the Academy of Fine Arts Vienna (Baldauf, 2016, p. 169).

In the first round of coding the interviews, it appeared that some students emphatically highlighted positive experiences when they were improvising together in their groups. Different participants pronounced that they “clicked” together, that they had a “magical time” discovering “surprises”, and one even described the experience as akin to being “on the biggest high”. In focused coding, we became aware of reports of seven students from both cohorts, who experienced rewarding moments in their collaboration when they came upon surprising new ideas through collective improvisation. Some students pointed out that the playful exercises helped them to improvise together. In the second cohort, a student from Northern Ireland declared that using games “was really fun” and “added a different kind of

approach”. A teammate from Canada remarked that it “brought up a lot of new avenues”. In the first cohort, some groups developed their final seminar projects based on their playful exercises. The written reports of two students from Germany and Northern Ireland illustrate how this game helped them to collaboratively develop a project. The pair reached a dead end with their initial approach and used the game to recalibrate. Initially, they worked on the base of a previous project from the German partner, creating posters that addressed issues of climate change. The student from Northern Ireland felt unsure working with posters as artistic medium and wrote: „I believe, for both of us there was an instability in the concept.“ After they had exchanged some drafts, the German student “found it difficult to work on this graphic design task at a distance.” Hence, the pair gave up the poster idea and developed a new collaborative project. The German student recalled that *“The playful task (...) gave us the important impulse.”* The task was an explorative walk through the students’ respective cities letting the dice decide the direction. They set rules for where to start and what to do during the walk. Their rule was to document plants growing in the cracks and corners of the cityscape. From this experience, the German student noted that it became *“clear that the real recipients of our public art should be the uninvited flora in the streets.”* Instead of posters, the group created a performance, addressing plants with messages and poetry. The game encouraged the partners to develop a creative group process even through remote exchange.

The case of the two students from Germany and Northern Ireland also illustrates the role of another collaborative tool developed for the seminar, a weekly open agenda meeting called the “Maker’s Lounge”. When the student from Northern Ireland was in doubt about the group’s first poster idea, she was not immediately able to exchange her concerns with her team-mate due to timing issues and shaky internet. Thus, the student attended the Maker’s Lounge, where she was reassured by teachers and peers to reconfigure and to embrace the playful exercise for new ideas. This case was typical for the role of the Maker’s Lounge in the seminar. The weekly two-hour time slot was a reliable opportunity to exchange ideas outside of the regular sessions. It served as an important instrument of feedback and enabled a facilitation role of teachers as suggested by Herrera-Pavo (2021). Additionally, some students from both cohorts declared that the meetings gave them orientation in the course. A student from Canada in the second cohort told that when she *“wasn't sure (...) what was most important for me (...) it was always grounding, when we got together and had conversations about it.”* Burke & Larmar (2021), report that feelings of isolation and disorientation are more likely to emerge among students in online settings than in-person. The Maker’s Lounge was a connective feedback instrument that helped strengthen bonds and provide orientation.

3.3. Challenges

While many groups recounted positive experiences, some challenges emerged, and some students dropped out before the seminar ended. Not all challenges and dropping out were related to group work. However, some findings were pertinent in the context of this study.

Interviews with students who dropped out showed that asymmetries in leaving and staying within one's own comfort zone created negative experiences of unequal participation. In this practice-based seminar, two students from Germany in the second cohort especially felt that they had to work outside their immediate fields of interest and their artistic media, while their teammates did not. One of them affirmed that *"this is really not my safe ground"* The student used to work with objects and "do things in the streets", while her group worked fully digitally. The student "liked that a lot". However, she added: *"it was difficult because I felt so far away from the things I was used to. So, for me, it was really hard to connect with them."* The other two members were also on a higher academic level. As the group worked in an area that was very familiar for those two, the younger student with less practical experience felt isolated and demotivated. Another student from a different group reported a similar problematic. She also worked object based, while her group designed a performative experiment. The researcher's fieldnotes recount that the student normally felt comfortable and *"would take the lead in such group situations"*. In this group *"she did not feel qualified to do so because she was working outside of her strength in fields that her teammates were more qualified in and she was 'not a specialist' in."* The seminar demanded students and university staff to master multiple challenges including working remotely with public spaces across different countries. Not being able to work in one's own fields of interest and artistic media created additional challenges for the two participants quoted above. The asymmetrical situation that their teammates were working in their fields and media was experienced as a barrier to equal participation. Instead of benefiting from the others' expertise, the students felt intimidated and did not see a way of meaningfully or equally contributing.

4. Conclusion

In our seminar, similar personalities, interests and cultural backgrounds were essential preconditions for fruitful creative group work in an international virtual setting. Our tools helped students from different backgrounds to develop meaningful and rewarding collaborations and provided orientation. In some cases, negative experiences emerged when group members asymmetrically worked within and outside their fields of interest and artistic media. This challenge can be met by monitoring and mediating asymmetries in group processes. With a focus on social factors of collaboration and with attentive support of a facilitator, the seminar established relationships among students and faculty, some of which are still lasting and have led to follow-up projects. This indicates an important first step for a community of practice to form and to establish virtual exchange in public art.

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Introducing a collaborative learning strategy in a hybrid and traditional laboratory for undergraduate computer science students

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Abstract

Collaborative learning is an advantageous pedagogical strategy to include in e-learning. In this study we aim to demonstrate a methodology created to implement this strategy in an undergraduate student population. We will present our findings from running this experiment in two scenarios, namely an in-person environment and a simulated remote environment. We analyse the impact this methodology has on students understanding of the topic along with how their assessment compares to their peers in a previous year. We also analyse the different perception of personal and collaborative work in both scenarios. We conclude that this methodology is effective in increasing a student's understanding of the work being assessed and contributes to an increase in students' assessment grades.

Keywords: *E-learning; collaborative learning; hybrid; undergraduate.*

1. Introduction

The exponential rise of accessible e-learning recently has brought forward many different types of strategies and methodologies. Turlaram (2018) discusses that there are several variables that contribute to the success of an e-learning strategy including technological awareness of students, general mathematical ability, and teacher competence. Mhouti et al. (2017) consider how the use of Web 2.0 can be integrated into e-learning practices and how collaboration, not only between students, but between students and teachers, is crucial. They do however report that this aspect of collaboration is usually difficult to achieve if the contents presented are not adapted to the context of collaborative e-learning.

Active learning engages the student and enables the knowledge to be cemented with practice and understanding. When creating an e-learning methodology, it is essential to consider how a student's perception of a task changes in an offline, hybrid and fully remote scenario. Jensen et al. (2017) contribute that e-learning can only reach the same benefits as traditional teaching if an active learning approach supports it. In comparison to passive learning, where students absorb information from a lecture or tutorial, active learning places an effective outcome on the effort put in by the student. Khan et al. (2017) state that integrating active learning into course materials is crucial to engage students, regardless of the learning environment. They acknowledge that when it comes to online courses, an appreciation of the unique approaches to active learning is required.

Motivating the student to the same standard as in-person teaching in a hybrid or fully remote environment can be challenging but it is essential to the student's development in the course material. Collaborative e-learning, as a strategy, enables students to have motivational benefits from social interactions with their peers, even when remote. Collaborative learning as a strategy enables students to relay and gain information from their peers and put into practice the theory that they have learned passively. Each student is different, but many who participate in e-learning positively display similar traits. Punnoose (2012) found three personality variables positively influence students when it comes to e-learning, namely a high level of conscientiousness and extraversion along with a low level of neuroticism. This study aims to foster these traits by means of collaboration and social interaction.

This paper aims to contribute to research around introducing an active e-learning strategy to higher education students. We have focused in this study on how active learning can be facilitated through e-learning and looked at what role collaborative learning plays within that. This study will include a deeper dive into understanding what methodology creates the best learning environment for an e-learning study group, and how that methodology can be replicated outside of one subject. For this study, we have focused on computer science students at the start of their respective degrees, where we have incorporated active learning

components within weekly laboratory assignments as a crucial part of their learning experiences.

One priority of this study was to innovate and build upon current educational practices. Students' typical laboratory work involves completing a set list of coding problems, where the majority are released at the beginning of the week and can be completed at home. A further one or two problems are released within the set laboratory time; these are considered more challenging than the initial set. While this work is active learning, the addition of collaborative learning allows students to discuss problems and difficulties they are having with their peers and encourages students to explain their work clearly and concisely.

Introducing a mobile/web application has enabled students to keep a digital log of their discussions and notes. Utilising tools such as this is integral to innovating the teaching and learning experience as the expectation to be technology literate within the workplace is ever-growing. Roehl et al. (2013) conclude that "one's adaptability to new technologies is crucial for graduate students to succeed in the workplace." This underlines the need for the provision of technology-infused learning environments at educational institutions, where their pedagogical benefits have been identified. Many workplace tools involve a collaborative element, be it paired work or online communication. Building these skills within the classroom helps set students up for success and create a well-rounded workforce.

2. Methodology and Data Gathering

2.1. Methodology steps

This study aimed to understand how students collaborate with coding problems in offline and emulated online environments. To achieve this goal, we designed a strict set of parameters for both settings, as follows:

1. **Group Size:** A group size of 4 students was used.
2. **Access to Questions:** Students were only given access to the coding problem, for the collaborative session, at the beginning of the session.
3. **Review Time:** Students were given 10 minutes to review the question and write notes on the topic.
4. **Group Discussion:** Students were placed into groups and given 20 minutes to discuss and create a robust pseudo-code algorithm to answer the question.
5. **Assistance:** Students were allowed to ask for help from a lab demonstrator in the final 10 minutes if they needed help understanding the problem.
6. **Survey:** Once the session was finished, students completed a survey describing their experience with the session and how helpful each section was in completing the

algorithm. The survey also requested information on the student's background and their contributions to the discussion.

The experiment was run in two separate scenarios:

(1): In-Person, students were face-to-face and expected to communicate and write down information on paper. (2): Simulated Online, students were asked to communicate in the simulated online scenario through a web/mobile app. They were expected to discuss the problem and ideas they had for a solution through text chat in the app.

After completing the session, the algorithm was looked over by an experienced demonstrator in both scenarios, and the students were provided feedback on their work.

2.2. Data gathering

In this study, data from 3 distinct student populations were selected over a 12-month period.

1. Group 1 - Undergraduate students in their second semester of university. (n = 476)
2. Group 2 - Higher diploma students in an accelerated introduction to programming module over three weeks. (n = 47)
3. Group 3 - Undergraduate students in their first semester of university. (n= 570)

Group 1 and Group 3 undertook weekly lab assignments, where a new topic was assessed each week. Due to the accelerated nature of the content that Group 2 was receiving, they had multiple lab sessions within a week. For the purposes of this paper, we will report Group 1 and Group 3 in a weekly fashion and Group 2 in a session fashion.

To evaluate the effectiveness of the collaborative sessions, we used an initial survey¹ (<https://forms.office.com/e/MbS9vWMs0T>) with 12 different items representing a student's background, administered in the first week of the study with each group. Participants provided information on their education, parental education, gender, and geographic upbringing, as well as questions on their perception of collaborative learning.

A follow-up survey² was administered within each weekly session, gathering information on the session itself. Participants in the weekly follow-up surveys provided information on their perception of the session, including their understanding of the topic at the beginning of the session versus the end, how effective the group work was on a scale of 1-10. They were also asked about how effective the solo work was on a scale of 1-10.

¹ <https://forms.office.com/e/MbS9vWMs0T>

² <https://forms.office.com/r/7xmmNHcbnD>

In total, we received 2341 completed surveys. They were broken down as follows:

1. Group 1 - 571 surveys over four sessions. (202 initial, 369 weekly session)
2. Group 2 - 122 surveys over nine sessions. (15 initial, 107 weekly session)
3. Group 3 - 1648 surveys over seven sessions. (233 initial, 1415 weekly session)

Group 1 took part in the in-person experiment, while Group 2 took part in a simulated online experiment. Group 3 completed the experiment in both an in-person and simulated online scenarios. For Group 3 the students were divided into two groups: a larger group of 540 students who took part in the session in person and 30 students who utilised both in-person and simulated online sessions throughout the seven sessions.

3. Results and Discussion

To determine the effectiveness of this e-learning strategy, we investigated three factors of the student's learning experience. These were:

1. Did the student find the collaborative session useful in increasing their knowledge of the topic?
2. Did the personal or group work affect the students' understanding of the problem?
3. Did the students' grades improve compared to those that did not utilise collaborative learning sessions in the previous year?

3.1. Group 1's findings

We first introduced this methodology to a cohort of undergraduate computer science students, Group 1, after the midpoint of their semester. We have chosen to exclude this data from our final conclusions as it depicts data from the methodology running in a much less strict environment and we could not conclude whether these changes had an impact on the experiment. This group was, however, instrumental in helping to refine the methodology for Group 2 and Group 3. From the feedback we did gather, we know this group had a positive perception of the methodology and could see the benefit it would provide in the future.

3.2. Usefulness of collaborative session

We wanted to gauge the students' perception of the usefulness of collaborative sessions within their weekly laboratory session. Figure 1 presents the average perception of how useful the students in Group 2 found the sessions throughout the experiment. The average response was 7.6 out of 10. The perception of usefulness fell to 6.6 at the midway mark before recovering to its highest in session 8. In general, we can see that the perception was positive and is something the students identify as valuable.

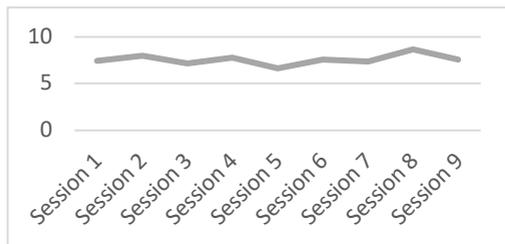


Figure 1. Group 2 students' average perception of session usefulness over a 9-session period.

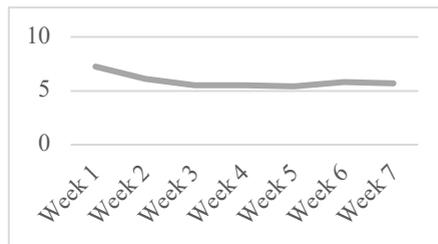


Figure 2. Group 3 students' average perception of session usefulness over a 7-session period.

In relation to Group 3, despite there being a large spread of values week to week on the students' perception of how useful the collaborative learning sessions were, it can be seen in Figure 2 that overall, the students found the session helpful and gained both knowledge and confidence in the topic they were working on. In the initial two weeks, the average perception was scored at 7.25 and 6.1, respectively. The average then balanced towards 5.7 as the students grew used to the sessions taking place.

When asked “how helpful did you find the session”, it can be seen in Figure 3, that for each week a minority of students rated the session as having a low impact on their knowledge of the topic, peaking in week 5, with 25.1% of respondents giving the session a low rating. The inverse of this is that at least 74.9% of participants each week found value in completing the session. During Week 1, 70.1% of participants ranked the sessions highly, which fell to 42% by week 7. Week to week, the level of difficulty in the sessions' problems rose gradually, and students' technical skills increased as they built upon past topics.

Variable	High rating 10 – 7	Mid rating 6.9 – 3.1	Low rating 3 – 0
Week 1	83	27	7
Week 2	80	61	30
Week 3	77	84	52
Week 4	64	64	36
Week 5	53	57	37
Week 6	62	54	23
Week 7	53	47	26

Figure 3. Group 3 students' perception of the usefulness of the session over a 7-week period.

3.3. Preference for session work type

In relation to a preference of the type of session work within Group 2, either personal work or group work, the preference seemingly varied widely from week to week, as shown in Figure 4. The average response was 46% in favour of personal work and 54% in favour of

group work. Due to the lack of eye-to-eye social interaction, seemingly the students felt little difference between the two.

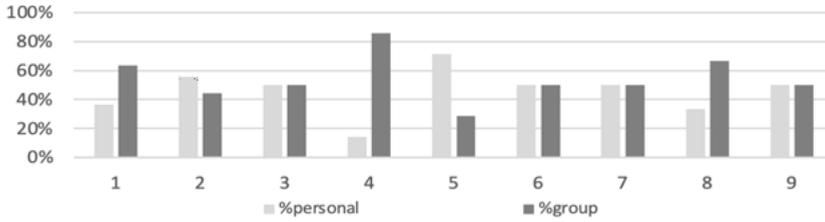


Figure 4. Group 2 students' preference of session work personal vs group.

For Group 3, students mostly preferred to work in their group's week to week. The largest variance in responses received was in week 7, with a difference of 47.9% between the two options, as shown in Figure 5. The smallest difference occurred on week 4, with a difference of 13.5%. The results, in general, follow a parabolic curve with the precipice at week 4. There was a consensus that the group work benefited the student the most. The mid-term break scheduled after week four may have impacted the students' motivation to engage with their classmates and gain more benefit from their discussions.

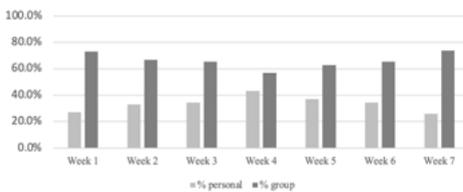


Figure 5. Group 3 students' preference of session work personal vs group.

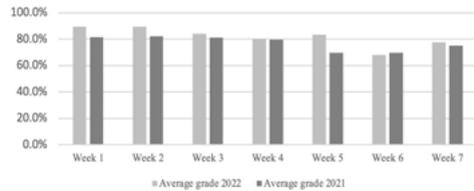


Figure 6. Group 3 students' Grades in 2022 in comparison to 2021.

3.4. Comparison with previous years'

The data presented in Figure 6 shows the average score of students in the module, where 100% means they got the answer fully correct, and 0% means they did not receive a grade for the lab. We identified an increase in the average grade of a student who participated in this study compared to their peers who took the same module in the previous year. Excluding week 6, the 2021 average grade was 1.4% higher than in the 2022 cohort. When comparing student grades with students in previous years, we need to do so with care and note a threat to validity around this. It is worth noting that for this analysis, the lecture content remained the same year by year, along with the lecturer delivering the content and the content covered in the labs.

Figures 3 and 7 show that students' confidence in their understanding of the topic can be mapped to the average grade received each week. A higher perception of understanding correlates with a higher grade received overall.

4. Conclusion

The introduction of a collaborative learning strategy drives engagement and motivation in students to discuss issues with their peers, and consequently gain a greater understanding of the solution to the problem. Our work has shown that most students prefer to work within groups compared to on their own, when it comes to solving technical problems in an in-person session. In an online session, students are more evenly balanced in their preferences.

The grades of students have marginally increased in previous years when this collaborative learning strategy was implemented. Again, we present this result with care, cognisant of the inability to correctly compare distinct student cohorts.

The perception of the usefulness of such a collaborative learning approach fell to its lowest around midway through the module for both in-person and online students. The use of a simulated online medium to utilise this strategy has been successful and opens future work opportunities in re-examining this experiment in a fully online format. In a fully online scenario, it is important to provide adequate social interaction features to ensure students get the most benefit out of the collaborative work possible.

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School, university and community collaboration for inclusivity: the Turin experience with the university courses “expert in the processes of inclusive education” and “expert in educational and didactic processes”

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Abstract

The COVID-19 pandemic has shed light on the persistent disparities in the Italian education system and the urgent need for inclusive education. This study focuses on the crucial role of university training programs in addressing the issue of school dropout and promoting inclusiveness in the education system. The University of Turin has taken a pioneering approach by launching programs for secondary teachers and social educators aimed at providing them with the necessary skills and competencies to design and implement effective inclusive educational interventions. The university has also established partnerships with other organizations to further foster the culture of inclusiveness in the region. The programs offered by the University of Turin serve as a model for bridging the gap between inclusive theories and socially just practices, paving the way for a more equitable and inclusive education system.

Keywords: *Expert; inclusion; multi-professional work; school dropouts; social educator; teacher.*

1. Introduction

In Italy, a comprehensive reform of teacher training programs is underway to meet the demands of a changing society. This is especially crucial given the challenges posed by the COVID-19 pandemic, which have further exacerbated existing disparities in the education system. According to the Italian National Institute of Statistics [ISTAT] (2022), students from socio-economically disadvantaged backgrounds, those who speak a different language, or those with disabilities still face difficulties accessing and participating in school activities. This is reflected in the rising rates of school dropouts and failures, as well as declining levels of learning (AGIA, 2022; Save the Children Italia, 2022).

A 2016 report from the OECD [Education at a Glance] revealed that Italy has one of the lowest rates of educational mobility in Europe. Only 8% of young Italians between the ages of 25 and 34 whose parents did not complete upper secondary school obtain a university degree, compared to the OECD average of 22%. The percentage rises to 32% among young people with parents who have completed secondary education, and 65% among those with parents who have a university degree. These figures demonstrate the persistent impact of socio-economic status on educational outcomes, which the OECD refers to as a "lottery of nature".

It is also important to note that equalizing action of the school can only be effective if pupils from different socio-economic and ethnic backgrounds have equal access to the same schools. If school segregation is high, the school may be formally open to all but not equally accessible to all students, thereby limiting its ability to provide equal opportunities (Caritas, 2022; Pacchi & Ranci, 2017; Ranci, 2019).

In addressing the issue of exclusion in education, it is crucial to consider various factors beyond socio-economic conditions. For example, factors such as belonging to ethnic minorities, having a disability, or being female, can contribute to marginalization and reduced educational opportunities (Migliarini et al., 2022). To mitigate these challenges, it is necessary to provide teachers with theoretical and practical tools that are suitable for their daily work environment (Tino & Fedeli, 2015). Additionally, social educators must also be equipped with up-to-date and relevant skills, as they play a crucial role in supporting students with disabilities and collaborating with classroom teachers. By employing workshop-style didactics that emphasize student participation, both teachers and social educators can effectively enhance the learning experience. Ultimately, the objective is to not only strengthen the theoretical and operational abilities of teachers and educators, but also promote inter-professional collaboration and exchange, resulting in more comprehensive and impactful educational interventions.

2. Enhancing Competencies of Educational Professionals: Addressing Gaps in Training for Inclusive and Equitable Education

According to several studies on the competencies of educational staff (Sharma, 2012; Caena, 2011; OECD, 2019), the implementation of training programs that specifically target these competencies is crucial for promoting inclusive educational practices. This shift in perspective moves away from the notion of "fixing" differences, and instead aims to empower pupils to become critical individuals who can live and participate as conscious citizens.

Unfortunately, many teachers continue to have a rigid and unchanging approach to their teaching methods, which can hinder the creation of inclusive classrooms (Aiello et al., 2019; Mura & Zurru, 2019). Without proper training, teachers can perpetuate inequalities and struggle to provide educational opportunities for students with special needs (Fiorucci, 2019; Romano et al., 2021). This is particularly concerning in Italy, where at the moment there is a lack of university courses specifically designed to prepare secondary school teachers.

The promotion of inclusive practices within educational institutions requires the engagement of educational staff who are capable of embracing diversity and utilizing it to advance educational and pedagogical outcomes for all students (Bocci, 2021). However, a tendency to treat students with special educational needs as a challenge to be managed rather than as a valuable asset to be cultivated has been documented in the literature (Harry, 2014). This mentality, rooted in a charitable rather than a rights-based approach, is partially the result of insufficient and inconsistent training opportunities for school professionals (Gavosto, 2020).

The absence of specialized training programs for secondary school teachers in the Italian education system has significant consequences for the education system as a whole. Furthermore, social educators often navigate the complex educational landscape without sufficient preparation to design and implement effective interventions. As a result, they are forced to develop their own competencies, relying on their own strengths and dedications to compensate for gaps in their training.

3. Collaborative Efforts for Inclusive Education: An Analysis of the University of Turin's Inter-regional Partnership for Teacher Training

The University of Turin has been making efforts to bridge the gap between the theories and practices of inclusion in the education system by providing support to the schools. To achieve this, the University has launched a series of initiatives aimed at empowering educational professionals with the necessary tools to drive positive change (Damiani et al., 2021). In accordance with a memorandum of understanding signed between the University of Turin, the Piedmont Region, the Regional School Office for Piedmont, the Metropolitan City of Turin, the University of Eastern Piedmont, in collaboration with the Trade Unions

representing schoolteachers, the Department of Philosophy and Educational Sciences at the University of Turin launched the University Course of Professional Development (CUAP) "Expert in the processes of inclusive education" in the academic years 2020/21 and 2021/22.

In the academic year 2022/23, the University further strengthened its offerings by launching the First Level Master Course "Expert in educational and didactic processes at school". The aim of this course is to prepare future teachers and social educators to operate in an increasingly inclusive and conscious manner, by providing them with the necessary knowledge and skills to engage in inter- and multi-professional work. The course has been designed in a modular format that takes into account both the demands of high-level university teaching and the training needs of working students. The goal is to support the professional growth of teachers and social educators, filling the void left by the abolishment of qualifying pathways and promoting didactic innovation.

These initiatives align with the national teacher training guidelines set by the Italian Ministry of Education (Pettenati, 2021), which prioritize the development of "facilitator teachers" to support continuous and widespread training within schools.

4. The Development of the Competences of Educational Professionals through Interdisciplinary and Inter-Professional approach

The development of non-disciplinary competencies among university students is becoming a crucial aspect of higher education. These competencies, including personal traits such as character, judgment, and empathy, are significant for both employability and active citizenship (Chignoli et al., 2020).

This shift in focus is supported by the literature, which stresses the need to study teachers' attitudes and personal competence, as well as to consider the interplay between technical and disciplinary competencies and personal qualities in professionals. Effective teaching involves constant adaptation, evaluation, and response to student engagement and participation. Hence, training approaches must be based on comprehensive and integrated perspectives that account for the multi-dimensionality of competencies. The literature highlights the importance of "Teacher Thinking" (Perla, 2015; Buitink, 1993; Clark & Lampert, 1986) and participatory approaches (Cardarelli et al., 2009) that showcase the unique professional aspects of teaching. Training models such as those based on Transformative Learning Theory (Taylor & Cranton, 2012), mixed method approaches (Suchman, 1987), and educational principles (Fabbri, 2007) are instrumental in supporting the development of non-disciplinary competencies. For example, the Embedded approach integrates cross-curricular skills and teaching of disciplinary content (Yorke & Knight, 2004). Non-disciplinary competencies are not distinct from other technical knowledge or skills and must be incorporated into the curriculum (Gopalaswamy & Mahadevan, 2010).

4.1. *Fostering the Professional Growth of Teachers and Social Educators through Training*

The courses "Expert in Inclusive Education Processes" and "Expert in Educational and Teaching Processes at School" aim to enhance the professional development of teachers and social educators in the area of inclusiveness and to prevent school dropout. These courses aim to foster positive relationships, improve teachers' emotional and relational skills, and enhance their overall well-being. Additionally, they aim to increase both the technical and disciplinary knowledge and skills of school professionals, aligning with the core principles outlined in the European profile of inclusive teachers (EADSNE, 2014). The courses place equal emphasis on both the non-disciplinary and disciplinary aspects, encompassing cultural, organizational, cooperative, and strategic awareness, as well as emotional-relational and body dynamics.

The didactic structure of the courses is founded on a Competency-based education and training approach. The CUAP pathway consists of a total of 100 hours of blended training, divided into general and workshop parts, where trainees work together to develop a shared culture and exchange good practices. On the other hand, the modular master's course consists of 60 ECTS and 1600 hours, which are tailored to the needs of educators, teachers, and social professionals. Trainees have the option of taking the entire course or specific modules, depending on their requirements. Furthermore, the core of the course is a 100-hour internship coordinated by a university supervisor and a 50-hour discussion reflecting on the experience. The internship takes place in schools participating in the 'Play It Again, Sam' project, which has a primary prevention intervention implemented in the majority of Turin schools, aiming to prevent unfavorable learning conditions and school attendance. Trainees participating in this project gain a unique opportunity to gain a multi-professional outlook on education, working alongside educators, teachers, and social service workers.

4.2. *Teacher Inclusiveness in Teacher Training: Achieving Personal and Social Competencies*

The training approach outlined in earlier sections emphasizes the practical application of acquired competencies and is in line with the Embedded model. The focus of this training is to enhance the personal and social competencies essential for both learning support teachers and teachers combating school dropout, through a blend of lessons, workshops, curricular, and transversal activities. These activities were carefully designed to promote inclusiveness, both in terms of methodology and content, and were well-received by the participants for their effectiveness in mitigating stressors such as online learning or a heavy workload. The participants emphasized the importance and effectiveness of the focus on inclusive teaching, particularly in terms of professional development. They recognized that both the emotional and communicative aspects are just as crucial as the technical and educational ones, with the

element of sharing and awareness consistently highlighted as a key factor in developing a professional demeanor that promotes inclusion. It was noted that the creation of inclusive networks is the most effective means of achieving this goal (Damiani et al., 2021).

5. Conclusions

The training approach described in this article constitutes a valuable contribution to the field of pedagogy and teacher education. The innovative blend of practical lessons, workshops, curricular and transversal activities, as well as the focus on personal and social competencies, make this approach unique in its nature (Di Masi et al., 2023). Furthermore, the approach has demonstrated positive results in enhancing the professional skills of learning support teachers and reducing school dropout rates.

In conclusion, the present study provides novel insights into the support of teachers in creating inclusive educational environments and promoting student well-being. The potential impact of the Expert in Processes of Inclusive Education and Expert in Educational and Didactic Processes at School courses on the international scientific community serves as a stimulus for future research and advancement in the field of teacher training and professional development. The results of this project reinforce our conviction that universities have a critical role to play in advancing inclusive processes and treating education as a means to effect social change, rather than perpetuating existing inequalities.

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Experiential learning using short-term global virtual team projects

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Abstract

Institutions of higher education are facing new challenges when preparing their graduates for today's global workplace. Digital communication and project management skills as well as intercultural competence are imperative in light of the transitions to remote and virtual teamwork. Global virtual team (GVT) projects provide students with experiential learning opportunities, increasing their chances at employability and professional success. This qualitative study involves a client-based GVT project conducted over the course of four semesters and engaging approximately 400 students enrolled at universities in Germany and the United States. Responses regarding students' perceptions of the project's value for self-efficacy and employability confirm the importance of incorporating short-term GVT projects in university curricula in order to offer students opportunities for professional development.

Keywords: *Global virtual team projects; digital communication competence; employability; experiential learning in higher education; interdisciplinary project work.*

1. Introduction

More now than ever, business schools are facing the pressure of adequately preparing graduates for the contemporary global workplace. In the post COVID-19 pandemic era, the focus for higher education has turned to imparting skills and abilities conducive to remote work. The skills fundamental for post-pandemic employment include digital fluency, virtual project management skills, as well as intercultural communication competence (Crawford, 2021; Elliot, 2021; Engler, 2020).

An effective method for developing these valuable skills in students involves engaging them in short-term, global virtual team (GVT) projects (Burluson & Peters, 2021; Swartz & Shrivastava, 2021). Over a designated period, students work on projects with their peers in other countries using digital communication channels. Ideally, these projects are embedded in the syllabi, and instructors share similar learning outcomes and assessment criteria. The students as well as the focus of the projects may involve similar disciplines or be of cross-disciplinary nature.

Short-term GVT projects belong to a growing movement of incorporating Virtual Exchange (VE) at institutions of higher learning, also known as Collaborative Online International Learning or COIL.¹ COIL projects offer students the opportunity to gain valuable international experience (Barbosa, et al., 2019; Starke-Meyerring, 2010; Swartz & Shrivastava, 2021). VE has been especially valuable in providing students, who would otherwise not be able to take advantage of study abroad programs, experiential learning opportunities for intercultural exchange. During the pandemic, when students were unable to participate in study or internship abroad opportunities, GVT projects filled the void (Logemann et al., 2022).

This study investigates the value of short-term GVT projects for developing business students' skills and thus increasing graduates' employability. The GVT projects under investigation were carried out several times over the course of several semesters between 2020 and 2022. The projects involved approximately 400 students enrolled in an undergraduate business administration program at a German university of applied sciences. These students collaborated with peers from a partner university in the United States of America over the course of six weeks on a project involving the design of an app. Randomly chosen and heterogeneous teams of five to six students communicated through the collaborative platform SLACK, ZOOM and other digital communication channels in order to create a collaborative virtual presentation. After the project, the German students submitted reflective papers in which they answered questions regarding the relevance of such projects.

¹ Collaborative Online International Learning (COIL) is a pedagogical approach, which includes projects involving participants in different countries utilizing digital communication channels (<https://coil.suny.edu/>).

The study involves a qualitative investigation of students' responses to questions about their project experiences and the project's significance for preparing them for future employment. The findings underline the importance of digital and intercultural competence for the post-pandemic global workplace, as well as illustrate how experiential learning through GVT projects can contribute to students' development of this skill set. Finally, the results encourage higher education instructors across all disciplines to incorporate COIL projects into their curricula.

2. Background

GVTs refer to geographically and culturally diverse teams that have minimal face-to-face contact, and communicate primarily through digital channels, utilizing collaborative platforms such as MS Teams or SLACK (Chudoba & Maznevski, 2000).² Their team members represent a wide diversity of backgrounds, national and management cultures, global variations of English and professional jargons (Neely, 2013).

Although virtual team projects can have a long duration, there has been a growing tendency towards short-term, temporary projects, requiring team members to change their constellation often as projects end and new ones begin (Hollema, 2020). As a result, team members must continually adapt to new teammates with different cultures, personalities and priorities (Edmonson, 2012; Gupta, 2018; Hollema, 2020).

GVTs face many challenges, which include working across diverse time zones, overcoming cultural barriers while communicating exclusively through digital communication channels. The lack of non-verbal cues creates further obstacles to working across cultural differences and building rapport. Furthermore, the short duration of the projects requires that team members develop "swift trust" (Crisp & Jarvenpaa, 2013).

In order to overcome these challenges, a specific set of skills, including digital communication and intercultural competence, is required (Makarius & Larson, 2017). Underlying these attributes is team members' self-efficacy in dealing successfully with digitally and culturally diverse environments (Hollema, 2020). GVT projects embedded in the curricula of higher education institutions ensure that graduates bring the skillset required for today's global workplace (Crawford, 2021; Brewer et al., 2015; Leask & Bridge, 2013; Starke-Meyerring, 2010).

² Microsoft Teams and SLACK are software solutions, which allow for the forming of teams according to projects, as well as the sharing of files, messaging and video conferencing among team members.

3. Methodology

3.1 The Project

Over the course of six weeks, teams of German and American students worked on a client-based project for a leading global tech company. The students collaborated across a six-hour time difference using digital communication and collaborative platforms (ZOOM, SLACK, and WhatsApp). The project involved creating an app, which was meant to solve an issue such as parking on campus, incorporating sustainability efforts at their universities or finding study buddies. In order to support them in the conception of the app, the students took part in virtual software workshops carried out by the tech company. The apps were presented in the form of a virtual pitch.

The learning objectives of the GVT project included developing students' project management and digital communication skills, as well as honing their intercultural competencies. The instructors communicated regularly before, during and after the project; they synchronized the tasks, the deadlines and the expectations. The projects were embedded in the respective course modules, and the deliverables constituted at least one third of the students' final grades.

The pitches were evaluated with a grading roster using the same criteria. These involved the approach to solving the issue, user-friendliness, as well as features and creativity. The top three pitches were presented to a jury of experts from the tech company and external professionals for the final ranking, who provided in-depth feedback on the finalists' concept and presentation. All students received a certificate as well as a digital badge, which could be posted to social media platforms such as LinkedIn, upon completion of the project.

3.2 Research Method

In order to assess the success of the project in achieving the learning outcomes, students from the German university were asked to submit a debriefing on their project experience upon completion of the project. This debriefing, also referred to as reflective paper, involved two main questions:

1. What impact do you think these types of projects have on your ability to communicate effectively in an online environment and to lead virtual teams?
2. How do you foresee employers valuing the intercultural communication skills developed in projects such as this - in your case and in general?

4. Results

4.1 The Impact on Communicating in an Online Environment

The respondents overwhelmingly agreed that GVT projects developed their online communication skills. In addition to an improvement in their English language, students noted their experience in overcoming communication barriers. This was especially true concerning non-verbal communication across digital channels. Although these students belonged foremost to the digital native and social media generation, the majority pointed out the benefits of working online with people they did not know and were different from themselves.

I learned to be more open and direct in my communication, because everything took place online, and you often couldn't recognize and interpret the direct reactions of the team members. It also helped me to be more open with people I don't know or don't know personally.

Furthermore, students acknowledged that participating in GVT projects offered them the opportunity to recognize challenges they may face working remotely in future and to develop strategies for dealing with those challenges.

Through this project I had the opportunity, for the first time in my life, to work in a completely online environment with people outside of my country. Thanks to this experience I now have a number of difficulties in my head that may occur in such a digital environment and various tried and tested strategies for overcoming them.

In general, students concurred that engaging in the GVT project developed their self-confidence and helped them discover abilities that they were previously unaware existed in themselves.

... in the course of this project, I completely led a team for the first time. This experience is very valuable for me, as I have realized that I am better at this, than expected. As a result, I can trust myself more in the future and lead the group work with more self-confidence.

Almost all students appreciated the opportunity to have taken part in a GVT project during their studies, and felt that such projects should be an integral part of their studies in order to develop the skills they would need later on in their careers. Some students recognized also the gains they had made on a personal level.

An environment in which mistakes are allowed and people meet at eye level without hierarchies is a valuable platform for experiencing everyday life in international projects. The basics of communication, the use of different communication media as well as structured problem solving, are taught in projects of this type using real

situations. The ability and competence to communicate effectively in an online environment and to lead virtual teams can be learned in this way very effectively.

Another student valued the social aspect of the project:

For me personally this experience is priceless! I am really grateful for the given opportunity to be a part of this international project and to work with people, who I would have otherwise had no chance of meeting! And last but not least, I am thankful for the new friendships, that we managed to build!

4.2 Student Perceptions on the Value of GVT Projects for Employers

The majority of student responses agreed that future employers value the skills they have acquired through having participated in such projects.

Considering that one day I would like to work as a tax consultant or an auditor in a big company, with offices all around the world, communicating with people from many different cultures will be an integral part of my everyday work. Participating in such a project has given me a glimpse at what my future work life might look like. I learned a lot about how to overcome different barriers, such as different time zones, how Americans deal with different complications and how they search for their solutions. Having this project on my resume may, in fact, one day be a decisive factor if I will get the job that I want or not.

The fact that participation in a GVT project during their studies could provide them with a competitive advantage when applying for a position at both national as well as multinational companies was pointed out continually in the responses.

As companies are placing more and more emphasis on these kinds of skills, I consider these skills to be very well recognized. This is mainly due to the fact that an increasing number of companies have a lot of contacts abroad, especially due to globalization. This type of project shows the company, that you can also be deployed internationally and keep a cool head in special circumstances.

All in all, students' responses emphasized the value of GVT projects for exposing them to the challenges of working in a global environment and developing the skills necessary for success in their future careers, thus increasing their prospective employability and chances of success. As one student described it:

This group work could have been a pioneer what we will have later in our professional life. The world is growing together. The world of work has also become more international. This makes intercultural competence more important in order to be successful in a global working environment.

5. Discussion

Research conducted on students engaging in GVT projects has found that GVT projects are conducive to developing students' skills in digital communication, virtual project management skills and intercultural competence, thus preparing them for the global work environment (Crawford, 2021; Swartz, et al., 2021; Hackett, et al., 2023). This study's qualitative responses further substantiate these findings. Furthermore, this study shows that students recognize the potential of GVT projects for acquiring these skills and increasing their chances of employability and success at the workplace. Thus, this study underlines the need for incorporating GVT projects into university curricula.

Additional research into the subjects' career trajectories would provide valuable insight into determining the impact of GVT projects on developing students' skill set and improving their employability as well as job performance. Until now, follow-up studies have not been carried out on GVT project participants. The extent to which interdisciplinary GVT projects benefit students is another area for future research. Further studies may guide instructors on the kinds of GVT projects suitable for various learning outcomes.

6. Conclusion

For instructors and students, GVT projects can be both rewarding and time-consuming. Instructors must work closely together to coordinate the assignments, monitor progress and evaluate the learning outcomes. At the same time, students face multiple challenges of finding meeting times, working together on collaborative digital platforms, and bridging language and cultural barriers. However, student responses have shown that the rewards are greater than the challenges. Embedding even short-term GVT projects in university curricula would offer students the opportunity to acquire the skills necessary to overcome those challenges, thus better preparing them for the global work environment.

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Adopting learning circle approaches to equip academic staff for community engaged research and learning practices

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Abstract

The purpose is to explore the potential of Learning Circle (LC) approaches with an aim of equipping academic staff for Community Engaged Research and Learning (CERL) practices. We draw on the experiences from a three-year Erasmus+ project, CIRCLET. It aimed to meet the demand to better align higher education with the needs of the rapidly changing 21st century society, by enhancing the professional development of academic staff and fostering a culture of engagement. The article presents a case study-based argument that the LC – as a community of practice approach – is an effective instrument for, and has the potential to tackle, many of the challenges of professional development. We draw on a combined method, building case studies from post-interviews, personal notes and observations. We present four different cases, and offer suggestions for how LCs created a safe space, thus enabling learning at different levels which supported academics to build CERL into curricula.

Keywords: *Learning circle; community engaged research and learning; science shop; community of practice; professional development.*

1. Introduction

The purpose of this article is to explore the potential of Learning Circle (LC) approaches to equip and support academic staff in their professional development for Community Engaged Research and Learning (CERL) practices. Research indicates that CERL activities are capable of benefiting teachers, community partners and students (Moriau et al., 2022). However, studies also highlight that academic staff do not always feel equipped to properly design and support such practices, stressing the need for (continued or more appropriate) professionalisation opportunities (Boland, 2014). In recent years, LC approaches have emerged as a promising solution for supporting academic professionalisation. LCs provide a safe and supportive environment for academic staff to reflect on their practices, share their experiences, and engage in ongoing learning. Through regular meetings and activities, participants in a LC can build a supportive network of peers and engage in meaningful dialogue and reflection on their teaching and research practices. In this article, we will explore both strengths and points of attention for adopting LC methodologies with an aim of supporting quality implementation of engaged research and learning in academic curricula.

Our research is rooted in CIRCLET (Curriculum Innovation through Research with Communities: Learning circles of Educators and Technology), a three-year, five partner Erasmus+ Strategic Partnership Project that ended in 2022. It aimed to enhance the professional development of lecturers for CERL via facilitated participatory peer learning processes with the contributions of various stakeholders – community partners, CERL brokers and support staff, students, educational development staff, university management and involved 104 academic participants.

This paper is organised in three more parts. In the next chapter we introduce the concepts discussed, including CERL, LC and professional development. It is followed by our research methodology and we elaborate on four cases, describing the adopted approach and its impact on the professional development of the participating lecturers.

2. Theoretical Background

In this chapter we provide conceptual foundation for both CERL and LCs and provide a picture on contemporary issues and trends regarding professional development of academic staff.

2.1. Conceptualising Community Engaged Research and Learning

CERL aligns with a socio-constructivist methodology (see e.g. Palincsar, 1998), which supports learners to co-create knowledge. Our approach draws on constructivism, experiential learning and critical pedagogies. The relationship between these has been explored by Tassone et al. (2018). According to Boland (2014) these “approaches to teaching

and learning share an explicit civic focus and combine the features of experiential learning with opportunities for engagement” (p. 180). In CERL students and lecturers are working with community partners on collaboratively-designed, real-life projects, for mutual benefit, embedded in the curriculum (McKenna, 2022). Community partners can have a wide variety of formats from Civil Society Organisations (CSOs), charities, non-profits, via social enterprises, social cooperatives, statutory bodies, schools, to other communities (Bates et al., 2022).

CERL intertwines the three missions of higher education institutions: Teaching/Learning, Research, and Engagement. It is often supported by Science Shops, which are often university-based units (Fokkink & Mulder, 2004) providing responses to questions of communities and civil society organisations through research and learning. Although operations and formats of Science Shops vary, their community “demand driven and bottom-up approach” (Steinhaus, 2014, p. 72) are common characteristics.

2.2. Contemporary Trends Regarding Professional Development of Academic Staff

The key question underpinning this study is how obstacles to professional development of academic staff can be tackled by the adoption of LC approaches. Professional development activities are often seen as an effective means of encouraging academics to alter their teaching practice. Conventionally, the aim of professional development activities has been to provide them with new knowledge, building on the assumption that this will act to alter their beliefs, which in turn will motivate them to rethink their classroom practices. Yet, studies indicate that teachers’ beliefs are resilient, and as Guskey (2002) argues, most often beliefs only change after lecturers themselves have experienced the effectiveness of an alternative practice through improved student outcomes.

Xethakis (2019, p. 46) states that “for any proposed change or reform to be effective and take hold in the classroom, teachers themselves have to buy into the proposals, change their way of thinking about teaching and adopt new classroom practices themselves”, calling for models of professional development that allow teachers to take a more active role in their professional development. More impactful professionalisation initiatives, according to Drijs-Esser and Stark (2015), demand a shift in agency – a move “away from programs that focus on creating change in teachers” to activities that focus on “providing opportunities for active engagement, influencing teachers to take responsibility for their own learning and to reflect on their practice” (Drijs-Esser & Stark, 2015, p. 1). Building on these observations, one might argue that a different conception of professional development is needed. One in which lecturers themselves generate the kind of knowledge that can aid them in altering their beliefs and adopting new practices in order to achieve the successful implementation of reforms and curriculum changes.

2.3. Conceptualising Learning Circles as Community of Practice (CoP)

Our study builds on a LC approach. LCs are small gatherings of people who meet to study a subject of interest to its members. LC members share their knowledge and experience, learn to apply and test new information, skills, methods and ideas. The goal of LCs is to support participants to develop new practices or action plans they can take back to their working contexts. For the purpose of this study, we will frame LCs as a Community of Practice (CoP). A CoP promotes collaboration and relationship-building among its members, leading to a sense of belonging and support (Wenger et al., 2002).

It could be argued that LC approaches offer a flexible, relevant, and sustainable alternative to traditional training initiatives aiming to inspire academic development of university lecturers and researchers. By being participant-driven, LCs ensure that the content covered is relevant and responsive to the needs of academic staff, resulting in a more personalised and effective learning experience. The peer-to-peer nature of LCs helps to ensure their sustainability over time, as participants are able to continue learning and sharing with each other beyond the formal learning event. LCs promote collaboration and relationship-building among participants, leading to a sense of community and support.

3. Research Method

This qualitative research applies a case study method to show the practical relevance, and the diverse applicability of the approach applied in CIRCLET. It builds on the works of Eisenhardt (1989) and Yin (1994) for whom the main goal of the case study methodology was to build a theory. This aim has been slightly revised as building and showing viable and inspiring practices with useful implications both to theory and practice. According to Yin (1994) case studies investigate a contemporary phenomenon – in this case: CERL, supported by the LCs – within its real-life context, “especially when the border line between the examined phenomenon and context cannot be drawn clearly, therefore there is an opportunity for a deeper analysis of contextual factors” (p. 13).

A combined method was used to select cases with a goal of finding confirming, and theoretically supported ‘typical’ cases (Miles & Huberman, 1994, p. 28.), while also showing challenges and opportunities. Of the five universities participating in the project, four adopted similar approaches and these were selected as cases to include for analysis. Due to a very different local context, the fifth university chose an alternative LC aim, process and structure which is not discussed in this paper. Following Yin (1994) the research relied on data from several sources such as LC plans and facilitation guides, interviews with facilitators, reflective journals of participants in the LC process (including participant lecturers and facilitators), and participant observation from other contributors, all of these inputs are coming from different angles for triangulation reasons.

4. Findings and Discussion

The LC processes were collaboratively designed across the four cases and consisted of a series of whole group workshops interfused with small group discussions. Since LCs are driven by the needs and expectations of the participants to a large extent, the shared basic design resulted in local variations based on local considerations. Table 1 introduces the key aspects of LC cases in a summative and comparative manner. Besides enumerating the considerations in setting up and running an LC, the table also provides insights on the similarities and differences of local LCs. The Shared/Varied column gives an overview of the cases from this respect.

Table 1 also describes foci of participants' diversity, a key element for encouraging peer discussions and learning on CERL approaches which inherently build on diverse voices. LCs were designed to make space to incorporate the various experiences of participants and to integrate the areas of expertise of the lecturers, to give them the opportunity to showcase and develop their strengths (e.g., their expertise in their field of research and teaching; their experience of being engaged with community partners outside of work, etc.). Key LC elements included implementing experiential learning cycles, identifying learning styles (see Kolb & Kolb, 2005, Manolis et al., 2013), and using reflection tools supporting reflection by lecturers as well as learning about reflection in a way to support student reflection in CERL projects (Matolay & Frigyik, 2022).

Our data offers insights into the experiences of participants in the CIRCLET project. Participants highlighted the feeling of being part of a safe and supportive group and the ways in which this served as a foundation for awareness raising and learning necessary to build CERL projects into curricula. They appreciated meeting "*people who are like minded*". This sense of being part of a community created commitment towards the group, its members and to support each other's learning by sharing their own experiences.

In addition, they highlighted that their experiences in the LC created the condition not only to reflect on their teaching practices, but to discover their blind spots, those values, beliefs that may limit their learning new ways of teaching for CERL: "*It was quite unexpected to see how similarly we reacted when ... told us about the communication of one of her projects. It was uplifting to see that academics all around Europe face the same challenges and struggle with mental blocks that stop us from doing something in a new way*".

Participants learned teaching techniques to support CERL, that may be put into practice immediately. This gave a sense of learning about changing their teaching practices but does not necessarily reflect a readiness for more in-depth changes. The first step towards in-depth changes were made by increasing awareness on their teaching practice through a better understanding of CERL: "*Community partner speakers ... allow for deeper discussion of the topics, how to do things better, what to keep, what lose and how to develop further*".

Participants learned from each other, so next to relevant content and techniques, they also learned how to get in meaningful contact with each other, and with other relevant stakeholders, the community partners and students: *“I particularly found useful hearing the feedback of a student who took part in a CERL course and [of] a community partner.”*

Table 1. Learning Circles: Design Considerations and Variations for Embedding CERL.

Aspects of LCs	Description of Aspect	Shared, Varied	Explanation of Similarities/Differences
Key foundations of Learning Circles for CERL			
Goal	Professional development of lecturers to embed community engagement into existing courses	Shared	All LC processes were set up with the shared goal of promoting CERL via engaging and upskilling lecturers. Focus was on already existing courses with the potential to experience transformation for CERL and to prevent obstacles of major changes of – e.g. launching new courses in – curricula
Format	Facilitated peer learning	Shared	LC design for learning with and from each other with the potential to build a CoP, facilitated by CERL experts/support team
Other	Reflection	Shared, Varied	Reflection by lecturers and equipping lecturers to support student reflection were central to all LC, various tools and activities applied though
Learning Circle Participants			
Numbers	5-12 lecturers per LC	Varied	The general aim was 6-10 persons, this varied due to differences in numbers of local applications
Diversity	experience - in teaching - in CERL - disciplines	Shared	A key aim – reinforced in the call for and selection of participants – was to create diverse groups within the LCs to allow for peer learning
Learning Circle Process and Structure			
Length	1 or 2 semesters	Varied	Building on CERL principles, the 1st was designed and decided collaboratively, the 2nd was customised by feedback/needs of local participants and facilitators
1st semester process	3+3	Shared	3 large group sessions of 2-3 hours + each followed by 1-hour small group sessions
2nd semester processes	- Same as in 1st semester - Check-in and show & tell sessions - Indiv. check-ins	Varied	Based on CERL principles, considerable variation – where appropriate to local context, facilitators worked one-to-one with academics or continued with full LCs and/or small groups
Access	Online, in-person, both	Varied	Online due to local characteristics (e.g. distances between campuses) and to COVID. In-person options offered where possible

Source: Compiled based on data collection for cases and Matolay & Frigiyk (2022).

The stress and time pressures of academic life impacted the CIRCLET project, resulting in participants not being present physically or emotionally, not having time to read and prepare, or to share and fully support peer learning. This generated further negative feelings, an

internal conflict: “sadly I had to miss some, but that is not a reflection on my peers but me as a member”. Lack of time may limit the desired learning and change too: “interesting conversations, but the benefits are not always that visible or plausible (maybe need more time to mature)”, “It was an excellent source of learning, exchange of ideas and experiences!” The LC community could be a source of inspiration and practical learning, with experiences and impacts on a spectrum from limited reflection to in-depth changes related to the lecturers’ identity and/or teaching practice.

5. Practical and Theoretical Implications

In conclusion, LCs offer important vehicles for professional development of academic staff in the context of CERL. CERL is acknowledged as a challenging pedagogy to implement, and the opportunity for peer-learning, self-reflection and sharing of experience offered by the LC approach was evaluated as successful by project facilitators and participants, notwithstanding the time pressures that many experienced. Participants particularly valued hearing the experiences of others who had undertaken CERL projects, including students, community partners and other lecturers, and valued the role of the facilitators in supporting relationship-building with community partners. Whilst participants acknowledged the challenges for workload in implementing CERL, many have gone on to extend and deepen their CERL practices. Through CIRCLET, 53 modules were redesigned and over 3,000 students participated in CERL projects.

LCs were seen as safe and inspiring learning spaces, where a sense of belonging was created, and peer learning was possible. The diversity of participants and the experience sharing by/with different stakeholders led to a better understanding of CERL, increased awareness on their own teaching practice and changes needed. The latter requires sustained effort from the individual even after the LC: learning in LCs serves as foundation, and the relationships may continue to fuel peer learning, even against the experienced time and workload pressure.

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Interdisciplinary week in game design: a learning experience

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Abstract

Interdisciplinarity promotes competencies like asking meaningful questions about a complex problem, examine, and synthesize multiple sources of information, methods, and perspectives, in order to integrate knowledge and ways of thinking across two or more established disciplines to produce cognitive advancement. The Interdisciplinary Week of Game Design challenges the students to demonstrate an interdisciplinary understanding of a complex problem that students define, organized by teams, having as its starting point a given theme. Teamwork between members of different academic years favors the sharing of knowledge among peers with different aptitudes, technical skills, and degrees of competence.

Keywords: *Interdisciplinarity; project-based learning; soft skills; assessment.*

1. Introduction

The higher education system has been changing rapidly in recent years, with a greater emphasis placed on developing not only hard but also soft skills, the inter and intra-personal skills required to be effective in the workplace, a raised awareness about cognitive diversity and aligning aspects (cognitive, affective, behavior and context) of self-regulated learning (SRL). Two of the proposed approaches to developing these skills are through interdisciplinarity and project-based learning. Interdisciplinary competencies and soft skills, as the ability to understand issues in a holistic way, to connect both the analysis of problems and the devising of solutions with relevant disciplinary knowledge and methodologies, and to reflect on the role of scientific research in solving societal problems (Fortuin et al., 2013) can be highlighted on a curriculum vitae (CV) or in a job interview as contributions that a person brings to a future work team, cutting across academic and professional contexts.

In the interdisciplinary paradigm, students must ask meaningful questions about a complex problem, examine, and synthesize multiple sources of information, methods, and perspectives, from two or more disciplines, see how they intersect, and use reflective skills to carry out the solution of a problem or learning outcome (Ashby & Exter, 2019, Repko et al., 2019;). At its core is the ability to integrate knowledge and ways of thinking across two or more established disciplines to produce cognitive advancement in ways that would have been impossible or improbable through mono-disciplinary means (Boix et al., 2000). However, pedagogical approaches that challenge students to demonstrate interdisciplinary understanding remain relatively limited (Repko et al., 2019), and there is no single pedagogy that facilitates interdisciplinary teaching and learning (Ashby & Exter, 2019).

In recent years, interdisciplinary teamwork has become increasingly relevant in higher education (AWTI – The Dutch Advisory Council for Science, Technology and Innovation, 2022; Ashby & Exter, 2019). Interdisciplinary trends also surface in publication data, research agendas, and interdisciplinary innovation hubs (Klaassen, 2018). Various authors point out that at the meeting point of different perspectives there is a space that stimulates critical thinking, which allows the development of new knowledge, where the co-construction of learning is triggered (Akkerman & Bakker, 2011; Almasi, 2016). Engaging students in interdisciplinary experiences helps them develop higher-order metacognitive skills, guiding them to synthesize disciplinary knowledge to devise innovative solutions (Ashby & Exter, 2019). Thus, interdisciplinarity often materializes in global thematic areas such as sustainability, entrepreneurship, or big data, for example, where different disciplines come together to create solutions, products, or joint explanations of the world (Lam et al., 2014). This suggests a high level of breadth and complexity in the problems to be addressed.

As the implementation of the European Higher Education Area (EHEA) has evolved towards shifting the focus of attention from teaching to learning (Moya, 2017) and to the students'

own experiences (López-Pastor et al., 2013), the factors that allow students to be aware of their strengths and weaknesses have been studied. One of them is assessment and the way it responds to the students' need to judge their own practices and increase their autonomy and self-management skills (Calkins et al., 2018). The triple assessment approach, which combines self-assessment, peer assessment and teacher assessment in the same instrument, before the final grade of a given assessment procedure (Pérez-Pueyo et al., 2019), responds to this issue. Peer assessment is a very useful learning strategy for improving the feedback process in students (Kuo et al., 2017), fostering critical thinking (Topping, 2009), and studies have shown that it is remarkably robust in a wide range of contexts (Double et al., 2020). Self-assessment contributes to promoting self-regulation and awareness of learning by the student, helping train future responsible, critical, and reflective professionals (Pérez et al., 2022). Encouraging student participation throughout the assessment process also favors extrapolating the learning to various contexts.

Research has also suggested encouraging student innovation by supporting their autonomy during learning tasks (Martín et al., 2017). Project-based learning (PBL), which is based on the science of active construction of learning (Krajcik & Shin, 2014), emphasizes the construction of knowledge. Product creation is one aspect that differentiates PBL from other forms of learning. Product creation is important because it helps students integrate and rebuild their knowledge, discover, and improve their professional skills, and increase their interest in and ability to work with others. Therefore, the final products are the concentrated expression of various competencies that students can develop during PBL (Guo et al., 2020). Other authors have stated that the PBL method positively contributes to increasing student motivation to participate in the learning process (Pan et al., 2019).

Furthermore, understanding how teams effectively deal with continuously and rapidly changing contexts is an important issue for organizations. Teams capable of effectively responding to shifting conditions and aligning their member resources into processes that generate consistency in performance, are more beneficial to organizations than teams that fail to cope with changes in the environment. A moderate amount of cognitive style diversity has been shown to enable such team ability since having less doesn't provide the cognitive capacity and flexibility to take on tasks that invoke different ways of encoding and processing information, while too much may negatively impact cooperation and coordination. Additionally, these team skills or collective intelligence, forecast the rate at which teams improve in their implicit coordination, processes which are exceedingly important in high-resistance organizations (Aggarwal et al., 2019). Therefore, interdisciplinary project-based learning can leverage valuable team skills awareness and perception that will support students in their future endeavors.

2. Interdisciplinary week

The Interdisciplinary Week (IW) is a period, in the middle of the academic semester, in which all students of the Game Design degree, at the School of Public Management, Communication and Tourism of the Polytechnic Institute of Bragança, divided into small teams, reflect on a specific topic, in the form of a response to an unstructured problem, defined by them, in the three fundamental areas of the degree: game design, computer science and visual arts.

The IW aims to develop skills that we can divide into four fundamental transversal competencies (Sá & Serpa, 2018) – problem solving, teamwork, communication, and self-management; and, furthermore, create positive and productive attitudes, solving problems as a team through collaboration, debate and the sharing of ideas, research, flexibility, and interpersonal skills.

It should be noted that the design and development of games implies demonstrating the thinking, language, and attitudes of different disciplinary fields that are related to each other, and an integrative approach is key to finding new solutions to problems in this context.

2.1. The process

The week begins with an informative session in which the objectives and skills to be developed are described, the topic to be explored is revealed, the daily goals to be achieved are presented, and the week's agenda is defined. and work groups are formed and registered.

The activities, using Discord as a complementing platform, are carried out in face-to-face, synchronous on-line moments and autonomous work, which can be on-line or face-to-face, with the aim of meeting the goal of each day:

Goal of day 1 – Problem Definition: through a brainstorming process and based on the references provided by the teachers and the research carried out by the group, the students define what they want to delve into within the proposed topic and record what they prove in the form of a question to examine;

Goal of day 2 – Executive summary: definition of what the student team intends to develop in response to the question they have defined, which can be a game, an animation, an app, a website, an interactive narrative, a service, etc.;

Goal of day 3 – Prototype development: through rapid prototyping, the student team begins to implement the core features and must register what they still intend to develop;

Goal of day 4 – Prototype and poster: refinement of the prototype and articulation of the result in the form of a poster;

Goal of day 5 – Final pitch: Through a 5-minute pitch, each the student team presents the problem, argument, project features, work process, and demonstration of results.

All results and processes are recorded in templates provided for this purpose and are reviewed throughout the design and development work cycle.

On the second and fourth day there are moments of interaction between peers, fostering dynamics between students that contribute to the construction of useful feedback to the design and development cycle and to the structuring of reflective skills that, in turn, will inform the formative evaluation.

During the week, teachers supervise the work from their perspective of the topic, for which they are invited to make a short presentation.

2.2. Assessment

The developed work is evaluated among colleagues from the same team and between teams, by all those interested in the developed projects, and by the coordinating committee, contributing up to 10% to the classification in all curricular units in which the student is enrolled in the semester.

In order to assess students' progress in the project's evolution, quality feedback is sought every day, on the one hand to facilitate students' development and task improvement, on the other as a contributor to the quality of the student experience and as an enabler of team's identifying their strengths and weaknesses to further improve (Lizzio & Wilson, 2008). Assessment is understood as integral to the learning process and, as such, it is the locus of letting students formulate personal learning goals, activating prior knowledge to support debate, teachers informing students (collectively or individually) on what to accomplish next, as well as activating students as instructional resources for one another and as holders of their learning paths during the week, according to formative assessment strategies (Leenknecht et al., 2021). Therefore:

Feedback of day 1 – the student teams pitch the ideas discussed in the brainstorming process in order to define the problem and teachers give oral feedback in order to develop and improve the task;

Feedback of day 2 – each team registers the feedback resulting from the interaction with other teams and gives feedback to other teams about the conceptual results already achieved, as well as developing an Executive Summary for the project taking all collected feedback into account;

Feedback of day 3 – the students start prototyping, articulating their ideas in a product and pitching the first implemented features as well as identifying what they want to do; other

teams give structured feedback identifying a positive aspect, something to improve and also giving a suggestion about something that could be added;

Feedback of day 4 – teams test the prototypes from each other and register the feedback gathered from observation of testing and debate during the interaction;

Feedback of day 5 – on the last day teams publish a poster of the project and pitch the final results gaining feedback from those in terms of generated debate between teams as well as voting.

Hence, to complement what has already occurred in terms of assessment throughout IW, at the end of day 5's tasks the developed work is evaluated:

- from the student's perspective, by filling in a form with questions relating to the internal teamwork, interaction with other teams, the contributions and fulfillment of the tasks performed, and reflecting on learning throughout the process;
- from the point of view of all those interested in the developed projects, by voting for the ones they consider the 3 best projects considering the theme/problem identified, the originality, the degree of development, and the quality of the presentation;
- from the perspective of the coordinating committee, by evaluating all documentation produced during the process and the active participation of students.

3. Results

The IW has now been running for eight editions and has contributed greatly to the culture of the students and the degree in Game Design. The exploration of a topic allows unfolding research methodologies, supporting the double approach necessary for interdisciplinary thinking – having knowledge and having skills (Chatterjee & Das, 2021). Based on the iterative cycle of design and development, the learning process is itself iterative, with goals in which questions are asked.

Teamwork between members of different academic years favors the sharing of knowledge among peers with different aptitudes, technical skills, and degrees of competence. Widespread interactions between peers, as well as between students and teachers, combine to develop a critical stance essential to move away from notions of absolute knowledge and consider and apply different points of view and reconsider the strategies used within the project, favoring intellectual maturation of the students. The templates that support the autonomy of the students during the learning tasks in the IW prove to be sufficient scaffolding. They also enable a focus on personal characteristics, described in the literature as sub-competencies of interdisciplinary thinking: curiosity, respect, openness, patience, diligence, and self-regulation (Chatterjee & Das, 2021).

Table 1. Interdisciplinary Weeks that already occurred.

	Date	Theme	Number of students	Number of the projects
1st	26.11 to 30.11.2018	INTERCONNECTED	109	21
2nd	01.04 to 05.04.2019	(UN)USEFULL	88	15
3rd	11.11 to 15.11.2019	POST-HUMANISM	160	22
4th	26.11to 03.12.2020	VIDEOGAMES 2020 international conference	112	25
5th	06.04 to 09.04.2021	MEMORY	89	16
6th	06.12 to 10.12. 2021	FUTURES	128	23
7th	04.04 to 08.04.2022	MAGIC	95	18
8th	14.11 to 18.11.2022	DOPPELGÄNGER	127	22

The final results presented in the IW are usually divided into three types of artifacts – documentation, physical objects, and digital prototypes. As a concentrated expression of the various skills developed by the students, they are an incorporation of the reconstruction of their knowledge, a reflection of the discovery and improvement of their skills of ideation, critical analysis, discursive articulation, communication, and collaborative capacity. They also demonstrate productive moments in the student's academic itinerary.

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“Strategy just isn’t like that”. A case study on the use of a cooperative game to experience the strategy roller coaster

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Abstract

This is a case study of teaching strategy based around a geo-political “fantasy” simulation to give students a taste of both theory and practise.

It was designed as the public image of consultants offering little useful help has a basis in truth. Many do not have a firm grasp of the realities of “doing strategy”. They fail to understand that problems of implementation are not individual failings but inherent to the academic teaching of strategy based on economic models. They either teach a rational approach to decision making or produce populist texts based on emotions and apparent first-hand knowledge without evidence. Both approaches suffer from a reality gap either by abandoning practice or academic rigour.

The intention is to introduce students to the emotional roller coaster that is the strategy journey. Strategy is about relationships and conflicts, emotional interactions in a world of bounded rationality, and negotiating within and between participants.

Keywords: *Strategic Planning; simulation; educational games; emotion; teams; communications; skills; negotiation.*

1. Introduction

There has long been a public image of a know-nothing consultant who enters public sector institutions and offers little useful help and lacks understanding of the culture of non-profits. In doing so they cause more problems than they cure as they try and introduce marketization, or some other concepts adapted from models and concepts developed for profit-oriented organisations. Although a crude stereotype this has a basis in truth. Many consultants and strategy educators do not have a firm grasp of the realities of “doing strategy”, they have learnt only through applying models to case studies and trying to copy from the greats.

The possibility that the problems of implementation are not individual failings but inherent to the academic teaching of strategy, including political strategy, is seldom addressed. They teach a rational approach to decision making based on carefully designed models crafted by intensive research based around industrial economic models and then express surprise when people do not respond. Others abandon any pretence at academic rigor and produce populist texts based on emotions and apparent first-hand knowledge without evidence, often these sell well at airports but last only as long in the memory as the single serving meal provided on the airline (Mintzerg, H. Ahlstrand, B. W., Lampel, J, 2008). Both approaches suffer from a reality gap as there is a need to maintain academic rigour while introducing students to the emotional roller coaster that is the strategy journey, while these approaches only, at most, do one or the other.

I struggled for many years to answer the following questions in a manner that provided for a good student experience:

1. How, in the classroom, do you best capture the strategy journey in complex and changing environments?
2. How do you teach emergent strategies rather than just prescriptive?
3. How do you replicate the complex, messy nature of the strategy world?

As we looked into these questions it became clear that many of these missing elements of strategy are also key skills many employers are looking for, and that employers often criticize universities for not producing these in students, and that this is not a coincidence.

I decided to answer these by making a dramatic change in approach by introducing a dynamic strategic geo-political simulation with elements of both competition and co-operation, set in a fictional world where great powers struggle to forge alliances across a steam punk continent emerging from years of domination and oppression to new statehoods. This is a case study report on this simulation or game.

2. Simulations

The use of simulations is not in itself a new idea, though the intensity and the academic interaction is greater in this than in any others of my experience, which have tended to be either short or more intensely related to employability skills and not theory, this game develops both and is thus a learning innovation.

2.1. Assessing Learning

Capturing and assessing the learning was a challenge as the importance of the experiential learning had to be driven in via assessment or many students would not engage (Hand, L., Sanderson, P., O’Neill, M., 1996) and therefore 20% of the marks are allocated by a peer review and negotiation under strict conditions to stop agreements to merely share marks and with a backstop of a lower grade should the students fail to reach agreement, 20% by the ability to act strategically in a group and 60% individual reflective diaries kept during the game.

2.2. Groupthink

The natural tendency to groupthink in strategy is difficult to overcome, and the anxiety levels of this module are often high exacerbating this,

The students are a highly diverse group, normally all continents except Australia (and Antarctica) are represented, and the involvement develops both academic skills. such as critique and synthesis, and employability skills including difficult to develop ones such as Resilience, Cultural Awareness and Adaptability.

3. Interest

The module has proved very successful with students, with very positive feedback but also very good outcomes with a number using the game in interviews and applications and reporting employer interest.

Example student feedback includes:

- “the simulation game triggered extreme enthusiasm”
- “the simulation game helped us to realize how to Do not only Explain things”
- “the game was run over one whole term, which helped to try new approaches and acknowledge the messy, emergent character of strategy”
- “The module was very interactive providing opportunities for learning that a normal lecture and seminar would not do”

- “I definitely enjoyed participating in 'the game' - Also, I believe that by having practical sessions, it allowed me to understand what it is like to be a *stratigikós stochastic*.”

A recent further innovation is the development of an advisory group for this module that consists of former students, 5 of whom returned to the university recently to talk to the present students as guest lecturers and also to give a careers talk in the evening attended by over 200 students, which is more than three times bigger than the department previous record attendance. The advisory group has a none binding role in designing the module and the assessment and has proved useful in improving both and is a major contributor to positive student outcomes. outcomes.

4. Method

In the department of Politics at the University of York, on the MPA/MA module Strategic Planning, a simulation based around a scenario where teams representing international great powers have to deal with dividing up a continent of recently independent nations to make allies and drive development and/or exploitation was developed and introduced.

Teams are provided with details of their initial resources and over a period of 9 weeks they make a series of moves and develop and implement a strategy. Unusually for such a “game” this one allows for extensive cooperation as well as intense competition, and the individual roles within teams also are a source of cooperation and competition.

Each week of the game students are introduced to new strategic models and they are guided in their groups to apply them to the game. They learn to recognize the strengths of the models but also the weaknesses of them in a dynamic environment influenced by the behaviour of others.

Over the period of the game there are several events that affect the players and the game board, randomly assigned, and the students need to react to these while building up their assets. They negotiate both with the game masters and with other players, and they receive a final group mark after which they must negotiate with their fellow team members to receive a share (equal awards are forbidden by the rules). This way the students are introduced to a real impact of their game playing.

5. Covid Adaptions

Covid caused the game to be moved onto the VLE creating unique challenges but the virtual tools that were developed to allow diverse and dispersed students to work together have proved so successful they have now been implemented into the game, much of the work is

extremely varied and helped to improve student engagement to a huge extent both during covid and after.

6. Conclusion

Many students struggle at first, the intensity is high and they feel the pressure, time can be an issue but eventually it settles down and feedback suggests students enjoy the module and find it useful.

Success measures include:

- High Average grade;
- High “Real Learning”;
- Good understanding of theory and reality;
- Creation of community of learning that continues after graduation;
- Students start to care.

However, a problem has been the development of the whole gamut of emotions, with examples of:

- Tears;
- Fights;
- Walkouts.

During the game, but in the long run the feeling is the experience has been worthwhile for all involved.

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Combining computer-based training, virtual, or augmented reality with peer teaching in medical and bio-technological education

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Abstract

The Interdisciplinary Biomedical Education and Research Center (BioMed) at our university offers a modern approach to biomedical education that addresses the challenge of understanding complex medical fundamentals and devices and their application in a clinical setting. This is especially relevant for our students of biomedical engineering, biotechnology, or bioengineering. The concept combines real medical devices with advanced simulation technologies and realistic training through computer-based training (CBT), virtual reality (VR), and augmented reality (AR). Peer teaching, small group activities, and tangible CBT are also incorporated into the hands-on approach, along with a focus on training with current and future technologies to prepare the students for the medical research/-engineering industry. Students responded overwhelmingly positively to the first peer-taught course that utilized VR and AR e-learning experiences, resulting also in improved exam results. This article provides an overview of the concepts used and their implementation in the biomedical engineering curriculum at our university.

Keywords: *Blended learning, virtual reality, augmented reality, education, peer teaching, computer-based training,*

1. Introduction

In a rapidly changing environment where new technologies emerge frequently, it is crucial to keep up with progress and integrate state-of-the-art as well as upcoming innovations into medical and biomedical curricula. Only by doing so can students be prepared for their future careers. Peer teaching has been shown to benefit academic performance, particularly in more practical subjects (Brierley et al., 2022), and the potential of technology such as virtual reality (VR) or augmented reality (AR) to enhance education has already been demonstrated (Wu et al., 2020). Studies have also shown that using 3D models to teach anatomy is superior to 2D learning materials (Ye et al., 2020). Peer teaching can foster teamwork, collaboration, and communication skills as students work together to teach and understand the material, which are essential skills in both academic and professional settings. When students are actively involved in teaching each other, they are more likely to retain the information, as they are forced to think about the material in a different way and explain it to their peers. However, in many cases, medical education is still taught in isolation from medical devices, neglecting the circumstances under which medical equipment (e.g. intensive care or emergency gear) is used or relying on traditional, non-interactive teaching resources like front-line teaching.

At the Interdisciplinary Biomedical Research and Training Center (BioMed), directed by Prof. Dr. med. Dipl. Ing. Christian Hanshans, a holistic concept has been developed and successfully implemented in cooperation with the University Hospital of Würzburg. It combines traditional teaching methods (such as lectures, self-study, and textbooks) with advanced digital supplements, including VR or AR-based simulations (e.g., 3D anatomy and physiology training), case-based training, anatomical models, and wall charts. The approach also includes computer-based training with learning success control, peer-guided tutorials, and the option for unguided self-study using all media. Furthermore, medical devices are demonstrated in a hands-on manner within a realistic clinical environment (such as functional diagnostics, operating rooms, or research settings). This hybrid teaching approach integrates anatomical and physiological expertise with technical skills and cross-links different classes, leading to a better understanding of complex subjects and promoting method competency. The purpose of this paper is to introduce the holistic approach and present preliminary data on student feedback obtained through evaluations, as well as compare pre- and post-intervention exam scores.

2. Concept structure

The learning concept is divided into three main subject orientations: (1) anatomical and physiological basics, (2) pathologies and medical imaging, and (3) operating principles of medical equipment and fundamentals of biomedical signal measurement. The concept is designed to provide students with fundamental knowledge in the first semesters, followed by

an introduction to how dysfunction of the previously introduced organs leads to diseases and disorders. In subsequent semesters, the focus shifts to the application of medical devices for proper diagnosis or therapy. The following paragraphs will provide a detailed description of each of the aforementioned categories.

2.1. Anatomy and physiology

As students begin their studies, they often struggle with the sheer amount of material they have to learn in a short amount of time. The courses, enriched with media and supported by tutors, provide an opportunity for students to deepen their understanding of anatomical structures and physiological processes using VR and AR. By allowing students to explore complex medical procedures, anatomy and physiological systems in a 3-dimensional and interactive way (see Figure 1), VR can provide a highly immersive experience for students. With VR or AR they get one more opportunity to consolidate the information they have already learned from lectures or books. Take the human heart, for example. You can read about its structure, how electrical impulses are generated and conducted, and when the different valves open and close. But because pictures cannot convey a sense of depth or movement your next step is to look at a plastic model to combine the 3D perspective with tactile feedback. But that still doesn't do much for your understanding of bio-mechanics or physiology. And this is where VR can be a great addition to the teaching portfolio. You can walk around a 3D animation of the heart contraction while simultaneously comparing it to the output of an electrocardiogram (ECG). This way, students learn to directly associate the state of the contraction with the spikes in the ECG. Unlike a video of these mechanisms in VR, students can scale, rotate, scroll through layers, hide and show structures like arteries, veins, or muscle fibers at will.

Another benefit of using VR and AR is that it allows for targeted teaching and learning. Bioengineering students, for example, focus more on histology and cellular processes, students of clinical optometry need to know more about the anatomy of the human eye, its diagnostic, related pathologies and clinical therapy, while the curriculum of biomedical engineering is aligned to the operating principle of medical sensors and devices.

A key factor of this learning concept is the use of different media and senses to approach the same topic. For example, as shown in Figure 1b, students can take a skeleton apart and do a practice exercise to find a particular bone. Seeing it on the AR image, they can compare and reinforce their knowledge by trying to find the same bone on a solid anatomical model and with that associating the same information with a haptic sensation.



Figure 1 a) Student while studying cardiac anatomy and physiology using a virtual reality headset. 0000b) Students using an AR software on a tablet to virtually dissect a skeleton while plastic 0000000models like the one in the display case in the background are used for comparison.

2.2. Pathophysiology and medical imaging

Various pathophysiological conditions such as tumor genesis, cardiovascular diseases, or neurological disorders are implemented in the curriculum through the use of VR, AR, or animations. This approach helps students to comprehend the underlying mechanisms and effects of these conditions on the human body. Additionally, it provides insights into the dynamics of diseases, such as the Covid-19 infection (see Figure 2).

Subsequently, students are taught about various medical imaging techniques such as X-rays, CT, and MRI, to enable them to comprehend the principles and applications of these methods and improve their ability to interpret and analyze medical images. This approach also provides a cross-reference to their prior knowledge of anatomical structures and pathologies.



Figure 2 Displaying the progression of a virtual Covid-19 infection on a patient simulated to be in a real-life training replica of an intensive care unit with real medical equipment, using AR glasses.

2.3. Functionality and use of medical equipment

Finally, students have the opportunity to apply the theoretical knowledge gained from lectures to a variety of real medical devices presented in a realistic setting. Armed with their knowledge of anatomy, physiology, and pathology, they have the basic skillset to better understand the requirements of medical devices and the needs of their users, such as doctors and nursing staff. The actual use or simulation of medical devices and procedures prepares students for their future work environment in clinics or medical device development. It is highly motivating and reinforces the knowledge acquired in previous semesters. VR is a valuable tool to simulate equipment that cannot be obtained for safety (e.g. infectious diseases or radiation), logistical, or ethical reasons (section course or visiting a real surgery or intensive care unit with an entire class), or due to financial constraints. This hands-on training can boost their confidence and prepare them for real-life situations. For instance, if they are tasked with improving medical instruments or devices, they will be better able to assess their clients' needs because they have gained experience using them.

3. Impact on student satisfaction and exam results

By providing a more interactive and engaging learning experience than traditional classroom and book-based instruction, this multimodal approach can increase student engagement and motivation. To investigate this hypothesis student evaluations were conducted. A five-point Likert scale (1 - strongly disagree, 2 - disagree, 3 - neither agree nor disagree, 4 - agree, 5 -

strongly agree) and free text fields for positive and negative feedback were used to evaluate the teaching concept. For this sample, the course "Human Biology" in the 2022 summer semester was used. This module combines the stated learning objectives of basic anatomy and physiology, pathology, and medical instrumentation. In addition, it is offered in three different undergraduate programs (Bioengineering n=26, Medical Technology n=12, and Clinical optometry n=10) resulting in a diverse total cohort of n=48 students participating (30 female, 17 male, 1 Not specified).

Many students praised the vividness that a VR or AR implementation allows. Statements like: "When I was learning the eye movements, I had a hard time understanding which muscle did what just from the script. Being able to turn the virtual eye the way I wanted and then let one muscle contract helped a lot." or "I found the animation where you could adjust the severity of the macular degeneration with the slider to see how someone sees the world with this condition very vivid" were submitted. As shown in Figure 3a, 92% of participants agreed or strongly agreed that VR helped them understand anatomy more than the lecture alone would have. The responses to the statement about the benefits of combining VR and AR with plastic models and the lecture for learning anatomy in Figure 3b were even clearer, with 94% of students agreeing or strongly agreeing.

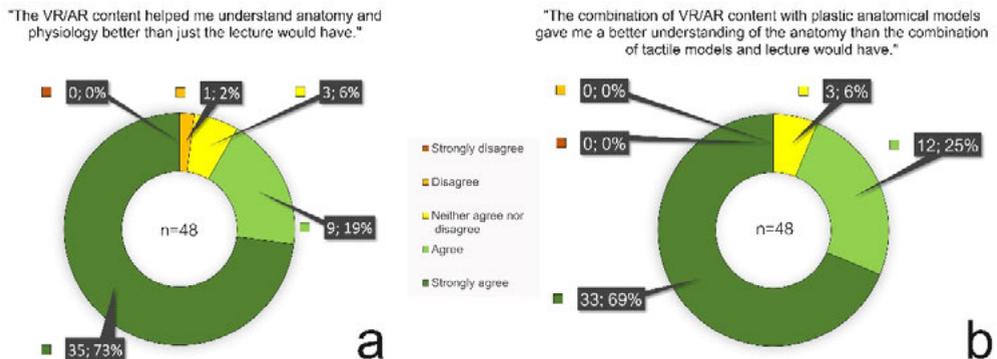


Figure 3 a) Results of the student evaluation regarding the benefits of adding VR/AR compared with the sole use of lectures for learning anatomy.

b) Results of the student evaluation regarding the benefits of combining VR/AR with the use of plastic models and the lectures for learning anatomy.

Some reported that they were more motivated to engage with the content because of the way it was delivered. They stated "It was easier to motivate me to go to the lab for tutoring than to go to the library because it feels less like learning and you have more fun in a group." and "Because looking for bones on the tablet was like playing a game, I can remember them better now." Feedback also emphasized the immersive nature of the experience. "It was kind of depressing to see the Covid patient having more and more trouble breathing. It really looked like he was sitting there on our bed struggling to breathe while his machines were

beeping.” one student wrote in their text field. The peer-teaching approach also received positive feedback. Praise like *"I liked that I could just ask stupid questions. "*, *"The patellar tendon reflex was well explained by the tutor."* or *"The tutor's mnemonic about the exits from the aortic arch was funny"* was given. The survey results demonstrate that the first statement quoted was not an isolated case. 73% (n=35) fully agreed and 27% (n=27) agreed with the statement “Being supervised by a student tutor instead of the professor made me feel more confident to ask questions.”

There has been negative feedback as well. Some students reported discomfort and dizziness while using the VR goggles. Three students had to stop the exercise early due to motion sickness. It has also been criticized that the university does not provide funding to make the software shown in the tutorial available to students as a campus license. Because of this, the software can currently only be used by one student at a time due to the single license, which has sometimes led to considerable waiting times. As a result, students who wanted to use the software on the tablet always had to come to the university to use the lab's device-locked license instead of being able to use the software at home for private study.

In addition, a comparison of pre- and post-intervention exam scores was made using the bioengineering students as an example. This group was chosen because they made up the majority of those attending the tutorial and were therefore the most representative group in terms of the effectiveness of the tutorial. A peculiarity worth mentioning is that the Munich University of Applied Sciences offers the possibility for students not to take an exam, even though they are registered, without having to face any consequences. Especially in the medical subjects only a fraction (40 - 70%) of the students enrolled in the course actually take the exam. The subject Human Biology was chosen for the evaluation because this basic subject is perceived as particularly difficult by students and tends to have lower results than other subjects. In 2021 n=33 and 2022 n=30 of n=59 in 2021 and n=62 students in 2022 visiting the lectures that took the exam were compared. In both years, the exam was an online electronic exam (using Moodle) with a mixture of multiple/single choice questions, matching questions, picture marking questions, and mathematical problems. The grade average (1 to 6, with 1 being the best and 6 the worst) showed a visible improvement in the grade distribution (2021: $\bar{x}=3.50$, $\tilde{x}=3.30$; 2022: $\bar{x}=3.07$, $\tilde{x}=2.85$). Although two more students failed in 2022, the upper range of scores improved considerably. While in 2021 no student scored between 1.0 and 1.7, the number increased by 5 in 2022 (1.0 n=2; 1.3: n=1 1.7 n=2). The correlation between the introduction of the peer-taught tutorial and the improvement in grades suggests that this intervention may be particularly helpful for students in the lower to middle performance spectrum to achieve better exam results.

4. Conclusion

Overall, the use of a consistent implementation of blended learning with traditional and peer teaching, the introduction of interactive technologies such as VR, AR, case based training and real-world models or devices in a realistic environment can elevate the education of medicine and biomedical technology to a new didactical level. However, although the student evaluations and improved exam results provided a valuable first glimpse into the full potential of this broad didactic concept, further studies are needed to objectively quantify the success of the intervention on a larger scale and to identify and eliminate potential confounding factors. Yet despite the limitations this study showed that blended learning can promote motivation, comprehensive understanding, enhances social skills and collaboration and allows competence oriented teaching. In addition, students come in contact with emerging technologies (such as VR, AR) and are provided with an immersive learning experience, which can improve their understanding and readiness for real-world scenarios and their future professional career.

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They want to fly! – International students attitudes concerning the climate crisis and their air travel behavior

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Abstract

What do international students think about the impact their travels have on climate change?

As the relationship between academia and higher education institutions with regards to protecting the environment and mobility continues to be complex, universities and other higher education institutions are trying to reduce their carbon footprint. However, international students often travel globally for their study programs and other associated trips, raising questions about their awareness concerning the impact of their travels on climate change.

A qualitative case study conducted in two international study programs in Austria reveals the presence of five different types of students. While most students are aware of climate change, only one group is taking active steps to address it at an individual level. Furthermore, there is also a distinct group of students who are unaware of basic climate change-related issues.

The findings of the study highlight the importance of incorporating climate change education into international study programs on both a curricular and practical level, from the admission process to program-related travels. It is crucial for universities and higher education institutions to address this issue and promote sustainability in international student programs.

Keywords: *Climate change; international study programs; case study; travel behavior.*

1. Introduction – The complicated relationship between climate change, internationalization in academia and higher education

What do international students think about their contribution to climate change and climate change-aware behavior overall? The answer should be simple, as the effects of human-induced climate change have led to a wide range of increasingly catastrophic events. The UN is urging nations around the world to take substantive action to combat climate change (IPCC, 2022). Despite decades of research supporting this call to action and more than 196 parties promising to fulfill the Paris Agreement to limit global warming, actual actions are limited (Nunez et al., 2019). As a result, research and higher education institutions must increase awareness and strengthen their efforts to combat the climate crisis (Borgermann et al., 2022).

However, the situation in universities and higher education institutions is not straightforward. From a normative perspective, internationalization and mobility are considered essential for academic excellence (Altbach et al., 2009). Consequently, many universities and research institutions aim to attract a diverse range of international scholars and students (Uzhegova & Baik, 2022), and they actively organize events such as conferences, research stays, staff and student exchanges, and international study programs (Nurse-Bray et al., 2019). Most of these activities depend on extensive travel, often via heavily greenhouse gas-emitting planes. This tension between academic internationalization and climate change has sparked a widespread discussion in the international higher education community.

At the organizational level, research and educational institutions are reassessing their ecological impact, taking steps to reduce it, and trying to act as role models when it comes to sustainability (Eskander & Istiak, 2022; Filho et al., 2022). Many universities have established guidelines to evaluate and restrict staff travel, substituting on-site events with virtual or hybrid ones, and fostering the creation of an environment that allows for more decentralized research (Filho et al., 2022; Nikula et al., 2022).

When it comes to faculty, the scientific community recognizes the impact of their intensive travels and saw the COVID-19 pandemic as an opportunity to establish a new normal, permanently cutting back on travel and greenhouse gas emissions (Kreil, 2021; Filho et al., 2022). However, individual scholars report that they are afraid of competitive disadvantages if they are not mobile and perceive air travel as intricately tied to doing their work 'well' (Kreil, 2021, p. 60).

For students, the situation is somewhat similar problematic, but even more pronounced. While many students are "demanding action, as evident in the agendas and activities of groups such as Students Organising for Sustainability International in the UK, the Young Academy in the Netherlands, and the Erasmus Student Network in Europe" (Nikula et al. 2022, p. 2), recent surveys indicate that international students, in particular, do not care about the environmental impact of their travel and greenhouse gas emission. For example, only

about 5.5% of Erasmus students engage in sustainable behaviors during their international travels, according to a report by Green Erasmus (2022, p. 26). This supports previous research suggesting that despite the rapid pace of climate change and the potential catastrophes it may bring in the future, many international students view global travel and study abroad experiences as a right rather than a privilege (Reilly and Senders, 2009).

These findings highlight a gap in understanding between organizations and researchers in higher education and students regarding the impact of international mobility on climate change. While institutions and scholars recognize the need to reduce their carbon footprint, students' attitudes towards sustainable behaviors while traveling can be paradoxical. Therefore, this paper aims to contribute to this field of research by addressing the following questions:

1. What perceptions and attitudes do students of international study programs show regarding climate change?
2. How do they evaluate their personal environmental impact?
3. How do they view internationalization as well as their own mobility, when it comes to dealing with the issue of flying and greenhouse gas emissions in particular?

To gain a deeper understanding of this complex issue, a qualitative case study was conducted in Austria during the winter semester of 2022/2023, focusing on two groups of international students – one attending a bachelor's program at the Johannes Kepler University of Linz and one a master's program at the Paris Lodron University of Salzburg. The second section will provide a short discussion about the state of the research in the field, before section three outlines the study design used, describes the sample, and gives insight into methodology. The fourth section will present the empirical findings and provide an in-depth analysis of the data, highlighting the different types of students that could be identified in the case study. The paper will conclude by drawing relevant conclusions and offering recommendations on how international study programs may address climate change education and foster an environment that encourages students to be more aware and conscious of their actions in an international setting.

2. State of knowledge

In response to the urgent issue of climate change, the academic community has initiated a self-reflection process on its greenhouse gas emissions. Numerous universities are implementing policies to reduce their environmental impact, and research shows that scientists are increasingly mindful of their international travel (Eskander & Istiak, 2022; Filho et al., 2022). Similarly, there is a growing body of research that examines students' attitudes towards climate change. While students generally display a high level of awareness of the issue, awareness and concern tend to be greater among those studying science and

academic subjects rather than practical or applied programs (Eskander & Istiak, 2022). Moreover, international students and those in international study programs exhibit notable differences from their peers:

1. International students, particularly those from developing countries or regions severely affected by climate change, tend to display a relatively high awareness of climate change (Uzhegova & Baik, 2022; Eskander & Istiak, 2022).
2. Students participating in international study programs, both short-term and full Bachelor's and Master's degrees, are more likely to engage in environmental campaigns, use public transportation, and recycle than regular students, but show little willingness to limit their travel behavior (Green Erasmus, 2022). Case studies have demonstrated that the level of education on climate change is less important than engagement in climate change relevant actions and workshops (Akrofi et al., 2019).
3. Researchers have noted a cognitive dissonance among students in recognizing the need for action to limit the effects of climate change and committing to changes in their personal behavior, particularly with respect to travel and consumption (Green Erasmus, 2022; Kreil, 2021; Nikula et al., 2022).

Given these observations, it is necessary to explore international students' views on climate change, their responsibility with respect to the climate, and how they perceive their academic and non-academic travels in this context (Reilly & Senders, 2009).

3. Study Design and Sample

The presented study is based on qualitative interviews conducted with students from two different international study programs at two medium-sized universities in Austria - one for a Bachelor's degree program that focuses on management and the other for a Master's degree program that focuses on leadership. Both programs target international students, require them to spend time studying abroad after their initial stay at the host university, are taught entirely in English, and emphasize in their mission statements that their students are expected to become leaders and/or internationally active experts in their respective fields. The study involved interviewing eight students from the Bachelor's program and 21 students from the Master's program. The interviews were conducted using a peer process, where trained student interviewers interviewed the selected group of students to minimize the effect of social desirability. Cluster sampling was employed to select the classes for the interviews, and all students within each selected class were interviewed. The selected class for the Bachelor's program started their studies in October 2021, so they were in their second year of studies, while the selected class for the Master's program started in October 2022, and they were in their first year of the Master's program. The interviewees were given the flexibility to choose

the time and place for their interviews. Those were completed in *CAPI – computer assisted personal interviews* – mode and thus the talks were in person, recorded and transcribed.

The age of the respondents ranged from 20 to 36 years. Three of the bachelor students identified as male, five as female. When it came to the master students seven were men, and fourteen were women. While most of the people in the bachelor's program came from Europe (two eastern Europe, five central Europe, one from Asia), the masters' program had a more diverse class. Around a quarter of them came from Latin America, another quarter from South-East Asia, a quarter from central to northern Europe. The rest came from the Middle East. One individual was from the USA.

The average length of an interview was around twenty minutes, with the shortest one taking ten minutes, and the longest one forty. Before conducting the study, interviewers were introduced to the interview guide, could prepare themselves for one week and could request coaching from the head researcher. While only a limited number of interviewers requested coaching, all of them had some training on the method in corresponding classes.

A semi-structured interview guide was used, including a consent form as well as a metadata sheet to be completed by the interviewers. The first question dealt with the *interviewees travel behavior*, before continuing with questions about the *relevance of travel for their personal and professional lives, their attitudes towards climate change and flight shaming*. The interviews were wrapped by a *summary* provided by the interviewers, that offered the interviewees a chance to amend their statements or add further information.

Next to the four main questions that had to be covered in the pre-arranged order, the interviewers were provided with a set of follow-up questions in case initial responses were insufficient.

The analysis of the data followed the method of typology building through qualitative content analysis, as outlined by Kuckartz (2016). The data was systematically organized, taking into account the relevant aspects previously identified (see section 2). Specific responses were categorized based on commonalities, coded accordingly, and then compared and contrasted with each other. Demographic information was also taken into consideration during this inductive research process. The following section presents the results in the form of a classification.

4. Results and Classification

Taking the interviews into account, five distinct types of students could be identified:

(A) The first type of student comes mostly from less developed regions in Africa or South-East Asia and either consciously or unconsciously contributes to actions against climate change, such as protesting against deforestation or promoting sustainable agriculture.

However, this group shows little concern about their (air) travel behavior and sees it as a means to create professional and social bonds and pursue individual dreams, prestige, and stature. Anchor quote: “[Air Travel] improves the quality of life where people travel to pursue dreams, connect, and gain massive achievements... I’m not seeing myself as environmentally conscious when it comes to traveling... but I want to contribute to a safe world in terms of climate stability.”

(B) The second type of student mostly comes from Western and Northern European countries as well as the USA. They are mostly younger, female students, with only one exception being male. They believe in individuality and, especially, their right to travel because it is highly important to them on a personal and professional level. They feel that they cannot be criticized, even if they harm the environment, as their individual enjoyment is more important. They are oblivious of environmental and societal issues at large and become highly emotional, defending their positions. Anchor quotes: (1) “The plane would fly to Australia with or without me... I’m an individual, I want to live my life to the fullest, and my choices don’t matter in the grand picture.” (2) “The media says flying is really bad... But everybody flies... It can’t be that bad for the environment as everybody does it.”

(C) The third type is the counterpart to the second one and consists of older students, mostly in the master's program, who are well-reflected on their environmental impact and individual behavior. They come from European countries as well as Latin American ones. They are highly aware of the issues of climate change and see hegemonic structures in place that work against substantive change. They see it as their civic duty to act against climate change and bring examples of their personal life, comparing their past actions with their present understanding of the issue. They highlight that, at least in Europe, it is easily possible to travel without resorting to air travel. Anchor quotes: “I travel by train. I plan to move from [Country A] to [Country B] for my next study destination via sharing a pickup with my classmates”; “I flew a lot when I was younger. I would sometimes flight-shame myself now.”

(D) The fourth group is mostly composed of students from South-East Asia and the Middle East. Before participating in international study programs, they were not too concerned about climate change and the impact of their often-frequent air travel behavior. However, they now reflect that more sustainable forms of travel are available. They now recognize the dangers of climate change and believe that individuals can make a difference. Anchor quote: “[...] I think my travel behavior is not environmentally conscious. Especially after this interview, I'm a bit ashamed of my answers. I've realized that some people consider other modes of transportation because of the environment and I didn't even know that.”

(E) The final group is not particularly aware of the environmental impact of their travels or of climate change in general. They also do not place much emphasis on travel, either because they have traveled in the past or because they have never considered it as important and see

it as more of a necessity. They are open to learning about climate change and there is no clear pattern in terms of their socio-demographics or background. They are a residual category. Anchor quote: “I don't think that traveling is that important to me. It's not because of climate change that I don't fly at the moment. I don't really care either way.”

5. Conclusion and Recommendations

The aim of this paper was to investigate the attitudes of international students towards climate change, their personal environmental impact, and internationalization and mobility. The results of the qualitative case study revealed worrying attitudes towards air travel and its prioritization among most interviewees. While the results cannot be quantified, they align with previous quantitative studies while providing a nuanced starting point for future studies, that may aim for generalization.

Firstly, it is concerning that international students, who are being educated to become future decision-makers, lack an understanding of the severity of the climate crisis and their own contribution to it (Nikula et al., 2022). Such apathy and lack of awareness can have disastrous effects on the planet and future generations. Secondly, five distinct groups of students could be identified, with different attitudes. Of those only one group (B), consisting of young, Western, mostly female students, who placed high value on personal enjoyment, showed no reflection on their behavior and were dismissive. Three other groups had varying levels of awareness and willingness to reflect on their impact, either before or after the interviews. And the final group (E) did not have strong opinions on climate change or travel but was willing to learn more.

Those different groups of international students with varying levels of awareness and willingness to reflect on their impact on climate change also hint at a more hopeful outlook concerning the issue, suggesting that universities and higher education institutions can play a crucial role in promoting environmental awareness and sustainability among international students. To do so international study programs need to provide transparent information on the environmental impact of individual mobility during the admission process, creating early awareness. Furthermore, international programs – no matter the discipline – should include mandatory courses on climate change and embed the topic into regular classes as well. And finally, universities offering international study programs should incentivize sustainable mobility among their students and actively promote sustainable transportation for all program-related travels. Grants need to be tied to climate friendly behavior.

By implementing such practices, students can continue to engage in internationalization and mobility programs while gaining a deeper understanding and later promoting sustainable practices, fostering a culture of environmental responsibility.

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A project-based learning approach for engaging undergraduate students in UN SDGs using GIS

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Abstract

The paper presents project-based learning conducted within a Geographic Information System (GIS) course offered to senior-level undergraduate students enrolled in the civil engineering program at the German University in Cairo (GUC) during the academic semester of Spring 2022. Project-based learning enables students to achieve competencies that meet modern society needs in relation to monitoring and assessing world countries attainment of the United Nations Sustainable Development Goals (UN SDGs). The United Nations Economic and Social Council (ECOSOC) established the United Nations Committee of Experts on Global Geospatial Information Management (UN GGIM) in July 2011, where the UN GGI mandates were identified as a motivation for conducting project-based learning with the GIS course by the author. The emphasis in project-based learning was on; SDG 11 on Sustainable Cities and Communities, and SDG 13 on Climate Action. A Model of United Nations (MUN) students' group at the university provided a simulated UN General Assembly at the end of the project-based learning activities. During this Assembly, students enrolled in the GIS course, playing roles of country delegates, delivered to the Assembly their GIS analyses and findings on the current status of SDG 11 and SDG 13 at the end of the project-based learning. The success of the project-based learning in achieving its objectives, along with engagement and interest shown from both GIS enrolled students and MUN group have resulted in plans to conduct another project-based learning during Spring 2023.

Keywords: *Project-based learning; geographic information systems (GIS); geospatial information; UN SDG.*

1. Introduction

Many studies have proposed project-based learning for achieving competency, where students are active learners; integrating knowledge, skills, and values (De los Ríos, et al, 2010). Problem-Based Learning (PBL) is a teaching method in which complex real-world problems are used as the vehicle to promote student learning of concepts and principles as opposed to mere presentation of facts and concepts. In addition to course content, PBL can promote the development of critical thinking skills, problem-solving abilities, and communication skills” (Center for Excellence in Learning and Teaching, 2022). Project-based learning allows students to acquire newly knowledge based on what they learned earlier. Power (2019) has indicated that student engagement and collaboration allow for the consolidation of such new acquired knowledge. Upon the successful implementation of a project-based learning, examples of competencies that could be achieved are; teamwork, risk-taking, accountability, problem-solving, innovation, critical thinking, and communication skills.

The study presented herein is concerned with making the students aware of the benefits of geospatial information in support of sustainable development. Student awareness of the use of geospatial information and the development of their technical skills and capabilities in handling geospatial information is considered within a project-based learning approach. United Nations Sustainable Development Goals (UN SDGs) indicators are practicable objectives for an academic course. The objectives of a GIS course taught by the author at the university to senior undergraduate students were lately augmented. Course objectives included awareness of UN SDGs. Early in 2015, prior to the project-based learning implementation, the UN SDGs related topics and themes were discussed through lectures and case studies relating to GIS and UN SDGs. Low student engagement was detected in this important topic, namely, UN SDGs. More recently during academic year 2021-2022.

The author considered project-based learning approach to further engage students in UN SDGs, and make them more aware of the importance of the use of geospatial information and the implementation of geospatial analyses tools and techniques when assessing UN SDGs indicators worldwide. Project-based learning may be categorized into three “closely related teaching techniques: case studies, role-plays, and simulations”, (Center for Excellence in Learning and Teaching, 2022). The author selected role-plays which is most fitting for a UN General assembly, where students play the roles of country delegates.

2. Project-based Learning in GIS Course

2.1. About the course

The course in the context of this paper is related to Geographic Information System (GIS) for Civil Engineering Applications. GIS is a system designed to; collect, store, handle, analyze, manage, and present spatially georeferenced data; i.e. referencing data to geographic locations on the earth, commonly known as geospatial data. Further, GIS links tabular attribute textual and numerical data with a GIS geospatial database. Through querying the GIS geospatial database, users would be able to; spatially analyze, manage large datasets, and display information in a map-like and other graphical representations for better insight and in support for decision-making processes. (Dempsey, 2001).

One of the courses that the author teaches at the university is a course on using GIS in Civil engineering applications, for the senior civil engineering students. The course introduces senior undergraduate civil engineering students to GIS in terms of; concepts of GIS, and practice GIS-based processes. First, students become familiar with types of geospatial data, such as; engineering surveys, digital maps, satellite images, and Global Navigation Positioning System (GNSS). Next, students use GIS-based geospatial analysis tools and techniques in relation to civil engineering tasks and applications, such as; terrain mapping and analysis, location selection, construction management, route planning, watershed analysis, and environmental impact studies. Students become familiar through hands-on activities with; capturing geospatial data and integrating it with attribute data as input to develop a GIS geospatial database, use GIS-based tools and analyses to query the geospatial database, and produce output depicting spatial relationships, patterns, and trends, using histograms, charts, photos, satellite images and thematic maps, for better insight and in support for decision-making processes

2.2. Motivation for the Selected Project-Based Learning

Geographic Information System (GIS) was recognized by the United Nations (UN) as an enabler in implementing and tracking progress on the UN's seventeen Sustainable Development Goals (SDGs), UN SDGs targets, and indicators. Further, it was stated that GIS and location are key technologies that enable counties to monitor and assess progress at local levels, and in worldwide setups (Brown, C. and C. Brigham, 2021)

The United Nations Economic and Social Council (ECOSOC) established the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) in July 2011, to further the cause of using geospatial information in sustainable development processes worldwide. UN GGIM adopted a Global Statistical Geospatial Framework (GSGF) as the basis for supporting efforts for combining geospatial and statistical information (Scott and Rajabifard, 2017).

The UN GGIM in 2019 specifically demanded using geospatial information and GIS-based analysis approach to improve the availability, quality, timeliness, and disaggregation of data to support the implementation of the new development agenda at all levels (FIG Task Force on FIG and SDGs (2019). In view of this important global drive that happens to overlap with the GIS interest in utilizing geospatial information, and as the instructor of a GIS course, the author decided to introduce a project-based to help civil engineering students become more aware of GIS potential contributions to UN SDGs, and have the students use their acquired GIS understanding and analyses skills, through role-playing, in project-based approach designed specifically to engage GIS enrolled undergraduate students in UN SDGs. Worth mentioning that over the years of course delivery, the use of GIS and geospatial addressed UN SDGs among topics covered by lectures and reports. However, the project-based approach presented herein was first introduced in this format in Spring 2022.

2.3. Description of the Selected Project-Based Learning

In Spring 2022, students enrolled in the GIS course were asked to form teams, and select countries, where they acted in role-playing mode as country delegates. Using GIS, students were to present as country delegates their respective GIS assessments of the selected SDG indicators to a simulated UN Session to be held at the end of the semester. The emphasis in the Project-based Learning was on; SDG 11 on Sustainable Cities and Communities (Make Cities inclusive, safe, resilient and sustainable) and SDG 13 on Climate Action (Take urgent action to combat climate change and its impacts). An appendix is given at the end of the study describing the tasks required fro students.

As course instructor, along with teaching assistants, we regularly met with students during project milestone activities. Occasional question and answer sessions were held for task clarifications and guidance through project-based learning activities during Spring 2022 semester. Each group of students selected a country from a short- list of nine countries (worldwide, namely; Belgium, Brazil, Chili, Denmark, Ecuador, Greece, Kenya, Mexica, and Norway). During the course, students were asked to role-play as country delegates, and be prepared at the end of the semester to present the report in a simulated UN General Assembly meeting. During the semester, students researched and collected geospatial data and conducted GIS-based analyses as the course progressed.

A Model of United Nations (MUN) at the university participated in the closing session of the project-based learning. MUN mirrors the mandates and activities of United Nations ECOSOC. Which made cooperating with MUN give a realistic environment for the project-based learning. Most student members of the current MUN were not enrolled in the GIS course, except for one student. MUN is considered one of the most popular and prestigious student activities in the university. MUN activities included simulating different UN functions and activities, to enhance MUN student members' personal, intellectual and social

skills of the Egyptian Youth. MUN provides hands-on experience to undergraduate students, and future leaders in the international area of diplomacy.

3. Results

Table 1 shows growing student interest and appreciation of the tasks related to the project. Early in the second week of the semesters just more that 55% of the students were engaged and had no inquiries or complaints, by the sixth week of the course the percentage of engaged students were over 70%. By the end of the course in the twelve week, and before the PBL group presentations, all students were excited and were looking forward for presenting their work to other student groups. To date, I still hear from alumni words of appreciation about this PBL experience and its impact on their views of their roles of them as civil engineers.

Table 1. Growing student interest and appreciation of the tasks related to the project.

Manage	Week	Type	Title	CountView	Complaint
View Content	2/18/2023	Supplementary notes	integration-geospatial-information-statistical-sdg-indicators	55%	none
View Content	3/16/2023	Lecture slides	Lecture 6 Metadata - NSDI	73%	none

For the presentation of PBL group work, a simulated UN General Assembly was held, at the end of the semester during June 2022. An active working group of students known as Model of United Nations (MUN), cooperated. The venue for the in conclusion of the GIS project-based learning activities was held on campus, in a large rounded hall; with layout setup, the procession of the meeting, and document format exchange, method of addressing the Assembly, were as much as possible similar to UN General Assembly official sessions. Figure 1 presents the simulated UN General Assembly session.



Figure 1. The simulated UN General Assembly session

Over seventy students enrolled in CIG 1002 GIS for Civil Engineering Applications attended as country delegates. Each country delegate delivered oral reports, in UN SDG Country Report format, presentations supported by their GIS analyses findings on the current status of each of the nine countries. The MUN General Assembly was held for three hours. Each country delegate presented a short PowerPoint summarizing the SDG country report and findings. Each country delegate was handed a UN "Resolution Template" to complete and read to the Assembly. The event was recorded by the Media Production Center (MPC) for documentation and to be used to introduce the project in the coming semesters to more students. Figure 2 presents a group photo taken at the closing ceremonies of the event.



Figure 2. A group photo at the closing ceremonies of the event

4. Conclusions

The project-based learning presented herein enabled students to independently collect new knowledge, and present it in written and oral formats that are novel to them as country delegates during the simulated UN sessions. Hence, enhancing their technical capabilities and soft skills, addressing one of the critical mankind challenges; namely, achieving UN SDGs. Further, the project-based learning enhanced engineering students' engagement and awareness of UN SDGs. As well as, encouraged students through critical thinking to relate UN SDGs to their engineering major, provided a platform for meaningful collaboration among the teams of students enrolled in the course, and fostered cross-discipline between engineering students with interest in GIS course and students with MUN student members with backgrounds from other majors. More interesting was that the project-based learning stimulated interest of civil engineering students in MUN. Owing to the success of the project-based learning implementation in the GIS course, and interest of the MUN student members at the university, plans are currently being made to conduct another project-based learning during Spring 2023 semester within the next GIS course delivery, with a new batch of

students and new country delegates, ultimately working with new student country delegates addressing simulated UN General Assembly.

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Appendix: Tasks Required from Students

CIG 1002 GIS in Civil Engineering
Spring Semester 2022

Assigned 17 May 2022

A Brief UN SDG Country Report
On Current Status With Focus On Geospatial Data
(Emphasis on SDG 11 and SDG 13)

Introduction:

The scientific literature delineates numerous benefits of geospatial information in support of sustainable development. Accordingly, the presence of geospatial information within the United Nation Sustainable Development Goals (SDG) should provide more quantifiable measures to the SDG indicators. The United Nations Global Geospatial Information Management (UN GGIM) adopted a Global Statistical Geospatial Framework (GSGF) as basis for supporting efforts for combining geospatial and statistical information. (Baraka, 2021).

https://fig.net/resources/proceedings/fig_proceedings/fig2021/papers/ts08.2/TS08.2_baraka_10997.pdf

Requirements:

Accordingly, you are asked to prepare brief country report, and make a presentation during the GUC MUN (Model of United Nation) on Thursday, 2 June 5:00 – 8:00 pm. (location to be announced). The country SDGs report will be limited to SDG 11 and SDG 13 goals, with focus on the role of the geospatial data.

Instructions:

1. You will be divided into 10 groups based on your tutorials. (Check GUC CMS)
2. Each group will select ONE “country” to represent, from country pool list assigned to each group. (Check GUC CMS)
3. The representative and co-representative of each group will notify by email Prof. Moustafa Baraka, of the country selected by his/her group, no later than Wednesday 18 May, 2022, 5:00 pm
4. As a group you will work together, prepare and upload online your country SDG report and findings, no later than Tuesday, 31 May, 11:00 pm. (link to be announced)
5. As a group you will attend a GUC MUN General Assembly meeting event at GUC. Some members from each group will be randomly selected during the event to present a 10 minutes PowerPoint to the GUC MUN, summarizing the SDG country report and findings on Thursday, 2 June 5:00 – 8:00 pm. (location to be announced).

Required Report Content & Format:

A Cover page with group members names, IDs, and the country represented
Acceptable report page range 4-6 pages including maps, figures, and tables.

A reference section for all material used have to be included

Required Presentation Content & Format:

A Cover page with group members names, IDs, and the country represented
Presentation no to exceed 10 minutes; including maps, figures, and tables.

A reference section for all material used have to be included

Important note:

For resources for the report and presentation check posted: CIG1002 - GIS - UN SDG Country Report.pdf

Take the challenge: compute the CO_{2e} emissions of your programming course

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Abstract

Sustainability constraints ask for quick and drastic changes in the ways to teach at university. Here we study the amount of carbon emissions of lecturing a first course in programming. In addition to fix costs estimations, our study relies on a pool on student mobility patterns at our university. We estimate, per campus and level of presentiality, the amount of CO_{2e} emissions of the course. Our results show that the main contributed cost of the course is not always due to transportation. Indeed, the difference in emissions between virtual and face-to-face is not huge and in some cases face-to-face is even better. This offers a discussion about the convenience of replacing face-to-face by virtual teaching through minimizing transportation emissions. We claim that the former can be made CO_{2e} competitive by disseminating the lectures across the city avoiding the use of costly traveling means.

Keywords: *CO_{2e} footprint; virtual teaching; face-to-face teaching; programming courses.*

1. Introduction and Methodology

As it is well known, the recent coronavirus pandemic caused drastic changes in Universities. The most important one was having to transform teaching from face-to-face to online in record time. The change had various consequences, some positive and others not so much. Among the positive ones we find the beneficial impact on the environment thanks to reducing CO_{2e} emissions due to transport mainly in large cities. Of the refusals, there is talk above all of the serious impact of confinement and online teaching on the mental health of young people mainly due to the lack of socialization and movement [Sahu (2020)]. As a consequence of this facts there is a growing discussion on the necessity of rethinking the teaching methodology at the university level moving from traditional face-to-face teaching to complete online teaching through virtual meetings. One of the benefits of a pure online teaching model is the possibility of implementing the so called Distributed university [Heller (2022)] in which a distributed effort to design the online courses could be used. Another one is to reduce traveling time which reverts in less CO_{2e} emissions.

In this paper, we provide a first study analyzing the teaching design among both extremes (totally online versus totally face-to-face) taking into account the environmental impact of the implementation of the course. For doing so we take as a base for our study the PROGRAMMING1 course (PRO1) of the Barcelona School of Informatics (FIB) at the Universitat Politècnica de Catalunya (UPC).

In order to estimate the total carbon emission, we separate the estimation in two parts on one side we estimate the carbon emissions due to teaching and on the other the ones due to transportation. For the first estimation, we take a coarse-view to the main carbon emission sources involved in the teaching, we identify the following ones:

- **Computer Usage:** a running computer can generate between 52 and 234 gCO_{2e}/h.
- **E-mails:** It depends on the size of the message and how large the attachments are. It oscillates between 4 gCO_{2e} (no attachments), to 19 gCO_{2e} (single simple attachment), up to 50gCO_{2e} (large multiple attachments, e.g., images) (eCo2greetings).
- **Cloud Storage:** The data centers' electricity consumption represents a total emission of 97 MT (million tonnes) of CO_{2e} a year [Masanet et al. (2020), Obringer et al. (2021)].
- **Virtual Meetings:** As for a quite standard video meeting, we could assume a 1-hour time, 25 people in it, with HD 1080p video quality. That would emit around 210 gCO_{2e} according to Zoom emissions' calculator. Turning off the camera, lowering the streaming quality and having small groups reduces the environmental footprint of the meetings drastically (up to by 96% [Obringer et al. (2021)]).

Among the previous sources, we considered only computer usage and virtual meetings. The main data centers' suppliers (i.e., Google and Microsoft) declare themselves as carbon neutral companies and are rapidly moving to buy renewable energy to match all their energy usage.

In view of that, we did not consider this source of emissions. The amount of paper in teaching is very small and thus can be neglected. It is difficult to measure the e-mail traffic, however in our experience the volume of e-mails due to teaching has been similar in face-to-face and online teaching; therefore, we did not take it into account.

The second source of carbon emissions is **transportation**. An average European car emits around 120.4 gCO_{2e}/km, a local bus around 82 gCO_{2e}/km and the underground 14 gCO_{2e}/km, approximately (European Environment Agency). These values have to be averaged by the number of people traveling together. Nevertheless, figuring out the particular transportation patterns of the students is not easy. In recent years, the UPC has given increasing importance to the sustainability of its studies and infrastructures. Taking advantage of its scientific and technical nature, and as a preliminary need to make strategic operational decisions that adapt to the future, the UPC is carrying out very interesting studies in this regard (UPC Sostenible). One of them is a study on the carbon footprint of student transportation to its different campuses [Zamata Romero (2020)]. UPC campuses are distributed throughout the province of Barcelona, but they are of different sizes and are located in cities of different size, connectivity and importance. It can be seen from the study that there are big differences in the transportation patterns (and consequent carbon emissions) of the different campuses. We analyze the carbon emissions due to student mobility when face-to-face teaching is done in one of the UPC campuses.

2. Case of Study: PROGRAMMING1 at FIB-UPC

The PRO1 course for the Bachelor Degree in Informatics Engineering at FIB-UPC receives each semester around 700 students. It is a 7.5 ECTS course, consisting in 5 hours of lessons per week (2-hours theory with 60 students/group, plus 3-hours lab with 20-22 students/group), plus approximately 7 hours of autonomous study. The course has two midterm exams and a final exam. Every exam runs for 2 hours in a lab classroom (with a PC for each student). The UPC dedicates around 20 lecturers for covering all the teaching necessities of PRO1 and two of them take also care of the coordination. Our estimations assume that all students attend all lectures. The results can be easily tuned to the adequate abstention percentages, when it is the case.

In order to calculate the cost in CO_{2e} emissions of this course, we identify the elements that are involved in its production for each type of lecture and use the power consumption calculators at Energguide and DisplaySpecification websites. Let us start with the lab sessions, where every student (and lecturer) uses a PC for working [Adán Navarro (2020)]: *Lightning*: 600Wh (32 LED tubes); *Purifiers*: 170 Wh (2 per room); *Monitors*: 300 Wh (20 of them); *PCs*: 2000 Wh (20 PC towers); *Projector*: 300 Wh; *Jutge.org*: 300 Wh (3 servers at maximum computation).

We are not considering the costs of heating/cooling classrooms since this data is difficult to estimate and, moreover, one can consider that it is probably quite equivalent to the costs incurred by heating/cooling private homes when working 100% virtually.

We consider the differences in cost for the theory sessions with respect to the lab sessions:

- **PCs and Monitors:** now only one for the lecturer that consumes about 150 Wh.
- **Laptops and Tablets:** we observed that at most 20% of the students at FIB-UPC use an electronic device to take notes during the theory lesson; so, assuming that 10 out of 60 do that, that represents a consumption of 800 Wh.

Gathering all together, a 1-hour lab class (for 20 students) at FIB-UPC consumes around 3670 W, while a 1-hour theory class (for 60 students) consumes about 2020 W. Thus, every 3-hours weekly lab session of PRO1 requires about 11 kW (2.85 kgCO_{2e}, considering that a kWh produces 259 gCO_{2e}) and every 2-hours weekly theory session of PRO1 uses approximately 4 kW (1 kgCO_{2e}).

The 700 students enrolled in the course are organized in 12 groups for the theory lessons, and in 35 groups for the lab sessions. Thus, the total approximated carbon footprint of the PRO1 lessons for those 700 students sum up to 112 kgCO_{2e} per week. Multiplied by 15 weeks, that represents an approximated total emission of 1680 kgCO_{2e} per semester (that we approximate as 1.7 mt – metric tonnes –). Please note that these costs do not include transportation, which we take care of in the next section.

3. Different Scenarios at the UPC Campuses

In what follows we calculate the costs in CO_{2e} emissions of two opposite (in terms of transportation costs) models of lecturing: completely face-to-face and completely virtual.

Face-to-face Model: Many of the big Universities in the world are placed in big cities since it is an easy way to maximize the number of students that have the university relatively near from home. Depending on the cities, these Universities are sometimes placed in huge campuses (where everything is centralized) or they may have its schools and faculties distributed within the city.

There is also a type of distributed model of big university in which the campuses are around the big city, placed in smaller cities that have a good transport connection with it. One of the big problems with this model is the high daily traveling distance of many of the students, since they use to live in the big city or in other smaller cities close to it. Cities are too close to each other to make students change their living place, but too far to avoid carbon-producing transportation. This is the case of the UPC that is distributed across the province of Barcelona and structured in big and medium-size campuses. The bigger concentration of students is to be found at the combination of Campus Nord plus Campus Sud, which are both placed at the SW-border of Barcelona (at one end of the 50-meters wide grid-crossing Diagonal street in

Barcelona). At the opposite NE-end of the Diagonal, 12 km away from the Campus Nord and Campus Sud, there is the medium-sized Diagonal-Besòs campus. UPC has other medium-sized campuses in smaller cities like Terrassa and Vilanova i la Geltrú.

As currently designed, students are enrolled to a specific campus and do not have to move through several campuses. However, lecturers might teach in different campuses on the same day with the corresponding impact in fatigue, time consumption and CO_{2e} emissions due to their mobility (even if this is not significant in comparison with the travel emissions due to all the students). As an example of this let us note that a lecturer that teaches both at Campus Nord and at Campus Diagonal-Besòs on the same day, needs more than one hour by (probably highly-crowded) bus to travel from one campus to the other (even that both campuses are inside the same city, Barcelona).

Coming back to our PRO1 course, let us calculate, in terms of CO_{2e} emissions, the cost of transportation of the 700 students of the course to each of the UPC campuses. Just to attend our PRO1 course, each student needs to move to campus twice a week (one day for the theory lessons and one day for the lab sessions); this makes 4 trips a week, which for the 15 weeks of classes it is a total of 60 trips per student. Multiplied by the 700 students of the course, it represents a total of 42000 trips.

In order to have the corresponding impact on CO_{2e} emissions of the total amount of trips per campus, we multiply this amount by the average distance of trip per person by campus and the cost in CO_{2e} emissions per kilometer per person per campus. The obtained results are shown in Table 1.

To obtain the total number of emissions due to the PRO1 course as if it were given at a particular campus it suffices to sum the total emissions due to the transportation of the students to the emissions calculated in previous section (around 1.7 mt – metric tonnes –) where only the transportation cost was missing.

Virtual Model: Under this model, students and teachers work completely remotely from somewhere outside the university, typically at home. A number of traditional Universities also offer nowadays an online option for students who wish to pursue a degree but cannot attend courses in a traditional classroom setting. The virtual university model uses the Internet to deliver classes and seminars. As we already mentioned, this is optimal in terms of transportation costs but it is not optimal in students' achievements and mental health [Son et al. (2020), Sahu (2020)].

Table 1. Transportation to the different UPC campuses. The 1st column states for the UPC campus, the 2nd and 3rd columns contain information concerning students of the different campuses individually [Zamata Romero (2020)]. The 4th column is the result of multiplying the first two (and this refers also to a single student), and the last one represents the whole emission of the semester (4 trips per week multiplied by 15 weeks and applied to the 700 students).

Campus	avg. km/trip	avg. gCO _{2e} /km	gCO _{2e} /trip	KgCO _{2e} /course
Vilanova	40	0.8	32	1344
Nautica	13	1.46	19	798
Terrassa	22	0.25	5.5	231
Sant Cugat	19	1.05	20	840
Manresa	50	0.67	33.5	1407
Campus Sud	15	0.12	1.8	75.6
Baix Llobregat	27	0.39	10.53	443
Diagonal-Besòs	19	0.29	5.51	232
Campus Nord	19	0.13	2.47	104

In order to calculate the total cost of the course in a pure virtual model we consider as fixed cost the around 1.7 mt (metric tonnes) of CO_{2e} calculated previously. This is a simplification, since we consider that the cost of lighting a classroom of 60 students is almost equivalent to the up to 60 home-spotlights used virtually, we also consider that the cost of the projector plus the air purifiers and others might be, roughly, similar to the cost of using personal computers, laptops, cell phones or tablets to view the zoom transmission during theory lectures. Considering that an hour of virtual meet for a group of 25 students contributes with 210 gCO_{2e}, the five hours per week along the 15 weeks of the course for the 28 required groups we obtain a total of 441 kgCO_{2e}. The total is about 2 mtCO_{2e}.

4. Conclusions and Further Work

On-line working, climate change and associated health problems (both mental and physical) are today trending topics. University has to be aware of that. University studies need to be redesigned to deal with this new reality. To do that, more data and more models should be developed. This work is a step in this direction. Our study quantifies in terms of CO_{2e} emissions the cost of lecturing the PRO1 course in the different UPC campuses. The results of our study show that, in terms of CO_{2e} emissions, transportation is in some cases competitive with on-line teaching. The total amount of CO_{2e} emissions of the PRO1 course at FIB-UPC is of about:

- 1.7 mt (metric tonnes), without taking transportation into account.
- 2mt, when taught 100% virtually.

- 0.5 mt are strictly due to virtuality. This is similar of the amount of CO_{2e} due to transportation of the Campus Baix Llobregat and –surprisingly– some campuses (such as the Campus Nord and the Campus Diagonal Sud, for instance) are more efficient in CO_{2e} emissions than the fully virtual version of the course.

We can observe that the campuses with highest CO_{2e} emissions per km, Nautica and Sant Cugat, are small campuses, below 800 students, offering quite specialized studies. The campuses with highest total CO_{2e} emissions, Vilanova and Manresa, are the ones with largest transportation time. They are located in small cities at around 50 Km from Barcelona. The other campuses are located inside the city of Barcelona and the average CO_{2e} emissions show that their students reach the university mostly by low emissions public transportation.

We can draw from our studies some ways to reduce the carbon emissions due to lecturing. In those cases, with costly travel, a balance among face-to-face and on-line teaching together with improvement on the public transportation will reduce emissions.

Complete on-line teaching has relevant drawbacks on mental health and sociability as it was observed in [Sahu (2020)] and therefore it should be avoided or tuned. On the other hand, as we see it, it makes no sense that every day, a student takes private transportation to travel for about 45 minutes to go to university. With the city design in mind, we envisage a model of university that tries to avoid the transportation cost by “spreading” the university across the city. We advocate for a solution having campuses distributed in the different neighborhoods of the city in a similar model to the one of undergraduate schools agreeing with the general design principles of the 15 minutes city planning [Moreno et al. (2021)]. With this idea in mind it should be possible to place university at most at 15 minutes walking distance from students and (in most cases) lecturers’ homes. The university could re-use and share existing infrastructures like civil centers for instance which in general are underused and improve on the assignment of students to campuses. In the case of late afternoon lectures schools could be reused. It makes no sense to duplicate to infinity expensive technical labs. To allow the students to work with expensive technical material they can be asked to go where those labs are placed, in general the big campuses, but only once a week or every two weeks, depending on the course, the lab, the specific topic, etc.

The data in which the present study is based corresponds to the first pool on mobility launched by our university. Due to this fact, the level of participation, especially in some smaller campuses, was low. We expect, that in the forthcoming pools participation will improve. We plan to perform a comparative study as soon as new data is available.

We are working towards devising a model quantifying other aspects involved in the learning process with regard to sustainable development goals. In particular, we want to relate the learning effort and (a quantification of) the well-being with a teaching paradigm that considers a combination of face-to-face and virtual lessons. As our goal is a medium-sized

macroscopic approach because we are not interested in countries but in university campuses. One line of work is to ground the model in the Cobb-Douglas production function [Cobb et al. (1928), Jones (2002)], that measures the GDP production of a country in terms of the capital and the labor.

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Investigating learners' perceptions of completion and certification in MOOCs

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Abstract

Understanding learners' perceptions of their own learning outcomes is critical for accurately interpreting those outcomes and planning interventions to help improve them. Past research in massive open online courses (MOOCs) shows that many learners enroll in courses they do not finish, and much research has been conducted investigating the patterns and trends driving this. This paper uses a qualitative methodology to understand how learners perceive course completion and certification, and why they do or do not meet their learning goals. Data were analyzed from fifteen interviews with learners who had enrolled in at least one MOOC. The data suggests that learners have a complex understanding of completion that varies depending on their own goals and access to the material. It also shows that they see certification as distinct from completion, and will only be willing to pursue certification under certain circumstances.

Keywords: *MOOCs, completion, certification, retention, qualitative.*

1. Introduction

Understanding student's perceptions of their own educational experiences is crucial towards interpreting their behavior, and designing materials that best meet their needs. Massive Open Online Courses (MOOCs) pose a particular challenge towards understanding learner's experiences, as they are asynchronous, online courses designed to accommodate a large scale of learners with minimal instructor feedback. Online platforms have the ability to capture user's actions in the course, allowing researchers to study behavioral patterns and trends in and across courses. Although this data is very rich, it does not give insights into the learners perceptions of their own behavior and reasons motivation this behavior. Research has shown that MOOCs have a high dropout rate, with many learners enrolling in courses that they don't complete (Khalil et al, 2014). Others have sought to characterize completion and dropouts in MOOCs (Anderson, 2013; Kizilcec et al, 2013; Zhong et al, 2017), and predict what types of learner engagement will lead to completion (Al-Shabandar et al, 2018; Kloft et al, 2014). However, defining completion in MOOCs is complicated by the various options facing learners enrolling in courses. Typically, learners have the option to audit most of the course for free for a limited time period, or to pay a small fee for the opportunity to access the full course and the opportunity to earn a certificate of completion. Much of the recent research investigating completion rates in MOOCs focuses on learners who have paid for the course, assuming that the act of paying signifies their motivation to complete the course (Reich & Ruiperez-Valiente, 2019; Roy et al, 2022). However, many studies have shown that learners have complex motivations for enrolling in courses that may not always necessitate completing the entire courses as designed (Kzılcec & Shnieder, 2015; Milligan & Littlejohn, 2017; Salmon et al, 2017). This project seeks to shed light on learner's definitions of completion and certification, and the underlying reasons surrounding their course outcomes.

1.1. Related Work

Previous research has investigated learners conceptions of course completion and the reasons behind when they do not complete. Early work from Fini (2009) in a MOOC offered in 2008 showed that learners had varying definitions of course completion, and there was not a single standard that was uniformly shared by all learners. Researchers have since sought to unpack the reasons behind these variations. Tanner (2013) found that learners often dropped out of courses because they did not meet their expectations. Others pointed to a range of factors such as conflicts arising in learners home and work lives, their perception of the course design or pedagogy, the perceived usefulness of the material, or the learner's ability to manage time effectively (Eriksson et al, 2017; Hood et al, 2015; Wang & Baker, 2018). Several studies have found that the possession of certain personal characteristics such as goal orientation, grit, and time management had an impact on completion rates (Doo et al, 2021; Fellman et al, 2020; Gupta, 2021; Kroll & Reed, 2017). This work has given important insight into the

broad trends of learner behavior in MOOCs, though questions still remain about how the learners describe their own course behavior and outcomes, particularly regarding when they choose to pay or audit the course for free, earn a certificate or not, and how they define completion. Drawing on the previous literature, this research sought to understand how learners interpret their own completion of a course, when and why they choose to purchase certificates, and what are the factors that they note for not completing a course or earning a certificate.

2. Methodology

This project utilized qualitative research methods to address the research questions, as the key interest is in the learner’s own interpretation of their learning experience. The study population of interest were adult learners (18+ years old) who have enrolled in at least one MOOC. The study used a structured sample (Shah & Gorbatai, 2015) which identified learners based on pertinent variables to the study: gender, course completion, and verified status. A sample of 60 learners was drawn from 5 courses on edX covering the topics: history, political science, research methodology, mathematics and music. 15 learners consented to participate in the study, which are described in Table 1. Semi-structured interviews were conducted for data collection, and grounded theory was used for data analysis (Strauss & Corbin, 1997). The interviews were approximately ~30 minutes to 1 hour long, and participants were invited to speak about all of the MOOCs they had taken, not only the one they had been sampled on. The interviews were recorded, and transcripts were created. These transcripts were analyzed in nVivo, and coded twice. The first codes were derived from the text itself, and a codebook was created based on these condensed codes, then the data was analyzed again using the codebook and synthesized into the findings presented in this study.

Table 1. Demographic Percentages of Sample 1, N=15.

Gender*		Course Activity*			Status*		
M	F	Sample	Explore	Complete	Audit	Verified	
%	53	47	20	47	33	40	60

Note. *Indicates variable was included in the structured sample criteria.

3. Findings

Learners described a range of outcomes and reasons for those outcomes, based on their motivations for taking the course, the quality of the course, and their own circumstances. While definitions differed slightly, overall participants defined “completion” as having completed the parts of the course relevant to their interests and motivations. As one learner

noted, “completion is to be exposed to the most relevant points of importance to me.” The outcomes presented use this interpretation, assuming learners were able to complete the course according to their own determination. The learners’ ability to complete the course is additionally hampered by their willingness to pay for gated-content, with audit students having only partial access to the material and verified students having full access. Paying for verified status also gives learners the opportunity to earn a certificate of completion if they obtain a high enough grade on the course. Participants described the reasons why they might or might not pay for verified status, and the circumstances under which they would try to earn the certificate. Table 2 presents these various outcomes for learners, and learner’s reasons for these outcomes.

Table 2. Outcomes for learners, and learner’s reasons for these outcomes.

	Completed	Did not Complete
Audit	<ul style="list-style-type: none"> - “Well-designed, engaging course” - “Complete as much as I can access for free” 	<ul style="list-style-type: none"> - Unexpected conflicts - “Wrong course”
Verified (No Certificate)	<ul style="list-style-type: none"> - “Well-designed, engaging course” - “Purchased course for full access only” 	<ul style="list-style-type: none"> - Unexpected conflicts - “Too difficult” - “Slacked off”
Verified (Certificate)	<ul style="list-style-type: none"> - “Well-designed, engaging course” - “Need the certificate for credibility” - “Sense of accomplishment” 	<ul style="list-style-type: none"> - Unexpected conflict - “Did not need too

All varieties of learners reported outcomes of completion, regardless of verification or certification status. They all also reported the quality of course design, and a positive learning experience in the course as a reason for their completion. Participants noted that “[a faculty member] who is really engaged, and seems to know their subject matter and loves teaching” as a factor in their decision to complete. Another felt that their level of learning was an important factor, noting “there was a lot of new information to learn, and I was enjoying the course actually, so that’s a huge part of it.” Others noted the course design itself, including the length of the videos and whether there was an opportunity to apply what they learned.

Many participants described being uninterested in paying for certificates, generally because they did not have a professional use for it. As one learner explained, “For work purposes, certificates are still important and in Brazil specially still important. But for personal things, I don’t think this is an important thing, I mean it’s cool to show friends and family but, in the end, it doesn’t affect much.” Others noted that the money was a factor, saying “I audit the courses and I don’t pay, and I am actually a bit furious that they push [the price], and more

and more to push for the certificate.” Still, learners reported completing as much of the course as they had access too, saying “if I don’t pay for it, I do all of [the course] that I can.”

Some learners reported paying for verified status and completing the course, but not earning a certificate. As one learner described, “I think for me, the problem is not the certificate, I want to have the full access to all the content, that is why I pay the fee.” These learners may choose to complete the course on their own schedule, once they have access to all the materials. For learners who paid for the verified status and did earn the certificate, the reason given was either out of a personal sense of accomplishment, or to use the certificate as a marker of credibility for professional or personal reasons. One participant said, “I think if one has a certificate, it also gives a sense of achievement, although maybe it won’t matter much at my level, I still felt it like happy, okay I’ve done this.” Another reported “I took those certificates because I wanted to be proud of my [skills] and I put it down on my Facebook so that all my friends could see.” Some noted that they earned a certificate because it may help them professionally in the future, “I don’t really have a use for the certificate, but in long term I can see that my interest is in [this field] and I definitely feel like in the future it will probably come in handy.” Many reported needing the certificate for professional reasons, noting the “credibility”, or the importance of certificates in their work culture, “in the Indian system they’re always looking for certificates whenever we are promoted, so you have to get a certificate for everything.”

Learners also reported many reasons for not completing a course. No matter whether the learner paid for verified status or not, all learners reported unexpected conflicts as a barrier to completing the course. As one participant said “I want to complete them most of the time, but I’ll be honest, I might have enrolled in three or four other courses which I have not been able to finish because of others things, you know I have my work assignments, I have family to look after, and I have all those requirements and then also do courses.” Other participants noted that they missed important deadlines due to a conflict that caused them not to be able to finish the course. One said, “I actually a failed a course because I didn’t make it to the final exam, because the three days it was available I was sick.”

Many participants described exploring a course before deciding to pay, to ensure that the course was worth taking. They described many reasons for dropping out of courses due to it being the “wrong course” for them. This could be because the course is different than they expected, “you realize that it’s not what is on the label, you know you get in it’s just something else.” It could also be that the course is inappropriately challenging, “they were way too easy, some of them are just so easy and silly”, or it is above their level, “sometimes the content is too much”. Others felt that the faculty teaching the course was “boring”, causing them to lose interest in completing the course.

Some participants who paid for verified status were not able to complete the course or earn a certificate due to the course being “too hard”. As one participant said, “You have to apply yourself a bit more but yeah, the ones that are hard you try to read up if you can, and if you don’t get it you don’t get it. Some of them are really hard. I see the comments from the other students that they are having the same challenges.” Others took personal responsibility for not finishing, saying “I was kind of slacking, yeah I was not watching not so often”. Another blamed their own lack of grit, saying “actually some of that has to do with self-discipline, I’ll be honest not finishing courses is probably my thing”. Participants also reported earning a certificate, but not actually completing the entire course. As one participant explained, “I wasn’t able to submit the essay on time, because I was working on the policy paper [for work] and they had the same deadlines, but I had already received a passing grade. You know, maybe I will still write that essay though, and try to publish it somewhere else.”

4. Discussion

These findings show that learners have a dynamic understanding of completion in MOOCs, depending on their interests in the material, and their willingness to pay. Learners reported feeling a sense of completion when they met their own goals for themselves, regardless of whether they had earned a certificate or technically completed all sections of the course. Indeed, learners are aware of the limitations in their ability to technically complete the course without paying to earn a certificate. As one learner said, “Usually I do everything. If I pay for it, I will do all the exams of course. And if I don’t pay for it, I do all the exams that I can.” Or as another learner explained, “If you are not interested in the certificate, you can just skip. I prefer it if I don’t see the tests, I just don’t need that I would like to keep going with the classes.” Learner’s benchmark for completion is dependent on fulfilling their own learning goals, their intention to earn a certificate, and their willingness to pay for full access to the content. Indeed, some learners paid for verified status for full access to the content, and did not attempt to earn the certificate but nonetheless felt that they had completed it to their satisfaction. This shows that learners view completion as a distinct outcome from earning a certificate. This is further illustrated by learners who reported feeling that they had not completed the course, despite earning the certificate. Interestingly, learners noted that the act of earning the certificate disincentivized them from completing the course “because [they] did not need too”.

This sheds light on previous research on retention in MOOCs which uses certification rates as a proxy for completion (Reich and Ruiperez-Valiente, 2019), suggesting that the certification rate in a course might be poorly aligned with the learners’ sense of completion. Despite this, the findings show alignment with much of the literature investigating retention in MOOCs. For instance, learners reported a lack of self-discipline and poor time management as a cause for not completing a MOOC (Doo et al, 2021; Kroll & Reed, 2017;

Fellman et al, 2020; Gupta, 2021; Hood et al, 2015; Cohen & Magen-Nager, 2016; Wang & Baker, 2018). A common reason cited for dropping out of course was that they did not find it engaging, either due to the course design, the instructors, or the level of the course (Hone & El Said, 2016; Goopio & Cheung, 2021; Chen et al, 2020). They also described having to drop out of a course because it was too hard, and they didn't feel they had access to the support that they needed (Greene et al, 2015; Aldowah et al, 2020). Finally, many learners did not complete courses due to external conflicts arising from their professional and personal lives (Eriksson et al, 2017).

While learners' sense of completion varied based on the circumstances, their understanding of certificates was fairly uniform. Most learners reported choosing to earn a certificate because they had a use for it. As one learner explained that they did not pursue certificates in MOOCs because, "I don't need the certificates for anything". Others noted that they chose to earn a certificate because they planned to put it on their social media profiles to boost their credibility and demonstrate their skills. As others have found, pursuing certificates could be used for short term professional goals, or to support long-term career trajectories (Littlejohn et al, 2016; Dillahunt et al, 2016). For some, however, a sense of accomplishment was enough of a reason to earn a certificate. One learner said, "You spend enough time reading, putting in all the hours, so why don't you get a certificate? I have to get the certificate." Another reported collecting almost 50 certificates in a binder as keepsakes to demonstrate her learning journey. Learners decisions about when and why to earn certificates depends on whether they had an internal or external use or need for the certificate.

5. Conclusion

This study sought to characterize the ways in which learners perceive completion and certification in MOOCs by conducting interviews with MOOC learners. The data suggests that learner's definition of completion is complex and relative to their own personal goals and perception of the material. It also shows that learner's perceptions of completion are distinct from the process of earning a certificate, which may or may not be in alignment depending on the circumstances. Finally, the data shows that learners typically only choose to earn a certificate if they feel they have a use for it, whether personal or professional. Further research could shed light on how pervasive these variations are across the population of learners, as well as point to interventions that could be useful for some learners to help them accomplish their goals.

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An augmentation framework for efficiently extracting open educational resources from slideshows

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Abstract

Open education is a way of carrying out education, often using digital technologies. This paper gives a brief background on open education and its constraints. To make courses more accessible, teachers need to have an effective way to preserve and share their materials. We derive the requirement of keeping the choice of tools completely open while we pave the way to a teaching transport format based on open standards allowing for extending existing lecture material with interactive content. A simple learning system that helps to detect and save changes of a slide deck was developed. The linkage of relevant knowledge and interactive context can also be added through this implementation which outputs a final transport format. This provides a good starting point for future work on removing learning barriers and widening access to education.

Keywords: *Open education; online material generation; software tool.*

1. Introduction

Open education is widely acknowledged as important for successful learning for university students. Research across disciplines has demonstrated that well-designed online learning can enhance students' motivation and improve their learning (Hegeman, 2015; Zheng et al., 2017). Online learning further played a crucial role during the past years with the COVID-19 pandemic and lockdowns, when attending in-person lectures for teachers and students was severely constrained.

From a more general perspective, open education is a modern movement aiming to make access to education easier hoping to stimulate other fields of political and societal which including lifelong learning (United Nations, 2015; Zawacki-Richter et al., 2020). In the current debate, open education is often reduced to open-access learning over the Internet. We are convinced that this perspective is only partly valid, as open education is not only about openly accessible education over the internet but is supposed to transform existing learning paradigms including frontal teaching and teaching in presence in all educational formats from primary school to high school and university.

One consequence of this perspective is the fact that traditional teaching formats like frontal teaching using a blackboard, slideshow presentations, conversations in class, group work and project work are to be part of open education and we want to make them more visible, as they are the backbone of education for a long time. Most professors in universities and teachers in schools are expected to give classes in presence. For traditional methods of teaching, it is evident that slideshows – despite us knowing that they have limitations – find wide adoption. Unfortunately, transforming such slideshows into interactive online teaching material turns out to be difficult and laborious.

Furthermore, playing out such educational material remains challenging. While software like PowerPoint is routinely used to generate slideshows that often serve their educational purpose quite well, the shareability is limited. Very often, slideshows are converted to PDF to share online and prevent editing, in which animated slides cannot be read very nicely.

This paper aims to describe a novel and simple procedure to enable teachers using traditional formats such as a slideshow to progress in opening and enhancing their education towards more aspects of good open education while avoiding a radical change such as changing the underlying toolkit. We comment that a similar framework can be applied to any temporal-visual system, for example, a blackboard lecture could be held once on a digital blackboard and augmented very much along the same lines. Furthermore, we note that the procedure is future-proof in the sense that future updates to the teaching material do not break augmentation and that it does support advanced visual aids such as animations out of the box.

2. Background

In response to COVID-19 pandemic lockdown measures, higher education like universities closed their premises. Although such institutions were quick to replace face-to-face lectures with online learning, these closures affected learning and examinations as well as raised questions about the value offered by higher education which includes networking and social opportunities. To remain relevant, universities will need to reinvent their learning environments so that digitalization expands and complements student-teacher and other relationships (Schleicher, 2020).

One obvious measure to stay relevant is by adopting state-of-the-art good learning practices throughout the curriculum. Learning resources are mostly part of a curriculum designed to fulfil certain learning goals and have the purpose to satisfy certain learning objectives, and it is therefore essential to achieve a successful learning experience for the students. In the following, we would like to highlight some aspects of good learning, not to provide a theoretical discussion, but interlink with our work.

One aspect is the shift from teacher-centred learning to student-centred learning. While the input slide deck might originate from the former, we see the potential of our tool to help transition the material to the latter in the process by deconstructing, enriching, and augmenting it. Another aspect is competencies-based learning, which can be enhanced to the point of an active learning experience by augmenting an existing slide deck with interactive content. With respect to another aspect, constructive alignment, one could for example augment a slide deck with a self-test.

The main goal is to facilitate the transition to an (inter-) active open online learning experience for students, as it has been shown that a student-centred approach, as well as online learning and active learning, can be beneficial to the learning outcomes of students (U.S. Department of Education, 2009; Hegeman, 2015).

3. A Simple Learning System Concept

Many learning systems are implemented, designed, and share a large set of features, unfortunately, combined with high complexity in using them all. For example, the online teaching system Moodle has found wide adoption and provides a decent set of features most of which are, however, difficult to implement especially in hybrid courses which shall be taught synchronously in presence and over the internet at the same time. Excellent teaching material is currently non-open and frequently available as slide decks while open education would require a modularized presentation based on open standards supporting interactive contents and linking of open resources. In simple words, an experienced teacher might ask you: “How do I get my slide deck into your system?”

We propose to maximize the simplicity of turning existing education into a form in which they can grow towards open education by replacement of problematic sections¹ and augmentation *within the teacher's tools*. While teaching material for teaching in presence requires considering temporal constraints of the teaching situation (e.g., lecture time), open online education should provide a more flexible temporal layout in which the learner can progress self-paced. For building a bridge between existing, high-quality teaching material with a strict temporal organization used in class and flexible open education, we need to define a system that supports segmentation into smaller pieces (“units that can be skipped or replaced with an imported other unit”) and augmentation with additional material (background information, additional pieces to consider, challenges, quizzes, tasks, etc.). With many teachers relying on slide deck presentations, an online teaching system for a diverse body of teachers and a diverse audience needs to provide a few key features:

- Feature 1: The framework shall enable teachers to convert their existing material into open education material with zero or low complexity in terms of work (time) and learning.
- Feature 2: The framework shall enable the sustainable extension of existing material with online-only features such as quizzes and background information linkage.
- Feature 3: The augmentation scheme shall not be limited to content, but also include curricular logic by, for example, linking or proposing other (micro-modules) to learn or linking with a knowledge base.

We realize a research prototype of such a system and are aiming at using it in large-scale research studies within the national research data infrastructure NFDI4Earth for our education. Based on the existing teaching material of the partners involved, we want to pave the way to accessible and high-quality online teaching, preferably reusing existing material. Note that this is perfectly in line with the principles of findability, accessibility, interoperability, and reusability (FAIR) which have recently been applied to open education as well. Findability is improved by fragmenting temporal teaching material and augmenting it with metadata, accessibility is provided by open internet access, towards interoperation, we use only industry-standard datatypes (e.g., MPEG video) and community-driven standardized representations (e.g., H5P). And reusability is provided by the editable and extensible nature of our output H5P containers and the explicit integration of all tools that can map the temporal teaching material to a video. While we demonstrate the system on slide decks, note that this can be easily extended and applied even to handwritten text on a digital blackboard.

¹ we decide to use the unclear term problematic here as it covers all legal, ethical, didactical, or otherwise occurring limitations of the value of a shared version as opposed to a version used in the original learning context.

- *Decision 1:* For the prototype, we decided to first concentrate on slide decks and rely on the **video export features** ubiquitously available in slideshow software to bridge existing slideshow technologies.
- *Decision 2:* The **linkage of background information** must be implemented within the teachers' toolkit (e.g., PowerPoint) as only in this way future structural modifications like inserting slides do not break the linkage and the improved version can still be edited with the already established software knowledge of the teacher.
- *Decision 3:* As a **transport format** for open education, we rely on the idea of H5P containers. Such containers are essentially collections of presentation software and content that are based on open standards and can be readily deployed to existing teaching systems like Moodle or ILIAS.

The transformation procedure is then structured as follows: Starting from slides, we first use the teacher's software to convert the results to video. Opposed to exporting as individual slides, we can perverse all animations and videos that might be embedded in the presentation. Furthermore, presentations on a digital blackboard with a pen can as well be recorded as a video stream while most digital blackboards do not have a suitable concept of a slide that we could use and especially in handwritten lecture notes, the genesis of the material as a video is more valuable than the final page. We then implemented a simple software that decodes the video frame by frame and tracks significant visual changes. For each longer time period without significant visual change, we emit an image slide. For longer periods of change, we emit a slide showing a video segment (e.g., for animations). These sequences are then automatically assembled into an H5P container using image slides and video slides.

3.1. Basic Augmentation through Pictograms

Now, you can easily imagine that the simple procedure works well but will have some pitfalls. For example, in animations, it should be possible to generate key frames, that is, we need a mechanism that the teacher selects that a certain visual state within the animation is going to be used for longer time as a slide. Furthermore, you might realize that some parts are good for presence teaching but might not be ideal in online scenarios. For example, a presentation in a school could contain instructions such as "We need your math book today" or university lectures could contain information, especially directed to online participants such as when exactly the lecture starts.

These functions are implemented in our framework with a visual language that contains certain pictograms triggering the required behavior in the processing of the video slideshow. Table 1 contains the visual language used for our current version of the prototype. This visual language is sufficiently simple and can be implemented in any slideshow system that is able to show images. In addition, good usability can be provided by extending the toolbar with

buttons that insert exactly these images or with a small tool that efficiently provides these images through the clipboard of the operating system.

Table 1. Pictograms (icons) with their conditions, semantics, and actions.

Icon	Condition, Semantics, Action
	<p>When this pictogram is visible, emit a snapshot of the middle frame of visibility of this pictogram as a still image slide.</p> <p>Note that this can be used in animations by a sequence of showing followed by removing this pictogram to generate a still image slide within an already existing animation.</p>
	<p>While this pictogram is visible, no output frames can be emitted or (based on a prerequisite) an error message is shown or the output is blurred significantly and overlaid with a message.</p>
	<p>This marks the start of an autoplay section. That is, from the time on, this is visible, we will emit the plain video segment as a video slide.</p> <p>This allows for supporting pseudo-animations, for example, when multiple slides are used for something that should be an animation. This has often been done to facilitate reasonable PDF export and printing.</p>
	<p>This marks the end of an autoplay section.</p> <p>Note that this does not emit a still frame, hence, the video might be looping or whatever preset we are having. If you want to have the result as a slide, you can combine this with a camera icon.</p>
	<p>This icon denotes a chapter start.</p> <p>In this case, optical character recognition (OCR) can be used to extract the text depicted in the largest font as the title of the chapter and to build a Table-of-Contents using this information.</p> <p>Such a structure can also be used for skipping forward and backward in long presentations.</p>

4. Demonstrative Implementation

The proposed system is implemented as a computer vision system based on a rather simple heuristic of change detection. As a first step, we decode the video frame by frame. For each frame, to save computation time and increase stability with respect to video coding artifacts, we perform a resize operation to a size of 256 x 256 pixels, convert the color space to grayscale, and extract edges using the Canny detector with thresholds of 50 and 200. With this representation, we scan through the video and compare each frame with the next frame

using a normalized correlation coefficient $R(x, y)$ as given in the following formula for two grayscale images T' and I' .

$$R(x, y) = \frac{\sum_{x', y'} (T'(x', y') \cdot I'(x + x', y + y'))}{\sqrt{\sum_{x', y'} T'(x', y')^2 \cdot \sum_{x', y'} I'(x + x', y + y')^2}}$$

For an example slide deck, this leads to a correlation profile between slides as depicted in Figure 1. In this figure, one sees strong peaks away from almost perfect correlation (e.g., $R = 1$) for each slide change. Hence, for detecting a slide change, we propose to use a threshold of $\tau = 0.5$. As a second observation, you see small regular peaks which are related to keyframes of the MPEG codec and providing artifacts. However, you also see that the third slide has some non-trivial correlation. This slide has a small animation (e.g., a small circle moves around). This leads to an overall high correlation as most of each pair of frames is the same, but we need to detect this movement. Therefore, we employ a trick: We incrementally build a sum image of all edge-detections while we do not detect a frame change. And as soon as we get a frame change, the correlation of this sum image with the last image of the previous frame is computed to detect, if there is an animation. Figure 2 depicts this situation for our animation: while almost all frames are very similar to their successor, the sum of all frames clearly depicts the movement of the ball and does not well correlate with any of the frames of the animation. Hence, if this correlation is low enough, we mark the previous range of frames as an animated region that needs to be kept in a video format as opposed to creating a still image representation in H5P.

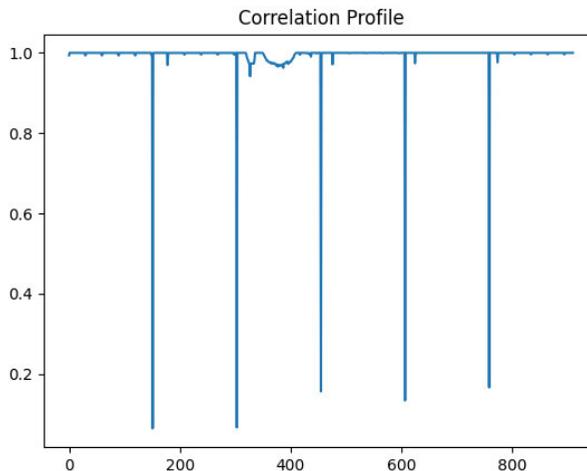


Figure 1. Video frames correlation profile.

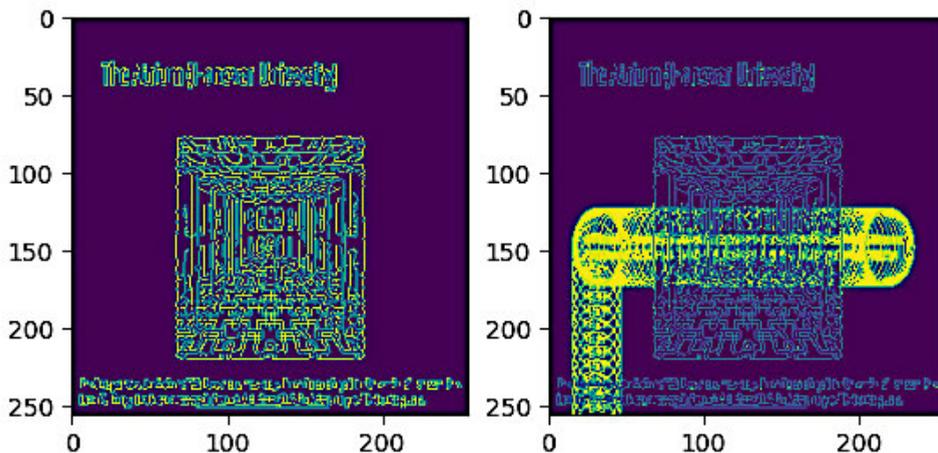


Figure 2. Sum of correlations.

During the scan, we also employ template matching with the library of defined symbols. For this template matching, we assume that the aspect ratio of the symbols is the same and that the scale is kept similar with the template. Under these assumptions, we can use the same correlation technique (edge detection followed by computing the normalized correlation coefficient), but this time sliding the template over the frame. Varying the frame resolution introduces the required partial scale invariance and symbols can be detected.

This processing stage then provides the following information: the decomposition of the video in slices related to each slide, the information on whether a video slice contains significant animation, and for each frame the presence of any of the symbols from the symbol library. From this information, an H5P container can be generated which contains all the required features.

5. Conclusion

With the proposed simple method of content augmentation without additional or external toolsets, just where the teacher is used to be, we hope to enable most university teachers to share high-quality interactive content and to improve step by step towards open education.

The framework is implemented and demonstrated for PowerPoint, but the augmentation scheme is general and completely independent of any presentation software or framework, as the functionality is driven by visible elements.

For future work, the complete set of features including PowerPoint animation, voice explanation and interactive materials (reference links and quizzes) should all be embedded

into one file. Teachers can then easily share it online within and out of their own universities for open education.

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ChatGPT in higher education: the good, the bad, and the University

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Abstract

This research examines the opportunities and risks of artificial intelligence (AI) in the context of higher education, using ChatGPT as an example. The hype around AI tools in education has led to a skeptical attitude among many educators towards this technology. Based on a comprehensive literature analysis, the opportunities and risks of ChatGPT in higher education are identified and analyzed. The research concludes with a recommendation for a sensible use of ChatGPT in higher education. The results of this study can support educators in their decision-making process on whether and how to use ChatGPT as a tool in their teaching contexts.

Keywords: Artificial intelligence; higher education; ChatGPT.

1. Introduction

The potential that artificial intelligence (AI) offers for the teaching and learning process is diverse, providing new opportunities for personalized and effective education (Zawacki-Richter et al., 2019). AI technologies are gaining increasing importance in universities, as confirmed by a survey of university leaders in Germany in 2019: AI technologies offer a range of opportunities for personalized and effective education, with 26.4% of universities already using AI, machine learning, text mining, and data mining in their research and teaching activities (Gilch et al., 2019). In addition, universities are increasingly offering courses in AI, integrating AI modules into the curricula of courses, and developing interdisciplinary study content to provide basic digital and AI-specific ‘literacy’ (Laupichler et al., 2022; Mah and Büching, 2019). Thus, AI plays a key role, especially in the context of digital transformation of higher education, and AI applications, such as intelligent tutoring systems, teaching robots, learning analytics dashboards, adaptive learning systems, personalized learning systems, assessment and feedback systems, human-computer interaction, or intelligent virtual reality, have become established over the years (e.g., Bearman et al., 2022; Ouyang et al., 2022; Hinojo-Lucena et al., 2019; Zawacki-Richter et al., 2019; Ma and Siua, 2018).

However, there are also concerns about AI’s potential risks in higher education, including reinforcing existing inequalities, increasing plagiarism, and replacing teachers (e.g., Cotton et al., 2023). In this context, ChatGPT (Generative Pre-trained Transformer), a language model for providing conversational responses, is attracting a lot of attention in higher education, with potential applications for text analysis and automation of writing tasks (Zhai, 2022). ChatGPT is developed by OpenAI and has been trained on a massive amount of human-generated text data using the “Transformer Network” machine learning technique for natural language processing (OpenAI, 2022). As a result, ChatGPT has a comprehensive understanding of human language and is able to have human-like conversations. ChatGPT can therefore be used for a variety of applications in higher education, such as text analysis or the automation of writing tasks, making it a tool with far-reaching implications for teaching. Therefore, ChatGPT has the potential to revolutionize applications and services related to universities. This, in turn, calls for critics as well as advocates.

This research seeks to address this disconnect by exploring the opportunities and challenges associated with the use of ChatGPT in higher education. Specifically, this paper addresses the following research questions (RQ):

- RQ1: What are the opportunities and risks of using ChatGPT-based chatbots in higher education?
- RQ2: How can ChatGPT-based chatbots effectively shape teaching, learning and administrative processes in higher education?

To answer the RQs, this paper identifies and analyses the advantages and disadvantages of ChatGPT based on a literature review and provides recommendations for the effective use of ChatGPT in higher education. The aims of the paper are (1) to contribute to the understanding of the role of ChatGPT in higher education, (2) to provide insights into the opportunities and challenges associated with its use, and (3) to help educators make informed decisions about the use of AI in higher education.

2. Literature review

To provide an overview of the current use of AI technologies, specifically ChatGPT, in higher education, a systematic literature review was conducted. However, the heterogeneity of European universities (Lepori, 2022) makes it difficult to collect a complete and up-to-date literature review. Therefore, the aim of this thesis is to identify key literature on the implementation of AI technologies in higher education. As a result, the review results presented in Chapter 3 do not claim to be exhaustive. Rather, it is intended to provide a general orientation of the literature. The following section describes the literature review procedure, which follows the methodology of Mikelsone and Liela (2015).

Prior to conducting a literature review, the following criteria were used to narrow the search area: (1) *Content limitation*: The literature reviewed is intended to be as comprehensive as possible in highlighting different approaches to implementing AI in higher education contexts. For better comparability of approaches, the term “university” is used generically, without specific reference to individual disciplinary orientations within higher education. (2) *Linguistic limitation*: The focus of the literature review is on European higher education institutions. Therefore, for better comparability, only English language literature is used for this study. (3) *Type of publication limitation*: To achieve the best possible and appropriate results through the literature review, research papers, conference papers, proceedings, monographs, books, and dissertations are examined and evaluated. (4) *Time limitation*: Since the focus on AI in higher education, especially on the recently published ChatGPT, implies the identification of only a few sources, there is no limitation on the time of publication. Nevertheless, an attempt is made to consider current literature.

The literature review is based on an extensive keyword search of the following literature databases: *Google Scholar*, *Scopus*, *Ebsco Academic Search*, *ScienceDirect*, *Emerald Insight*, and *Sage Journals*. The search was conducted in several steps: First, a complete overall search was performed. The keywords were combined into a search string: Each main keyword was AND-linked with the corresponding thesaurus terms, while the latter were OR-linked, e.g., “ChatGPT” AND “higher education” OR “university”. The search was then restricted to article titles, abstracts, and keywords. In a second step, the first results were limited to fully accessible publications only, and in a third step, duplicates within the results

were eliminated. Finally, the results were analyzed by reading the abstracts and references of the remaining research papers. Again, publications that did not address the research problem were excluded.

3. Research findings

As predicted before, only a few scientific papers were identified in an initial search. One reason for this is that ChatGPT was first published in November 2022 (OpenAI, 2022). Therefore, the keywords “artificial intelligence” and “AI” were added to the initial keywords and the search was performed again. Finally, a total of 120 literature sources were identified, of which 88 sources were considered for this study after the elimination of duplicates. The content of the collected publications can be summarized in the following topics:

- The implementation of ChatGPT in the context of higher education (e.g., Döbeli Honegger, 2023; Cotton et al., 2023; Zhai, 2022).
- The use of AI technologies in teaching, research, and development (e.g., Ouyang et al., 2022; Mah and Büching, 2019; Zawacki-Richter et al., 2019).
- The teaching of AI-specific digital literacy and curriculum development (e.g., Laupichler et al., 2022; Wannemacher and Bodmann, 2021; de Witt et al., 2020).
- The development and use of AI-based learning systems, including chatbots or feedback tools (e.g., de Witt et al., 2020; Seufert et al., 2019).
- Ethical aspects of the use of AI applications in higher education (e.g., Bearman et al., 2022; Zhai, 2022; de Witt et al., 2020).
- Future scenarios and potentials of AI technologies in higher education (e.g., Wannemacher and Bodmann, 2021; de Witt et al., 2020).

The following sections discuss possible trends, opportunities and challenges, and recommendations for implementing ChatGPT and AI in higher education.

3.1 Opportunities and risks

First, the opportunities for ChatGPT in higher education are summarized before the identified risks are listed. This provides an answer to the first research question.

Developing digital literacy: ChatGPT can be used in general to learn how AI works, what the consequences of its use are, and how AI specifically changes working with and on texts. In addition, students can learn to critically question the origin, composition, and quality of AI-generated data (e.g., Laupichler et al., 2022; de Witt et al., 2020).

Supporting scholarly practices: ChatGPT can support researchers in carrying out scientific work, such as conducting literature searches, analyzing and evaluating data, recording experiments, or producing scientific texts (e.g., Cotton et al., 2023; Zhai, 2022)

Automated student support: ChatGPT can be used to quickly and efficiently assist students with questions about their courses, assignments, exams, or other academic matters (e.g., Cotton et al., 2023; Zawacki-Richter et al., 2019).

Personalized learning support: ChatGPT can be used as a tutor to help students with concepts and skills they are struggling with. For example, ChatGPT can optimize texts based on given criteria and adapt them to different needs (e.g., Bearman et al., 2022; Ma and Siua, 2018).

Encourage creativity: ChatGPT can function as a creativity technique, using unexpected or incorrect answers constructively, e.g., to deviate from well-trodden paths of thought or to stimulate one's own thought processes (e.g., Cotton et al., 2023; Zhai, 2022).

Generation of text passages, summaries, and formats: ChatGPT can quickly generate suggestions for text passages, analyze and summarize longer texts, and generate suggestions for special formats (e.g., press releases, blog posts) from existing texts (e.g., Döbeli Honegger, 2023; Zhai, 2022).

Encourage interaction and collaboration: ChatGPT can be used to motivate and help students interact and collaborate with each other by serving as a moderated platform for discussions and questions (e.g., Cotton et al., 2023; Ouyang et al., 2022).

However, ChatGPT is not perfect and may sometimes generate inaccurate or inappropriate responses. The following additional risks exist when using ChatGPT:

Biases and training through inputs: Using ChatGPT can introduce various types of bias because the data used to train the model may contain certain distortions and imperfections that become embedded in the model and may be reflected in the responses it generates. Examples of possible biases include (1) gender bias, (2) race and ethnicity bias, (3) political bias, or (4) incomplete data bias (e.g., Brennan, 2023; Zhai, 2022).

Misinformation: ChatGPT not only generates text, but also offers explanations for scientific contexts. In addition to incorrect, randomly generated citations or sources, misinformation is also possible (e.g., Döbeli Honegger, 2023; Cotton et al., 2023).

Difficulty in evaluating the results: It is difficult to distinguish texts generated by ChatGPT from those written by humans, as the source of the result remains opaque. This also makes it difficult to detect misinformation (e.g., Döbeli Honegger, 2023; Cotton et al., 2023).

Lack of consideration of current and scientific sources: Because ChatGPT's database is not currently up to date, relevant information may be missing. Also, results from scientific studies that are not freely available are not considered (e.g., Döbeli Honegger, 2023; Cotton et al., 2023).

Unclear authorship: It is currently unclear how text generated by ChatGPT should be cited in publications. It is also unclear to what extent ChatGPT's use of existing documents may violate copyright, even if the content is not copied literally (e.g., Döbeli Honegger, 2023).

3.2 Recommendations for implementation in higher education

Based on the results of the literature review, the following section provides recommendations for the implementation of ChatGPT in higher education. This will answer the second research question.

ChatGPT as a tool for teachers: ChatGPT is particularly suitable as a working tool for teachers. The focus here is less on automated text generation. Instead, experimenting with ChatGPT should sensitize teachers and give them ideas for their lessons, such as ideas for quiz questions, arguments for pro-contra discussions, or impulses for role plays. ChatGPT can also help create individualized materials, such as assignments for students. It can also transfer existing content into new formats, such as scripts for podcasts or instructional videos. It can also help streamline instructions, overviews, and the like, and create standardized text types such as event descriptions.

ChatGPT as a didactic element of courses: Teachers should use the chatbot as part of their teaching approach, which limits the privacy issue to the teacher's data. In addition, the use of ChatGPT should be transparent to address the potential and risks of AI systems and to promote the development of digital literacy among students. Didactic scenarios could include identifying fake news, managing discussions, comparing summaries, comparing text formats and writing styles, and developing criteria for a successful scientific text.

Use of ChatGPT in exams: The use of ChatGPT in the context of examinations (e.g., written exams, term papers, presentations) naturally poses an increased risk of cheating, especially since current plagiarism detection software does not yet recognize ChatGPT-generated texts as plagiarism. Even though tools are being developed to detect ChatGPT texts, concerned and uncertain lecturers should refrain from traditional term papers or take-home exams, or only use them in combination with an oral defense. If ChatGPT is to be used as a tool to assist students in the future, there will inevitably be new rules requiring students to indicate which tools they have used. ChatGPT could also be a reason to change the culture of examinations at universities to one where students refrain from cheating and recognize the value of academic integrity.

4. Conclusions and outlook

In conclusion, the use of AI, particularly ChatGPT, in higher education is attracting attention due to its opportunities and implications for teaching and learning. However, there are also concerns about its potential risks. This paper aims to address this disconnect by exploring the

opportunities and challenges associated with ChatGPT in higher education and providing recommendations for its effective use. A literature review of European universities and their use of AI technologies in higher education was conducted to provide a general orientation of the field. Based on the results of the literature review, this research also aims to contribute to the understanding of the role of ChatGPT in higher education and to help educators make informed decisions about using AI in higher education.

Currently, any specific recommendations for the implementation of ChatGPT should be understood as impulses for reflective experimentation and as an invitation for discourse on the design of AI-based teaching in higher education. It should be emphasized that an uncritical and automated use of the results of ChatGPT is not recommended. Furthermore, the opportunities and risks summarized in this paper should always be understood in relative terms, as they are based solely on the results of the literature review. An exact representation of the real opportunities and risks is hardly presentable, since a feasible evaluation always depends on the concrete context and the objective.

Like other new digital tools, ChatGPT presents both opportunities and risks. However, by making AI accessible at a low threshold, ChatGPT can be expected to make qualitative leaps compared to previous digital developments, the consequences of which cannot yet be assessed with certainty. Regarding the implementation of AI-based technologies in higher education, Hinojo-Lucena et al. (2019: 1) state that “this technology is already being introduced in the field of higher education, although many teachers are unaware of its scope and, above all, what it consists of.” In this context, this paper contributes to filling this gap, and the authors accordingly recommend further research, both qualitative and quantitative, on the implementation of AI in the different activities of higher education, not only in the context of teaching and research, but also for administrative, recruitment or accreditation tasks.

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ChatGPT in the classroom: friend or foe?

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Abstract

The use of Artificial Intelligence (AI) and specifically, OpenAI's ChatGPT, has been increasing in the educational field as a tool to enhance learning and teaching processes. Understanding the potential of ChatGPT in the classroom is crucial for instructors and educators because it can provide significant benefits in the preparation of classes, exams, and instructional materials. But it is even more crucial to understand how students may use it because many will use it regardless of its adoption by the instructor.

This paper analyzes the potential of ChatGPT in the classroom, exploring its applications as a writing assistant, study tool, personal tutor, and more. Our aim is to shed light on the present capabilities of ChatGPT in higher education and to provide a comprehensive view of its advantages and challenges.

Keywords: *Artificial intelligence; ChatGPT; pedagogy, technology.*

1. Introduction

The integration of Artificial Intelligence (AI) in education has been a growing trend in recent years. Early applications of AI in education focused on providing more efficient and effective ways to support the learning process, such as automated grading and personalized learning (Zawacki-Richter et al. 2019). With the advent of language models such as ChatGPT, the use of AI in education has become even more accessible, as these tools offer a more human-like interface.

ChatGPT is a language model developed by OpenAI (OpenAI Team 2022) that utilizes AI techniques to generate human-like text. It is based on a Generative Pretrained Transformer (GPT) model, which predicts the probability of each word to occur next conditioned on the previous words in a text, and based on the training dataset (Floridi and Chiriatti 2020). This way, it is capable of completing sentences, paragraphs, or entire articles based on the context provided as input. The model has been trained on a vast amount of text data and in multiple languages. Its ability to perform language-based tasks offers a great opportunity for instructors in a wide variety of fields. The natural language interface is its disruptive characteristic, as it enables instructors and students to easily incorporate AI without requiring dedicated software or coding skills.

In a higher education context, ChatGPT can be used to enhance the teaching and learning process in a number of ways. For example, it can assist students in generating written responses to prompts or questions, helping them to improve their writing skills. Additionally, ChatGPT can provide students with personalized feedback on their work and answer their questions in real time. It can also be used as a study tool by generating summaries of key concepts and providing students with practice questions to help them prepare for exams.

Another way to use ChatGPT is as an assessment tool, where it can automatically grade student responses to some open-ended questions, providing teachers with data on student understanding of a topic. It can also be used as a content creator by generating educational materials such as quizzes, worksheets, and lesson plans.

Understanding the potential of ChatGPT in the classroom environment is crucial for instructors and educators because it can provide significant benefits in the preparation of classes, exams, and instructional materials. But it is even more crucial to understand how students may use it because many will use it regardless of its adoption by the instructor, so assignments and exams must be prepared accordingly. The objective of this paper is to examine the current state of AI in education and its potential as a tool to support the teaching and learning process. The paper aims to provide an overview of the benefits of using ChatGPT in the classroom and to discuss the main challenges and pedagogical concerns that must be considered. It is worth noting that the use of AI in education is still in its early stages, and further research is needed to fully understand its effects and potential limitations.

The remainder of the paper is structured as follows. In Section 2, a literature review is presented, which covers the current state of AI in education and its potential applications. Section 3 explores how ChatGPT can be used for good, to create content and assist students. Section 4 reviews some of the challenges regarding the integration of AI tools in classroom. Finally, Section 5 draws some concluding remarks.

2. Earlier uses of AI in education

There have been a number of previous applications of AI in education that have aimed to enhance the learning and teaching process, from planning to assessment (Pender et al. 2022). One of the most notable examples is the use of AI-powered educational games and simulations. These games and simulations use AI algorithms to adapt the level of difficulty and provide personalized feedback, making the learning experience more engaging and effective (Bennani et al. 2022).

Another area where AI has been applied in education is in the development of intelligent tutoring systems (ITS). These systems use AI algorithms to provide students with personalized feedback, guidance, and support based on their unique learning needs. ITS have been shown to be effective in improving student performance, particularly in subjects such as mathematics and science (Mousavinasab et al. 2018).

The utilization of automated writing evaluation and natural language processing (NLP) in the analysis of student writing is also an application of AI in education. NLP algorithms can be used to identify and correct grammatical errors, provide feedback on the coherence and organization of writing, and identify plagiarism. This can help to improve student writing skills and reduce the workload of teachers who have to grade student work (Wang et al. 2013; Bohra and Barwar 2022).

AI has been used in automated assessment and scoring, where AI-based algorithms are used to grade student responses to open-ended questions (Zhang et al. 2022; Smith et al. 2020). This can help to provide teachers with data on student understanding of a topic and can also reduce the time required to grade assessments. This is particularly relevant in large class environments or in Massive Open Online Courses (MOOC) (Vittorini et al. 2021).

Chatbots are one of the closest antecedents to ChatGPT in education. They have been used in e-learning platforms to simulate one-to-one interaction with instructors and provide personalized feedback (Clarizia et al. 2018), such as suggesting to follow some tutorials or watch some videos according to some rules. However, the versatility of such chatbots is limited because they are like scripted conversations with linear flows (Kuhail et al. 2022). ChatGPT's advanced natural language processing capabilities enable it to generate more sophisticated and contextually appropriate responses than traditional rule-based chatbots.

3. ChatGPT for good

3.1. Content creation

ChatGPT can be utilized to create custom quizzes on a variety of topics and modalities, such as multiple choice, true/false, fill-in-the-blank, or matching questions and answers. By asking it to "Generate a multiple choice quiz on the Consumer Theory," for example, it can provide a set of well-crafted questions and answers that can be used in classes or exams. The ability to easily generate quizzes on any subject matter makes ChatGPT a valuable resource for educators. Figure 1 offers an example of how these questions can be generated.

User:	Prepare a multiple-choice question on shifts in the demand in competitive markets.
IA:	Which of the following factors can cause a shift in the demand curve in a competitive market? A) A change in consumer tastes and preferences B) A change in the price of a substitute good C) A change in the population size D) All of the above.

Figure 1. Example of a multiple-choice question created by ChatGPT.

Open-ended questions are another type of content that can be created using ChatGPT. In response to the user's request, it can generate questions that encourage reflection, discussion, explanation, creativity, or opinion-based responses. By asking ChatGPT to "generate open-ended questions about the Consumer Theory," instructors receive a list of thought-provoking questions that can be the basis for class discussions, written assignments, or other interactive activities that promote deeper learning and understanding, as illustrated in Figure 2.

ChatGPT can also provide relevant information on a wide range of subjects. When asked for an explanation of a topic, such as "How does nuclear power work?", ChatGPT can respond with a detailed response that can be used to supplement lessons or as a starting point for further study. Therefore, it can become an excellent tool for creating class materials.

Finally, ChatGPT can be used to create simple games, such as trivia, and role-playing games, to engage students with educational material. For instance, it can generate a trivia game about a certain topic by simply being asked. Role-playing games, such as the dialogue presented in Figure 3, allow students to understand complex situations by experiencing different perspectives.

3.2. Assisting students

There is a number of ways in which ChatGPT can be used as a study tool to assist students in their academic pursuits. Some of them are reviewed below.

Firstly, it can be used as a personal tutor and offer custom guidance. Students can ask questions to gain relevant information and explanations on a topic in real-time. ChatGPT can also offer personalized feedback by evaluating students' answers to questions and providing

User:	Prepare a comparative question that considers AI, GPT, and BERT.
IA:	How does the language generation capability of GPT compare to that of BERT, and how do both models differ from traditional AI approaches in terms of their language processing capabilities?
User:	Generate an open-ended question to encourage critical thinking about the Consumer Theory
IA:	What are some of the real-life situations in which the principles of Consumer Theory can be applied, and how would you go about applying them in each situation?

Figure 2. Examples of open-ended questions created by ChatGPT.

some insights into their understanding of the material. Furthermore, ChatGPT can create personalized study plans following some requirements by asking, for example, “Create a 10-hour study plan for the consumer theory for a visual learner”.

Secondly, ChatGPT can be employed as a writing assistant in multiple ways, such as helping students generate written responses to questions, summarizing key concepts, and providing feedback and corrections. For instance, students can use ChatGPT to create a first draft of an essay, summarize a text, or receive feedback on their writing regarding grammar, vocabulary, and coherence. This way, it can assist students in improving their writing skills, understanding the material, retaining information, and identifying areas for improvement.

Thirdly, ChatGPT can provide students with opportunities for conversational practice and language development. For example, students can ask “Let’s engage in a conversation about the weather in Valencia” to practice writing in a foreign language or to develop their communication skills in their native language. In a conversation with ChatGPT, students can improve their fluency and vocabulary and can also receive feedback on their writing abilities. This can help students to become more confident and proficient communicators.

4. The Dark Side

Despite the potential benefits of integrating ChatGPT in the classroom, it is not exempt from some potential challenges that educators should consider.

Firstly, ChatGPT’s ability to generate answers to any question can be tempting for students looking to cheat on exams or assignments. Besides encouraging honesty and ethical behavior, instructors should be very aware of the capabilities of technologies such as ChatGPT when designing exams or assignments. Similarly, when used as an assistant, students can use ChatGPT to complete homework assignments without fully understanding the material. Including self-reflection and critical thinking exercises are essential to prevent this.

Secondly, ChatGPT may provide students with false or misleading information or simply wrong answers, as illustrated in Figure 4. In this vein, ChatGPT is particularly inadequate in

User:	Let's start a role-playing game. You are a bookstore manager that is experiencing a decrease in sales. I am advising you on how to improve your business. Please, keep this role until I say otherwise.
IA:	Understood, I am now the bookstore manager facing declining sales. Please proceed with your advice.
User:	When did the decline start? What do you think the reason is?
IA:	I would say that the decline in sales started about 6 months ago. (...) Some of the possible reasons could be increased competition from online bookstores, changes in consumer spending habits, a shift towards digital reading, or a decline in foot traffic to the area where the store is located.
User:	You mentioned a decline in foot traffic near the store? Are there construction works around?
IA:	Yes, I did mention a possible decline in foot traffic due to changes in the area around the store. To my knowledge, there are currently no construction works happening in the immediate vicinity of the store, but there could be other changes, such as road closures or new developments, that could be affecting the flow of foot traffic.
User:	And what about your costs? Are they mainly fixed or variable?
IA:	I can say that our costs are a mix of both fixed and variable expenses. Fixed costs, such as rent, insurance, and salaries, remain relatively constant regardless of our sales volume. Variable costs, such as the cost of books, shipping expenses, and advertising, can fluctuate depending on our sales and other factors. (...)
User:	Which percentage of costs is variable?
IA:	I don't have exact figures on hand, but I would estimate that around 30-40% of our costs are variable and the rest are fixed. This can fluctuate from month to month, depending on factors such as the cost of books, shipping expenses (...).
User:	Since the foot traffic has declined, you might try to negotiate a reduction in the rent. How is your contract?
IA:	I can say that rent is a significant fixed cost for our business and negotiating a reduction in rent could definitely help improve our bottom line. Our current lease agreement is set for a fixed term, and any changes to the agreement would require the consent of both parties. (...)

Figure 3. Example of a role-player game with ChatGPT.

providing references and Digital Object Identifiers (DOIs) that can be used to track down the original source of the information. This lack of information makes it even more challenging to determine the accuracy and reliability of the information provided. Although future developments in the technologies could improve the accuracy of the information provided, fostering critical thinking is again key for avoiding wrong learnings.

User:	Demonstrate that $x+7$ is even.
IA:	If x is an even number, then it can be represented as $2k$ for some integer k . Therefore, $x + 7 = 2k + 7$, which can also be represented as $2(k + 3)$. Since the result is in the form of $2n$ for some integer n , it is an even number. Therefore, if x is an even number, $x + 7$ is an even number.
(...)	
IA:	Suppose the demand for apples is given by the equation $P = 120 - 2Q_d$ and the supply is given by the equation $P = 2Q_s$. What is the market equilibrium price and quantity?
User:	$Q=40$
IA:	That's correct! Now let's move to scenario 2. Suppose there is a technological breakthrough in apple production, which reduces the cost of production. How does this affect the market equilibrium price and quantity?
User:	Both price and quantity will increase.
IA:	Exactly! An increase in supply, as a result of a technological breakthrough, will shift the supply curve to the right. This will result in a higher quantity and a lower price at the new market equilibrium. Great work!
(...)	
IA:	To find the market equilibrium, we need to find the intersection of the supply and demand curves, where the quantity supplied is equal to the quantity demanded. We can start by setting the demand and supply equations equal to each other:
	$120 - 2Q_d = 2Q_s$
	Solving for Q , we get: $Q = 60$. Then, substituting $Q = 60$ into either the demand or supply equation, we can find the market equilibrium price:
	$P = 120 - 2(60) = 120 - 120 = 0$
	So the market equilibrium quantity is 60 and the price is 0.

Figure 4. Three examples of wrong answers by ChatGPT.

Furthermore, there is no guarantee that ChatGPT is available during class time. At this moment, it is offered as a free research preview with limited availability, and its access might be canceled at any time. This makes it unreliable for educational purposes and raises concerns about the dependability of the technology.

5. Conclusions

Artificial intelligence has the potential to revolutionize the way we teach and learn. One promising AI application is the use of large language models, such as ChatGPT, in various educational contexts.

ChatGPT can be used as a writing assistant, study tool, personal tutor, assessment tool, content creator, game-based learning tool, and language learning tool. It can generate instructions, procedures, explanations, dialogues and responses to students' inquiries. In all these applications, ChatGPT can help to make the learning process more interactive and engaging, and to provide students with exposure to the target content.

As a natural language model, ChatGPT is well-suited for educational settings where plain language is used to convey knowledge, for example, in the humanities or social sciences. It can also be useful in scientific and technical studies since it can understand specific jargon or terminology. Being based on a natural language model is a primary advantage, but it is also a significant drawback because its limited understanding of mathematical and specific notations may restrict its effectiveness in fields that rely heavily on them.

In order to reach learning objectives, future educators should learn which prompts spark productive conversations with ChatGPT. This process is analogous to coding but utilizes natural language and is therefore accessible to instructors without programming skills. Future learners should include ChatGPT into their repertoire of tools for both academic and professional endeavors while developing critical thinking skills to evaluate the quality of the responses provided by the AI.

Despite the potential benefits of integrating ChatGPT in the classroom, educators should be aware of the potential challenges it poses, such as those related to cheating and availability, since they may affect the class even if the instructor does not adopt it. The limitations of AI, evidenced by the inaccuracy of the information provided, emphasize the need for human intelligence to promote critical thinking.

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“Building” knowledge by creating manipulatives with the 3D printer: a course for mathematics student teachers

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Abstract

3D modelling and printing (3DMP) is a suitable context for education. With it, own manipulatives for mathematics education can be created, which was not possible easily before. We develop a seminar at Goethe University, in which use 3DMP to teach mathematics student teachers about mathematics, pedagogy, and technology. In this paper, we present the general 3DMP process, and how we integrate it in the seminar. The structure and contents of the seminar, as well as results from the students are laid out. The hardware and software used are shown and explained, as well as our approach to 3D modelling with the help of programming. The individual iterations of the seminar and the conclusions show that students mainly benefit from being able to realize their ideas very early and having the freedom to choose their own topic.

Keywords: *3D modelling and printing; mathematics education; project-based learning.*

1. Introduction: 3D Printing

With 3D printing it has become possible to create anything that fits on or in a printer. There are some variations on how 3D printers work: some work by using powder and glue, while others use lasers to harden special resins. The method mostly used in affordable printers is additive manufacturing (FDM, “Fused Deposition Modeling”), which will be referred to in the following as 3D printing (3DP). In 3DP, the printer heats a special form of plastic (“filament”) until it reaches the right temperature (and therefore viscosity), and then “prints” it on top of a print bed—or the previous layers (see figure 1).

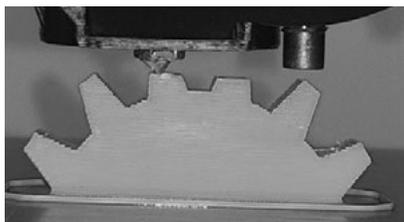


Figure 1: The layers of an additive 3D-print. The upper layers are printed on top of the lower layers.

In general, 3D modelling and printing (3DMP, see Anđić et al., 2022, Läufer & Ludwig, in press) follows the following steps (also shown in figure 2), with an example of a mathematical object (Menger sponge with recursion depth of 2) in figure 3:

1. The process starts with a concept or aim that is to be achieved and notes and calculations are written down.
2. Inside a modelling program or application, a 3D model is created with the help of said notes (Figure 3, top left).
3. This 3D model is then imported into a so-called “slicing”-Software, which “slices” the model into layers (figure 3, top right) and creates a file with a series of commands specific for each printer model.
4. The printer then prints the model in layers by following the commands inside the file (Figure 3, bottom left).

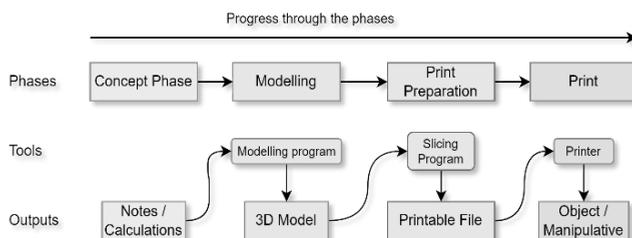


Figure 2: The 3D Modelling and Printing (3DMP) process, divided into phases, tools, and outputs. From every step, we can go towards an earlier step in case a change is needed. After the process has been completed, the manipulative can be validated if it fulfills the aim by using it in class.

This process is iterative. After a first prototype has been printed, multiple changes might be done in following iterations. Either expanding or modifying the original concept (by shifting focus), model, or commands for the printer in the file. This does not only happen after a process has been finished. It may also occur in previous phases. For example, in the slicing program, we can see whether a 3D model may be printable or not, sometimes requiring a remodelling in the modelling program before printing.

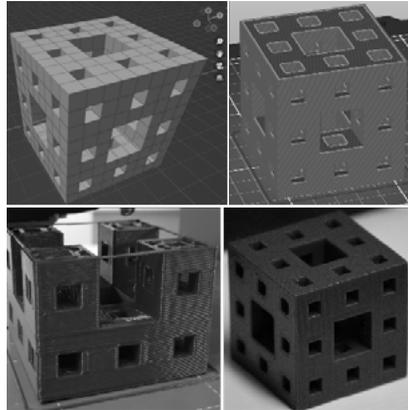


Figure 3: The Menger sponge in the modelling program (top left), the slicing program (PrusaSlicer, top right), during the print (Prusa i3 Mk3S+, bottom left) and printed (bottom right).

In their meta-study, Ford and Minshall (2019) have compiled multiple educational uses of 3D printers. Teachers using 3D printers in their lessons is popular, which has also shown in the studies by Pearson and Dubé (2022) and Kit Ng, Tsui, and Yuen (2022). Ford and Minshall (2019) also report that 3DP in school brings a range of benefits, namely increased motivation and realism inside the classroom, raised student engagement, interest in subject material, and student understanding in the respective fields. Pearson and Dubé (2022) identified multiple studies showing promising effects for (mathematics-) education, such as increased mental rotations skills and understanding through visualization. (Huang & Lin, 2017; Katsioloudis & Jones, 2015) However, these effects are only possible with significant effort of the teacher. (Ford & Minshall, 2019)

While this opens possibilities for students, teachers, and educators, the negatives of 3D(M)P are considerable: long print times for even small objects, a large technical overhead, and a high need for instructor support and training indicate that the complexity of 3D(M)P may not be fully advantageous and integration of 3DMP into lessons faces difficulties. Educators find it difficult to change from their traditional methodology towards a new one (Medina Herrera, Castro Pérez, & Juárez Ordóñez, 2019), and the professional development opportunities needed to use 3DMP in school as a teacher are missing in current teacher education. (Ford & Minshall, 2019; Simpson, Williams, & Hripko, 2017)

2. The Seminar

As described above, 3DP is a rich possibility to produce even complex models according to one’s own ideas. Therefore, we offer a 3DP seminar at Goethe-University, in which student teachers can develop and print suitable manipulatives for their teaching ideas in the context of mathematics education. The seminar (see figure 4) has been developed for the education of 10-12 mathematics student teachers (at least in the 3rd semester). It is the aim to teach them the entire process of 3DMP in one semester. In particular, the seminar aims to increase the mathematical, technical, and pedagogical knowledge and to foster the creativity of the students. The first iteration of the seminar (in the following: “first iteration”) was held from April-July 2022 (13 weeks). The second iteration of the seminar (in the following: “second iteration”) was held from October 2022 through February 2023 with a span of 15 weeks. Between the sessions (2x 45 min/week) the students could make appointments to print their models with the university's printers under the condition of them being present for the entire printing time.

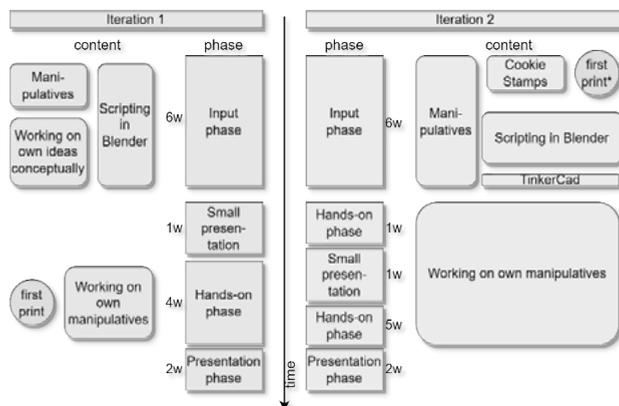


Figure 4: The structure, basic contents, and duration of each phase of the seminar per iteration. On the left side are the elements of the first iteration. The right side holds the second iteration. The “first print” of the first iteration (left) was the first time the students completed the 3DMP process themselves. In the second iteration, the “first print” was in the second session.

The student teachers must create and present manipulatives (individually) that are unique, not easily manufactured by other means, available in shops for a reasonable price, embedded in a lesson plan, complex to a certain degree (i.e., a single simple irregular shape is not sufficient), and do not exist or do only exist virtually, like a sketch or drawing in a book.

2.1. Software use, hardware used and script-based modelling

3DMP is a technologically advanced topic. At least 3 of the 4 phases of the 3DPM process (3D modelling, Print Preparation, and Print, see figure 2) use specific technology and applications. Common 3D modelling applications used for 3DMP may be TinkerCad,

Fusion360, SketchUp, and many more. All of them are complex programs, which try to find the balance between usability and powerfulness of the modelling possibilities. We set the criterion that the students must use their mathematical skills to think about all aspects, geometric objects used for, and dimensions of their manipulative before starting the modelling.

Therefore, we chose the free, open-source modelling program Blender. Blender meets the set criterion since it supplies an integrated interface to use scripts – small programming snippets – for 3D modelling. We then developed a library of programmatic functions that reduce the complexity of Blenders’ internal interface. This allows script-based modelling of 3D models with a low-threshold programming language, with us being able to adjust the complexity of the programmatic functions and therefore scaffold the students receive. For example, as shown in figure 5, the function “box” only needs two points to create a cuboid. It also supplies the benefit of being precise and the students needing to be prepared before they start modelling, requiring them to think before they do. Depending on the object, demanding calculations are required by the students during 3DMP (Kostakis, Niaros, & Giotitsas, 2015; Nemorin & Selwyn, 2017, cited by Pearson & Dubé, 2022). Depending on the complexity of the manipulative, this may be different from other modelling applications where objects can be dragged, dropped, and edited. A precise measurement may only be needed for complex objects. Additionally, algorithmic structures like loops can be used in the scripts as well, allowing manipulatives like the hundreds chart in figure 5 to be created efficiently and precisely, without needing to place 100 individual cuboids *manually*.

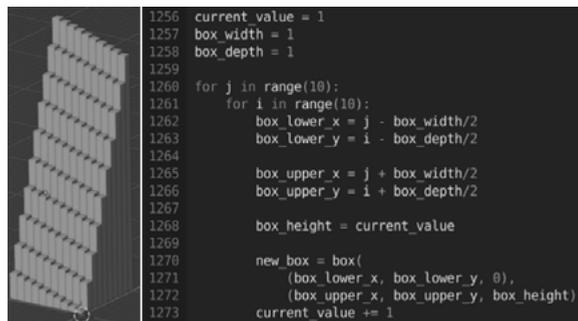


Figure 5: The hundreds field (left, zoomed out to fit) and the code that created it (right) in the Blender scripting area. There are two nested loops in lines 1260 and 1261, each iterating the respective variables – representing the row j and the column i – from 1 to 10. The programmatic function “box()” in lines 1270-1273 creates a cuboid where one side is parallel to the x - y plane, and where the given points (line 1271 is one (x,y,z) point, line 1272 is the other) are in the corners diagonally away from each other.

Slicing software takes the 3D model and creates a set of instructions for a specific type of printer, due to different types and brands having different components and calibrations. The slicing software, PrusaSlicer, is not only free, but tailored to our printers by the creators themselves, reducing the need to fine-adjust the settings in the slicer to get good prints.

The printers we use (Prusa I3 Mk3S/S+) are well suited for shared use, like in the university or school, due to the features the printer has, like a detachable print bed, auto-calibration of the print head, and a filament sensor, which makes switching filaments easy. We chose these printers because they are reliable and there is a slicing software tailored to them.

2.2. First Iteration

The first iteration started with a presentation of the basics of manipulatives and the basics of the 3DMP process. By showing an example of how to create a 3D puzzle, we presented each step. Afterward, we introduced the students to the scripting library, and they started conceptualizing their first ideas, which were then presented shortly to the group in the 5th week. Feedback on the progress was given. This phase was called *input-phase*.

The first conceptualizations showed that the students did not understand the printers’ limits or misunderstood the justification for 3DP to create manipulatives. Some designed long, floating pieces that cannot be printed without significant changes in their design, while others used the 3D printer just for the reproduction of pre-existing manipulatives that can be bought cheaply or easily created with alternative materials. We traced this back to us not enabling the students to print their ideas in the beginning. The first time that students printed something of their design was after 7 weeks (see Figure 4). After the feedback, we continued giving input on the phases and then began the *work-phase*, where attendance was not needed. These could be used for working on the concepts, printing, and asking questions. This phase is called *hands-on-phase*. The objects that the students then created and printed were (among others):

- A puzzle for the cubic formulae with different levels of complexity and distractors,
- A puzzle on approaching the surface of a sphere with triangles,
- A board and pieces for visualizing a path in statistics as a game.

2.3. Changes in the second iteration

Learning from the first iteration, we began the second iteration similarly, but let the students create and print their own mathematically themed cookie stamps in the beginning. Due to the small size and limited complexity, these could be printed in about 20–30 minutes. With our 3 available printers, we managed to print them for almost all students. The only part in the 3DMP we took over was the slicing of the model due to the amount of experience required.

After the students experienced the complete 3DMP process themselves and the input sessions on how to create their own, the students could focus more on the mathematical and didactical side of the process. In the following sessions, more complex models were created by the student teachers with scripts. There were more (creative) and realistic ideas than in the previous iteration, and the students hesitated significantly less to start printing their ideas.

We found that allowing the students to print their models (cookie stamps) early on, was truly motivating. This motivation was upheld by the students, with work-sessions (no attendance required) being filled with almost all students. The evaluation of the seminar was also very positive. Some examples of what students are developing are:

- Platonic Solids as a solid object and their dual solid as an edge model.
- A hundreds-field for early and special education, where the value of the numbers can be felt. (See figure 5 for the 3D model)
- A puzzle of the partner numbers to ten.

We also used one session, right before the *hands-on*-phase, to present a different way to create 3D models with TinkerCad, which has been used by some students to create parts of other models. This was done to allow the students to create simple prototypes more quickly and test the printer settings (like different layer heights) more easily.

3. Conclusion and what is to come

In this paper, we have presented how 3DMP works, as well as how we used it in the context of a seminar at Goethe University. The comparison of iteration one and two makes clear that showing the whole process early on is crucial for student motivation and creativity. The students used a lot of their own ideas and can handle the 3D modelling, preparing the print, and printing on their own. Some support, especially on the technical side, needs to be given nonetheless. The students in the second iteration were motivated and produced innovative manipulatives for mathematics education. Further integration and studies thereof in other subjects such as computer science are of high interest.

The following iterations will embrace the work more with project diaries that will be used as a basis for a PhD-research. Additional interviews with the students on how the design and print processes work for them individually will be held and analyzed. We believe that letting students print their own manipulatives increases their mathematical, didactic and technical knowledge (see TPACK Model, Mishra & Koehler, 2006). The individual 3DMP phases which the students experience and their relation to the TPACK model are to be investigated in this research project.

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The complexity of grading student work and the reconstruction of the meaning of criterion-referenced assessment

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Abstract

This study explores how assessment criteria are applied in grading student work. It is found that explicit assessment criteria do not work as authoritative guidance as expected and that tacit criteria are more decisive in awarding a certain grade. Various sources that form idiosyncratic tacit criteria are identified. These sources, including values on curriculum and assessment, teaching experiences, and the way of supervising grades, work as different social contextual elements that influence judgements on grading students' work. The study suggests that tacit criteria and the different sources that form the tacit criteria need to be identified, perceived, and communicated in the community of practice to reduce grade variability and achieve a shared understanding of grading.

Keywords: *Criterion-referenced assessment; grading process; assessment criteria; tacit criteria; shared understanding.*

1. Introduction

Criterion-referenced assessment (CRA) has been recognised as a common method for assessing what students have achieved in a specific course (Sadler, 2017; Svennberg, Meckbach, & Redelius, 2018). Compared with norm-referenced assessment, which evaluates a student's work by ranking it within a group (Lok, McNaught & Yong, 2016), CRA is based on scoring according to a series of explicit criteria (Popham, 1978, 2014). CRA has many positive impacts on student assessment. As grading in a bell curve is no longer required in criterion-referencing, pursuing higher grades becomes a matter of an individual's efforts, rather than competing with others. Additionally, by providing explicit assessment criteria, students can form a clearer understanding of what the assessment task entails, how it will be judged, and what the level of achievement is (O'Donovan, Price, & Rust, 2001).

Although CRA has many advantages, it is still need to note that the grading process is complex and intermingled with assessors' internal judgement (Bloxham, Boyd & Orr, 2011; Orr, 2007). Previous researches indicate that besides explicit criteria, tacit criteria commonly exist in grading judgement (Sadler, 2005, 2009). Tacit criteria are usually personally determined, which could easily lead to a substantial difference between different assessors when judging the same student's work (Bloxham, 2016a). Consequently, how an assessor applies the explicit and tacit criteria to award a grade greatly affects the reliability and quality of an assessment. To review and to reflect upon the quality of student assessment, a thorough investigation of the process of grading judgement is necessary.

2. Literature review

2.1. The complexity of grading process

Several studies reveal similar findings, stating that making judgements in grading is more likely to happen implicitly rather than being based on external sources. In other words, the real standards are locked inside the teacher's head (Bloxham et al., 2016a; Grainger, Purnell, & Zipf, 2008; O'Hagan and Wigglesworth, 2015). Furthermore, the interpretation of each of the standards for the criteria is highly diverse among assessors, thus leading to a large gap in assessment results for the same student's work. For example, Bloxham et al. (2016a) invited 24 teachers from four disciplines to assign five students' writing works respectively; they found substantial differences in the awarded grades. Only one of the 20 pieces was graded in the same rank by six teachers in any of the disciplines. The assignment gap for the same student work was at least three positions. Bloxham points out that assessors' internal standards framework plays an important role in awarding grades. This internal framework, also called tacit criteria, commonly exists among assessors, even when explicit criteria are provided (Sadler, 2005, 2009; Gonzalez & Burwood, 2003). The nature of tacit criteria is recognised as idiosyncratic (Matshedisho, 2020; Adie, Lloyd, & Beutel, 2013), to be

perceived unconsciously and expressed uneasily (Sadler, 2009, 2013). Tacit criteria increase the opacity of the grading process and make grading complicated to understand.

Beside the effect of tacit criteria, grading judgement is also contextually influenced. Shay (2004) used conceptions of 'field' and 'habitus' to discuss the basis of decision making in assessment. It concludes that assessing complex tasks is a socially situated interpretive act. Assessors' interpretations are shaped by their disciplinary orientations, years of experience, and level of involvement with students. These interpretations are constituted not only to sustain systems of belief but also to maintain identities and interpersonal relations. Given social practice, grading is not merely decided individually. More precisely, it is closely related to the backgrounds and experiences of assessors and the institutional culture they encounter (Watty et al. 2014; Zahra et al. 2017).

3. Research questions

This study aims to explore how teachers internalise, interact with, and interpret explicit criteria to illuminate the mechanism of using explicit criteria to frame internal decisions. The role of tacit criteria and its influence in grading judgement will also be investigated. The following research questions are considered:

1. What are the roles of explicit and tacit criteria in determining the final grade?
2. How are tacit criteria formed and how do they influence the assessor's grading considerations?
3. What insights are proposed to improve CRA practice by revealing the formation of tacit criteria and the nature of the grading process?

4. The case

4.1. Background

A general education programme of University A in Hong Kong was selected as the case study. There are currently 28 full-time teachers involved in this programme to teach two GE courses. In 2018, CRA was required to be fully implemented in all faculties and teaching units at University A. A task force was initiated in the GE programme to respond to the shift, which involved five teachers from two GE courses and one researcher. Grading rubrics were developed based on the intended learning outcomes to echo the outcome-based approach advocated by the Quality Assurance Council. In addition to developing grading rubrics, several meetings were also held to discuss CRA and how to use the grading rubrics.

4.2. Data collection

Interviews were the main sources of data collection. Seven GE Programme teachers were invited to attend one-on-one interviews, and each interview lasted 1–1.5 hours. Interview questions addressed teachers' considerations of using grading rubrics, understanding the assessment criteria, and their views on CRA, GE learning goals, and assessment. Five of the teachers had more than six years of teaching and assessment experiences in this programme. Two were novice teachers with less than one year of work experience. In addition to conducting interviews, the author joined the task force, developed grading rubrics with other task force members, and attended all meetings on CRA. Other sources of data included reflective notes of CRA meetings, emails of the discussions among teachers, and a brief survey of teachers. As a complement to teachers' thoughts on CRA and grading judgement, some informal talks were also collected and used to support teachers' viewpoints. In CRA meetings, the author was an observer and took notes on what happened in the field, such as questions raised, interactions, and responses among teachers.

5. Results

5.1. Role of explicit and tacit criteria in grading judgment

All teachers reviewed the descriptions of explicit criteria and expressed their evaluations on them. Grading is not like enacting orders under the guidance of external requirements; it is rather an application of internalised criteria. A typical problem of internalising explicit criteria was about abstract expressions such as 'focused topic', 'relevant evidence', and 'logical and specific conclusion'. Teachers noted that these wordings were very general and needed more explanations.

Because elaborating and communicating explicit criteria were not recognised as a regular practice, most teachers took individual interpretations on these explicit criteria as common; nevertheless, they did not realise the necessity of illuminating their own interpretations. Among the seven teachers, only one showed the notes, which explained in detail what the abstract descriptions in each criterion mean, whereas the other teachers did not specify the meaning of those abstract wordings. It seemed that teachers had examined the meaning of criteria implicitly, but they did not explicate and reflect their interpretations or seek other ways of interpretations.

Sometimes, personal interpretations were in conflict with the explicit criteria. Three teachers noted that they did not completely agree with the standards for each criterion. Even so, they had their way of reconciling the external standards with their internal standards. For example, a teacher noted that they would grade leniently on some criteria which were set higher in their views:

'I use different standards in grading reflective journal and term paper. For reflective journals, standards will be set lower since they're completed in the middle of the course and where in this stage, understanding is most important other than higher-order thinking skills. I would give the score leniently in the reflective journal. If students show a good understanding of texts, I will give them a good grade even if they do not exert complex thinking skills'.

Not every teacher would refer to all criteria listed in the grading rubric. Among the seven teachers, three indicated that they would make a holistic judgement, rather than make one by referring to every criterion. One teacher stated disagreement in dividing criterion into several parts, for it will spoil the integrity of student achievement and make each part of performance separate and irrelevant to each other:

'All criteria should be related, and they actually reflect the whole. I will focus on the integrity of student's performance'.

5.2. The formation of tacit criteria and its influence on grading considerations

What qualities should be cultivated for students affect the interpretation and usage of explicit criteria. Teachers held different expectations regarding the GE curriculum. These individual notifications were not fully covered either by learning outcomes or explicit criteria. Both learning outcomes and assessment criteria were worked out by the representatives of teachers, instead of all of them. Consequently, these uncovered expectations became tacit criteria. This may explain why personal interpretations and various grading strategies were common. For example, a teacher who regarded curiosity as an essential characteristic noted that 'he would adjust the descriptions of explicit criteria and inject the element of curiosity into them'. Another teacher who did not hold the value of curiosity would not interpret the criteria in this way.

Compared to novice teachers, experienced teachers were more flexible in using explicit criteria. Experienced teachers were able to interpret the meaning of criterion from a broad perspective, instead of translating the keywords of a criterion literally. In addition, they were more confident in determining the 'right' grade for students. Experienced teachers seemed to know how to adapt explicit criteria to make grading decisions more consistent with their tacit criteria. Such an adaptive strategy was scarce in novice teachers. For novice teachers, interpreting explicit criteria involved many uncertainties. It was difficult for them to connect teaching experiences with the criteria to give an appropriate grading judgement. Unlike 'technically adjusting' the meaning of explicit criteria, as done by experienced teachers, novice teachers more often adopted direct methods. They added or deleted criteria to make explicit criteria more consistent with their internal judgement, although these methods would lead to various patterns of criterion-referencing. Confidence in grading was also inadequate

among novice teachers. Assessment training was more frequently mentioned by these participants.

'I hope I could receive some trainings on how to award a grade. Differences in each grade level, especially between A- and B+ or some similar cases, were not very clear for me to identify. Maybe we could invite some grading experts and share with us how to grade accurately'.

The other difference between grading considerations of experienced and novice teachers was their adoption of holistic judgement. Two novice teachers indicated they would adopt analytic judgement, whereas, of five experienced teachers, three noted that they preferred holistic judgement. Although task force members communicated with experienced teachers that analytical judgement was indispensable in criterion-referencing, it was hard to change their views. Adopting a holistic judgement was related to the issue of trust and efficiency. For some teachers, holistic judgement would be more reliable. Teachers worried that the final grade might be unmatched with their original judgement by adding sub-scores to each criterion. The other consideration was time. Teachers noted that analytic judgement was too time-consuming:

'I have tried grading according to the criterion one by one and find it wasted too much time. After doing this, I still need to review the grade and examine if the judgement is appropriate with a holistic approach'.

Besides the influence of teaching experiences that form the different basis of grading judgement, many teachers treated grade distribution as a boundary to keep assessment results 'safe'. In other words, although CRA called for 'giving students a real grade' and 'abandoning grading in a bell curve', in the grading practice, norm-referenced grading was still being tacitly used.

There were two patterns of tacit practices. One examined the entire grade distribution after grading and compared it with the previous policy. If any 'abnormal' grades were discovered, they would be adjusted. Some teachers chose to examine grade distribution in the mid-term to adjust the coming grading strategy:

'I would first examine the results of the reflective journal, if the grade distribution is not good, I would reconsider the grading of the term paper. If there are too much A's in term papers, I probably would make some adjustments'.

Another way of applying the principle of grade distribution is to set a line to guide grading. In this way, grades were regulated during the grading process to satisfy the hidden criteria of the specific distribution. This approach was more undisclosed and even discerned that teachers were using norm-referencing. In sum up, Grading was still reckoned on norm-

referencing because of the obscure policy of monitoring grades. In the brief survey results, many teachers indicated that grade distribution was still applied in their grading practice.

6. Discussion

Although CRA has been practised over the years, this study revealed that the educational ideas of CRA are not thoroughly manifested in grading practice. The core idea of CRA is to consider the explicit criteria reflectively, so as to minimize the subjectivity in grading affected by student image (Shay, 2004), peer relationship (Zahra et al., 2017), department culture (Deneen & Boud, 2014) and so on. The marginalisation of explicit criteria and amplification of the power of tacit criteria may be due to a superficial and inappropriate understanding of CRA. Elaborating and reconstructing the meaning of CRA is, therefore, necessary to clarify some common misconceptions of criterion-referenced grading and to ensure a fairer grading process.

First, explicit criteria should not be regarded as the absolute standard, nor should personal interpretations be taken for granted without examining them in the community of practice. As judgement making based on teachers' professional experiences is in terms of whether academic freedom is respected and protected (Sadler, 2011; Lee, 2006), while explicit criteria provide a basis for calibrating various individual judgements (Sadler, 2013; Dracuo, 1997), balancing the function of tacit criteria and explicit criteria is critical in deciding a consistent and fair grading. Criterion-referencing does not favour the approach of maximising unified standards, nor does it favour the opacity of the grading process. Letting explicit criteria and tacit criteria dance together would make them the true criterion-referencing. To balance the power of tacit criteria, it is critical to have empathy regarding understanding the rationality of grading judgement by discussing it in the community of practice (Bloxham, Hughes, & Adie, 2016b). It requires putting aside individual liberty in making grading judgements and embracing the liberty of the whole (Sadler, 2011; Berlin, 1969).

Second, assessment criteria are in the central position of CRA. Therefore, the appropriate usage of the assessment criteria needs to be clarified. This study argues that CRA is a social constructive practice (Rust, O'Donovan, & Price, 2005), which contains two levels of meaning. The first level represents how assessment criteria should be used among assessors. It suggests that assessment criteria should be identified, selected, discussed, and communicated in the assessment team. Furthermore, teachers' value in the curriculum needs to be elaborated and absorbed into the learning outcomes and assessment criteria pool (Watty et al., 2014). The second level represents how assessment criteria should be used among teachers and students. Assessment criteria and how they are interpreted by teachers should be communicated with students (Bearman & Ajjawi, 2021). Social constructive practice means to initiate a dialogue with students to address the meaning of criteria and build an

understanding on grading judgement. In this way, CRA plays a role of assessment for learning which emphasises the concept of student-centred approach and empowers students' experiences of assessment by involving them into the grading process (Sadler, 1987, 1989).

Third, CRA is a different grading approach other than the regularly-adopted norm-referencing approach. How grades are supervised and what should be accountable for a given grade substantially affects whether assessors will adopt real criterion-referencing. If departments or universities still take grade distribution as the accountability objective, it is no surprise that teachers will finally depend on grade distribution to award a grade. In this case, explicit criteria would be marginalised and, more notably, students may not get the real grade. Therefore, grade distribution as the only standard for reviewing students' grades should be abandoned. The focus can be on how the assessment criteria were set. Do they match course content? Does the assessment task reflect the assessment criteria well? How do students regard the assessment criteria? To answer these questions, the paradigm of grade review needs to abandon the result-oriented approach and focus more on the grading process, the decision making of the assessment team, and students' feedback on grades and grading.

7. Conclusion

For a long time, many educators believe that the variability of grading is normal and inevitable due to the existence of tacit criteria. However, should this passive attitude toward grading continue, it would increase students' negative perceptions of assessments. The current study argues that criterion-referencing can reduce subjectivity in grading. This is realized by reflectively examining the grading judgement, better understanding our own tacit criteria, and discussing the explicit criteria in the community of practice. Revealing the formation of tacit criteria and illuminating the sources can help assessors become aware of the unperceived hidden standards influenced by complex social elements, consider grading more carefully, pay attention to grade variability issues, conduct grade moderation effectively, thus making grading and grades more fair. By recognising the characteristics of explicit and tacit criteria and build a balance between them, the spirit of CRA, which emphasises the assessment for learning, can be achieved.

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The Reggio Childhood Studies PhD as a learning community

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Abstract

Exploring visions and methods to pursue high level education means to study how each person is allowed to develop new intellectual, aesthetic, and operational perspective, as well as grasp new insights for growth and enrichment of one's understanding of the world. The authors present the pilot phase of an analysis of the first industrial doctorate in Reggio Childhood Studies, organized by the University of Modena and Reggio Emilia in collaboration with the Reggio Children Foundation: its socio-constructivist matrix is highlighted. In fact, constructing a community of learners allows cross-fertilization among diverse disciplinary knowledge and many cultures. The study hereby presented explores the variables of such learning community, through the analysis of in-depth interviews of the PhD fellows. Results show factors and variables that can affect and challenge the existence of the community. Recommendations are made to continue exploring the doctoral community, bringing in the picture all the stakeholders involved.

Keywords: *Industrial PhD; learning community; multidisciplinary; socio-constructivism.*

1. Introduction

The municipality of Reggio Emilia has long been internationally recognized as an excellence, for its innovative pedagogical approach. The Reggio Emilia approach has been characterized by the organization and management of the city's nurseries and preschools since 1963, when it began to organize educational services, promoting the opening of the first kindergartens for children aged 3 to 6. Loris Malaguzzi (Edwards, Gandini & Forman, 2010) is the reference pedagogue who inspired a new way of perceiving the kid, his capacities, and the collective responsibility that stems from them.

One of the fundamental pillars of Reggio Emilia's pedagogy is the research component. Anyone who wishes to participate in the educational process must regard research as an ontological condition to which one must continually listen to be a part of a continuous route of knowledge building. In this perspective, learning is viewed as a continuous, individual, and collective process, whose stimuli and reflection on them are research topics in and of themselves and apply to any sort of research. Carla Rinaldi (2009) defines the child as the first researcher because: he is innately capable of listening to the various stimuli coming from reality and capable of selecting them to build his knowledge based on his skills, thus becoming a creator subject rather than a passive recipient.

1.1. The specifics of the doctoral program in Reggio Childhood Studies

The doctoral program in Reggio Childhood Studies was launched in 2019 and now it is on its fourth cycle. It is organized in collaboration between the University of Modena and Reggio Emilia and the Reggio Children Foundation. As such, the doctoral program has been envisioned as a learning community in support of specific research projects. Processes and procedures that encourage participation, relationships among participants, skill borrowing between fields of knowledge, and cross-cultural contaminations provide as many stimuli as possible to interrogate reality and train for a continuous vital exchange with it.

The pursued research projects span from inclusion to biomaterials, semiotics to translation, the study of prison environments to contemporary parenting models, the history of music to the fight against the mafias: the underlying belief is that contact between seemingly disparate fields increases the chances of innovative break-through studies and creative cross-fertilization.

Training methods range from seminars, lessons, conferences, and laboratory experiences, all based on innovative methodologies of peer-to-peer education, tutoring, mentoring, and flipped classrooms. During the years of the COVID-19 pandemic, multimedia was enhanced, moving formal and informal meetings online, through dedicated platforms and ICT tools.

The theoretical and methodological paradigm underlying this organization is one of complexity (Morin, 2008), in which the various components, each with its cognitive style

and training, as well as the levels of organization of the doctorate itself, are to be understood as related variables that participate in the construction of learning. Unpredictability or errors are also included in this system, making them peculiar and vital components for the research itself.

The theoretical frame of reference of the PhD upholds the concept of education as the creation of intellectual, aesthetic, and social learning opportunities in which everyone is free to learn autonomously as well as through the learning modality of others, in a horizon of meaning that is never definitively given once and for all but must be regained each time.

Reggio Approach inspiring theories are addressed during the mandatory-readings seminars: such meetings offer the opportunity to also experiment with different forms of teaching/learning. Becoming co-constructive and intrinsically relational, the PhD allows students to experience in practice what has been studied on a theoretical level, to monitor if and how the program has produced transformations.

1.2. The research questions

The present study aims to identify the specifics of a learning community within highly educated people, what themes emerge from a socio-constructivist approach when people talk about a community of learners. Specifically, it aims to investigate all those variables that have a positive impact on the emergence, functioning and sustainability of a learning community; and those variables that can hinder or negatively affect the existence of a learning community.

2. Methods and materials

2.1. Research design

The study comprises two phases: in the first pilot stage, the research aims to explore what the most significant features of a learning community are in the the experience of the student learners of the Reggio Childhood Studies PhD program. In this pilot phase, only a few learners are extensively interviewed to investigate their perception of which protective factors and which risks to the existence of the learning community they experienced in their years of doctorate.

The second phase is both qualitative and quantitative. At this second stage, not only all the PhD fellows are involved (a total population of 28 students) but also the faculty and the managing staff (directors, program manager and technical coordinator). The present article focuses on the results of the pilot study.

2.2. Sample and Tools

In this pilot study, the research team interviewed 2 student fellows per each cohort of the PhD program, excluding the current year that is only in its first months of activities. Therefore 6 students were interviewed, each couple corresponding to one different cohort of the program, that we named the “pioneers”, the “pandemics” and the “re-start”.

The criteria used to recruit the interviewees in this first phase were: gender, as males represent only the 18% of the total population of 28 students; and country of origin, as international students represent 29 % of the total number of fellows in the first three years of existence of the PhD.

The semi-structured interview had 5 areas of investigation. The first was the academic and working background of the interviewees together with their expectations. The second was to explore the construct of a learning community: what specifics, what limitations, what innovations etcetera in a constructionist approach (Gergen, 1994). The third area was that of the protective factors of the learning community, in the experience of the interviewee: they were asked to give specific examples of what elements of their doctoral life had a positive effect on the building and maintaining of the learning community. The fourth area of the interview was on the risk factors: that is what specific elements of their experience played a negative or challenging role in the making and surviving of the doctoral learning community. Finally, the last area was on the ideal prerequisites that they would consider when building a learning community: what were the unquestionable conditions that an educator should be aware of when fostering a learning community.

The more than three levels of headings, which will be numbered with Arabic numerals starting at 1. The interviews were transcribed and translated, when needed. The authors extracted all the themes that were mentioned in each interview; they then built a table with the lists of themes/variables and pasted the parts of each interview that fitted under the titles of such themes (see paragraph 3).

3. Results

The results are reported following the distinction in the five categories that the interviews explored: background, construct, pillars, challenges, ideal prerequisites

Table 1. Thematic variables emerged from the analysis of the interviews (only one of examples are shown, for brevity).

AREAS	VARIABLES AND EXTRACTED EXAMPLES
BACKGROUND	<p>Plurality and heterogeneity <i>"Most of us come from regular university structure, where you have for example to do certain things at a given time, you have like a clearly defined structure".</i></p> <p>The extended Community <i>"It can be extended to all the professors and all the people you meet while doing the project".</i></p>
CONSTRUCT of a LEARNING COMMUNITY	<p>Physical presence <i>"The physical presence much requested by the teaching staff has favored the construction of this community".</i></p> <p>Multidisciplinary <i>"A learning community should share ways of comparing possibly between different backgrounds to have different points of view".</i></p> <p>Team work <i>"It's a group of people who have a purpose, who have common goals."</i></p> <p>Leadership <i>"Nobody forced us, on the one hand it is good and on the other hand it is bad".</i></p>
PILLARS	<p>The Reggio Emilia Approach <i>"We tried to understand the concept of Reggio childhood from different perspectives".</i></p> <p>Informal networking <i>"Over time, closeness has become friendship".</i></p>
CHALLENGES	<p>The pandemic <i>"Covid has hindered and blocked the informal relationship that was fundamental humus at the beginning".</i></p> <p>Working online <i>"The fact that our group was formed online was somehow flawed by it".</i></p> <p>Spaces and times <i>"The question of spaces: there are not yet the conditions to offer a research laboratory but only an office".</i> <i>"A learning community exists when there are people who meet on an ongoing basis, with a fixed frequency, to create that type of exchange community".</i></p> <p>Legislation <i>"Our doctorate follows the national legislation according to which research is individual".</i></p> <p>Competition/Individualism <i>"If a group is made up of many individuals, the competitive logic prevails. Co-planning/co-leading can make a group supportive and non-competitive".</i></p> <p>Language <i>"There's the issue of language. An issue especially for international students because sometimes you want to bond and come closer to the community; but because of the language it was not always possible".</i></p>
IDEAL PREREQUISITES	<p>Shared co-design <i>"Involving PhD students in activities and in co-planning together with colleagues from the Foundation".</i></p> <p>Listening</p>

"Listening as a form of openness, of recognition of the other, of his diversity, of his individuality, as a form of curiosity".

Freedom of expression

"The facilitator must not be the one who organizes the meetings but the one who favors the creation of this spirit of trust".

Solidarity

"This start, so all together, unanimously, has certainly helped us a lot".

4. Discussion

4.1. The backgrounds

Phd fellows range in age and have a diverse professional backgrounds, including art history, biology, history, pedagogy, philosophy, languages, music, and psychology. The PhD students come from a variety of national and international geographical contexts.

The teaching staff and teachers involved at different levels in the training have heterogeneous backgrounds and curricula and come from universities all over the world, making a significant contribution not only to the contents transmitted but also because they embody the culture and teaching traditions of other universities.

All fellows saw such diversity as an asset of the emerging learning community. Plurality of backgrounds and expectations grounded a sense of diversity as the true richness of the human capital of the learning community, being considered both an enhancing factor of collaboration, but also a challenge in the flow of the process: because working in group is a real job (Clark & Wilkes-Gibbs, 1986).

4.2. The co-construction of a learning community

To create a culture of continuous learning and critical review of one's practices and beliefs, the doctoral program is envisioned as a learning community in which the processes of sharing, collaborative and non-competitive creation of knowledge and skills, and sharing each person's cultural heritage were constantly encouraged (Gardner, 1987).

Because of such a vision, the PHD program is organized as a residential community, with significant opportunities for formal, non-formal, and informal exchange, from the sharing of spaces and times to the actual study and research part, to enhance all the skills acquired, including soft skills.

The interviews show a general overlap between the theoretical idea of a learning community and the experience of it in the doctoral program. Concepts like teamwork, leadership, multidisciplinary are presented through the understanding of how the interviewee experienced student life in the program. The construct is the result of a process of sense-making of the experience itself.

4.3. The pillars that support and enhance

By experiencing the evolutionary processes of groups, students gradually assume roles of shared responsibility. In fact, the path provides both a path of reading, analysis, and comparison of the literature that constitutes the framework of the Reggio Emilia educational approach, as well as a parallel path, of a methodological nature, which allows for active participation in work and reflection groups, which are sub-units of the larger community and its same building blocks. The primary objective of this dual register methodology (cognitive-speculative and experiential-relational) is to facilitate an individual's affective, cognitive, emotional, personal, and interpersonal development, which is the foundation for the acquisition of the relational and professional skills required of PhD candidates in the RCS.

Each working group organizes itself autonomously at first, but with time, the groups begin to collaborate and increase the intensity of their synergy and mirroring activities. A team that works on the process level outperforms a task-oriented team. These small working groups regard the student as an active resource for the gained knowledge. Different personalities, sensitivities, and attitudes come into play to bring a common project to life in a situation where the group processes underpinning task delivery are examined. The outcome of the task groups and their methodological choices are debated and evaluated by the students present at the end of the classroom presentation: the classroom as a whole is measured with certain hypotheses on the type of work that brought that particular task group to that particular exhibition result, to find links between the dynamics of the small group and the dynamics of the class group.

4.4. The challenges at stake

With the pandemic, the PhD community and workshop model had to be reconsidered, with the shift to a virtual setting. The loss of bodies, of the physicality of the group, was undeniably a disadvantage that caused 'distance' and 'randomness'. On the other hand, online settings enabled more frequent interactions, the creation of intimate spaces in which participants' homes opened to the community, less formal and more equitable education in which technology 'levels out' certain inherent asymmetries (Weinberg & Rolnick, 2020). The group sessions that cannot be held in the physical classroom triggered a reflection on the distance-proximity polarities (working online breaks down transnational barriers of lockdown), formal-informal (the private and the public are sometimes contaminated with effort, others with amazement), learner-teacher (the sense of the role of co-construction of the setting, of the training methodology, of the constellation of objects of reflection that constitute the content of the community becomes more intuitive).

The analysis of the interviews also showed other existing challenges, that can threaten the sustainability of the community of learners. The same diversity of the group, which was previously referred to as a richness of the community, can trigger individualism and rivalries:

two dynamics that move the members away from the community, enabling self-centered modalities of learning and narcissistic drives.

Another theme is the conflict with existing resources: both a legislation that awards traditional academic research and the lack of sufficient spaces, that can welcome at any time all the cohorts of students and faculty, are mentioned as risks to the survival of the learning community.

4.5. The prerequisites of an ideal learning community

Every method of investigation, qualitative or quantitative, is allowed in the view that all contributions, if justified, have equal dignity and can contribute to the creation of shared knowledge. In such a diverse learning environment, everyone maintains a well-defined yet complimentary function to the others to achieve the established objectives, which in this case concern both specific scientific work and reflective metacognition on the personal style of learning and uncovering. Sharing and listening are seen as mandatory in the vision of a shared design of the learning process and its contents.

5. Conclusions and future implications

The goal of the Reggio Childhood Studies PhD is to train researchers through research, to invest in the creation of personal, original, and new lines of research, attempting to bring together quite varied domains of knowledge, skills, approaches, and concerns. It is crucial for the scientific community to be able to communicate with people from different perspectives and languages, which the PhD translates into a set of methodological and operational practices. In the complete research design, we intend to analyze all learning experiences, of all stakeholders involved, to evaluate and self-evaluate the quality (intended as the attribution of meaning) of the social and intellectual interactions established among peers and among generations, within contents, and through methodologies. The research can significantly highlight how such relational and dialogical experiences can become material to enhance metacognitive and critical skills, as well as to strengthen forms of individual and cooperative learning, through research-action projects (Bruner, 1996).

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Financial literacy decision tree game: A system development exposé

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Abstract

Poor financial literacy has significant economic implications, with limited savings, insufficient retirement provisions and higher dependency on debt. Concerns about the level of financial literacy among the youth or young graduates motivated this study. The study describes the design of a game to educate young graduates while imbibing life-long personal financial management skills. A system development approach was used to present the information. Scenarios and decisions were developed to guide the student (player) in planning and making decisions about their budget with real-life events or cases. The study will be beneficial to university students to transition smoothly into the workforce and take control of their finances. University authorities and stakeholders can also implement the game design to assist students in gaining financial education before venturing into the working world.

Keywords: *Education; financial literacy; game design; system development; universities; young graduates.*

1. Introduction

There is a strong focus on financial literacy, specifically on younger individuals and university students who graduate and need to be financially independent. The decisions made in the early working years may predict the financial well-being for the future, where one wrong financial decision can lead to another. Offering financial education at a young age is necessary as this impacts many areas - the economy, organizations, families, communities and the individual. With adequate financial literacy, working employees can positively attend to, make decisions and control their personal finances in the short and long term (Pearson et al., 2017).

Financial illiteracy during the first working years is identified through the lack of the most basic economic and financial concepts, which can have an unfavorable impact (Lusardi & Michigan, 2007). Therefore, students will benefit from a sound understanding of financial concepts including inflation, compound interest, savings, debt, and retirement planning, among others and avoid economic implications, insufficient savings and retirement provisions, and higher dependency on debt. Subsequently, there is more reliance on financial education's impact on financial literacy levels. Therefore, it is equally important to introduce financial literacy education and measure its effectiveness, as success is sometimes limited (Frijns et al., 2014). Improving financial literacy levels is a priority for the economy at large, and tertiary institutions have an opportunity to offer financial education to improve students' financial literacy.

Therefore, the study's objective was to describe the design of a game-based financial education program that positively impacts students' financial literacy. A detailed and systematic approach through a system development methodology (systems thinking) to create a solution to a problem (Nunamaker et al., 1990). Knowledge is created about the development process itself, and deeper understanding emerges about the problem that the system is designed to solve (Hasan, 2003). The paper focuses on the conceptual framework and game content, to produce knowledge and illustrates how students can acquire financial education to prepare them for the world of work. The technical development of the game by the developers falls outside the scope of this study.

2. Conceptual framework

2.1. Game-based learning and theories

Gamification research in the field of finance has been limited although it has become common in the sector (Bitrián et al., 2021). The game-based learning approach has grown exponentially in recent years in different disciplines. Academics have explored the use of gamification to enhance the transfer of knowledge and learning experiences (Nieto-Escamez

& Roldán-Tapia, 2021). The learning approach has grown significantly into a popular instructional approach due to its power to motivate and engage students in complex learning, problem solving, critical thinking and decision making (Aprea & Ifenthaler, 2021). Integrating game design elements into non-game activities enhance user engagement and has a great potential to motivate players and impart knowledge to them (Hoffmann & Matysiak, 2019). Incorporating gamification has gained momentum since the impact of COVID-19, resulting in learning outcomes (Nieto-Escamez & Roldán-Tapia, 2021).

Games are designed in different formats, types and strategies. Several theories have been identified in gamification, self-determination, goal setting and the flow theory (ibid.). Self-determination theory includes basic needs in terms of autonomy, relatedness, and competence, where at least one should be addressed (ibid.). Taking ownership of your behavior can be equated with autonomy, which is associated with financial behavior and decision making (Richter et al., 2015). The goal-setting theory includes student commitment, feedback, game complexity, and situational constraints. In comparison, the flow theory focuses on optimal enjoyment and engagement with the game (Nieto-Escamez & Roldán-Tapia, 2021). Sufficient planning is required in the game-based learning to maximize participation by students and increase student knowledge. For this study, the focus was on improving financial literacy.

2.2. Motivation to engage the content

Students think and learn differently, especially Generation Y (millennials) and Z (the students of today). For millennials, the largest generation, motivating and engaging to learn is very hard since they consider the traditional teaching methods as boring compared to their experience with digital technology (Woods et al., 2011). Gamification techniques in financial education can effectively enhance student engagement and learning for Generation Y, as demonstrated by Poole et al. (2014), using traditional lectures and game-like techniques. Nicholas (2020) found that 51% of Generation Z students prefer learning by doing (working through examples), 38% by seeing and 12% by listening. Generation Y students exposed to the gamification method of instruction perform better in assessments and experience higher levels of involvement, while Generation Z is more exposed to technology from a young age. Hence, motivation and the mode of offering are vital to engaging students in financial content.

Platz and Jüttler (2022) found that motivated students in finance have a positive link to the game experience. The success of financial education depends on “learning from doing”. Such programs should be implemented in a manner with the most significant impact (Massey et al., 2016). Therefore, tertiary education has a unique opportunity to introduce financial education that will promote and improve financial literacy by learning from doing in line with the preferred learning style of Generation Z.

Further, studies have shown a positive link between gamification and improved financial knowledge. Hoffmann and Matysiak (2019) found that gamification of financial education increased the motivation to engage in an investment topic. Kalmi and Rahko (2022) and Sari et al. (2022) applied augmented reality (AR) to school children who improved their financial knowledge more than was observed in the control group (traditional program). Johnson et al. (2021) evaluated the effectiveness of a free online financial educational program where financial knowledge improvement was significant. Nordin et al. (2022) investigated AR gamification technology use; 93% of the students reported that it was a better learning media.

Therefore, gamification can be considered a valuable tool for Generation Y and Z, motivating students for improved interactivity, engagement, and learning. However, necessary planning is required to ensure the effectiveness of the game. The right strategy and media will offer the best potential for financial education (Sari et al., 2022).

2.3. Game design and financial literacy influencers

In developing the conceptual framework to improve financial literacy, gamification was selected where learning from doing is the preferred learning style for students. Factors that influence financial literacy were incorporated into the game. Studies established the impact of life experiences on financial literacy. Liu and Lin (2021) demonstrated that including students' real-life experiences and choices in the teaching content promotes learning interest while teaching financial knowledge and improving literacy. Hoffmann and Plotkina (2021) found that intervention during an experiment where consumers recall and reflect on experiences regarding their personal finances promotes higher financial efficacy. Therefore, game-based learning that simulates real-life experience was developed in this study to improve knowledge and prevent decisions that have potentially negative impacts on personal finances.

3. Game methodology

System development was implemented to design the game prototype. The game methodology was applied to develop game-based learning that would simulate a life experience through the consequences of events. The basis of the game concept is the ability to process a life experience, adapt to new conditions with budget adjustments, make impactful decisions and readjust the budget, while successfully responding to existing game rules, which implies modification, here and now in a limited time. A similar methodology was used by Kubina et al. (2021), who designed a budget game model with illustrative elements in real-life scenarios; players had to adjust and make changes according to the changing conditions in a limited time. The advantage of gaming is experiencing the impact of a decision or reaction, copying a life event that adds to life experience.

A system development methodology systematically organizes efficient financial education in a game. The fundamental role of system development is the process of the developed system and then as an object (the game) that becomes the focus of further and continued research (Nunamaker et al., 1990). Therefore, system development was suitable in this study as it efficiently presented an optimal mode to include various elements, descriptions, and rationale. In developing the game, autonomy in self-determination theory was applied where the students must manage their finances and budgeting decisions, as suggested by Kubina et al. (2021).

4. Game description – Financial literacy decision tree game

The game starts with the student graduating from university and being employed for the first time. Four real-life scenarios were selected that may severely impact a young graduate if not prepared; thus, relevant situations are often experienced in the local and real context. These include allocating the budget between wants and needs, black tax (financial dependency of family members), wealth creation and theft, discretionary 13th cheque and retrenchment.

The game was designed with the following scenarios presented in Table 1 and Figure 1. You are a young graduate who is the first family member to graduate from a university, with the support of the entire family that relies on you for financial support in times of need. You get your first payslip from a big corporate entity. You have accommodation, transport, study loan, and credit card expenses. You must make provisions for needs and wants (groceries, toiletries, clothes, airtime, entertainment, eating out and credit card debt). Further specific information is provided regarding lunch at the office canteen, your current office outfits, data bundle expenses, streaming channels costs, your current savings and credit card debt, lack of insurance and medical aid and the monthly costs to make provision for it.

The students are then expected to consider all the information provided and draft a budget of their expected spending, how often they eat out or buy takeaways, their savings behavior and any other relevant information considering the information provided. They can enter R0 for entries that they are not utilizing or that do not apply to them. Once the student finalizes their budget based on the information provided, they are faced with four scenarios presented in table 1. Each scenario represents a real-life event that could impact a young graduate's finances if they do not plan accordingly. The four scenarios will have financial implications for the student. Each scenario will test their preparation for the unknown and how well they planned and managed their personal finances. The student makes another decision based on the specific scenario, which requires adjustments to the existing budget. The student also has an opportunity to reassess each line entry and consider the importance of their wants, needs, and financial well-being. Before they move to the next scenario, the student reviews and makes changes to their budget.

Table 1. Game decisions and scenarios.

Scenario 1 (budget, savings, emergency fund)	Scenario 2 (budget, wealth creation, insurance)	Scenarios 3 (surplus) & 4 (retrenchment)
<p>Three months later, you have a family emergency; your mom needs to replace a burst geyser during winter and relies on you for assistance. Options: 1) you have allocated savings from your budget (savings per month x 3), which can be used. If not enough, use the credit card (with increased payments) and reduce another expense; 2) you did not save and need to use your credit card.</p>	<p>Four months later, you are robbed and need to replace your stolen laptop. Options: 1) you have insurance and are covered entirely; 2) you did not take out insurance and have no funds. You can buy a second-hand laptop or take out a personal loan with a higher interest rate. Consider wealth creation, debt, interest rates and insurance to readjust your budget.</p>	<p>At the end of the year, you received a 13th cheque. Options: 1) save the funds in a savings vehicle for an emergency fund; 2) pay credit card; 3) pay student loan; 4) spend it on a holiday. Readjust your budget. Two months later, you are retrenched. You find another employment two months later, resulting in one month without any income. Consider your current savings, fixed expenses and necessities.</p>

Content for the specific scenario is then presented; this gives the student additional information to assess their decisions and how they could better manage their finances. Subsequently, the student has control over their personal finances and has to take responsibility for decisions. When a situation occurs, they can take ownership of it and consider available options (Kubina et al. 2021). That way, they gain financial experience to help them make decisions in real life. These views were expressed by Frijns et al. (2014), who found that financial experience positively impacts financial literacy and promotes improved financial knowledge. The game dynamics also help students to recall and learn by doing, as supported in previous studies (Massey et al., 2016; Hoffmann and Plotkina, 2021).

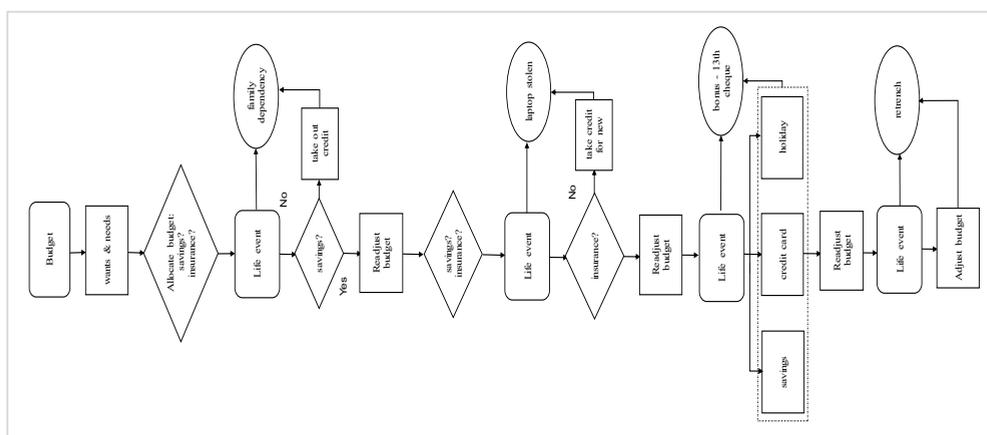


Figure 1. Scenario and decision tree.

5. Conclusion

Life experience positively impacts financial literacy, and where a gamified experience can be simulated, the individual may gain knowledge to make better decisions. Subsequently, a game was developed to allow students to improve their financial literacy before they start working. Game-based learning is generally effective, and it can promote financial literacy. If presented to university students, it will enhance the importance of the content as they transition from students to employees. However, this study did not explore the impact of the gaming experience on students' financial literacy. It only includes the description of the design of the game prototype to be used for further investigation. Future research will include testing the effectiveness and measuring if it adds to the students' experience of gaining financial knowledge.

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Fairness matters in higher education: student classroom justice perceptions and behavioral responses

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Abstract

Fairness in the higher education instructional context, i.e., classroom justice, is fast becoming a salient and widespread concern among scholars, instructors, and students alike. Drawing on research conducted in North America, Europe, Asia, and other world regions, the present article describes university students' beliefs about what constitutes unfair instructor behavior, and it explores the relationships between classroom justice and student behavioral responses. Results of this work indicate that university students identify grading procedures, instructor feedback, and instructor affect, attention, and caring as key factors in determining classroom justice. In addition, university students' perceptions of (un)fairness are associated with student learning, engagement, and antisocial classroom behavior. In short, classroom justice in higher education is integral to student learning and instruction. Classroom justice matters.

Keywords: *Classroom justice; fairness; student-instructor relationships.*

1. Introduction

Whether driven by the neoliberalization of higher education, rapid changes in information and communication technology, or the prevailing student-as-consumer orientation, fairness has become an increasingly salient topic for instructors, administrators, and students (Chory & Horan, 2018, 2022; Chory, Horan, & Houser, 2017; Chory & Offstein, 2017; Chory, Zhaleh, & Estaji, 2022). The study of fairness in the instructional context is known as *classroom justice* (Chory-Assad, 2002). In the present manuscript, the instructional practices and behaviors students perceive to be (un)fair and student responses to (un)fairness are examined, with particular focus on higher education. Findings from the United States of America (USA), where the study of classroom justice began, are discussed, as is burgeoning classroom justice research conducted in Europe, Asia, the Middle East, and other regions across the world.

2. What is Classroom Justice?

Classroom justice theory and research were originally grounded in industrial-organizational psychology, organizational behavior, and management theory and research in the USA (see Chory-Assad, 2002; Chory-Assad & Paulsel, 2004). As a theoretical construct, classroom justice consists of three *dimensions* enacted or evaluated according to multiple *principles*, which are applied in various *domains* (Chory et al., 2022; Rasooli, Zandi, & DeLuca, 2019; Estaji & Zhaleh, 2021a, 2021b).

Early classroom justice research focused primarily on the three *dimensions*. *Distributive justice* refers to perceptions of fairness concerning the outcomes (e.g., grades, instructor attention) allocated in the instructional context, whereas *procedural justice* refers to the fairness of the processes (e.g., grading procedures) used to distribute said outcomes (Chory-Assad, 2002; Chory-Assad & Paulsel, 2004). *Interactional justice* is defined as perceptions of the fairness of the instructor's interpersonal treatment of students when processes are executed or outcomes allocated (Chory, 2007).

A recent theoretical development in the realm of classroom justice centers on justice *principles*, i.e., the standards or rules used to judge fairness, and *domains*, i.e., the course elements or contexts in which the principles are applied (Rasooli et al., 2019). Classroom justice may be implemented or violated according to 17 justice principles (Chory et al., 2022; Estaji & Zhaleh, 2021a, 2021b; Rasooli et al., 2019). The domains include assessment, teaching, learning, and interaction, each of which has subdomains (Chory et al., 2017, 2022; Estaji & Zhaleh, 2021a, 2021b, 2022; Horan, Chory, & Goodboy, 2010; Rasooli et al., 2019).

Research on justice principles and domains revealed that university students reported their instructors violated the distributive justice principles of equity (in grading) and equality (in communicating affect) in equal measure (Chory et al., 2022), consistent with prior research

(Chory et al., 2017; Chory-Assad & Paulsel, 2004; Horan et al., 2010; Rasooli, Zandi, & DeLuca, 2018). University students most frequently reported instructor procedural justice violations of the bias suppression principle in the relational communication and student performance domains, followed by violations of accuracy in performance and reasonableness in course workload. Finally, students perceived instructors violated the interactional justice principles of justification in student performance domains and caring and propriety in relational domains (Chory et al., 2022).

3. What Classroom Justice Violations (Unfair Behaviors) Do Students Identify?

College students identify and label a variety of instructor behaviors, events, and practices as unfair. Quantitative research reveals that American university students perceive instructors who are incompetent, unethical, uncaring (Chory, 2007; Chory & Offstein, 2017) and verbally aggressive (Claus, Chory, & Malachowski, 2012) as unfair. They also find instructors who use coercive power (Paulsel, Chory-Assad, & Dunleavy, 2005) and do not effectively answer questions or provide enjoyable interactions (Young, Horan, & Frisby, 2013) to be unfair. Research across the world confirms the aforementioned findings and provides additional insight into the types of instructional behaviors and occurrences that university students believe to be unfair. See Table 1.

As shown in Table 1, university students identify unfair behaviors representing all three justice dimensions and occurring in various domains. Across samples, the most commonly reported justice violations pertain to the distribution of grades and instructor affect, grading procedures, feedback, and the extent to which instructors care about students. Singling students out for criticism, attendance/make-up policies, and not following through on one's word are classroom justice violations that are less commonly identified across groups. Regardless of the particular instance or form of unfairness, however, the perception of classroom justice has been shown to lead to observable and meaningful consequences.

Table 1. University students' reports of classroom injustice (i.e., unfair instructor behaviors).

Distributive Justice Violations (the instructor's distribution of...)

- grades ^{1,3,5}
- opportunities ^{1,3}
- affect or attention ^{1,3,5,6}
- punishment ^{1,3}

Procedural Justice Violations (the instructor or instructor's...)

- class procedures ^{1,3}
- grading procedures ^{1,2,3,5,7}
- course make-up/late/attendance policies ^{1,3}
- course schedule/workload ^{1,3,5}
- not following through ^{1,3}
- not providing students desired information for exams ^{1,3}
- making an error that affects students ^{1,3,5}
- not providing students adequate or timely feedback ^{1,3,4,5,6,7}
- not being available or accessible to students ^{1,3,5}

Interactional Justice Violations (the instructor...)

- was rude/insensitive ^{1,2,3,4,7}
- implied/stated student was stupid ^{1,3}
- made sexist/racist/prejudiced comments ^{1,3}
- singled student out for criticism ^{1,3}
- did not care about students/nonresponsive ^{1,3,4,5,8}
- accused student of wrongdoing ^{1,2,3,7}
- did not explain decisions (i.e., informational injustice) ^{1,3,6}

Sources: ¹Horan et al. (2010), ²Čiuladienė & Račelytė (2016), ³Chory et al. (2017), ⁴Rasooli et al. (2019), ⁵Estaji & Zhalah (2022), ⁶Chory et al. (2022), ⁷Bazvand & Rasooli (2022)

4. Why Does Classroom Justice Matter?

Classroom justice is important because it impacts student learning, classroom climate, and student and instructor well-being. On the positive side, student perceptions of classroom justice tend to enhance learning and student-instructor relational outcomes. College students' perceptions of distributive, procedural, and interactional justice were positively related to motivation, affective learning, and cognitive learning (Chory-Assad, 2002; Holmgren & Bolkan, 2014; Horan, Martin, & Weber, 2012; Vallade, Martin, & Weber, 2014). Fairness perceptions were also associated with students having higher quality leader-member exchange relationships with instructors (Horan, Chory, Carton, Miller, & Raposo, 2013).

In contrast to justice's positive effects, university students' perceptions of injustice are associated with outcomes that threaten the learning environment. For instance, perceived injustice predicted a stronger likelihood that students would engage in indirect interpersonal aggression and hostility toward their instructors and seek revenge on, deceive, and resist instructors (Chory-Assad, 2002; Chory-Assad & Paulsel, 2004; Horan et al., 2013; Paulsel & Chory-Assad, 2005). Perceived instructor injustice was also associated with a stronger likelihood of college students communicating antisocial compliance-gaining messages to instructors (Claus, Chory, & Malachowski, 2012), coming to class under the influence of drugs and alcohol, and communicating aggressively and offensively in the instructor's course. Distributive injustice and instructor unethical out-of-class behavior also interacted to predict university student incivility and offensive communication (Chory & Offstein, 2017).

Departing from quantitative-based research methodology, Horan et al. (2010) and Chory et al. (2017) used open-ended items to investigate college students' behavioral responses to perceived injustice. They observed that the most common behavioral response was dissent, which included complaining about the unfair incident to the instructor, another school authority figure, on teacher evaluations, and to family, friends, and other students. The second most common university student behavioral responses were inaction or acceptance of the unfairness (Horan et al., 2010) and changing one's approach to the course (Chory et al., 2017). These responses were followed by student verbal aggression, hostility, confrontation, and disengagement.

5. Do Classroom Justice Perceptions and Responses Vary by Country?

Since the introduction of classroom justice theory and research in the USA, scholars across the world have contributed to the body of knowledge on fairness in the classroom. Classroom justice has been investigated in Australia (Lizzio, Wilson, & Hadaway, 2007), Italy (DiBattista, Pivetti, & Berti, 2014), Poland (Lankiewicz, 2014), Serbia (Kovačević, Zunić, & Mihailović, 2013), Lithuania (Čiuladienė & Račelytė, 2016), Russia (Bempechat et al., 2013), Turkey (Argon & Kepekcioglu, 2016), Cyprus (Uludag, 2014), Iran (Estaji & Zhaleh, 2021a, 2021b, 2022), China (Tata, 2005; Yan, 2021), Nigeria (Kura, Shamsudina, & Chauhan, 2014), and other countries. In some cases, results are consistent with work in the USA. For example, perceptions of fairness were related to Italian (DiBattista et al., 2014) and Australian (Lizzio et al., 2007) university students' engagement, Serbian college students' achievement (Kovačević et al., 2013), Turkish college students' perceptions of instructor trustworthiness (Argon & Kepekcioglu, 2016), and Chinese university students' perceptions of instructor credibility and immediacy (Yan, 2021). In contrast with US-based work, Nigerian undergraduates' perceptions of procedural justice were not related to deviant behavior or honor codes (Kura et al., 2014).

6. Conclusion

Fairness in the higher education classroom is associated with a number of significant educational experiences and outcomes. University instructors enacting fair procedures tends to enrich college student learning and student-instructor relationships, whereas instructors violating justice expectations tends to harm student achievement and relationships. These are issues that deserve continued attention from those seeking to enhance student learning, as well as student and instructor well-being, in higher education.

In addition, there is a need for classroom justice research in more diverse settings. Future research should examine and compare justice perceptions and responses across countries with different cultural values (e.g., individualistic vs. collectivistic), sociopolitical structures (e.g., democratic, communist, post-socialist) and histories (e.g., colonization). As more and more university faculty and students engage in teaching and learning across borders, this work will grow in significance and utility. Classroom justice matters in higher education and it will continue to do so.

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University graduates enrolled in higher VET in Spain: an upskilling or reskilling choice?

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Abstract

Post-Baccalaureate reverse transfer students (PRTSs) are students that enroll at a VET institution after completion of at least a bachelor's degree. This paper is an exploratory, descriptive and correlational study of Higher VET graduates with a previous university qualification in Spain. The purpose of this study is to contribute to the knowledge of PRTSs in Spain by identifying if it is an upskilling or reskilling choice. The study uses data from the ETEFIL-19 survey to examine the demographics, previous degrees, program of enrollment, and prevalence of university graduates who get VET degrees. The results suggest that the transition of university graduates in Spain into Higher VET is best interpreted as an upskilling strategy due to a significant correlation between the original university field and the VET professional field of destination. A summary discussion of the results along with implications and recommendations for the practice, policy and further research are included.

Keywords: Higher VET; postbaccalaureate reverse transfer; university to VET transitions; upskilling; reskilling; university dropout.

1. Introduction

Vocational Education & Training (henceforth, VET) attracts very varied profiles of people in adulthood who decide to resume their studies at some point in their life (Cournoyer et al., 2017). In Europe, this trend has been accentuated in recent years and more and more VET providers are admitting adults to initial vocational training courses (Markowitsch & Hefler, 2019). In Spain, Higher VET programmes are seen to represent an incipient way of re-entry into the educational system for university graduates who seek to specialize in certain areas or complement their training (García-Brosa, 2019) but to date, this phenomenon remained largely unexplored.

This research has a two-fold objective. Firstly, it aims to quantify the number of Higher VET graduates in Spain with a previous university degree. Secondly, it seeks to establish whether this educational transition obeys a strategy of specialization (upskilling) or retraining (reskilling) by analysing the relationship between previous university degree and a Higher VET programme followed. To achieve our research goals, the paper taps on the Educational-Training Transition and Labour Insertion Survey (hereinafter, ETEFIL-19) carried out by the Spanish National Institute of Statistics in 2019 (INE, 2020).

The following section offers a review of the academic literature on this phenomenon. Later, the method used to carry out the study will be explained, as well as the data that make up the sample. In the third section the main results obtained will be presented. Conclusions and limitations of this research will be derived in the final section.

2. The transitions of university graduates towards Vocational Education & Training

The presence of university graduates in VET is not a new or exclusive phenomenon in Spain. The research work in this field has been developed mainly in countries such as Australia and the United States with lines of work aimed mainly at determining the volume of this flow, the context in which it occurs, the reasons behind this decision and the experience of people with a university degree in the vocational training system. The “counter-intuitive” nature of this movement may be one of the reasons for the scant attention that this phenomenon has received as an object of study in Europe.

In the United States, Townsend & Dever (1999) coined the concept "Post-Baccalaureate Reverse Transfer" to characterize the movements of people with university degrees towards Community Colleges (2-year vocational training). Two years earlier, a study for the National Association of Community Colleges estimated that between 10% and 20% of the students who accessed this type of training had a previous university degree (Gose, 1997 cited by Leigh, 2009). Since then there have been several authors (e.g. Friedel & Friesleben, 2017;

Leigh, 2009) who have continued this line of research with studies limited to the scope of certain educational institutions or states, for which reason there is no a clear vision at the national level.

In Australia, the movement of graduates from university to VET is known as 'reverse articulation' (Haas, 1999). In a study carried out in the state of Victoria between 1991-1997, Golding (1999) estimated that around 40,000 students a year entered VET with a previous university degree and that a similar number of VET students would have previously gone through university without having completed these studies. These figures were questioned years later by Moodie (2004) who specified that taking into account the quality of the data available at that time, the only thing that could be stated was that the movements from the university to vocational training were between 50% less and 50% higher than movements in the opposite direction depending on the definition and the transfer measurement strategy used.

3. Method

3.1. Data source

The key source for the aims of the present study is a survey about the Educational-Training Transition and to the Labour Market (ETEFIL) (INE, 2020). The National Institute of Statistics makes the microdata available to third parties completely free of charge. The latest edition of the survey (ETEFIL-19) surveyed a representative sample of 7,802 people who had completed a Higher VET Programme in 2013-2014 all around Spain from the whole set of professional fields (26 fields). The general aim of the survey is to collect data on their academic and employment situation five years after graduation (in 2019).

3.2. Sample

The study focuses on a subsample of 767 Higher VET graduates who got their degree in 2014 holding a previous university degree or diploma.

The number of people with a previous university degree who had obtained a Higher VET degree in 2013-2014 amounts to 767, which represents 9.8% of the sample for the entire country (n=7802). In addition to a university degree, 17.1% had at least a Master's degree.

The average age of this subset of the sample at the time of obtaining the Higher Technician degree in 2014 was 32 years and 50% were 30 years or older (min=23, max=45, SD=6.45). Both data indicate that the decision to enroll in a Higher VET programme does not occur immediately after completing their university studies. 67.5% are women, although an increase in the percentage of men is observed as the age group increases.

Almost half of Higher VET graduates with a previous university qualification come from the field of “Social and Legal Sciences” (49.9%). They are followed in order of importance by the field of "Engineering and Architecture" (16.8%) and "Sciences" (13.3%) which, considered as a whole, reveal that 30% of this group are STEM graduates. Health Sciences and Arts and Humanities provide a similar number of graduates to the sample, standing in both cases slightly above 9%.

Table 1. Higher VET graduates with a previous university degree, according to Academic Discipline of their university studies.

Academic discipline	Frequency	Percentage
Social Sciences	383	49,9%
Engineering and architecture	129	16,8%
Sciences	102	13,3%
Health Sciences	72	9,4%
Humanities and Arts	70	9,1%
Indeterminable	11	1,4%
TOTAL	767	100,0%

Source: Own elaboration based on data from ETEFIL-19.

Individuals have been classified according to two dichotomous qualitative variables: STEM professional family (Yes/No) and STEM University academic disciplines (Yes/No). The two branches of studies assigned to the STEM category are Engineering and Architecture and Science. In the case of Higher VET, 9 professional fields have been included following the classification proposed by the National Institute for Educational Evaluation (INEE, 2017).

Table 2. STEM-related Academic Disciplines and Higher VET professional fields.

STEM University Academic Disciplines	STEM VET professional fields
1. Science Degrees	1. Building and Civil Works
2. Engineering and architecture Degrees	2. Electricity and electronics
	3. Energy and Water
	4. Mechanical manufacturing
	5. Food industries
	6. Information Technologies and Communications
	7. Installation and maintenance
	8. Chemical industry
	9. Transportation and vehicle maintenance

Source: Own elaboration based on INEE (2017).

4. Results

4.1. Upskilling or reskilling

Interpreting the university graduates transition to VET as a complement to training or specialization (upskilling) or as a change of course in their professional career (reskilling)

requires determining to what extent the previous university education is related to the higher technical degree obtained in 2014.

Table 3. Contingency table of STEM VET qualification of destination vs STEM University Degree of origin.

VET (destination)	Qualification	Previous University Degree (origin)		
		STEM	NO STEM	Total
STEM	Observed	134.00	83.00	217.00
	Expected	72.10	144.90	217.00
	% line	61.75 %	38.25 %	100.00 %
	% column	65.37 %	20.15 %	35.17 %
NO STEM	Observed	71.00	329.00	400.00
	Expected	132.90	267.10	400.00
	% line	17.75 %	82.25 %	100.00 %
	% column	34.63 %	79.85 %	64.83 %
Total	Observed	205.00	412.00	617.00
	Expected	205.00	412.00	617.00
	% line	33.23 %	66.77 %	100.00 %
	% column	100.00 %	100.00 %	100.00 %

Source: Own elaboration based on data from ETEFIL-19.

The analysis shows 65.4% of university graduates from the branches of Science and Engineering and Architecture tend to opt for STEM-related Higher VET programs. This pattern is even more pronounced in the case of HASS graduates, where 79.8% of the graduates are concentrated in non-STEM Higher VET programs. The re-skilling strategy or career change is more frequent in STEM graduates (34.6%) than in HASS graduates (20.2%).

The χ^2 statistic ($\chi^2(1) = 122.7, p < .001$) shown in Table 4 indicates that there is a significant relationship between the original university field and the VET field of destination.. The magnitude of the relationship between the variables shows a moderate to large effect size (Phi 0.45).

Table 4. Chi-square test results for the correlation between the original university academic discipline and the VET professional field of destination

	Value	Degrees of freedom	p
X ²	122.77	1	<.001 **
N	617		
Phi	0.45		

Source: Own elaboration based on data from ETEFIL-19.

5. Conclusions

The presence of university graduates in Higher VET programs reflects the growing individualization, fragmentation and complexity of academic-professional trajectories (Montes Ruiz, 2019). The study provides quantitative evidence on the ambiguous, prolonged and indirect nature of educational itineraries and routes to employment (e.g. Golding, 1999; Moodie, 2004; Taylor & Jain, 2017; Townsend & Dever, 1999). The increasingly blurred borders between Vocational Education and Training and the University System in Spain point to the need to leave behind the excessively rigid conceptualisation of VET-University pathways. This study demonstrates that the flow in the opposite direction, from University to VET, is also taking place.

Up to now, Post-Baccalaureate Reverse Transfer has been occurring spontaneously. The magnitude and nature of this flow points to the need to adopt measures that improve and reinforce the permeability, the exchange of information and credit recognition schemes between Higher Education Institutions and Higher VET providers.

The results contradict the common assumption that associate the presence of University Graduates in VET programmes with the need for a career change. We demonstrate the transition of university graduates into Higher VET is best interpreted as an upskilling decision both for STEM and HASS graduates and that the re-skilling strategy is more frequent in STEM graduates than in HASS graduates.

6. Limitations and future research

Although the ETEFIL-19 microdata allows a higher level of disaggregation by VET professional field, it would still be difficult to estimate the relationship between the two qualifications (university and VET). In the same way, the complementarity of studies that at first are not related to each other may end up becoming evident in the medium or long term if the combination of both qualifications are revealed as a plus in a recruitment process. Further qualitative studies (e.g. interviews, discussion groups) are needed for the in-depth exploration of the motivations and reasons informing this decision.

Another line of future research is to determine the medium-term impact of this decision on employment-related indicators such as the employment rate, the relationship between VET program completed and the occupation, wages and other employment quality indicators.

University graduates make up only a part of the total volume of people who transit from University to VET. As a reference, Moodie (2004) estimated that in Australia almost two thirds of the protagonists of University to VET transitions correspond to students who had abandoned their university studies. In Spain, a recently released study commissioned by the Spanish Ministry of Universities found 13.5% of undergraduate students leave University

before completing their degree (Fernández Mellizo, 2022). Unfortunately, the ETEFIL-19 data does not include any variables identifying University drop-outs in Higher VET programmes so we consider that it would be interesting to further explore the destinations of this group in order to have the most complete picture of the University to VET transitions in Spain.

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Quality management in Italian Universities: a case study in the University of Cassino and Southern Lazio

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Abstract

This paper examines on a wider scale, quality management in Italian higher education institutions, and then progresses to focus specifically on the case of the Master Course in Global Economy and Business (GLEB), held in the University of Cassino and Southern Lazio. An analysis of the way in which the University of Cassino manages quality is undertaken to identify the responsibilities of those accountable for quality assurance. A preliminary study was carried out through the completion of a digital survey distributed to GLEB graduates, to monitor the success of the course. The results obtained highlight that this course is quite appealing to students, and what also emerges is how innovation and improvement are the foundation of quality education. Being only the first step towards a more exhaustive evaluation, this analysis must be extended by collecting more data, to compare the results with similar courses in other universities through a benchmarking process.

Keywords: *Higher education; quality management; institutions.*

1. Introduction

Education and the formation of qualified professionals are the predominant factors, from an international level, which significantly impact both the economy and society. Their rate of development is correlated to the quality of peoples' lives and the entire development of the country itself. This produces a domino effect, leading to the search for a more competitive, dynamic, and capable education system to ensure the country and corporations have a sustainable growth and achieve their goals of internationalization. From this viewpoint, higher education (HE) represents a critical factor and thus has assumed a fundamental role in determining the level of success of a country's economy, in terms of the development of capital and innovation. For this reason, this process is in continuous adaptation to our society (Teixeira-Quiros, J. et al., 2022). Being humans the main consumers and beneficiaries of educational services, defining the level of quality education becomes quite a complex task. The pressure and need for quality education are increasing. The ceaseless demand for wealth and security of societies and their populations is what manipulates the degree of quality that is expected of higher education. This has been the prevailing scheme for the enhancement of higher education institutions (HEIs) across countries worldwide, because of the proven effectiveness that these educational systems have had in yielding outstanding professionals to govern nations. Because the improvement of quality is a continuous process, the perceptions of its execution and index rate are incredibly decisive in terms of achieving a successful outcome. However, there is never only one insight available since people perceive the concept and degree of quality in diverse ways. Both Crosby (1992) and Juran et al. (1988), had their own perception of quality with Juran et al stating that "Quality is fitness for use or purpose", while Crosby believed the idea of quality is more in line with the "conformance to standards" (Crosby, 1992; Juran et al., 1988). Therefore, to be able to assess the level of quality, it must be defined by recognizable elements which convey its essence, and in turn these characteristics must be identified and understood by HEIs (Justino et al., 2022). Globalization, along with the various developments that are occurring worldwide, are forcing HEIs to go in search of new instruments to improve the quality of higher education. The supply and demand model can be referred to when analysing HEI management nowadays, as universities and other higher education institutions are much more diversified than what they once were in the past.

Thus, a higher education system that is classified as efficient and effective can only be obtained through the achievement of a certain degree of quality in terms of teaching and learning, which are the most important strategic issues in this kind of system (Seyfried, M. et al., 2018). In recent years, universities have been forced to face several challenges including internationalization, the increasing need for effective competitive strategies, the rapid development of indispensable technological changes and the never-ending concern of needing to reduce and control financial costs.

For these reasons, institutions have no other choice but to implement dynamic strategies and technological innovations, to be capable of achieving and actually exceeding what their stakeholders expect of them (Texeira-Quiros, J. et al., 2022; Budiharso, T. et al., 2020). Over the past twenty years or so, high quality management systems have been gradually established in HEIs, on both governmental and institutional levels. The issuing of enormous governmental funds has made it fundamental for those involved in the education sector to guarantee the provision of a productive service in universities and learning institutions, with the aim to deliver an ever more proficient and outstanding quality of learning (Krymets et al., 2022). The most frequent models that educational institutions refer to for quality calibration, adjusting them of course to the institutional environment, include the Malcolm Baldrige National Quality Award, the European Foundation for Quality Management (EFQM) excellence model, and SERVQUAL. Many HEIs also make reference to the Common Assessment Framework (CAF) which is a quality management method based on self-assessment that enables public organizations to achieve their objectives, facilitating a mode of comparison with other public entities. The significance of these quality models has been widely recognized among educational institutions (Sciarelli et al., 2020).

Having introduced these global concepts in relation to HEI quality management, the study can now progress forward to concentrate particularly on the quality management system instituted in Italian universities, taking as a case study the University of Cassino and Southern Lazio, which is the central focus of this paper. The primary objective is to initiate a preliminary evaluation on the success of the Global Economy and Business master's degree course. This case study analysis is simply the first step taken towards a thorough qualitative evaluation process that will be conducted for the GLEB course. Thus, it cannot be taken as a general reflection of the overall degree of quality of the master course.

2. Quality Management in Italian Universities

The management of HE and research institutes in Italy is dealt with by the MUR - *Ministero dell'Università e della Ricerca*, which is in charge of regulating funding, scrutinizing and assessing universities and establishing incentives based on their performance; applying student support policies and endorsing study curricula; making sure that the Italian education system has a significant international presence and is up to the standards of other institutions in the European Union. HEIs have been granted autonomy by the Ministry in 1989, provided they abide by the legal regulatory framework (Capano, 2014). They are free to establish their organisational governance, create their strategy and mission, design curricula and elaborate their own research projects (MUR, 2020). The Ministry also has strong ties with the ANVUR- *Agenzia Nazionale di Valutazione del Sistema Universitario e della Ricerca* (National Agency for the Evaluation of Universities and Research Institutes) which was founded in

2010 to monitor and assess HEIs as well as to improve the quality of Italian research (ANVUR, 2022). The ANVUR conducts assessment programs, in accordance with EU standards, to evaluate the quality of activities undertaken in HEIs with the use of the following practices:

- *AVA - Autovalutazione-Valutazione periodica-Accreditamento* (Self-assessment, Periodic Evaluation, Accreditation): aims to ensure that Italian HEIs are offering services of adequate quality; to sustain HEIs in utilizing public resources responsibly and autonomously and in operating appropriate actions in terms of education, technological transfer, and research activities; to ameliorate the quality level of higher education and research.
- *VQR – Valutazione della Qualità della Ricerca* (Evaluation of Quality and Research): aims to monitor the quality of research project outcomes of national HEIs, and to stimulate an overall improvement of the quality of research projects, to accredit doctoral programs, and to assign funding on a merit-basis to national institutions (OECD & European Union, 2019).

Italian HEIs are aiming to increment the level of involvement of students in assessment processes by conducting detailed investigations, in order to augment the degree of quality attributed to the institutions (Fondazione Crui, 2018).

2.1. University of Cassino and Southern Lazio (UNICAS)

UNICAS, founded in 1979, currently has approximately eight thousand students enrolled and offers thirty degree-courses covering multiple disciplinary sectors (Skoola Network Srl., 2022). As in all Italian HEIs, the main body responsible for planning and monitoring quality assurance activities at the level of the course of study is the Quality Assessment Team which is responsible for:

- verifying the correct performance of the planned activities, the pursuit of the objectives set by the study program, the resolution of any critical issues.
- managing interrelations between the Joint Teachers/Students Commission and the Quality Presidium.
- dialogues with the coordinator of the study program, for the identification of improvement actions, as well as with the external members of the Review Group, to monitor the effectiveness of the training offer for the employment opportunities of graduates.
- contributing to the drafting of the annual and cyclical Review Report.

(Quality of Services Office, 2022)

The University Quality Presidium is the main actor called upon to supervise and support the effective implementation of the university's quality policies. Every year the Presidium issues the Quality Policy of the University, describing the objectives and actions regarding the aspects of quality and quality assurance (QA), in line with the priorities of the university and its strategic plans.

In recent years, UNICAS has been particularly working on enhancing its offering of international courses held entirely in English, one of which is the Global Economy and Business Master course (GLEB) (Consorzio Interuniversitario AlmaLaurea, 2022).

3. Case Study

The study consists of monitoring the relevance of what the GLEB graduates studied during the course to their job positions and the overall success rate of the study course. This analysis was conducted in collaboration with the Quality Assessment Team of the economics department whose objective is to monitor the performance of the GLEB course and the satisfaction rate among students enrolled, in compliance with the national standards established by the ANVUR. As mentioned previously, this study is simply a preliminary analysis undertaken to initiate a complete evaluation process that will determine successively the overall quality of the course, highlighting its strong points and weaknesses, as well as identifying where improvement can be implemented. Therefore, this analysis is not entirely reflective of the overall results that will be obtained upon completion of the entire evaluation process.

A questionnaire was conducted between June and December in 2022, for a population composed of students that graduated from the course, all participating voluntarily. The sample size was a total of eighty-seven participants who responded out of approximately two hundred and fifty individuals who had been contacted, in order to understand what kind of experience these individuals had with the course through the completion of a digital questionnaire, comprising a selection of multiple-choice questions and only a limited number of open-ended questions for statistical study purposes.

3.1. The Survey

The survey is composed of questions regarding the demographic profile of the participants, such as gender, age, nationality, and residence. The questions aimed to find out the graduation age range, the time taken to complete the course, and the time taken to find a job after graduation. It is then divided into two sub-sections based on whether the participant is currently working or not. For those who are currently employed, the survey proceeds to identify which country they work in, the type of occupation, the sector of work, the job position, the approximate monthly salary range, the degree of satisfaction with their job,

whether the work is related to GLEB studies or not and finally an open-ended question asking for their personal input on how the GLEB course could be improved based on their work experience. In the second part, for currently unemployed graduates, participants are asked to explain why they are currently not working, and for those who have chosen to continue their education, the questions focus on where they are studying. The survey ends for all participants with the recommendation section asking them if they would recommend the GLEB course to others and the reasons why.

3.2. Data Analysis

According to the data obtained approximately 66% of the participants are males and the remainder females. Regarding the birth country, more than 50% of the participants are foreign students, while the remainder are Italian. Also, just over 75% of the participants reside in the European continent, which implies that most of the foreign students who enrolled in the GLEB course have remained in the continent even after their studies. Approximately 81% of the participants are currently working and 65% of these were either already working when they graduated, or they managed to find a job within six months after graduation. 59% of the working graduates earn an average monthly salary of €1500 or more (See Fig.1). Another important set of data to consider are the results of the job relevance to course study rating, in which almost 55% of the working graduates stated that their current job is related to their GLEB studies (See Table 1). Regarding the question of “Based on your experience, are there any contents/skills you would suggest providing to the incoming GLEB students?”, the main suggestions included to introduce more courses and training to acquire people skills, soft skills, analytical skills for data reading and interpretation, digital skills, project management abilities, project finance skills, SQL skills, statistical software utilization, debating skills, and how to use the Microsoft Office package. Other suggestions regarded the introduction of courses on new topics such as cyber security, cloud computing, financial modelling, regional and national policy, as well as supply chain management.

Some suggested to increase the knowledge of the students regarding economics by introducing more courses based on this topic, and to increase the opportunities for students to build connections with large corporations. Out of the total number of graduates, sixteen are currently not working, and among these, only two are continuing their studies, while the remainder are still searching for employment. Finally, over 85% of the total participants stated that they would recommend the GLEB course to other potential students.

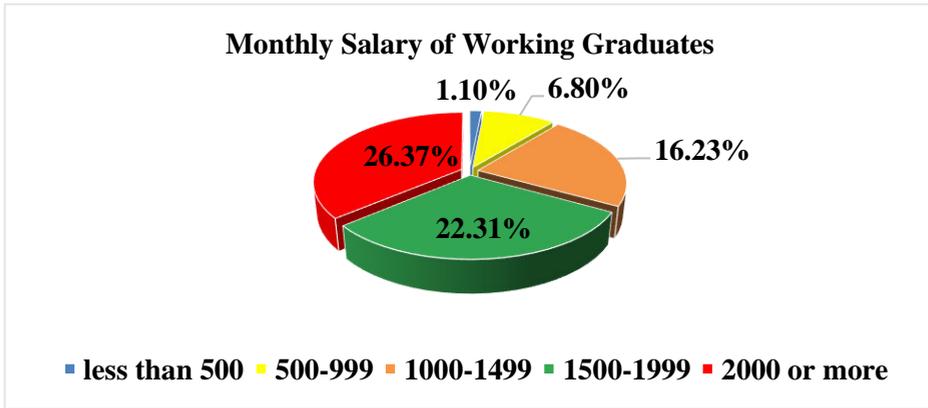


Figure 1. The average monthly salary ranges of working GLEB graduates. Source: Personal Data Source (2022/2023).

Table 1. The relevancy of the graduates' job to what they studied in the GLEB course.

Is job related to GLEB degree?	Working Graduates
Definitely yes	23.94%
More yes than no	30.98%
More no than yes	26.76%
Definitely not	18.30%

Source: Personal Data Source (2022/2023).

4. Conclusion

HEIs should be continuously assuring and enhancing the quality of their educational and research-based activities. Being well aware that for an advanced country scientific and technological research is the driving force of society, the University of Cassino and Southern Lazio makes an important contribution to the advancement of knowledge in the fields of humanities, social sciences, engineering, and economic-legal studies. From the results obtained, a critical issue has emerged, in that almost 50% of the working graduates stated that their GLEB studies are not relevant to their current jobs, thus a further investigation must be undertaken to verify the reasoning behind this issue. Despite this criticality, most of the graduates have expressed that they would most likely recommend the course to other students. This demonstrates that the methodological approach utilized has proven useful for this study, as criticalities can be identified and consequently rectified. However, it is not without limitations, since a limited number of participants responded to the questionnaire,

and thus, it is not completely reflective of the overall opinion of past students. For this reason, the results obtained may not be exhaustive and therefore a further study and evaluation must be conducted to obtain a more complete set of data.

From the suggestions received from the participants in the questionnaire, one of the future objectives of the University is to implement the program and the variety of courses offered. To do so as a future prospect, the benchmarking process could be applied to the GLEB course, firstly, to help maintain a certain degree of quality and stay in line with the institutional mission and reputation. Secondly, by undertaking a benchmarking analysis, the strong points and problematic issues currently connected with the course can be unveiled and monitored. Lastly, by comparing the performance of the course in UNICAS to other similar courses in other institutions, similarities and differences can be noted and subsequently evaluated to understand how this program can be improved. The concept of innovation and change is fundamental, not only because the GLEB course is open also to international students, but also because by implementing innovative methods, ideas, or processes it becomes more appealing to both national and international students, thus adding to the university's overall competitiveness on an international level.

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Robust estimation method for the economic subsidies to educational institutions in Chile

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Abstract

In Chile, the Ministry of Education of Chile (MINEDUC) provides resources to the various educational institutions in the country based on a budget estimation model, where the "attendance of students" is the main component to be considered by annual economic subsidies. In the process, this estimation must be computed in the middle of the year, and therefore, the reduction of the impact of error in the estimation face to uncertainty is a desirable goal. In this work, we propose an easy-to-implemented robust estimation method, which is based on the formulation, implementation, and integration of a set of mathematical models that target the minimization of the maximum estimation error. The obtained results show that the proposal obtains a better estimation than the current MINEDUC estimation model, providing an efficient alternative of robust estimation method for the decision makers in the process, exposing insights to be considered in the future.

Keywords: *School Subsidies; attendance, mathematical models; robust method; estimation.*

1. Introduction

Education is the fundamental basis for people's opportunities throughout their lives and constitutes the essential underpinning of a country's productivity and development (Marcel & Tokman, 2005). Therefore, States must finance school education considering its compulsory nature and guarantee access and equal participation of all members of the community in national life. In this context, the Ministry of Education of Chile (MINEDUC) is responsible for ensuring an inclusive and quality education system that contributes to the comprehensive and lifelong learning of people and the development of the country, through the formulation and implementation of policies, standards, and regulations, from kindergarten to higher education (Gobierno de Chile, 2022). For this purpose, MINEDUC grants municipal and subsidized private education and local education services the concept of school subsidy.

The schooling subsidy granted by MINEDUC finances an average of 10.595 educational institutions in Chile, which translates into an average of 3.269.831 students in the country. Moreover, concerning the distribution of financing resources for the educational system, in 2021, the Chilean government allocated 6.396.670.457 MM CLP, of which 3.670.242.048 MM CLP are destined for the schooling subsidy (MINEDUC, 2021), representing more than 50% of the annual budget ministry.

In this context, MINEDUC has a budget estimation model that is conducted in collaboration with the Ministry of Finance and is composed of different variables and parameters. The main assumptions are enrollment and attendance percentage, which are determined by analyzing the behavior of recent years. For example, the methodology used in the Ministry of Education's 2023 subsidy estimation considered the most recent enrollment at the time of the estimation (May enrollment) and a 2,48% increase in the number of PIE students (students with permanent or temporary special educational needs) according to the growth reported by the General Education Division (School Integration Program Coordination). To make the estimation, the percentage of occupied attendance corresponding to the average of the last four years was used.

However, the attendance estimation for determining the budget to be requested for the school subsidy delivery needs to be more explicit due to various situations, including social mobilizations and Covid-19, among others. On the other hand, MINEDUC must annually make the budget estimation for the following year in May. That is, with the information from January to May 2023, they must estimate the attendance for all the months of 2024. That generates uncertainty about the value of estimated attendance, causing a margin of error in the estimation, either underestimating or overestimating the actual budget. If the calculated

budget is lower than that needed in the subsidized educational institutions, MINEDUC must again request an amount to subsidize the educational institutions that should have been covered.

1.1. Our contribution

This paper deals specifically with the problem of uncertainty in the number of students attending educational institutions to determine the amount of school subsidy to be received. The contribution of this research is based on a robust estimation method, which involves the formulation, development, and implementation of a set of mathematical models that target the estimation error. This method allows determining a more efficient estimation of the number of students attending educational institutions per month, and per teaching modality, complying with the MINEDUC's request, that is, that the estimation values have at most a 2,5% error. This result will, in turn, be used as a parameter in the financing formula of the Chilean educational system and will reduce the margin of error in estimating of the total budget for educational financing. The data corresponding to Chile's municipal and private educational institutions and local education services were considered for the above.

2. Material and methods

2.1. Statement of the problem

In Chile, schools are characterized according to their administration, for which we consider a set of educational institutions D . Each educational institution can offer a set of days for holding classes, so we consider a set of days J for educational institutions. In turn, each educational institution has different teaching modalities that we denote by a set P that depends on the type of day J offered by that institution. Then, we define $P_c \subset P$ as the subset of teaching modalities for educational institutions with a full school day and a subset $P_g \subseteq P$ as the subset without a full school day. Student attendance is recorded from January to December for each year. We define a set of months M and a set of years A that depends on the collected data that considers information from educational institutions from 2017 to 2021. As MINEDUC annually must make the budget estimation in May for the attendance estimation, we consequently consider a subset $M_t \subset M$ representing the training months to be used for the estimation.

To estimate attendance, we rely on estimation errors. On the one hand, the mean absolute percentage error (MAPE), which relates the estimation error to the level of demand, is helpful to place the estimation performance in its correct perspective, where the objective is to minimize this error to obtain the lowest possible margin of error in the estimation (Krajewski, Ritzman, Malhotra, & Krajewski, 2008). On the other hand, the maximization of the

minimum of the errors (MINMAX) aims to obtain the minimum of the errors, that is, the most negative, to represent an overestimation of the real value of the attendance to make this overestimation the minimum possible subsequently. This last error is considered because, in conversations with MINEDUC, the latter stated that it wanted to obtain an overestimation in the estimations.

2.2. Mathematical model

To address the problem above, we propose a robust estimation method based on formulating two mathematical models that target the estimation error: the MAPE and the MINMAX. Specifically, we define the decision variables $\hat{x}_{d,j,p,a}$ and $e_{d,j,p,a}$ that express the estimation of the average attendance and the estimation error of the educational institutions of dependency $d \in D$ with a type of day $j \in J$ with teaching modality $p \in P$ in the year $a \in A$. A parameter α that expresses an estimation error of 2,5%. A non-negative decision variable $\lambda_{m,d,j,p} \in [0,1]$ that expresses the relevance of the training month $m \in M_t$ of the educational institutions of dependency $d \in D$ with the type of school day $j \in J$ with teaching modality $p \in P$. The parameters $x_{d,j,p,m,a}$ and $\bar{x}_{d,j,p,a}$ that express the real attendance and the real average attendance, respectively, of the educational institutions of dependency $d \in D$ with the type of day $j \in J$ with teaching modality $p \in P$ in the month $m \in M$ in the year $a \in A$. For both models, let us consider the following set of restrictions $\forall d \in D, \forall j \in J, \forall p \in P$:

$$\hat{x}_{d,j,p,a} = \sum_{m \in M_t} \lambda_{m,d,j,p} x_{d,j,p,m,a} \quad \forall a \in A \quad (2) \quad \sum_{m \in M_t} \lambda_{m,d,j,p} = 1 \quad (3)$$

$$e_{d,j,p,a} = \hat{x}_{d,j,p,a} - \bar{x}_{d,j,p,a} \quad \forall a \in A \quad (4) \quad -\alpha \leq \frac{e_{d,j,p,a}}{\bar{x}_{d,j,p,a}} \leq \alpha \quad \forall a \in A \quad (5)$$

where, the set of constraints (2) and (3) define the convex combination for the attendance estimation that corresponds to the weighted sum of the actual attendance value of the educational institutions in the training month $m \in M_t$. Constraint (4) defines the estimation error corresponding to the difference between the estimation and the actual average attendance. Constraint (5) defines the estimation error tolerance as 2,5%.

Then, the objective of the MAPE model is to minimize the mean absolute percentage error for which we consider an auxiliary variable $Y_{d,j,p,a}$ that expresses the linearization of the absolute value function of the estimation error defined by Expression (6) $\forall d \in D, \forall j \in J, \forall p \in P$:

$$[MIN] \sum_{a \in A} Y_{d,j,p,a} \quad (6)$$

Subject to the following restrictions (2) to (5):

$$Y_{d,j,p,a} \geq e_{d,j,p,a}/\bar{x}_{d,j,p,a}, \quad Y_{d,j,p,a} \geq -e_{d,j,p,a}/\bar{x}_{d,j,p,a} \quad \forall a \in A \quad (7)$$

where, the set of constraints in (7) defines the linearization of the absolute value function of the estimation error corresponding to the mean absolute percentage error. On the other hand, the objective of the MINMAX model is to obtain the most positive error to represent an overestimation of the real value of attendance, to subsequently make that overestimation the minimum possible for which we consider an auxiliary variable $Z_{d,j,p}$, defined by Expression (8) $\forall d \in D, \forall j \in J, \forall p \in P$:

$$[MIN] Z_{d,j,p} \quad (8)$$

Subject to the following restrictions (2) to (5):

$$Z_{d,j,p} \geq e_{d,j,p,a}, \quad e_{d,j,p,a} \geq 0 \quad \forall a \in A \quad (9)$$

where, the set of restrictions in (9) defines the auxiliary variable that rescues the most considerable overestimation of the estimation, and the estimation errors must be positive to represent an overestimation in the attendance estimation.

Then, to determine the attendance estimations of the educational institutions with their respective attributes, we formulated a compromise mathematical model that integrates the two models formulated above. Specifically, we defined two weights $W \in [0,1]$ to give weight to each mathematical model of estimation error. A FO_{MAPE} parameter that expresses the value of the objective function of the MAPE model. And a FO_{MINMAX} parameter that expresses the value of the objective function of the MINMAX model. The above, as shown in Expression (10):

$$[MIN] \frac{W * \sum_{d \in D} \sum_{j \in J} \sum_{p \in P} \sum_{a \in A} Y_{d,j,p,a}}{FO_{MAPE}} + \frac{(1 - W) * \sum_{d \in D} \sum_{j \in J} \sum_{p \in P} Z_{d,j,p}}{FO_{MINMAX}} \quad (10)$$

subject to the following expressions (2) to (9) and $\forall d \in D, \forall j \in J, \forall p \in P$:

$$Z_{d,j,p} \geq 0 \quad (11)$$

where, constraint (11) indicates which auxiliary variable $Z_{d,j,p}$ represents the minimum overestimation, such that if there is no overestimation $\forall a \in A$, its value is zero.

3. Results

3.1. Statement of the problem

To solve the problem above, we use the actual attendance data provided by MINEDUC of municipal, private subsidized, and local education services educational institutions from 2017 to 2021, corresponding to January to December. For educational institutions whose dependence is "Municipal" (Mun) or "Private Subsidized" (PSub), the corresponding

teaching modalities must have at least three years of historical data. Moreover, the teaching modalities must have at least two years of historical data for those with "Servicios Locales de Educación" (SLE) dependency. Attendance estimations will be made by teaching modality for the year 2021 to be able to compare our results with the results obtained by the MINEDUC model for the same year. Finally, the scope of this work involves the attendance estimations for the year 2021 of the educational modalities whose annual average attendance covers at least 50% of the global average.

3.2. Mathematical model

To solve the instance above, we implemented the mathematical models previously formulated using the Python programming language, considering the following considerations: Pyomo to formulate optimization models, Gurobi as a solver on a PC with an AMD Ryzen 9 5900HS with Radeon Graphics processor at 3.30 GHz and with 32 GB of RAM. Table 1 shows the attendance estimations for the year 2021 for educational institutions of dependency $d \in D$ with a type of day $j \in J$ with teaching modality $p \in P$ obtained by the MAPE model, MINMAX, Compromise Solution with two weightings W equal to 0,5 to integrate the MAPE and MINMAX models and the MINEDUC budget estimation model equally. And a comparison of the actual attendance data for the same year, where the acronyms "C.J" and "S.J" refer to educational institutions with and without a full school day, respectively, while "B" and "M.H.C" correspond to the modalities of primary and secondary scientific and humanistic education, respectively.

4. Discussions and Conclusion

In this paper, we address the problem of uncertainty in the number of students attending educational institutions to allocate the school subsidy in Chile. A robust estimation method is provided by developing a mathematical model that targets the estimation error, the MAPE, and the MINMAX and integrating these through a compromise solution mathematical model. The results obtained are illustrated considering the actual attendance data of the subsidized educational institutions in Chile from 2017 to 2021 delivered by MINEDUC. For this research, the selection of the MINMAX estimation error is because MINEDUC requested that the attendance estimations represent an overestimation of the real data in order not to have a budget deficit in the school subsidy that affects the administrative management of MINEDUC and the quality of the student's education. Now, the attendance estimations of the educational institutions were made at a disaggregated level according to the dependency $d \in D$, type of school day, $j \in J$ and type of education $p \in P$ because MINEDUC's budget estimation model requires it for the school subsidy financing formula. This implies having a carry-over error in each estimation, which could mean a significant error at the aggregate level, i.e., in the final amount of the school subsidy. Therefore, the overestimation could be

massive if we only use the MINMAX error for the estimations. As a result, we will obtain a surplus in the school subsidy budget, which generates inefficiency in the distribution of resources, on the one hand, in the reallocation of resources to other items within the subsidy program or, on the other hand, causing another MINEDUC program not to be executed. Therefore, the MAPE estimation error selection has a regulatory impact at the aggregate level of the school subsidy budget, i.e., the final amount is associated with a smaller confidence level or estimation threshold since some estimations will be overestimated. Others underestimated, where a negative value (underestimated) can save a lot in the overestimation of the estimation.

This behavior of the estimation errors is supported by the results obtained by each mathematical model separately. When estimating attendance only with the MAPE model, most of these estimations at the disaggregated level are below the actual attendance value. For the MINMAX model, most estimations are above the actual attendance value. Moreover, comparing the total amount of attendance, it is observed that when using only the MINMAX model, the total of the estimations is higher and closer to the actual value of attendance than when using only the MAPE model. Then, by integrating these two models in the compromise solution model, it can be verified, according to the results obtained, how the MAPE model attenuates the overestimates of the MINMAX model, finding a balance between underestimates and overestimates. In fact, at the global level of attendance, it can be seen how the total value of attendance decreases by only using the MINMAX model, but at the same time, how the total value of attendance increases by only using the MAPE model. Finally, the results obtained by our robust estimation method were more accurate than those obtained by the MINEDUC estimation model, which ratifies the effectiveness of our proposal and the improvement that our research could contribute.

Something interesting to note about the results obtained by the MINMAX model is that although these results represent overestimates, they needed to be sufficiently loose. This is because in the database provided by MINEDUC, the behavior of the data was stable; in fact, they were similar within and outside the estimation period. It follows that the dispersion of the missing data, i.e., the data to be estimated, varies a little, so because of applying MINMAX, the overestimates were not so loose. Therefore, the carry-over error needed to be bigger, which meant that the disaggregated estimations were relatively accurate in the final amount of attendance.

Table 1. Results of the attendance estimations for 2021 of the set of mathematical models versus the MINEDUC estimation model.

			MAPE	MINMAX	S.C	MINEDUC	
D	J	P	Real attendance	Estimation	Estimation	Estimation	Estimation
M	C.J	B. 1°-4°	230.576	230.121	230.313	230.121	230.462
u							
n							
M	C.J	B. 5°-6°	141.102	141.033	141.330	141.330	141.070
u							
n							
M	C.J	B. 7°-8°	143.919	143.905	143.905	143.905	144.616
u							
n							
M	C.J	M.H.C	145.965	144.205	144.241	144.205	148.472
u							
n							
P	C.J	B. 1°-4°	304.839	306.319	304.974	306.319	299.127
S							
u							
b							
P	S.J	B. 1°-4°	189.784	189.607	189.789	189.607	187.603
S							
u							
b							
P	C.J	B. 5°-6°	213.924	214.254	214.077	214.254	210.310
S							
u							
b							
P	C.J	B. 7°-8°	205.330	204.433	205.364	204.433	202.180
S							
u							
b							
P	C.J	M.H.C	308.533	305.253	308.821	305.253	304.686
S							
u							
b							
Total			1.883.972	1.879.130	1.882.814	1.879.427	1.868.526

Source: Own elaboration.

In conclusion, based on the results obtained, for future work, we propose the use of other mathematical models that target the estimation error, such as the mean absolute deviation

(MAD), the absolute mean square error (MSE), among others, to see how the integration of these in the compromise solution model alters the results of the attendance estimations, either overestimating or underestimating each of the estimations. Now, although in the compromise solution model, the weight assigned to the W weight was 0,5, it would be interesting to analyze how the values of the attendance estimations change as W changes in the objective function of the compromise solution model and also to study the behavior of the weights to see the importance of each month in the attendance estimations, that is, to analyze if there is any trend in the weights of the weights, for example, that March is the most relevant in the attendance behavior.

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Evolution of academic dishonesty in computer science courses

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Abstract

Online exams and assignments during the COVID-19 pandemic have introduced new forms of student cheating. In order to maintain evaluation criteria and preserve established ethical standards, professors have introduced new methods to minimize cheating. When returning onsite, the newly created cheating techniques evolved once again. They were supported by special groups on social networks dedicated to easier liquidation of exams and getting better grades. Crowdsourcing became frequent, particularly for homework assignment preparation. Recently, ChatGPT has become a new ally of students. This paper presents the evolution of student cheating in several computer science courses taught by the author of this paper. All examples of cheating are supplemented by the detecting methods and own applications used to prevent them from occurring again. The paper ends by predicting who will win in the eternal war between students and professors, at least in the short run.

Keywords: *Academic dishonesty; contract cheating; crowdsourcing; social media; versatile chatbots.*

1. Introduction

Academic dishonesty is a common phenomenon that has been going on for centuries (Lang, 2013). It is sometimes supplemented by bribing the examiner (Liu & Peng, 2015). Cheating usually happens during exams, but a large amount of cheating also comes from homework. The methods are specific to the field and type of study and are usually applied either during exams or during the preparation of assignments. In the pre-digital era, cheating during exams was done using more than 20 different techniques (Twomey, White & Sagendorf, 2009). At the Faculty of Computer Science and Engineering in Skopje (FCSE), the most common were:

- Cheat sheets, which our students hid in their pockets, inside their pants or taped inside thighs, while the girls hid them under the skirts or in their bras (Erbe, 2007). Sometimes they were placed in logarithmic tables, hidden inside pencils or stuck on plastic water bottles.
- Passing notes, prepared by better students after finishing their own solutions and shared with the students in their vicinity (Yee & MacKown, 2009). For shorter solutions, they could reach more than five students during one exam.
- Peeking into the test of a student who is ahead or behind (Newstead, Franklyn-Stokes & Armstead, 1996).
- Whispering or showing the number of the task and the correct answer with fingers (Twomey, White & Sagendorf, 2009).
- Distracting the proctor, often with banal questions, and enabling other colleagues to copy from the cheat sheets, passing notes or even from the test of a better student unhindered (Yee & MacKown, 2009).

The digital era introduced many new techniques, which complemented the previously mentioned ones (Twomey, White & Sagendorf, 2009). At FCSE, they included:

- Searching the Internet from the computer from which the student takes the exam or from the mobile phone (Harkins & Kubik, 2010).
- Entering the solution into a calculator (Kelley & Dooley, 2014), disk of USB flash drives that is shared with colleagues (Dawson, 2016).
- Sharing the solution using chat communication within the faculty local area network (Khan & Balasubramanian, 2012).
- Sharing the photo of the solution via mobile phone (Tindell & Bohlander, 2012).
- Turning off the screen to hide the solution that is intentionally left for a colleague who will take the exam from the same computer (Moten et al., 2013).
- Taking the exam on behalf of another student by logging into his/her account (Bretag et al., 2019).

Academic dishonesty during homework preparation did not change significantly with the transition to the digital era (Ercegovic & Richardson, 2004). It predominantly includes:

- Various forms of plagiarism, which embrace verbatim or Google translated text (Ducar & Schocket, 2018), fabricated bibliography (Lin & Wen, 2007), paraphrasing without acknowledging the original author (Newstead, Franklyn-Stokes & Armstead, 1996), potlucking sentences from several sources to harmonize them while retaining most of the original text (Myers, 2018) or self-plagiarism from assignments prepared for other courses (Bretag & Mahmud, 2009).
- Various forms of contract cheating that encompass: delivering or copying from other assignments with the approval of the original authors (Zdravkova, 2011).
- Hiring a ghostwriter (Zheng & Cheng, 2015), purchasing from paper mills (Medway, Roper & Gillooly, 2018) or using computer generated solutions (Vasylets & Marín, 2022).
- Appropriating a joint solution or homework assignment as its own (Newstead, Franklyn-Stokes & Armstead, 1996).

New learning management systems are Web 2.0-oriented, offering students the opportunity to work together using discussion forums, wikis, blogs and chats, enabling new forms of cheating (Aljawarneh, 2020). They introduce several new cheating activities:

- Idea theft in the discussion-based assignments inspired by what colleagues have written (Ellis, 2022; Zdravkova, 2014). Sometimes, the quality of stolen idea overcomes the quality of the original one (Zdravkova, 2014).
- Intrinsic plagiarism by combining parts of previously submitted discussions (Stein, B., Lipka, N., & Prettenhofer).
- Identity fraud when a student gives up his password to a colleague who does assignments for him/her (Bailie & Jortberg, 2009).
- Deliberate destruction of existing wikis or their fake editing (Zdravkova, 2014).

Last but not least is the use of social media in education (Greenhow & Lewin, 2016). They contain massive repositories of all information shared among the students, starting with exam questions and their solutions, through homework solutions, ending with strategies for outsmarting professors.

The paper continues with a review of observed cheating in two types of courses at FCSE during online education caused by the COVID-19 virus. All examples of cheating are supplemented with detection methods and display of proprietary applications used to prevent them from occurring. The paper ends with the post-COVID student cheating methods and the personal impression of the outcome of the eternal war between students prone to cheating and teachers who strive to prevent this academic dishonesty.

2. Cheating and prevention methods during online learning

Online education required extraordinary efforts to prevent students from cheating on exams and assignments. FCSE prepared a completely new environment, which contained many mechanisms to detect and minimize the effects of students' eternal desire to complete their assignments with minimum effort and get the highest grade in the process.

All exams were organized using Safe Exam Browser (<https://safeexambrowser.org>), which disabled browsing outside the exam website. Before the exam, students were identified through their smartphones, which were turned into web cameras using the Manycam (<https://manycam.com/>) or Droidcam (<https://droidcam.en.softonic.com/>) applications. The identification included careful observation of the room from which the exam was taken. During the exam, the proctors monitored each student, his/her computer screen, and listened to all the sounds he/she made. In spite of all these efforts, the success rate during exams increased, probably as a result of communication via alternative communication media.

Exams were recorded and kept for further inspection whenever the proctor suspected that some students were cheating. Based on the re-checking of the recorded exam, several fraudsters were discovered and their studies were suspended for one year.

2.1. Detecting and preventing academic cheating in technical courses

Plagiarism of exam solutions and homework assignments in technical courses was detected with JPlag (<https://github.com/jplag/JPlag>), a powerful tool that discovers software plagiarism and collusion in software development by mutually comparing the code. On each course and during each exam, at least one couple of completely identical and several almost identical solutions was detected, resulting in a disqualification of all involved students from the course. The same approach was implemented to prevent contract cheating of assignments.

The exam questions included the available commands of the programming tool presented as icons that must be correctly selected and assembled to generate the solution (Fig. 1). This time-consuming activity for the exam creators has proven to be extremely effective to reduce the use of cheat sheets and avoid the temptation to search for solutions from an alternative laptop or smartphone. Moreover, it enabled the automatic grading of exams.

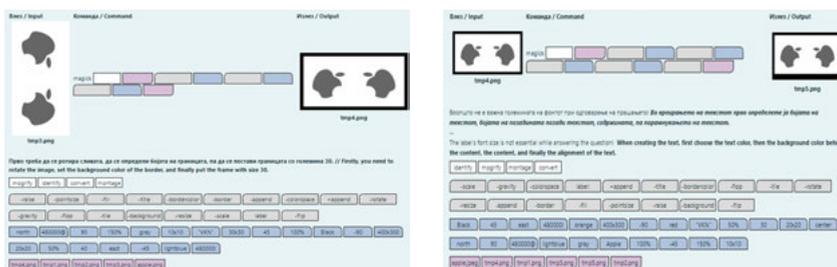


Figure 1. Typical exam questions of the Introduction to computer science course.

2.2. Detecting and preventing academic cheating in soft skill courses

Soft skill courses at FCSE are mainly realized using Web 2.0 features within Moodle (Zdravkova, 2014; Zdravkova, 2022a). Plagiarism by stealing from online sources was detected by careful checking of all posts, particularly those with a writing style not typical for a young computer science student. The professor translated them back into English and then searched the phrases on the web. This manual strategy resulted in the discovery of dozens of plagiarized posts out of hundreds, proving the suspicion that students are easily misappropriating other people's copyrighted material.

Detecting the theft of ideas required careful reading of posts and excellent memorization of previously published content. To facilitate visual discovery, the forums were divided into aspects to reduce the amount of published material (Zdravkova, 2022a). The same technique contributed to the detection of intrinsic plagiarism. In several situations, students whose ideas were stolen reacted within the same forum, making the professor's detective work easier.

An application for ghostwriting detection was developed to mutually compare homework assignments according to document metadata, used references, text ngrams and text similarity (Fig. 2.). The main requirement was that the documents should be delivered as source files. The application revealed several key facts:

- Students use their own crowdsourcing repositories where they have collected assignments from many generations. To prepare a new essay or journal, which is a collection of hot topics related to the curriculum, cheaters compose their own assignments from several similar assignments, reducing the text similarity.
- Contract cheating is more than obvious. Students from earlier generations and ghostwriters recruited from the current one create essays that are in accordance with the defined rules. The common feature of these essays is that they have 0 editing time. If the student who was suspected of handing in such an assignment knows well what is written in it, then he / she gets a grade depending on the quality of the work.
- Crowdsourcing was also noticed mainly because the writing style in the homework was too professional. Few students who were suspected admitted that they bought the homework from Amazon Mechanical Turk (<https://www.mturk.com/>).

File Name	Length Comparison	Metadata Comparison	Text Comparison	Text Similarity	Summary 2
13861487_assignmentdocument_0ha_1.txt	0	00	0.00	1.0	91.92
13861488_assignmentdocument_0ha_1.txt	0.47	00	0.04	0.30	50.84
13861489_assignmentdocument_0ha_1.txt	0	00	0.00	0.4	50.00
13861490_assignmentdocument_0ha_1.txt	0	00	0.06	0.24	50.0

Figure 2. Ghostwriting detecting application at work.

3. Returning to new normal and final remarks

The return to on-site education marked a new shift in academic dishonesty. The long-term reliance of students on the web during exams was the first challenge FCSE had to deal with. This was achieved by activating a firewall that prevents access to all websites except the exam and by disabling access to the exam website from IP addresses outside the faculty labs. That decision drew the ire of some students who insisted on online exams for medical reasons.. When entering the exam, students switch their cell phones to flight mode and leave them in a special place. It does not necessarily mean that they are prevented from cheating, because they can always have an alternative device hidden in their clothes.

FSCE has decided not to block the spy earbuds and mobile phones during exams. Typically, one proctor is responsible for a maximum of 20 students, which is more than enough to notice attempts to communicate with colleagues taking the same exam or with the cheating partner via the spy earbud.

The discovery of academic dishonesty in soft skills courses has not changed, as they have been mostly online for over 15 years (Zdravkova, 2022b). The only on-site activities, which are part of the student assessment, are presentations and discussions of collaborative projects. They have always been events that students liked and they never cheated on them. During the last discussions in January 2023, students revealed that there is “a new kid in town”: ChatGPT (<https://openai.com/blog/chatgpt>). Some have already experienced it and were impressed by its functionalities. It is probable that ChatGPT has already been used for the preparation of essays in the computer science course. According to the author of this paper own experience, the writing style in the essays compiled by this versatile chatbot resemble the writing of young students. If these essays are post-edited after being translated using Google Translate, there will no longer be a need for contract cheating and crowdsourcing support. This chatbot will do a great job in replacing days of homework preparation with less than a quarter of an hour of polishing. Ghostwriting detectors will become obsolete.

The paper presented a plethora of various techniques and activities of cheating on exams and during homework preparation. Many new techniques and methods of cheating have appeared, but the old ones still exist and are all widely used by dishonest students. Therefore, it is more than evident who will win in the eternal war between students and professors.

Cheaters are always at least one step ahead of their opponents. New technologies and crowdsourcing initiatives, driven by social media and versatile chatbots are their great allies. No matter how hard the professors try to prevent academic dishonesty, the students will always have an advantage and will manage to outsmart them.

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Place-based teaching amidst a global pandemic?

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Abstract

How did the COVID-induced switch to online learning impact attitudes and practices toward place-based teaching? To explore this question, a pair of surveys was administered to students and faculty in the University of Hawaii's School of Ocean and Earth Science and Technology in Fall 2018 (142 respondents) and Fall 2021 (83 respondents). Survey results indicate that PBT practices are highly valued by students and faculty, even (or perhaps especially) when courses are in online formats. Faculty report wanting to use more place-based teaching practices in online courses, but there are obvious challenges. The paper ends with concrete examples of how place-based teaching can be effectively implemented in online courses.

Keywords: *Place-based teaching, geoscience, STEM education, online learning.*

1. Introduction

The COVID-19 pandemic has had a dramatic and enduring effect on higher education. In early 2020, when the global pandemic first hit, nearly all colleges and universities shut their physical classrooms. Online learning rapidly became the norm, forcing students and teachers to grapple with learning new technologies and modes of interaction at breakneck speed. Despite a rocky start, students and teachers rapidly adapted. A year or two later, when the pandemic subsided, many students were no longer interested in returning to in-person instruction: they wanted to continue learning remotely (Inside Higher Ed, 2021, Clary et al. 2022). Students voted with their feet: universities that insisted on in-person-only instruction were punished with plummeting enrollments. Many institutions are now offering courses in various online, hybrid and in-person formats, in an attempt to meet student demand while maintaining academic rigor.

This paper examines the question: *How did the COVID-induced switch to online learning impact attitudes and practices toward place-based teaching at the University of Hawaii's School of Ocean and Earth Science and Technology (SOEST)?* Place-based teaching (PBT) has been shown to increase student interest and motivation (Smith and Sobel 2010), strengthen relationships to place and local communities (Sobel 2004); and raise environmental consciousness (Stapp et al. 1969). Whereas PBT can be a successful approach for engaging all students, it has been shown to be exceptionally effective with indigenous students (Cajete 1994). [See Böttjer-Wilson and Bruno 2019 for more on PBT].

2. Methods

To assess attitudes and experience regarding PBT at SOEST, we distributed an online survey to SOEST faculty and students in Fall 2018 (Böttjer-Wilson and Bruno 2019) and again in Fall 2021. In 2018, there were 142 survey respondents, including 59 faculty and 83 students. In 2021, the response was smaller (83 total), including 31 faculty and 52 students. Not every respondent answered every survey item, so the number of responses to each survey item varies. Comparing the two data sets enables us to gauge how PBT attitudes and practices have changed between 2018 and 2021. The timing of the 2018 pre-survey was fortuitous, as we obviously could not have anticipated the COVID-19 pandemic hitting in 2020, and allows us to consider the effect of the global pandemic on PBT. Throughout this paper, the graphs present the 2018 survey data in blue and the 2021 survey data in red.

3. Data & Results

3.1 Faculty Survey Results

In Fall 2020 and Spring 2021, all SOEST instructors used online course formats, with 92% teaching online synchronous classes. The majority of instructors (60%) taught only online synchronous classes, but some also used asynchronous (20%), hybrid (12%) and/or in-person (16%) formats. When asked which PBT practices they would have normally used during Fall 2020 and/or Spring 2021 but did not due to the COVID-19 pandemic, most faculty listed one or more practices (Figure 1). Topping the list of PBT practices reported were field trips (used by 48% of faculty), service learning (20%), and local/regional experts as guest speakers (16%) – all of which would have been much more difficult to do in online courses. About one-third (36%) of faculty responded “None of the Above”, which could either indicate that these faculty used PBT practices pre-pandemic and continued to use them post-pandemic, or that they never used PBT practices pre-pandemic.

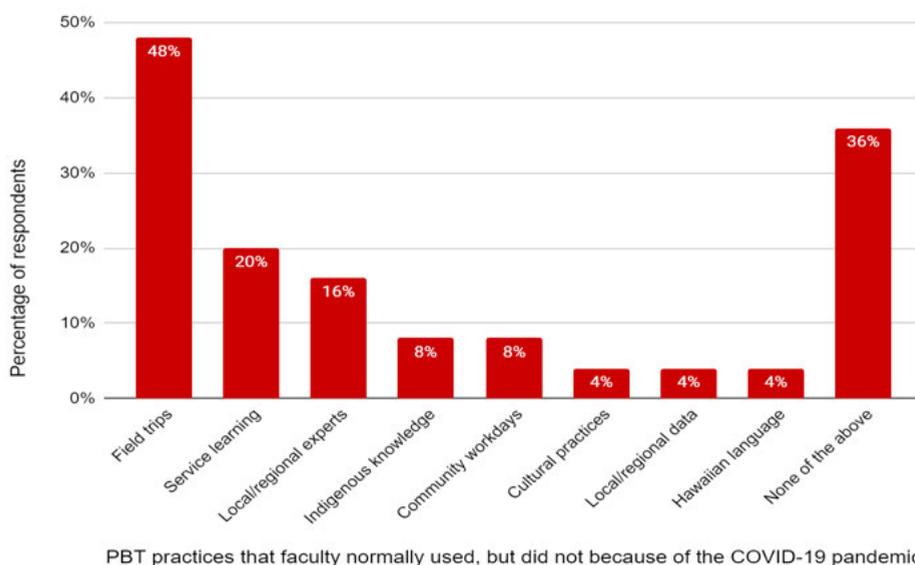


Figure 1. These data on PBT practices were compiled from faculty responses to the 2021 (n=25) survey question: Which of the following PBT practices would you have normally used during Fall 2020 and/or Spring 2021, but did NOT because of the COVID-19 pandemic? (Check all that apply). The listed practices (from left to right) are: Field trips; Service learning; Local/regional experts as guest speakers; Indigenous knowledge, or ways of knowing; Community workdays; Cultural practices; Local/regional data sets; Hawaiian language terms; and None of the above.

3.2 Student Survey Results

In student surveys administered in both 2018 and 2021, SOEST students were asked to state their agreement or disagreement to the survey item: “SOEST lab and lecture classes with strong ties to place (Mānoa, O’ahu, Hawai’i or the Pacific region) have greatly improved my learning experience” by selecting an answer choice on a five-point scale ranging from Strongly Agree to Strongly Disagree. Results are presented in Figure 2.

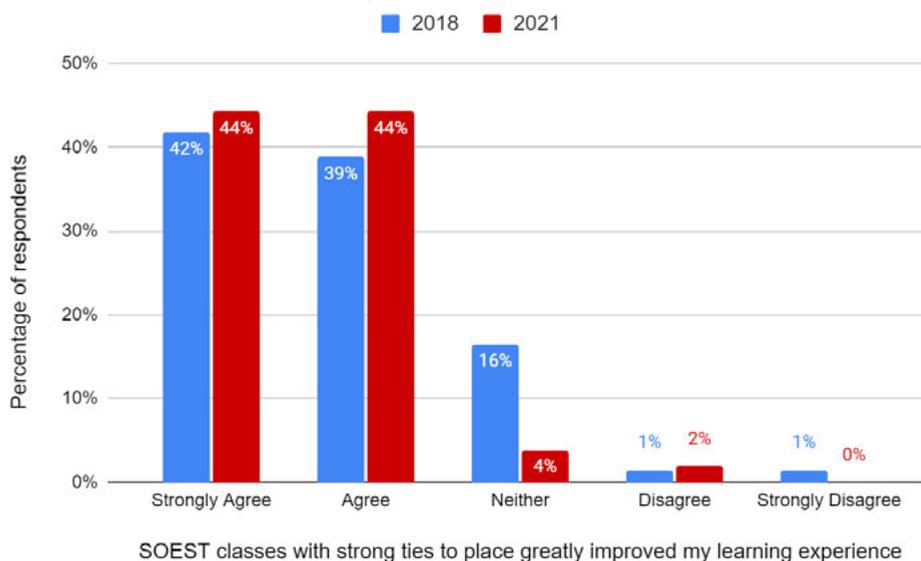


Figure 2. Student responses to the 2018 (n=67) and 2021 (n=52) survey item: SOEST lab and lecture classes with strong ties to place (Mānoa, O’ahu, Hawai’i or the Pacific region) have greatly improved my learning experience. “Neither” means Neither agree nor disagree.

From 2018 to 2021, the combined positive responses (Agree and Strongly Agree) increased from 81% to 88%, the neutral response (Neither Agree nor Disagree) decreased from 16% to 4% and the combined negative responses (Disagree and Strongly Disagree) decreased from 3% to 2%. [Note: Although Figure 2 suggests the combined negative responses remained at 2%, the combined 2018 value is 3%, due to rounding.] Together, these results indicate that, compared with the 2018 student respondents, the 2021 student respondents reported higher levels of agreement. In order to test whether the higher agreement in 2021 (vs. 2018) is statistically significant, we quantified the Likert Scale on a scale of 1 (Strongly Disagree) to 5 (Strongly Agree). This enables us to calculate mean values and run an unpaired, one-tailed t-test, using $\alpha=0.05$. The results were: 2018 mean = 4.18; 2021 mean = 4.42, t-statistic = 1.68 and $p = 0.048$, indicating statistical significance (as $p < \alpha$) – that is, the students reported significantly stronger agreement to PBT learning benefits in 2021, compared with 2018. This

result underscores the importance for faculty to use PBT practices, even (or especially?) when teaching online courses, despite the obvious challenges.

Figure 3 summarizes the types of PBT practices that students would like to see included in future classes. Each PBT practice listed on the survey was selected by 47-84% of 2018 respondents and 58-88% of 2021 respondents, with field trips (84% and 88%) topping the list in both years. All (100%) respondents who answered this question selected at least one practice; no one selected “None of the Above”. The percentage of respondents who selected each practice increased from 2018 to 2021. One possible explanation could be the COVID-19 pandemic, which caused many students to feel socially isolated and perhaps strengthened their desire to be connected to people and places (Smith et al. 2022).

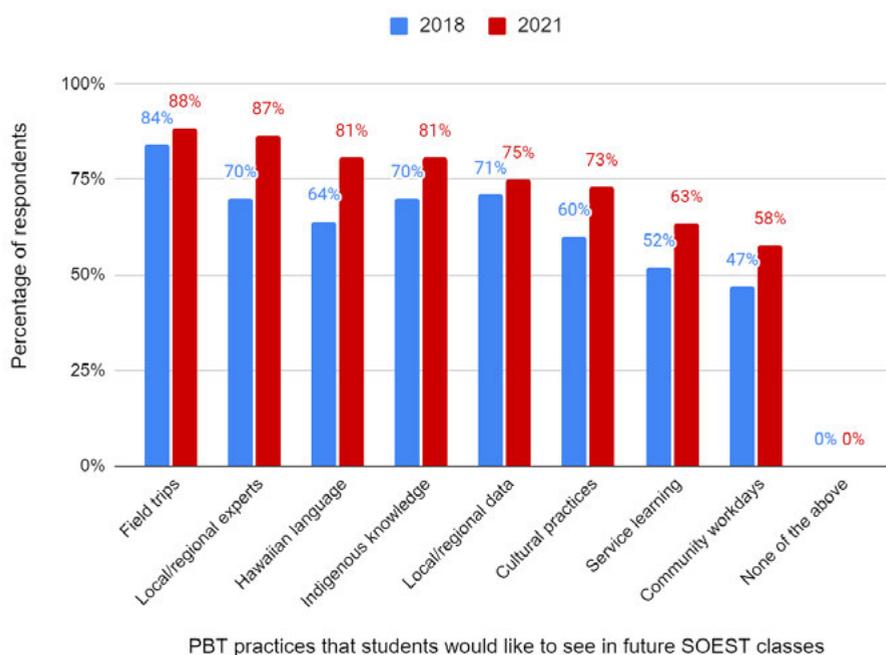


Figure 3. Student responses to the 2018 (n=73) and 2021 (n=52) survey question: What aspects of PBT would you like to see included in your SOEST lab and lecture classes in future semesters? (Check all that apply). The listed practices (from left to right) are: Field trips; Local/regional experts as guest speakers; Hawaiian language terms; Indigenous knowledge, or ways of knowing; Local/regional data sets; Cultural practices; Service learning; Community workdays; and None of the above.

4. Discussion and Conclusions

SOEST survey results indicate that PBT practices are highly valued by students and faculty, even (or perhaps especially) when courses are in online formats, and faculty report wanting to use PBT. When they do, students report their learning is greatly improved. Thus, an online

course format should not be considered a reason to discontinue PBT. Looking at the strategies listed in Figure 3, the most in-demand PBT practices were field trips. Through field trips, student can apply the knowledge learned in the classroom to real-life settings – for example, in the field, they can identify rocks and minerals in situ, conduct geological mapping exercises, detect evidence of glaciation, examine volcanic deposits and infer eruption styles, observe weathering and erosion, and use all of this information to unravel the geologic history of an area. Field trips also help students create connections with place and with other participants, strengthening student motivation and their sense of belonging to a learning community. But can these benefits be realized through virtual field trips?

Prior to the COVID pandemic, virtual field trips existed, but were relatively uncommon in the geosciences (see Bond et al. 2022 for a literature review of pre-pandemic virtual field trips). Their popularity exploded during the pandemic, driven by necessity. Virtual field trips pose unique challenges, and do have limitations, but there are many excellent virtual geoscience field trips that serve as exemplars in achieving well-defined learning outcomes. The Science Education Resource Center at Carleton College (SERC 2022) has perhaps the most extensive and varied collection of virtual geoscience field trips in the world, and includes a top-tier “Exemplary Collection”. Other useful collections of virtual geoscience field trips have been compiled by the American Geophysical Union (AGU 2022) and the European Geosciences Union. The latter highlighted 19 examples of virtual field trips, on topics ranging from simulations of traditional geologic mapping to gamified experiences, in a recent joint special issue (Toy et al. 2022).

Although the virtual field trips described above may not contain PBT content relevant to all areas, they can serve as useful models. In SOEST, instructors were able to quickly adapt their in-person field trips to virtual formats that retained PBT content, using a variety of strategies. One adaptation converted a campus-based geology field trip (Bruno et al. 2022) to a self-guided walking tour, using interactive prompts that the students could access via their cell phones. Another faculty member took photos and video of sites around O‘ahu, then voiced over content that allowed students to answer geology questions online without having to travel to the sites. The Hawai‘i Division of Forestry and Wildlife (2023) hosts virtual field trips that include geographic, historical and cultural information, which serves as an example of how locally relevant, pre-made virtual content could be used to fulfill PBT goals with a minimal time investment on the part of the instructor.

Apart from field trips (88%), several other PBT practices were in high demand by the student respondents, including Local/regional experts as guest speakers (87%); Hawaiian language terms (81%); Indigenous knowledge, or ways of knowing (81%); and local/regional datasets (75%) (Figure 3). While using local and regional datasets is a relatively accessible pedagogical technique for most faculty, the vast majority of SOEST faculty are neither Native Hawaiian nor from Hawai‘i, and few are experts in Hawaiian language, culture or indigenous

knowledge. Thus, it is essential for faculty to construct their own knowledge as well as partner with experts. Here are a few suggested starting points for incorporating PBT content into online classes, beyond virtual field trips and local and regional datasets. Though conceived for Hawaii-based SOEST faculty, these strategies can be extrapolated for a global audience:

- Regularly use Hawaiian terms (including place names) in geoscience classes, and learn to write and pronounce them correctly.
- Learn about history and culture, by visiting local museums (for example, Bishop Museum in Hawaii) and cultural sites, attending lectures, and reading.
- Volunteer at local community events, to learn, give back, and make connections with local experts. Investments in the community may result in opportunities to invite local experts into virtual classrooms.
- Incorporate local and indigenous knowledge into geoscience course content in consultation with cultural practitioners. Hawaiian-language newspaper archives are a repository of traditional practices (IHLRT 2018) – see Swanson (2008) for an example.
- Invest in reciprocal community-research partnerships, following protocols outlined in Kūlana Noi‘i (2021)

In summary, an online course format should not be considered a reason to discontinue PBT practices, but an opportunity to explore new and innovative ways of incorporating this important content.

Acknowledgments

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Surviving and thriving in COVID

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Abstract

Many summer bridge or other programs focus on initiating high impact activities (Kuh, 2008) as mechanisms of relationship-building among attendants and the university sponsoring these activities. Additionally, a broad spectrum of these bridge programs are grant-funded by either state or federal funding agencies. Mentored research within a university laboratory connects the undergraduate to career insights and cultural awareness of research. COVID- has altered but not cancelled this activity over the last two years.

Keywords: *Summer bridge; STEM research; undergraduates; DOED MSEIP grant.*

1. Introduction

Summer undergraduate research and summer bridge programs for entering undergraduates are staples to initial training of college-goers to the possibilities that mentored research offers their understanding of what the profession involves, what basic or applied research involves, and provides mentoring by PhD scientists such that undergraduates develop a consideration of what a career in research could/would involve especially within tier one laboratories.

Undergraduates become aware of theory, practice, success and failure at the bench. Moreover, they see modeled for them what scientists actually do in the day-to-day routine demands of their laboratories. Conversations between mentor and student can lead to greater insights and address limiting ideas the student may have of what it means to discover new concepts or information.

The summer bridge program involving mentored research for first generation students becomes a critical component to the student's consideration of entrance into a doctoral program as a career. Among institutions which are primarily undergraduate institutions with no doctoral programs, the summer bridge programs are crucial to introducing first generations diverse students to the possibilities that research holds as career stepping stones by enhancing the entire undergraduate experience through increased relevancy, substantive meaning of a career in science (STEM) (Mogk, 1993; Lopatto, 2004, 2007).

High impact practices often suggest strong connections to student retention and student engagement as well as character development as it connects to leadership development (Kuh, 2008; AACU, 2008; Kuh & Umbach, 2004). Many four-year colleges and universities encourage a common practice of mentored undergraduate research as a student support mechanism and as a career development opportunity, especially within the sciences (Lopatto, 2007). Several studies offer well-documented findings associated with undergraduates involved in research experiences in under the guidance of laboratory principal investigators or in the classroom setting using a student-centered, problem-based approach. Likewise, studies on the effectiveness of mentored research experiences indicate several important findings, such as: 1) enhancing the entire undergraduate experience and 2) on increasing the substantive interest in entering a career in science through advanced graduate work (Mogk, 1993). Gains in self-confidence and pathways to science careers, especially among first generation, minority, and female undergraduates were documented in several studies by Lopatto (2004, 2007) and Hathaway, et.al, 2002).

In the UHD Scholars Academy program a Department of Education MSEIP grant award (award #P120A190069) enabled the establishment of a summer bridge mentored research program supporting both incoming freshmen (FTIC) and current undergraduates in their initial mentored research experience. Year one occurred during May and June 2020 during the first lockdown of the COVID-19 pandemic spanning almost all institutions of higher

education. This paper provides explanations, data-gathering, outcomes associated with implementation of a virtual mentoring bridge program. The award was received in October 2019 and involved multiple targets including: 1) freshman UpSTART programs, 2) Academic Skill Monitoring, 3) Mentoring, Leadership/Teamwork Development, 4) Mentoring, and 5) Career and Research Skill Development, which will be the focus of this paper.

Goals of the awarded grant entitled “UHD Enhancing STEM Success Through Complex Problem Solving, Preparation and Access” address STEM success program components as well as some innovative mechanisms. A primary focused outcome is to encourage, prepare and support minority STEM students, especially females. Another is to target access for first time in college entering undergraduates through summer bridge program and transition activities into enrollment. Success is targeted in all years where transitions and rigor form barriers for undergraduates with some of the success activities to include freshman UpSTART, academic skill monitoring, mentoring in small learning communities, career/Research skill development and leadership/teamwork enhancement, then finally intentional financial literacy skill development. Other targets include support of STEM females through a Women in STEM series, Women Mentoring Women workshop approach, and career development through mentored research under the guidance of PhDs.

2. Beginning Under COVID-19 Virtual Environments

The grant administration team was comprised of PI and four PhD Co-PIs (Dr. Gabriella Bowden, Dr. Mian Jiang, Dr. Ting Zhang, and Dr. Weining Feng) spanning all College of Science and Technology STEM departments at UHD. Each a subject matter expert in their field provided the depth of knowledge and experience in mentored laboratory work to excel. Each had provided mentored research experiences during academic and summer sessions to undergraduates prior to the quarantining events associated with COVID. However, none had provided virtual mentoring and as such each became experts through experiential methods.

A little bit about each Co-PIs’ research is useful to best understand the magnitude of impact going virtual would present in order to reach the targets of the grant program.

Dr. Gabriela Bowden’s research involved measuring the human response to bacterial pathogens, or the study of spore-forming soil microorganisms. Studies that address the impacts of environmental contaminants on microbial populations which in turn could impact humans. Usually this type of research must be completed under strict safety protocols and within laboratory onsite.

Dr. Mian Jiang’s research involved the study of molecular nanowires. Specifically, participants will prepare conducting polymer-based nanowires, and nanowires from

conducting polymer/carbon nanotube composites. studies will extend the known facts of nanowires being used for mechanical devices and microcircuits into high capacity nanobattery and chemical sensing. Considering the sponging and biocompatible nature of conducting polymers, the proposed polymer nanowire sensors may represent nearly ideal detector elements since their size match that of biological macromolecules. Again, this type of research is usually always performed within a laboratory setting onsite.

Dr. Ting Zhang's research involved the study of robotics, neuroimaging, and artificial intelligence (AI) on web databases. Specifically, the cutting-edge techniques in computer science, electrical engineering, and biomedical engineering are investigated to advance interdisciplinary research approaches. This arena of research was very approachable through virtual environments.

Dr. Weining Feng's research involved electronics, power systems, measurement and instrumentation, control engineering, data communications, and networking. She has worked extensively in the area of robot manipulator dynamics and control and has brought her experiences in the areas of system reliability, failure mode, and effects of criticality analysis to both the research laboratory and her teaching classroom.

With the large numbers of highly interested undergraduate bridge and current students additional research PhDs were solicited for participation. Each received a small stipend per semester for their participation. Other PhDs brought a broad spectrum of research across other STEM disciplines including: mathematics, datascience, statistics, computer science, web development, robotics, organic chemistry, genetics, cancer research, bioinformatics, material sciences, microbiology, plant biology, and environmental biology. Each PhD mentored from 2 to 4 undergraduates per the five week summer bridge program. In keeping with the targeted support of STEM females, 12 PhDs were female and 5 PhDs were male. Of these PhDs with minority status comprised only 2 individuals. One minority male was part of the mentoring PhDs as well.

3. How Mentored Research Occurred in a Virtual Environment

This question was key to bringing all participating PhDs into an understanding of the outcomes expected for their research group/students. The question also provided some very interesting opportunities for all undergraduates as they entered into the mentored research program. The keys to successful outcomes were generated by outstanding, flexible, and creative PhDs providing the mentoring. Together in an initial meeting discussed the possibilities of what approach/es and accomplishments could be expected from the participating students. This conversation occurred via a Zoom video-conference meeting with the PI/Co-PIs and all other PhDs.

Begin with theory by offering readings of published literature in their SME areas. Generally, this is not where mentored research begins when normal “in the laboratory” conditions occur. So this was a revamped approach which provided foundational understanding of the research to be undertaken. Next, each PhD agreed to move to processes to be undertaken once back in the laboratory. In the case of Dr. Bowden’s microbiology research students investigated protocols for creating agar cultures, staining, etc. In the case of Dr. Jiang’s chemical laboratory, challenges to these students were to transform laboratory safe procedures into “kitchen chemistry” safe procedure that could be done in a home environment. The goal in one instance was to create a titration lab using kitchen chemistry. Both students approached the challenge from different perspectives as one student was a junior chemistry major and one a sophomore chemistry major, but both developed successful techniques. Further, Dr. Feng’s students decided upon their projects and she subsequently ordered materials to outfit kits per each student. These kits were put together and sent to each students’ home where they would meet with Dr. Feng virtually via Zoom and demonstrate where the project was moving. All activities took place over as five-week period.

As PI of the overall project, the role involved setting the milestones, meeting dates, mid-session presentation dates, and submission of final abstracts, posters/slideshows, and video with all members involved in the creation of the groups’ achieved outcomes. These deliverables were then sent to the DOED MSEIP program director for inclusion in the summer research conference (also held virtually).

4. Holding Student Researchers Accountable

4.1. Visual Accountability

Students were asked to document both in paper format and visual formats weekly discussions occurring with each of the PhD research mentors. These were uploaded into an MS Teams area within PhD folders. Other artifacts, such as Youtube videos, other videos, websites, e.g., BLAST were also uploaded as evidence of research and skill development. Review of safety practices associated with each researcher were documented within the TEAMS data system.

4.2. Meetings Accountability

Students met with their individual PhD research mentors weekly via Zoom video-conference meeting. Zoom meetings were to be recorded and uploaded into the TEAMS environment. All student researchers were asked to work from 8 to 10 hours per week on their research projects as well as complete a Weekly Research Report form documenting current status in the project, planned activities per discussion with the PhD, and overall progress. The report forms would be upload into TEAMS for review and signatures by PhD mentors.

4.3. Orientation Meeting/s

The PI/Co-PIs and other participating researchers were asked to attend an initial orientation meeting of one hour held via Zoom video-conferencing. An overview of the general objectives of the program was provided. Likewise, weblinks to the Zoom meetings, times, and attachments were sent through email but also uploaded into the MS TEAMS environment for transparency and access by all. All meetings were recorded to ensure all could have additional access to the meeting contents for refresher purposes or in the event they could not actually attend. As part of the orientation, the PI provided a general discussion related to goals, hours needed for weekly progress, expected outcomes for student deliverables. This was necessary as each undergraduate participant would be provided a research stipend of \$700 for the five-week period.

A mid-session Zoom meeting was scheduled for all participants to provide a one-slide overview of the progress within their research group. All members would have to provide speaking portions indicating they were all participating.

4.4. Deliverables

Student success was assessed via multiple measures. Deliverables were submitted to document project progress during the 5-week period of mentored research. Deliverables included 1) weekly research report forms, 2) attendance of all meetings including weekly PhD meetings, 3) DOED MSEIP abstract template produced and approved by PhD research mentor, 4) mid-session slideshow outlining progress, and 5) production of zoom video describing the cumulative accomplishments of research project/s for the 5-week program.

Participants were asked to complete a SURE Survey for Mentored Research taken from Lopatto, 2007, 2010. The survey was digitized into a Qualtrics survey for ease of analyses. All participants in years 1 and 2 completed the SURE survey. Additionally, all participants were asked to complete a Leadership Survey derived from Northouse, 2019. This survey was placed in a Qualtrics framework and distributed. Approximately 50% completed this survey. An additional survey was collected investigating confidence, competence, likelihood of pursuing STEM careers, increased likelihood of finding STEM employment upon graduation, increased academic capacity due to participation in mentored research, perceived improvement in critical thinking, technical writing, and presentations, and feeling more connected to college coursework.

In late July 2020 all student produced abstracts and powerpoint posters were provided to the DOED MSEIP Program Director for review and selection of presentation as part of the Competitive Capacity Enhancement Model Student Research Conference (CCEMSRC). Four abstracts from our university program were selected to present their virtual mentored research findings. The students included were mentored under the guidance of Dr. Ting

Zhang, computer science and robotics, Dr. Connie Kang, genetics, Dr. Ling Xu, computer science and web development, and Dr. Sanghamitra Saha, bioinformatics/biology. The students performed well and learned of other models of virtual research projects undertaken by other universities with similar awards.

5. Programmatic success measurements

The DOED MSEIP targets support of STEM, STEM minorities, STEM females in particular as outcomes to be reported. Figure 1 below describes the increasing number of participants involved in the mentored research virtual programs over the first two years of the grant award.

As can be easily noticed, all participating categories are increasing over the two-year period. Also, more minorities (who tend to be first generation students) are engaging in mentored research thereby connecting them to the university, to their course of study, and to the potential to move into STEM career pathways as they graduate.

A review of participating bridge and undergraduate research students indicates continuance among a majority of those beginning initially in the virtual environment. Figure 2 describes the fluctuation in participants but also shows increases in minority participation and females.

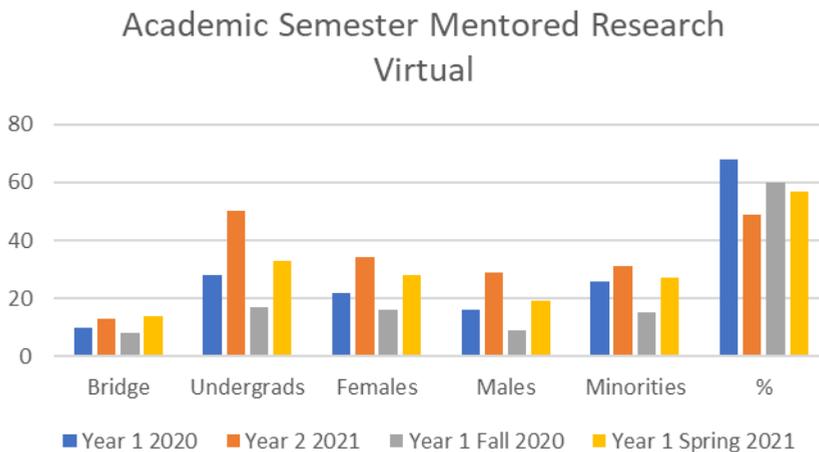


Figure 2. Participation by category in academic and summer virtual research.

6. Finding common interests for matching

Undergraduates are matched with on-campus UHD PhD research scientists within a variety of STEM lab settings. The SME PhD comes to understand the qualities/competencies and commitment the undergraduates bring to gaining deep learning of not only discipline content and skills, but also of what research is and what it can become for each of the mentees in the

pursuit of individual careers. Early mentored research students are guided by and learn from an upper division undergraduate who has worked with the PhD for some time (within the normal settings and possibly within the virtual COVID settings). As the early career research students develop expertise and competency in the lab and trust on the part of the PhD researcher, they move up within the lab setting and become perceived as a leader. Thus, student researchers are trained in skillsets and laboratory leadership is developed through this mentorship in research. Matching by common interests between PhD and undergraduate truly has long-term impact on post-baccalaureate graduate/professional program outcomes, individual ambitions, and confidence to enter STEM careers (Lopatto, 2004; 2007; Mogk, 1993). Funding support provides those engaged in mentored research a workforce connection encouraging chosen STEM research career pathways as well as transferability of the skills into the post-baccalaureate workplace.

7. UHD, SA and minority research student development

Based on current demographics that Hispanics and other minorities are likely to become the major ethnic group in Texas by 2030 (Associated Press, 2004) there is a need for Texas to close the science education gap and to recruit more Hispanic students and other minorities into university STEM degree programs. A clear need exists for more minority undergraduate students across a broad natural sciences, computer and mathematical sciences, and engineering technology degree emphasis to enroll in and complete STEM degrees, thus lessening an educational attainment gap evidenced among minorities (Dugan & Komives, 2006). At UHD this includes all degree plans within the College of Sciences and Technology. The ultimate goal of increasing the pipeline of minority students, entering and completing the baccalaureate degree, is strongly connected to the need for 1) familiarity of the college experience [most are first generation], 2) pre-college academic support, 3) academic monitoring, 4) mentoring by STEM faculty and undergraduates already successful in the STEM arena, 5) broadened exposure to graduate and industry experts and opportunities, 6) research and career experiences/exposure, and 7) training in leadership development across various aspects of STEM (DOED MSEIP 2013 award #P120A130040).

Unfortunately, minority students continue to dismiss the four-year university out of fear of the unknown prior to entrance or out of a lack of understanding of expectations. Minorities, particularly minority women, continue to fail-out of first-year barrier STEM courses as a result of no substantive support services within the designated/selected content discipline, lack of adequate pre-college preparatory coursework, and/or little to no acculturation into the study hours and techniques needed to grasp rigorous, often difficult STEM content topics/knowledge as presented in first year courses. First generation minority students, in particular, have no historical, familial connections to what the collegiate expectations are for STEM students, thus have less than supportive network available to them once entrance into

the STEM degree curriculum begins. Working with the mentored research program provides foundational knowledge and experiences to minorities to begin to see or envision their potential within a STEM career.

Because UHD is an urban MSI/HSI university located in the 4th largest metropolitan city in the U.S., the mentored research development program, virtual or otherwise, provides an intentional, purposeful vehicle aimed to 1) support minority students seeking university degrees through this large university, 2) examine how and what leadership through mentorship in the research arena influences STEM undergraduates college to career readiness enhancements, impact, and degree completion (baccalaureate and post-baccalaureate), and 3) creates processes and product knowledge for other universities, both minority-serving and other, to utilize in the support of undergraduate research development positively influencing the changing demographic constituencies and leadership capacity of Houston, Texas, and the U.S.

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A Post-Covid comparison of students' usage of an online learning platform

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Abstract

This paper explores the differences in the usage by students of an online platform for supplementary resources between a first year and final year entrepreneurship course which are traditionally face-to-face. We found a weak correlation between use of the online resources and higher marks. The average amount of time spent and other habits were identified. We can use this data to improve the online offering element for students at university where supplementary online resources are offered alongside face-to-face teaching.

Keywords: *Enterprise; entrepreneurship education; online resources; online learning.*

1. Introduction

Covid brought a shock to the education system with a sudden pivot online of university courses that were normally almost exclusively face-to-face. This was a particular challenge for those teaching entrepreneurship where the best learning environment is much more experiential. However, despite the far from ideal rushed nature for most of this challenge, having had time to assess the impact of online Covid teaching (Phillips, 2022), there are benefits of offering elements of online teaching that might help to augment any course and allow students to learn in the most appropriate way for their preferred learning style.

Entrepreneurship is a key factor in economic growth and entrepreneurship education is suggested as a key factor for reducing the fear of failure in potential entrepreneurs (Chapman and Phillips, 2022) and consequently raising the nascent entrepreneurship rate. The Quality Assurance Agency document on Enterprise and Entrepreneurship Education (2018) suggests students should be able to “identify and respond to opportunities using their ideas, knowledge, skills and confidence to create interventions that will address the challenges they meet.” They further suggest there are three types of enterprise education: Learning “about,” learning “for” and learning “through.” Of these, learning “through” is deemed to be the most effective at stimulating students to start a business. There has been considerable research into entrepreneurship education, although metrics for success are not clear cut (Duval-Couetil, 2013; Kuratko, 2005). With Covid reducing teaching interactions to online only, this was clearly a major issue for Entrepreneurship Education.

At the University of Manchester there is a varied approach to entrepreneurship with both on curricular (Papadopoulou and Phillips, 2019; Sanchez-Romaguera and Phillips, 2018) and extracurricular (Phillips, 2010; Phillips, 2017) activities widely used. A range of assessments are used rather than exams - such as consultancy reports, reflective journals (Phillips, 2008), posters, pitches, and feasibility studies. However, online learning as with many other institutions was not a high priority pre-covid. Covid has awakened us to the opportunities of online learning and the benefits it can bring. Ligiori and Winkler (2020) suggest that entrepreneurship education was behind even other subjects with its use of online technology, possibly due to the more active nature of entrepreneurship education with more of a need for face-to-face interaction, groupwork and networking. Covid has allowed us to re-evaluate online learning and to understand the reasons for student's level of engagement with it. For example, the increase in travel expenses means some students prioritise when to come to university attendance and poor scheduling might mean a student deciding not to attend in person if they have just a single session in a day. Some students who are disabled also may choose to prioritise attending only certain days for maximum efficiency, such as interactive seminars over a content-based lecture, and those increasing numbers of students with caring responsibilities or term time employment also might have extensive use of the online material. There are also some students who have always preferred using the podcasts over

lectures. Most units at the university now are face to face again, but have an online site with extra reading, lecture slides, quizzes, and links to podcasts of the lectures. Measuring the interaction with the online sites post-covid by students would be useful to determine how much they are valued and used by students and what their role should be post-covid in a mainly face-to-face course. There has been considerable research into online learning, both where online material such as podcasts are offered as an additional resource to a course that is principally face to face, and also where online learning comprises the entire course. For this paper, of particular interest is research into the former, to help understand how online platforms can augment teaching post-covid, with research suggesting the switch to pure online out of necessity during Covid is quite different to a more considered approach in applying lessons learned to post covid education (Adedoyin & Soykan, 2020, Ferri et al. 2020), although there is a sense that some universities are trying to return to pre-covid without incorporating any of the benefits learned from the sudden switch to online (Watermeyer et al., 2022). Several researchers have attempted to document the shift to online and analysed the strengths and weaknesses of different approaches (e.g., Dhawan, 2020; Adnan & Anwar, 2020). There are conflicting views on whether the availability of online material such as podcasts affects attendance, with purely online courses there have historically been issues with dropout rates (DiRamio & Wolverson, 2006), and indeed whether it affects the marks and satisfaction a student gains from a principally face to face course. Bolliger et al., (2010) suggest that offering podcasts to students is useful as they can repeat sections they do not understand and that the pace of face-to-face lecture might not be optimal for learning or for taking notes. They found 3 separate groups of learners – 1 group focussed on podcasts whilst attending few lectures, group 2 used very little of either, and group 3 made occasional usage of podcasts. Group 1 was found to be the highest in both achievement and satisfaction with the course. Traphagan et al. (2010) found that students who used the lecture podcasts as well as to face-to-face lectures had a similar level of achievement from students who only attended face-to-face lectures. In other studies, students reported lower anxiety when they could take notes from lectures they viewed later on their own without having to worry about missing important information (Owston et al. 2011), and that anxiety was reduced by viewing lectures before exams and tests (Traphagan et al. 2010). In terms of online learning, researchers have referred to the TAM (Technology Acceptance Model) (Davis, 1989) which builds on the Theory of Planned Behaviour (Ajzen, 1980) to predict usage based on the key factors of awareness, perceived usefulness, attitude to using the system, behavioural intention, and actual usage of the system. Since the online environment is an additional resource for the students used asynchronously, perceived usefulness is likely to play an important role.

This paper investigates the usage of the course Blackboard site post-covid, to determine how they are now viewed by students from two courses in order to maximise the effectiveness of the supporting services/activities, and to determine whether if there is any linkage between usage of the site and improved academic performance for a subject which is generally

accepted needs to be as hands on as possible. A year 1 and year 3 entrepreneurship course were examined. Both are open electives for students of a range of different subject areas, both sciences and arts (Phillips, 2020), and both are designed with the EntreComp Framework in mind (Bacigalupo, 2016). They also have one piece of course work as the assessment – an individual project – to be completed by the end of the final week of the course (See Table 1).

Table 1: Similarities and differences between first year and third year course analysed.

Details	First Year	Third Year
Format	Once session per week of two hours, one hour lecture with one hour class activity (11 weeks)	Once session per week of two hours, lecture with class discussion intermixed (11 weeks)
Assessment	2000 Word Report due at the end of course submitted via the Blackboard Platform	4000 Word Report, due at end of course submitted via the Blackboard Platform
Class size	120	34
Material on Blackboard Site	Lecture Slides, Submission Portal, lecture supplementary material, access to podcast site	Lecture Slides, Submission Portal, lecture supplementary material, access to podcast site

2. Methodology

Quantitative data was collected from the Blackboard software with the first-year course and third year (both semester one 2022) used as case studies. The class of first years was 120 students whilst class 30011 was 34. Data was collected from activation of the site on 15th September and ended on 25th January when the final student had submitted coursework. Both courses were chosen for their similarity – both were 100% coursework with a written report required at the end of the course. Both had a mixture of students from both science and arts subjects. It was expected that third years would have a higher average time spent using the site as they have experienced more online learning during lockdown. It was also hypothesized that third years would spend more time using the site as third year counts for a disproportionate amount of the marks for their degree classification and would engage with the material whilst writing their assignments. It was also hypothesized that the highest marks would be obtained by those who spent more time on the platform.

3. Results and Discussion

Table 2 shows the number of hours of engagement with the online platform by students of each course and a breakdown by day of the week and average numbers of hours of engagement per student.

Table 2: The hours of engagement on the Blackboard Platform for each of the courses.

Day of the Week	First Year Course	Third Year Course
Monday	133.14	183.76***
Tuesday	137.27	50.25
Wednesday	471.86***	56.95
Thursday	148.55	62.64
Friday	126.28	68.77
Saturday	46.71	18.98
Sunday	78.30	46.39
Total Engagement hours	1142.65	487.75
Ave engagement hours per student	8.46	9.20

*** = the course was timetabled on this day.

It was expected that third years would spend considerably longer on the platform on average as third years the marks more important for final degree classification. Interestingly, for both courses, engagement was three-fold higher on the day of the lecture which could be explained by the observation that many students take a laptop to class and follow the lecture using the online slides. Despite the assignment deadline being on a Friday, there was no particular spike in usage for either course at that time, this could be explained by students being more prepared as draft versions of their assignment were given formative feedback during the course, this hopefully meant fewer students leaving work until the last minute. There was a fairly similar profile for both courses with Saturday unsurprisingly the day of least usage.

Table 3: The percentage of time spent on each area of the Blackboard Platform.

Area of the Platform	First Year Course	Third Year Course
Course Content	64.50	80.18
Course Information	7.88	2.95
Podcasts	3.15	0.76
Coursework Submission Area	20.47	3.35

The data in Table 3 shows that the first-year students spend considerably more time on the submission area for the coursework than the third years, this could be because the online submission system is new to them and they are more careful to read instructions and get the submission correct (as failure to submit has big penalties for students' marks). Figures 1 and 2 plot marks obtained by the students against time spent on the online platform. The trendline for each is strikingly similar, with an approximate 15% increase in mark between students with the lowest engagement and the highest. There is however clearly a wide spread of datapoints with some very high marks gained by some students who had little engagement – this could perhaps be explained by those students being keen attenders of the face-to-face sessions having little need to catch up online.

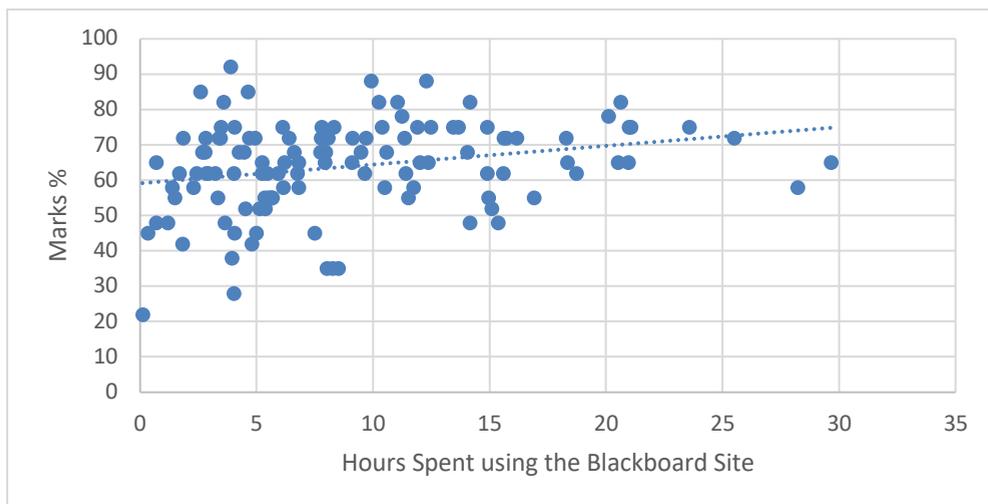


Figure 1. Marks obtained vs Hours spent using the Blackboard site for the First Year course.

4. Conclusions and further work

Although the trendline for both courses show a correlation between increased usage of the site and higher marks, the distribution of data points on graphs 1 and 2 suggest the relationship between use of the online platform as a supplementary resource and achievement of high marks is complex. This work can be expanded to a larger study where online habits of students can be established with more courses and a bigger sample size. Due to the individual nature of students preferred learning styles, qualitative research examining in more depth the usage of the site and how it might correspond to lecture attendance (for this instance it was not possible to do) can also be undertaken. It would also be useful to know if students were using the platform out of choice or because they were unable to attend lectures due to an understandable reason such as doing paid work or caring responsibilities. It might also be of interest to distinguish any differences between, for example, arts and sciences students.

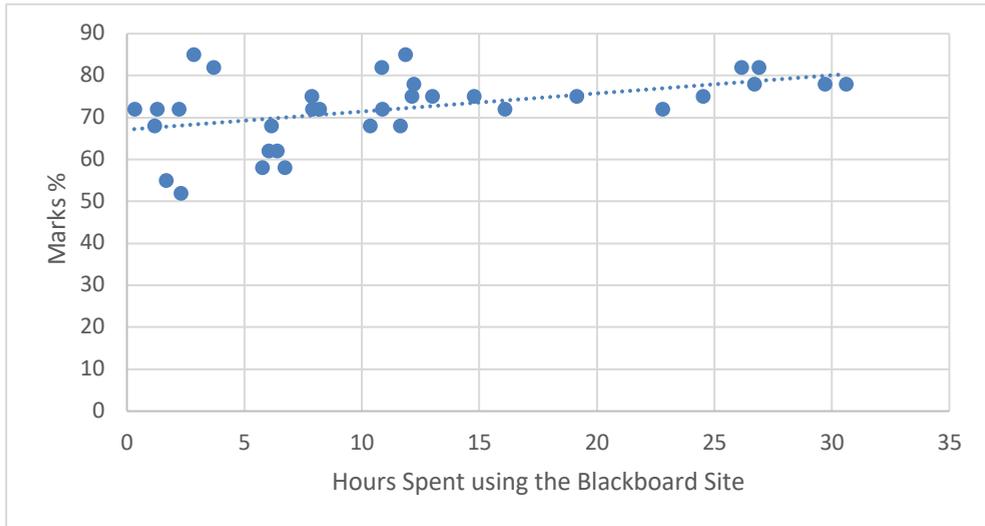


Figure 2. Marks obtained vs Hours spent using the Blackboard site for the Third Year course.

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Digital multitasking during academic lectures: did the Covid-19 lockdown change the students' behavior?

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Abstract

This paper explores digital multitasking during lectures for university students, attending to the impact of the Covid-19 pandemic. Digital multitasking is conceptualized in this research as engaging in a digital task (T1) during academic lectures (T2). This paper has three main goals: 1. Analyze the variations in digital multitasking in three different moments – pre-pandemic (M1), during the lockdown (M2), and after the Covid-19 pandemic (M3); 2. Explore the purpose by which students engage in digital multitasking – exclusive educational (ED), exclusive non-educational (NED), and combined (COMB), combining educational and non-educational purposes; 3. Explore the digital resources – between 16 categories – used in multitasking during lectures and their relationship with the different purposes – ED, NED, and COMB. This quantitative research appeals to the survey and descriptive, comparative, and correlational analysis. Results show that multitasking during lectures is expected among university students and has changed with Covid-19 to a more educational purpose.

Keywords: *Multitasking; digital resources; digital multitasking; Covid-19 pandemic; formal educative context; university students.*

1. Introduction

The present article focuses on the good practices driven by the experience acquired during the Covid-19 pandemic to bring some light to educational changes. As technological development and digital resources have been the primary support during the pandemic and demanded the development of teaching and learning processes at a distance worldwide, it seems relevant to understand better how this might have changed individual habits in the formal educative context.

2. State-of-the-art

Technological integration requires a diversified collection of learning strategies supported by a learning management system (Tran & Meacheam, 2020), having multiple advantages – enhanced communication, network collaboration, quick and easy sharing, permanent access to materials, alternative types of resources, learning support, and technical skills (Legaree, 2015). Learning happens when the subjects establish connections between the information acquired from their learning networks, encompassing numerous sources and technological resources (Siemens, 2004). Without educational guidance and support during distance learning, regulating the learning process becomes essential for achieving learning goals (Kizilceca et al., 2017). Self-regulated learning skills – conscious thoughts, feelings, and behaviors regarding management and guidance to achieve personal goals (May & Elder, 2018) – are traduced by the relationship between cognitive, metacognitive, and motivational components during learning (Karlen, 2016). Systematical differences in students' efficiency are related to self-regulation strategies traduced by the understanding and application of metacognitive resources, appealing to active control over the learning process (Karlen, 2016).

With the spread of access to media, concerns have been growing about the potential negative impact of digital multitasking on students' academic performance (Alvarez-Risco et al., 2020). Multitasking involves simultaneously engaging in more than one task (Lau, 2017), and when appealing to technological devices, it's known as digital multitasking (Judd, 2013). Leysens et al. (2016) and May & Elder (2018) found negative relations between digital multitasking during lectures and academic performance. Wu (2017) found negative relationships between perceived attention problems and self-regulation strategies. During the Covid-19 lockdown, digital multitasking negatively influenced self-efficacy (Alvarez-Risco et al., 2020). In opposition, Legaree (2015) found no significant relationship between media multitasking and academic performance. Xu et al. (2016) noticed that digital multitasking could positively influence students' well-being, acting as a stress management strategy regarding the demandingness of academic responsibilities (Xu et al., 2016). The nature of the tasks encompassed might explain the divergent evidence regarding digital multitasking, the motivational factors of each student, the perceived ability to achieve goals, moderators of

attention, digital multitasking, and studying forms (May & Elder, 2018). In sum, digital multitasking relies mainly on context, individual metacognitive skills, and self-regulation abilities (May & Elder, 2018; Xu et al., 2016).

3. Methodology

This paper explores digital multitasking during lectures among university students, attending to the impact of the Covid-19 pandemic. Digital multitasking is conceptualized in this research as engaging in a digital task (T1) during academic lectures (T2).

This paper has three main goals:

1. To analyze digital multitasking between three moments – before Covid-19 (M1), during lockdown (M2), and after the pandemic (M3);
2. To explore the purpose by which students engage in digital multitasking – exclusive educational (ED), exclusive non-educational (NED), and combined (COMB), combining educational and non-educational purposes;
3. To explore the digital resources (16 categories) used in multitasking during lectures and their relationship with the different purposes – ED, NED, and COMB.

The quantitative study developed had data collected through the survey by an online questionnaire where the university students self-assess themselves in three moments, followed by descriptive, comparative, and correlational analysis regarding digital multitasking during academic lectures.

Three main dimensions are considered:

- A. Digital resources: 16 categories of digital resources that can be appealed as parallel tasks (T1) during lectures (T2);
- B. Moments: three different moments where students have assessed themselves – pre-pandemic (M1), lockout period (M2), and post-pandemic (M3);
- C. Purpose: three different purposes (intentions) underlying the use of a parallel digital task during lectures – exclusive educational (ED), exclusive non-educational (NED), and combined (COMB), combining educational and non-educational purposes.

The categories of digital resources (A) encompassed were the following: (A1) store & share – store and share data; (A2) actuality – newspapers, journals, or others; (A3) commerce – buying and selling products and services; (A4) audio communication – exclusive audio communication; (A5) written communication – exclusive text communication; (A6) video communication – exclusive real-time video communication; (A7) education – online educational resources; (A8) entertainment – digital games, entertainment channels, and applications; (A9) online office tools – document creation resources; (A10) management &

organization – calendars, agendas, notes, checklists, and similar; (A11) language – online translators, dictionaries, text correctors, and similar; (A12) multimedia – photo, music, and video edition tools, programs, or applications; (A13) music – listening to music online; (A14) orientation – maps, guides, or similar; (A15) knowledge & research – browsers, wikis, and databases; (A16) social networks – personal and professional social networks.

The study hypothesizes the following:

- H.1. Students use (U) more (frequency) categories of digital resources during lectures in the Covid-19 lockdown (M2) moment than before (M1) and after (M3) this period (U: $M1 < M2 > M3$);
- H.2. Digital multitasking (T1) during lectures (T2) has a more educational purpose (ED and COMB) in the lockdown moment (M2) and after the Covid-19 pandemic (M3) than in the pre-pandemic (M1) moment (ED: $M1 < M2$ and $M1 < M3$; COMB: $M1 < M2$ and $M1 < M3$).

The quantitative data was submitted for descriptive, comparative, and explorative analysis. The analyses focused on: i) the frequency of use (U); ii) the purpose (ED, NED, and COMB) of using (U) each digital resource category (A) at each moment (M1, M2, and M3). It was also intended to verify any relationships between the categories (A) and the purposes (ED, NED, and COMB).

The population is university students. Participation criteria included: being an adult (≥ 18 years old); informed consent; currently a university student; having been a student since 2019/2020; having internet access since before the Covid-19 pandemic (2019); Portuguese or English language. Exclusion criteria relied on the non-observance of one of the inclusion criteria. This study collected quantitative data through the survey by appealing to an online questionnaire, ensuring participation and ethical criteria, and providing data security. The instrument encompassed five parts: informed consent; sociodemographic characterization; before Covid-19 (M1); during the lockdown (M2); and after the pandemic (M3). Participants assessed themselves regarding the use – did use (U) versus did not use (NU) – and the purpose – ED, NED, and COMB – of each of the 16 categories of digital resources at each moment – M1, M2, and M3. The data was collected between the 1st and 10th of December 2021. Data treatment appealed to SPSS from IBM and Excel from Microsoft.

4. Results

The sample of this study has 44 university students (N=44). Regarding the sociodemographic characterization of the sample: gender identification – 63.6% women, 34.1% men, and 2.3% other; age range – between 18 and 47 years old (M=23.48); nationality – most of them are Portuguese (61.4%), with (4.4%) Iranian, Brazilian and Mexican, and the rest (38.14%) not

responding; current academic level – 2.3% pre-graduation, 63.6% graduation, 25% master degree, and 9.1% doctoral degree.

In the first analysis, the frequency of engaging with a digital resource during lectures – did use (U) versus did not use (NU) in each category – was observed between the study’s moments (M1, M2, and M3). Before Covid-19, 83% of university students used (U) digital resources during lectures. During lockdown (M2), digital multitasking increased by 3% (86%). After the pandemic, the use (U) decreased by 4% (82%). Interestingly, digital multitasking was frequent before the Covid-19 pandemic (M1). Digital multitasking was more frequent during the lockdown period, as expected (H.1). However, it was less frequent in M3 than in M1, only confirming part of this hypothesis. A detailed analysis regarding the frequency variation of each category (A) between the moments is presented in Figure 1.

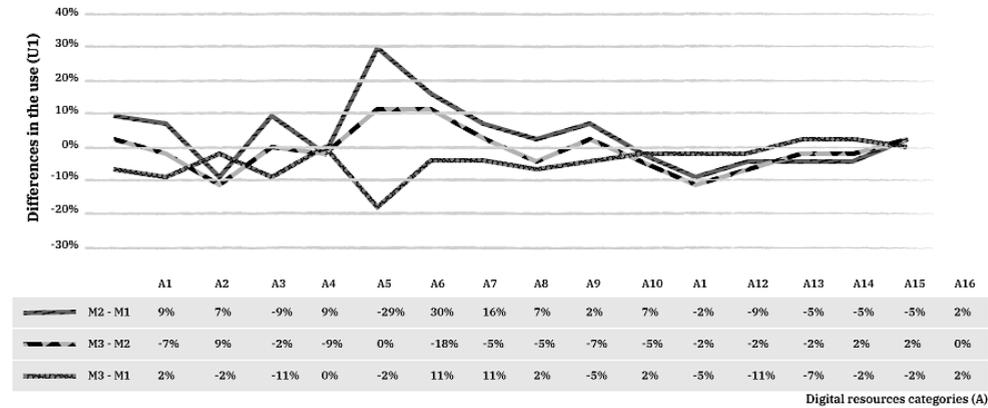
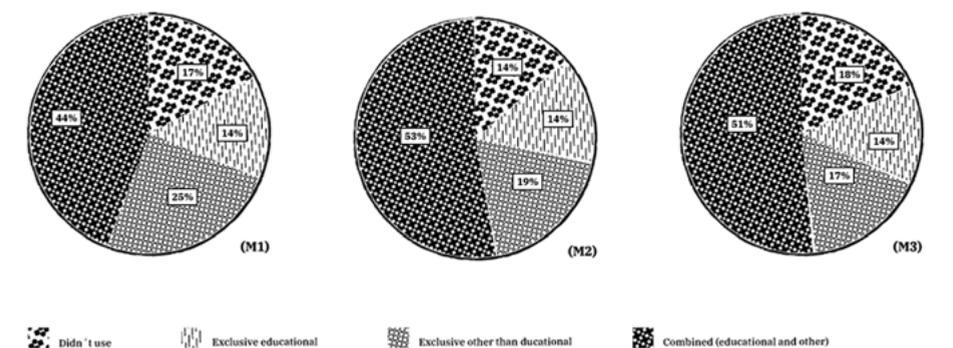


Figure 1: Graphical (line chart) and descriptive (table) analysis of the percentual differences in the use (U) of each category of digital resources (A) between the three moments – before Covid-19 (M1), during lockdown (M2), and after the pandemic (M3).

When comparing the frequency of digital resources’ use in multitasking behavior during lectures, higher variations occurred between the moments in written communication (A5), video communications (A6), store & share (A1), commerce (A3), education (A7), and office tools (A9). In a second analysis, we have focused on the purpose by which university students engage in digital multitasking during lectures (Figure 2).



	NU	ED	NED	COMB
M1	121	96	167	304
M2	98	100	127	363
M3	128	97	114	349

Figure 2: Percentual distribution (circular graphics) and absolute frequencies (table) of the purpose – exclusive educational (ED), exclusive non-educational (NED), and combined (COMB) – regarding digital multitasking during lectures, within the different moments – before Covid-19 (M1), during lockdown (M2), and after the pandemic (M3).

The frequency of university students using (U) digital multitasking during lectures has increased between M1 and M2 – with a lower percentage of “did not use” condition (NU) in M2. This percentage is altered again between M2 and M3, with M3 showing a higher frequency of not using (NU) digital multitasking during lectures. Educational purpose (ED) frequencies of digital multitasking during lectures remained constant during the three moments (M1, M2, and M3). The non-educational purpose was higher in digital multitasking during lectures before Covid-19 (M1=25%) than during lockdown (M2=19%) or after the pandemic (M3=17%). Combined purpose has an increased frequency in M2 (53%) when compared to M1 (44%), which seems to remain in M3 (51%). These results confirm the second hypothesis (H.2) only partially – although exclusive educational purpose (ED) didn’t seem to vary over time, the combined purpose (COMB) has increased during the pandemic, and exclusive non-educational purpose (NED) has decreased, with that trend being maintained after the pandemic (M3). It was also intended to test if the variance observed was significant. To see which categories (A) contribute to the different purposes, correlations between them and the purposes (ED, NED, and COMB) were conducted (Table 1).

Table 1: Non-parametric correlations between the categories of digital resources (A) and the purpose of engaging in digital multitasking during lectures – exclusive educational (ED), exclusive non-educational (NED), and combined (COMB).

Categories (A)	Purposes					
	ED		NED		COMB	
1 Store & share	np=-.028	p=.819	np=-.198	p=.103	np=.244	p=.041*
2 Actuality	np=-.273	p=.024*	np=-.175	p=.145	np=.340	p=.004**
3 Commerce	np=-.089	p=.459	np=-.327	p=.006**	np=.263	p=.025*
4 Audio communication	np=-.253	p=.051	np=-.196	p=.101	np=.399	p<.001***
5 Written communication	np=-.184	p=.140	np=-.161	p=.193	np=.332	p=.006*
6 Video communication	np=-.050	p=.679	np=-.084	p=.487	np=.287	p=.015*
7 Education	np=.089	p=.483	np=-.221	p=.079	np=.219	p=.076
8 Entertainment	np=.029	p=.812	np=-.278	p=.021*	np=.323	p=.006**
9 Office tools	np=.006	p=.965	np=-.376	p=.003**	np=.342	p=.006**
10 Organization	np=-.078	p=.517	np=-.287	p=.017*	np=.302	p=.011*
11 Language	np=.003	p=.980	np=-.246	p=.046*	np=.418	p<.001***
12 Multimedia	np=-.192	p=.144	np=-.174	p=.148	np=.482	p<.001***
13 Music	np=-.083	p=.494	np=-.277	p=.023*	np=.384	p=.001**
14 Orientation	np=-.069	p=.566	np=-.252	p=.034*	np=.397	p<.001***
15 Research & Knowledge	np=-.156	p=.211	np=-.297	p=.017*	np=.441	p<.001***
16 Social Networks	np=-.128	p=.290	np=-.342	p=.005**	np=.437	p<.001***

Note: * (p<.050), ** (p<.010), *** (p<.001).

These results are evidence regarding the educative use of digital resources during lectures (H.2) because they show that most of the categories have an inverted relation with the non-educational purpose (NED), meaning that the increase in the use (U) of those digital resources during lectures determines the reduction of non-educational purpose (NED) in a significant way. Besides, significant positive correlations were found between all categories (except for educational resources) and combined purpose (COMB).

5. Discussion

No study seems to have previously attended to the purpose of digital multitasking behavior during lectures among university students. It was verified that digital multitasking is a common trend and that research in this field is relevant as the learning processes are changing to a more demanding, versatile, and continuous search for information in our daily lives (Siemens, 2004). Besides, digital multitasking has been related to poorer academic performance in some studies (Alvarez-Risco et al., 2020; Leysens et al., 2016) and seems to have changed since the Covid-19 pandemic, supporting the need for more research in this field. During lectures, university students seem to use that behavior not only as a distraction factor, as suggested by Leysens et al. (2016), but also with a more educational purpose, although combined, as we have observed. However, it is important to notice that digital multitasking might only be productive if the demands are not competing for the same cognitive resources to respond to both tasks in parallel, with digital multitasking requiring

individual self-regulation abilities and high executive processes to be effective (Karlen, 2016; May & Elder, 2018).

6. Conclusion

This study provides exciting results. Although university students seem to resort more to digital multitasking during the lockdown, this behavior has decreased to inferior levels to the pre-pandemic moment more recently. The categories of digital resources that contribute to reducing the non-educational purpose of digital multitasking during lectures might be the ones that contribute to a more educational purpose, including commerce, entertainment, office tools, organization, language, music, orientation, research & knowledge, and social networks. The main limitations of this study were the small sample size (N=44) driven by the high dropout rate (78%), mainly related to its length, and the method of data collection – a self-assessment measure requiring the appeal to memory. Further research should introduce self-management assessment measures and analyze digital multitasking between learning contexts.

Acknowledgments

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The role of financial aid in college performance: the importance of class attendance, aid amount and type of aid

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Abstract

We use Social Identity Theory (SIT) and Tinto's (1975) theoretical framework on college dropout to argue how the provision of financial aid relates to undergraduate students' performance. Financial aid enables economically less favored students to pursue high quality university education achieving upward social mobility. We conduct this study using archival data of 4 cohorts of business administration undergraduate students of an international, elite university in Europe. We find that financial aid recipients obtain a higher first-year GPA than non-recipients. This positive relationship is partially mediated by class attendance. Financial aid recipients attend more classes, which also enhances their GPA. Moreover, unexpectedly, we find that the relationship between the amount of aid received and GPA is non-linear, and that merit-based aid and need-based aid increase students' GPA in a similar manner.

Keywords: *Student performance in higher education; class attendance; management of education; amount of financial aid; need- vs merit-aid.*

1. Introduction

The role of financial aid in determining academic outcomes has been widely discussed and researched. Previous research has focused on the impact of financial aid on academic outcomes such as attendance to college, persistence in college, grade completion, or student dropout (Cabrera et al., 1992; Allen, 1999; Kuh et al., 2008; Goldrick-Rab et al., 2016; Bettinger et al., 2019). A few studies have examined the effect of financial aid on students' grades (Kuh et al., 2008; Stater, 2009). However, grades are very important as they are strong predictors of college persistence and completion (Stater, 2009). Also, while many theorize that financial aid can improve student outcomes in college, there is still little evidence on how aid influences the building blocks of student success. We attempt to fill this gap in the literature by researching the impact of financial aid on students' grade point average (GPA), trying to understand the dynamics behind it. Relatedly, we add to prior work by examining the distinct effects of two different types of aid, need-based aid and merit-based aid, on college GPA.

Our main results indicate a positive impact of financial aid on students' academic performance – a result partially mediated by students' attendance to class -, independently of the type of financial aid received (merit versus need). Furthermore, we find a non-linear relationship between the amount of financial aid received and GPA.

2. Theoretical framing and hypotheses development

Social identity, and more specifically social self-categorization, refers to the part of individuals' self-perception related to their membership to a social group (Tajfel, 1982). Social Identity Theory (SIT) suggests that groups categorize their members between in-group and out-group, based on salient differences, such as gender, race, ethnicity, the organization they work for (Ashforth & Mael, 1989), or the college they study in (Lund Dean & Jolly, 2012). Individuals strive for upward social mobility, in their search for a more positive social identity (Tajfel & Turner, 1979). Through financial aid, students coming from less economically favored backgrounds may become members of the in-group of students at high quality institutions, achieving upward social mobility.

Once membership into the in-group is achieved, it is important to maintain membership. Tinto's (1975) theory on students' dropout from higher education, which has been widely used to understand students' performance and persistence in college, is useful to understand the dynamics of membership maintenance. Positive social and academic experiences and adequate academic performance at university would reinforce perceptions about the benefits that derive from the completion of studies. Financial support, and adequate academic and group integration would positively influence the decision to remain in the institution.

The combination of these two theoretical frameworks, SIT and Tinto's (1975) theory of dropout allows us to understand the dynamics that financial aid triggers when college students receive it. Financial aid allows students to be part of the mainstream group and motivates them to remain in the new group.

Being able to study at the academic institution we examine, and to join its international and privileged student body, creates among students that receive financial aid a sense of gratitude, and an incentive for better college performance.

Moreover, financial aid helps students be less anxious about how to finance their college education and be more focused on their studies. Scholars have suggested financial aid can lower this anxiety, leaving students to devote more time and energy to academic pursuits (Bean & Metzner, 1985; Cabrera, et al., 1990), and therefore achieving more academic integration. GPA is often reported in the literature as a proxy indicator for academic integration (Cabrera, et al., 1992). Therefore, GPA may be positively related to financial aid.

Empirically, financial aid has been shown to be positively related to GPA in one meta-analysis (Robbins et al., 2004) and in several studies (Kuh et al., 2008; Cabrera, et al., 1992; Allen, 1999). Therefore, our baseline hypothesis is the following:

Hypothesis 1: Financial aid is positively related to college performance.

Financial aid increases students' attendance to class due to several mechanisms. First, the gratitude felt by financial aid recipients to be part of this institution may help them make more efforts, which translate into higher class attendance. Second, financial aid recipients do not face the same financial restrictions as students who do not have this support. Students with financial aid can devote extra financial resources to engage in academic activities such as attending class. Third, students receiving financial aid are usually subject to specific performance standards. For example, in the institution examined, it is mandatory to attend 70% of sessions. Attending fewer sessions in any given subject translates into failing that course, and into losing part or all of the financial aid received.

Hypothesis 2: Attendance to class mediates the financial aid – college performance relationship.

In the present study, the amount of financial aid given to students is calculated as a percentage of the tuition. Higher percentages of aid are given to more economically needy students. For students who receive more financial aid, it would be more difficult to achieve membership in this institution without that aid. Therefore, students who receive a higher percent of aid will feel more gratitude about it than those who receive less, as it enables them to be part of this international and prestigious university, to which they would not be able to access without the aid. Therefore:

Hypothesis 3: The amount of financial aid given is positively and linearly related to college performance.

All scholarship recipients in the examined institution received financial aid for economic reasons. Indeed, they could not afford attendance without this financial aid. However, the institution's financial aid team classified the scholarships between those based solely on financial need, labeled need-based aid, and those that are given to economically needy students who also have strong academic records. We label the latter merit-based aid.

Merit-based aid recipients are more motivated and prepared to perform better academically and to be more integrated academically (Tinto, 1975), as this was already the case when they attended school. Also, due to their past academic success, merit-based aid recipients perceive they are more academically capable and performant, which have been found to be positively related to college performance (Richardson et al., 2012; Schneider & Preckel, 2017). Therefore:

Hypothesis 4: Merit-based aid recipients have higher college performance than need-based aid recipients.

3. Methods

3.1. Context and data collection

We use students' data from one private, international university in Spain. Data is retrieved from the university's records of all students who start an undergraduate business administration degree from 2014 to 2017 (n=1776). 55% of students are foreigners. Data is gathered at different times. Most of it is collected during students' admission process into the university. Class attendance is collected during the degree, and the cumulative GPA at the end of the first year.

3.2. Measures

GPA. We use students' first-year GPA using the Spanish grading system.

Financial aid. It indicates the student received institutional financial aid, 0 signals he/she did not. 34% of sampled students are financial aid recipients.

Attendance. It corresponds to the percentage of class sessions the student attends.

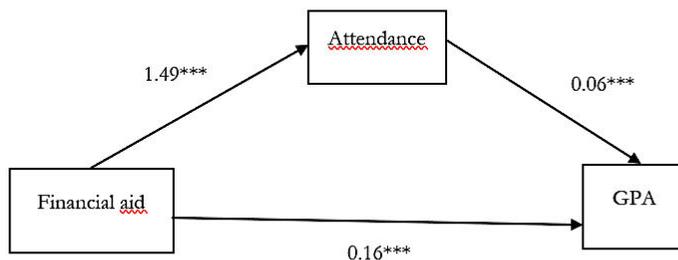
Type of aid. Need-based aid is given to students with financial necessity, and merit-based scholarships to students who have both financial necessity and high grades in secondary school. This variable takes 3 values: 2 if the student is a merit-based aid recipient, 1 for recipients of need-based aid and 0 when the student did not receive financial aid.

Percent of aid. It is the amount of financial aid given, and it corresponds to a percentage of the first year’s tuition. Regarding the requirements for aid renewal, the first year’s percent of aid is applied in subsequent years unless students fail one or more subjects.

Controls. We control for students’ education system in their last year of high school, their secondary education grades, the age at which they started the bachelor, their sex, the year they enrolled into the bachelor, the location of the campus, whether the language of instruction is always English or not, whether the student is a transfer from another university, and the degree they study.

3.3 Analyses and results

The first hypothesis states that financial aid has a direct and positive association with first-year GPA and the second one that class attendance mediates that relationship. Both hypotheses were tested using Structural Equation Models (SEM). The direct effect is tested entering financial aid and the controls as predictors of GPA. The indirect effects were tested by entering financial aid and the controls as predictors of attendance, and attendance as predictor of GPA. As shown (Figure 1), financial aid is related directly and indirectly (through attendance) to GPA. Hence, hypotheses 1 and 2 are supported. Financial aid recipients have on average 0.24 GPA higher than non-recipients, of which 35% is indirect through attendance.



*** p < 0.001

Figure 1. Path analysis of direct and indirect effect of financial aid on GPA.

The third hypothesis states that the amount of financial aid is positively and linearly related to GPA. We test it by regressing the GPA on percent of aid (as well as its squared and cubic terms) and the controls. Results show that the relationship is non-linear, when the percent of aid increases from 5% to 43%, so does the GPA. Onwards, the GPA depicts a plateau. Therefore, H3 is only partially supported (see Figure 2).

Hypothesis four states that merit-based aid recipients would have a higher GPA than need-based aid recipients. We tested this hypothesis by conducting a regression of the of GPA on

the control variables and the type of aid. Results indicate that merit-based aid recipients' GPA does not differ from that of need-based aid recipients. Thus, H4 is not supported.

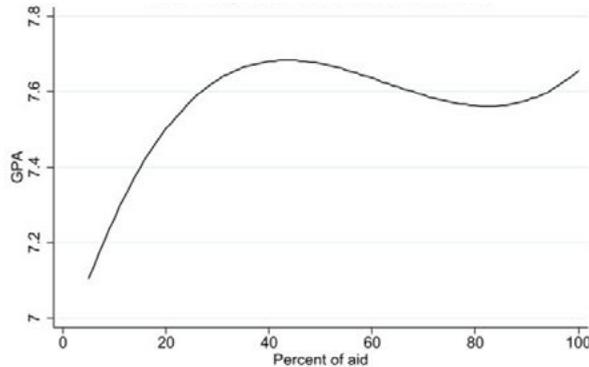


Figure 2. Relationship between amount of aid and GPA.

4. Discussion

In this study, we research the importance of financial aid in students' college performance, as a tool to integrate less privileged students into the main body of students, who do not receive any financial aid. Our results confirm previous findings showing a positive relationship between financial aid and college GPA (e.g., Kuh et al., 2008; Cabrera et al., 1992; Allen, 1999). We have argued that thanks to the financial aid received, students experience upward social mobility, and are especially grateful for being able to be part of an international, prestigious, and selective university, which could explain the positive relationship between financial aid and GPA. Although we have not conducted formal qualitative research to understand the reasons for this relationship, in several informal conversations with financial aid recipients, they express their gratitude for being able to study at this university. This gratitude may translate into more commitment to the institution, which has been found to be positively related to college performance (Schneider & Preckel, 2017).

Building on the second hypothesis, our results suggest that the financial aid-GPA relationship is partially mediated by attendance to class, as 35% of the total effect is indirect. That is, financial aid recipients attend more classes, which enhances their GPA. This mediation suggests that financial aid recipients exert more effort (as they attend more classes) which increases their performance. Previous research has shown that both effort and attendance to class are related to performance in college (Schneider & Preckel, 2017). Also, thanks to the scholarships, these students do not need to find alternative financial resources outside of college, which may enhance their performance, as working during college is negatively

correlated to GPA (Kuh et al., 2008), and having more time to study is positively related to college performance (e.g., Kuh et al., 2008; Schneider & Preckel, 2017).

Moreover, interestingly, and unexpectedly, we find that the amount of aid received is non-linearly related to GPA. Financial aid and GPA are positively related for students who receive from 5% to 43% of aid, which is the majority of students (80%). For the remaining 20%, who receive a percentage of financial aid higher than 43%, the amount of aid seems unrelated to GPA. The positive part of the relationship can be due to the gratitude these students feel to be part of this group, and to the efforts they exert to renew the scholarship (so, to maintain group membership). The part of the relationship where the amount of aid is unrelated to GPA may be because students are already part of the main group, and that their level of gratitude, effort or their grades cannot increase more. For example, scholarship is renewed when students pass all subjects, that is, when they obtain a grade of at least 5 (out of 10) in each course. The GPA at the turning point is 7.7. Once students realize how much effort is needed to pass a course, they may figure out that it is not worth making more efforts to increase their GPA, as these increases are not needed for financial aid renewal. Alternatively, a GPA higher than 7.7 is hard to obtain in the Spanish college standards. In this data, only 30% of students obtain a first-year GPA higher than this value. Therefore, even if they wanted to, financial aid recipients may simply be unable to obtain a GPA higher than this value.

Also, contrary to our hypothesis, we find that the average GPA of merit-based aid recipients is not different from that of need-based aid recipients. We expected that merit-based aid recipients, as they are more prepared academically, would integrate academically and socially better, and would therefore obtain better grades in college. However, we do not find evidence for this. One potential argument can be that because their pre-college academic ability is controlled for in the analyses by including their grades in secondary school, these effects may be reduced. Furthermore, we can also claim that any student that qualifies for financial aid, either merit-based or need-based, is somehow economically disadvantaged. Research has found that family income is positively related to college performance (Kuh et al., 2008; Richardson et al., 2012; Schneider & Preckel, 2017), and so, aid recipients' GPAs would be pulled downward. Hence, merit-based aid recipients' GPAs would be pulled upward by their stronger academic standing but downward by their lower income, which may explain the non-significant GPA difference with need-based aid recipients.

This paper makes important contributions to theory. Framed within SIT, it shows the importance of financial aid to students as a tool to reduce income inequality and enhance social mobility by allowing grant recipients to be part of the main student body group. To receive financial aid and reduce these income differences, students are incentivized to be efficient in class, attending more sessions and achieving a level of GPA that allows them to renew their grants every year. Financial aid is a key university tool to reduce students'

differences and to make less privileged students less salient in terms of income, which incentivizes them to excel academically, and to attend more to class.

4.1. Implications for universities

The implications of these results for universities are of great relevance. First, as financial aid is positively related to GPA, both students and institutions benefit from financial aid. For institutions, providing scholarships is equivalent to investing in better academic performance outcomes. Furthermore, class attendance is positively related to GPA. Therefore, monitoring and encouraging class attendance will ameliorate students' performance. Providing this financial aid to students incentivizes them to attend more classes, which is beneficial for class dynamics, faculty, and the whole student body.

Also, as shown, the amount of financial aid is non-linearly related to GPA. Universities need to consider that beyond a certain amount of financial aid (beyond 43% of tuition in this study) students do not exert more effort, and the GPA is not affected positively.

Finally, as noted before (Stater, 2009), need-based aid promotes more social class equality, and merit-based aid promotes higher academic achievement at the universities. This study suggests that both types of scholarships have a similar effect on GPA. Given this result, we suggest that universities choose need-based over merit-based aid, as the university's academic performance will not be affected.

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Changing higher education governance in Latin America: the cases of Chile and Ecuador

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Abstract

This article examines recent changes in the governance of national higher education systems in Chile and Ecuador. It focuses on the changes associated with the different roles of the State/Government as a coordinating mechanism. An analytical model is proposed that distinguishes between five roles of the State/Government: system designer, principal, regulator, evaluator, and funder. Recent reforms introduced in the sector by both countries are analysed and their impact on the State/Government profile is compared. The results show that the roles of system regulator, designer and evaluator are changing in opposite directions because of the respective reforms. On the contrary, the results show that both countries are moving in the direction of strengthening the state/government roles as funder.

Keywords: Higher education; governance; Chile; Ecuador.

1. Introduction

Over the last few decades, the governance of national HE systems has been subject to significant changes at a global level (Capano & Pritoni, 2020). These changes have redefined roles and power relations between state, market, HE institutions (HEIs) and various external stakeholders (Facchini & Fia, 2022). Indeed, HE governance reforms are acknowledged to be influenced by global patterns associated with the main public sector transformation streams: new public management (NPM), networked governance and neo-Weberian (Donina, Meoli & Paleari, 2015). Moreover, the growing interest in studying HE governance has led to increasing complexity in the conceptual and analytical approaches used to understand its changing dynamics. Over the last two decades, the so-called governance equaliser approach (de Boer, Enders & Schimank, 2008) - inspired by Clark's (1983) coordination triangle - has gained increasing legitimacy among researchers in the field and has been used for the study of HE governance transformations in several countries. See, for example, Donina, Meoli & Paleari (2022). The results of these studies confirm the strong dominance of local contexts in the direction of change, while showing a trend towards configuring hybrid HE governance systems (Capano & Pritoni, 2019). In Latin America (LA), national governments of different political tendencies have introduced adjustments in the governance of HE aimed at strengthening the state-market axis. In this sense, a process of policy accumulation (González-Ledesma & Álvarez-Mendiola, 2019) is recognised as a recent trend that, on the one hand, increases the role of the state through increased public funding of the sector and greater control over private HEIs, and, on the other, maintains public policies and regulations that are recognised within the framework of academic capitalism (Brunner et al., 2021). Indeed, it can be argued that changes in the governance of national HE systems in LA seek to strengthen the role of the state as a counterbalance to the strong historical influence of academic autonomy and self-governance on the one hand, and to the power of market forces in deregulated contexts on the other. Recently, however, some national governments in LAC, such as Chile and Ecuador, have undertaken important reforms that are changing the trajectory of HE governance followed over the last decade. On the other hand, given the growing diversity and complexity of national HE systems in LA, existing typologies - especially those developed in the global North - have limitations in organising the complex reality of their governance. Thus, their application in the region faces the challenge of converging towards models of analysis capable of addressing the heterogeneity of national HE systems and their ongoing processes of transformation. This article therefore has two central objectives. First, to propose a conceptual and analytical approach to examine HE governance from the perspective of the state's role as main system coordinator. Second, to analyze the changes in the governance of national HE systems in Chile and Ecuador, focusing on the similarities and differences between the two cases, based on the respective reforms adopted in recent years. Its content is divided into four sections. First, it shows the conceptual

and analytical framework used to examine the case studies. Next, the methodology used is displayed, including the data collection mechanisms and sources of information. It then presents the major findings and finally draws the main conclusions.

2. Conceptual framework

To approach the complexity of the state's role as a coordinating force in HE, we turn to the concept of multi-governance (Chou et al., 2017). This concept consists of four dimensions. The first is related to its multilevel quality, which refers to the degree of concentration or distribution of authority at different vertical levels of State/Government: national, regional, and local. The second dimension relates to the multiple actors or stakeholders interacting in the sector, such as state or governmental bodies (ministries, agencies, and others) and non-governmental organizations, including HEIs associations, academics, business and labour, students and their families. The third dimension relates to the multiple issues competing for priority space on the public agenda. A fourth dimension is the multiple organizational and coordinating arrangements that result from the interaction between the various forces of State/Government, markets, and HEIs. Amid this complexity, the State/Government can play different roles depending on the nature and emphasis of the public policies it promotes. Indeed, we distinguish five different roles in the LA context, based on the orientation of the oversight (behavior and/or outcomes) and various arrangements that the State/Government uses: system designer, principal, regulator, evaluator, and funder. In the role of system designer, the State/Government establishes the policies and norms that regulate the behavior and relationships between the different actors that are part of the HE system. Indeed, it is within this framework that the traditional academic autonomy and self-governance widely recognized in LA take form. It is also through this design that the State/Government sets the conditions for the participation of the private sector in the provision of HE. Next, in the context of agency theory, the State/Government acts as a principal vis-à-vis HEIs, which act as agents. In this model, the State/Government defines objectives and expected outcomes, control mechanisms and accountability. As principal, the State/Government seeks to align the performance of HEIs with the public policy priorities of the sector. This format has been used in LA to guide the production of public goods in HE by both state and private institutions. It is also argued that this coordination modality has installed a new form of regulated autonomy. The third role adopted by the State/Government is that of regulator. In this case, the State/Government defines, enforces, and monitors compliance with rules aimed at regulating the functioning of markets in HE. Currently, a new regulatory landscape is emerging in the global North after several decades of a trend towards deregulation (Capano et al., 2020). Similarly, in LA, Rama (2006) observed this emerging phenomenon early on, characterizing it as the latest wave of regulatory reforms in national HE systems. Fourth, we distinguish the evaluative role of the State/Government, a function that the European

literature refers to as steering at a distance. By focusing on measurement, the State/Government aims to increase the productivity, efficiency, quality, and effectiveness of academic work at both institutional and individual levels. To this end, it deploys a set of indicators and metrics that seek to align the outcomes of HEIs with the public policy priorities of the sector. In fact, this role is increasing in LA countries, as part of national policies aimed at the measurement and evaluation of outcomes. Finally, the fifth State/Government role is associated with its role as funder. In this schema, funding is understood as more than a mechanism for allocating resources to HEIs and students. Rather, it is a governance tool to change behavior and maximize certain outcomes with limited resources. As such, State/Government is oriented towards seeking greater effectiveness and efficiency in the use of public resources by HEIs (Capano & Pritoni, 2019). In LA, there is a perceived shift from block grants (allocated in an inertial, automatic, and discretionary manner) to formulas that seek to influence the behavior and results of HEIs (García-Fanelli, 2019).

3. Method

To develop this study, we used the methodology of documentary research on secondary sources, with two foci. Firstly, the literature on HE governance published over the last two decades by the global north and LA scholarly communities was reviewed, serving as a basis for the elaboration of the conceptual framework presented in the previous section. Secondly, legislation, regulations, policy reports, and academic and grey literature related to the national HE systems of Chile and Ecuador published over the last 20 years, and relevant for the purposes of this study, were reviewed. Of particular interest were the recent HE reforms introduced by the national governments of both countries. In the case of Chile, the Law on HE (N°20.091), published on 29 May 2018, and the Law on State Universities (N°21.094), published on 5 June 2018. Regarding Ecuador, the Organic Law published on August 2, 2018; and the Decree (N°494) amending the Organic Law on HE (LOES) of Ecuador, published on July 14, 2022. Each of these reforms was analysed through the lens of the five roles of the State/Government. Next, each of the authors separately assessed the changes in the roles of the State/Government in each country since the implementation of their respective reforms. Both authors then shared the results of their analyses. Differences were discussed until a consensus was reached.

4. Findings

In both countries, the State/Government has played an important role as a system designer, albeit with different approaches and emphases at each stage and in each political context. In the case of Chile, the State/Government has played an active role in the design of the HE system, especially since the 1990s, seeking a balance between the State/Government, the

market and HEIs. However, after the recent reform of 2018, adopted during the administration of Michelle Bachelet, the role of the State/Government as a system designer became less important, along with a strengthening of its roles as regulator, evaluator and financier, and the maturation of the system itself. Indeed, the State/Government has strengthened and increased its influence in the management of public and private HEIs, which has led to greater regulation and supervision of HE. Despite these changes, the State/Government continues to be involved in setting up bodies and formulating policies and strategies to guide the sector's development. This is the case with the Under-Secretariat of HE as the sector's governing body, the Superintendence of HE as the supervisory body, and the Quality Assurance Council as the guarantor of HE quality. In Ecuador, the State/Government has gone through different stages in its role as system designer. During the Rafael Correa administration, the State/Government assumed a strong regulatory role, reducing the autonomy of HEIs and centralizing decisions in the central government (Benavides et al., 2018). However, in subsequent reforms under the administrations of Lenín Moreno and Guillermo Lasso, the State/Government has shifted its focus towards a more diversified profile, strengthening its role as a designer of the rules of the game (policies, norms, and instruments) that condition the relationships between different HE actors. In particular, the changes have granted greater autonomy to HEIs and have also strengthened the institutional framework of HE, creating inter-institutional and regional consultative planning committees with greater participation of the various stakeholders and less influence of the central government (Andrade, 2021). This indicates a more active role of the State/Government as a designer of the system.

Similarly, the State/Government plays an active role as principal in both countries, but with different degrees of relevance. In Chile, the State/Government has increased its influence in the management of both State/Government and private HEIs through performance-based contracts in priority areas. A notable example is the program to strengthen State universities with 10-year development plans based on objectives and expected results approved by the Ministry of Education. Although the State/Government remains an important factor in defining objectives and accountability, its role as principal seems to have lost importance compared to its roles as regulator, evaluator, and funder. Indeed, the State/Government's influence on the objectives of HEIs has been complemented by other financial, evaluative, and regulatory mechanisms, such as formulas for the distribution of resources, compliance with quality criteria and standards, and new norms. In Ecuador, recent reforms have strengthened the leading role of the State/Government, giving greater importance to the definition of objectives and the accountability of HEIs and academics. An example is the introduction of a new regulation to financially incentivize academics to carry out research and development work, establishing monitoring and accountability mechanisms like a contract between a principal and an agent. In addition, the reforms have put in place financial incentives to improve the productivity of individual researchers.

Regarding the role of the regulatory State/Government, the two countries show different trends. In Chile, it has increased its relevance in recent years, especially after Law 21.091/2018. This reform introduced a series of new regulations that explicitly establish the mission of HE; it sets up new rules that increase the State/Government's capacity to supervise HE in terms of compliance with the law, especially the use of public resources; it establishes new rules for access to and use of public funds for free education; and it determines the obligation to accredit quality based on more demanding criteria and standards. On the other hand, in Ecuador, the regulatory State/Government played a very strong role in the 2010 LOES reform, which established a high level of public regulations and reduced the autonomy of HEIs through the implementation of regulations and the oversight function by bodies under the control of the executive branch. However, subsequent reforms in 2018 and 2022 have weakened the role of the State/Government as regulator and granted greater autonomy to HEIs; for example, by simplifying procedures for creating new programs and making curricular changes.

In addition, in both Chile and Ecuador, the State/Government has taken an active role as evaluator in HE, albeit with different approaches. In Chile, the State/Government focuses on compliance with criteria and standards, while in Ecuador it has moved towards a focus on continuous improvement and greater involvement of HEIs in the evaluation process. In fact, the Chilean State/Government has strengthened its role as evaluator with the creation of the National Quality Assurance System, which is composed of different public bodies that should establish a coordination plan, define, and coordinate criteria and standards for improving HE quality. Law 21.091/2018 also introduces a new quality assessment model that emphasizes the fulfilment of criteria (18 in the case of the university subsystem), each with three performance levels. In effect, it creates an integrated and mandatory institutional accreditation system that covers all academic functions, campuses, and programs. Thus, according to the results obtained, HEIs are classified into three levels: basic, advanced and excellence. Furthermore, new regulations also make mandatory the accreditation of doctoral programs. In Ecuador, the role of the evaluative State has evolved from an approach based on compliance with metrics to one focused on continuous improvement during the last decade (Ponce & Intriago, 2022). The 2018 LOES reform established a new quality evaluation model that distinguishes between accrediting and non-accrediting evaluation, ensures greater involvement of HEIs in the evaluation process, and gives greater importance to self-evaluation. It also emphasizes qualitative aspects and removes the previous categorization based on compliance with metrics. The new model is binary, i.e., it determines whether a HEI is accredited or not. Similarly, the latest reform of 2022 makes the annual evaluation of the performance of individual academics in HEIs mandatory.

On the other hand, the funding State/Government role has been strengthened in recent years in both countries. In Chile, Law 21.091/2018 increases public funding and introduces free

tuition for students from the six lowest income deciles. It also regulates fees per undergraduate education program and limits the annual growth of new students. The Chilean Law 21.094/2018 also institutes a specific amount of public funding to strengthen State universities. These measures make HEIs more dependent on State/Government, thereby restricting institutional decision-making autonomy in the use of resources. In Ecuador, the LOES reform of 2018 introduced a formula mechanism to distribute public resources according to results, based on teaching, research, extension and administrative indicators (Ponce & Intriago, 2022). In addition, the new regulations allow universities to generate private income through technical assistance and consultancy to strengthen their academic projects.

5. Conclusions

This article contributes to the academic international debate on analytical models for understanding changing State/Government roles in the governance of highly diverse and complex national HE systems. A new model is proposed and applied to the Chilean and Ecuadorean HE national systems, proving its usefulness for understanding changes in the governance of HE in the LA context. The findings related to both case studies suggest four conclusions. First, the results are consistent with previous research showing the strong influence of the political, social, and economic national contexts on changes in HE governance over a given period. Second, the results show that the reforms adopted since 2018 in both countries led to opposing changes in the role of the State/Government in regulation, design, and quality evaluation. On the one hand, Chile increased regulations, reduced HEIs' autonomy and moved from a quality assurance model focused on continuous improvement to a compliance and classification system for HEIs. On the other hand, Ecuador reduces state regulation, increases HEI autonomy and shifts its quality evaluation model from a logic of compliance and categorising HEIs to a model of continuous improvement and binary (accredited/non-accredited). Thirdly, in general, both countries maintain regulations and policies aimed at strengthening the funding role of the State/Government and its role as principal. Also in both countries, a formula is used as part of the allocating mechanism for public resources and performance contracts are employed as a tool for aligning HEIs with the objectives and results expected from public policies. Fourth, the analysis of changes over the last decade shows that Ecuador has been more radical than Chile in its reforms related to the role of the evaluative State/Government. While Ecuador has swung from one model to another like a pendulum, Chile has done so gradually. Lastly, we suggest that the application of this analytical approach can be useful for studying other Latin America and Caribbean national HE systems.

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Resource orchestration and the higher education programme director

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Abstract

With approximately half a million students, universities of applied sciences are the largest providers of highly educated professionals in the Netherlands. The programmes offered by these universities have a certain degree of policy freedom when it comes to connection and knowledge exchange with professional practice. Programme directors (PDs) are responsible for the organization and development of the education programmes. In this role, they have, within the institutional framework of the university, powers in the areas of personnel, finance, quality assurance and planning. They have become the central pivot in the organization of these programmes, and they are responsible for optimizing the work processes and guaranteeing the quality of the graduates. In this study, we interviewed 25 PDs how they use their resources for innovation within their managerial frameworks in educational organizations. This research shows that innovation requires room for experimentation.

Keywords: *University of applied sciences, resource orchestration, agency, knowledge exchange, professional field, programme director.*

1. Introduction

Universities are the driving force behind innovation and knowledge development in today's Western European societies. However, academics need an incentive to actively realize knowledge sharing (Sormani & Rossano-Rivero, 2023). Stimulating innovation and knowledge exchange are strongly influenced by the opportunities offered by the educational institution (Cabrera & Cabrera, 2005). Programme directors (PDs) within a university are responsible for the organization and development of the educational programmes. They have become the central pivot in this, and they are responsible for optimizing the work processes and guaranteeing the quality of the graduates (Westerheijden, 2022). In this study, we look at how PDs use their resources for innovation within their managerial frameworks in educational organizations.

2. Theory

Twenty-five directors were interviewed, spread over eleven educational institutions and seven educational sectors. Nine women and sixteen men, all with more than five years of experience in the management of a higher education institution, These PDs were interviewed with open-ended questions about their experiences as managers, their successes, and their failures over the past 4 to 5 years. In these interviews, attention was paid to topics such as innovation in education, the relationship with the professional field, and the possibilities and limitations that the university gave them as PDs. All higher educational sectors were represented, with the exception of the art education sector.

We looked at awareness of institutionalized habits and routines (Emirbayer & Mische, 1998), ability to identify problems in current institutional arrangements (Battilana et al., 2009) and the ability to conceptualize alternative outcomes (Emirbayer & Mische, 1998). Central were the institutional aspects of formal authority, including the actor's right to make decisions (Hardy & Phillips, 1998) and access to the financial costs of change (Greenwood et al., 2002). We addressed resource orchestration by linking value creation in dynamic environmental contexts to management resources (Sirmon et al., 2011). The components of the resource management model included structuring the resource portfolio, bundling resources to build capabilities, and leveraging capabilities to provide value. This document could be used as a template for formatting the papers. All texts, figures and tables must be included within the document margins.

2.1. Resource orchestration

A review of the literature showed that most papers that measured resource orchestration were limited to commercial entrepreneurship and shed little light on the dynamics of commercial enterprises (Ghalwash & Ismail, 2022). Resource orchestration processes that explain how

opportunities are created, operationalized and legitimated in the institutional environment of universities have received less attention (Owusu & Janssen, 2013). The goal of this study was to explore these concepts to show how in higher education, middle managers in an institutional environment overcome resource constraints and achieve value through innovative resource orchestration (Ireland et al., 2003; Sirmon et al., 2011).

2.2. Institutional entrepreneurship

Institutional entrepreneurship theory highlights how actors with sufficient resources see opportunities to realize interests that they value highly” (DiMaggio, 1988, p. 14). Institutional theory is characterized by adherence to a given way of acting – of doing things. This is streamlined within predetermined frameworks. When actors want to act in a change-oriented way, they will act outside these bandwidths. Thus, a contradiction arises. The question here is how, within the usual course of action, change-oriented action takes place or, even better, is conceived of at all? We used this change-oriented attitude to subdivide the ways in which PDs use their powers and capabilities to act innovatively or to adopt a more administrative attitude.

3. Method

The 25 interviews, each at least an hour, were transcribed verbatim, stripped of social talk, anonymized and then coded based on Sirmon et al. (2011). ATLAS.ti was used for the coding (Figure 1). Where the quotes are from an interview, reference is made to a letter and a number. The letter stands for an education sector: E for education / teacher training, H for health care, A for agriculture, M for management, S for social sciences and T for technology / IT. The numbering is consecutive.

The following concepts were coded: structuring, bundling or leveraging available resources, looking for new opportunities and combining them with development opportunities, and integrating identified resources to increase effectiveness or efficiency. In addition, search terms such as profession, professional field, knowledge exchange, company, contacts, knowledge, knowledge innovation, and relationship were used. This coding was arranged in paragraphs to give an initial picture of the possibilities that PDs saw for maintaining and renewing their study programmes.

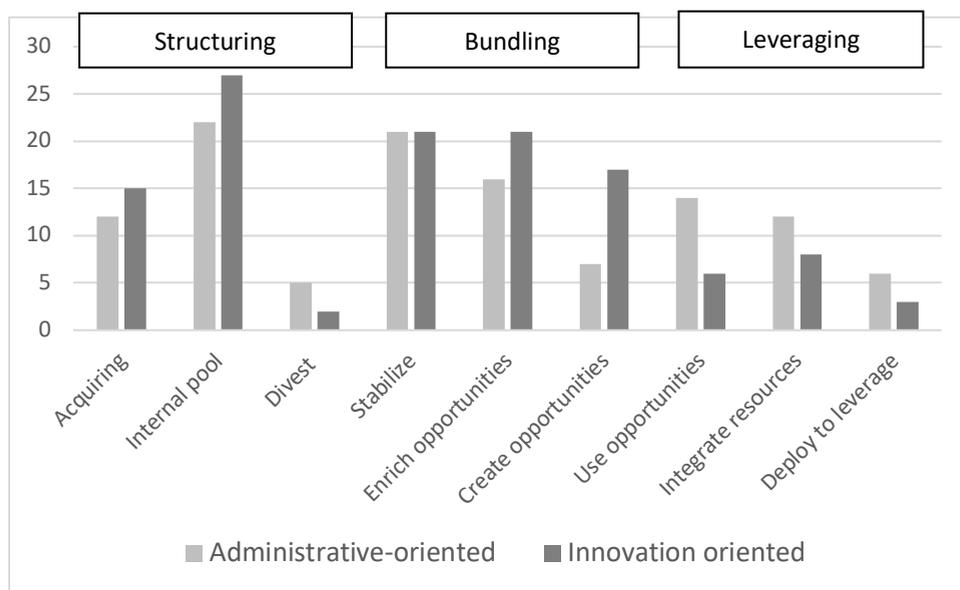


Figure 1. Resource orchestration categories based on Sirmon et al. (2011).

4. Results

These results provide a picture of how PDs used their duties and powers. The numbers on the y-axis are percentages of the total number of statements made by the PDs, ranked according to the reasoning of Sirmon et al. (2011).

The left (blue) columns reflect the answers of the PDs whom we recognized as administrative-oriented, in accordance with DiMaggio (1988). The right (green) columns reflect the statements of PDs recognized as aiming for innovation. This distinction was the result of the first coding in which the following question was distilled from the interviews: How do the relevant PDs view the possibilities and limitations that were given by their educational institute? (Tiberius et al., 2020).

All PDs indicated that innovation or modernization in relation to the professional field was of great importance to them (H6: “I am manager of Education & Innovation, and that word says it all – to really look from that point of view. What is needed? What is that dot on that horizon?” S3: “We are doing several innovations – curriculum revisions anyway – making crossovers in the context of interprofessional learning and working.” T6: “And whatever we started doing, that was also quite innovative – was a kind of open maker space type of thing”).

Differences became visible in the extent to which directors saw opportunities to actually get started. The connection with the professional field was often guiding them (S3: “We have

done all kinds of sessions with the professional field: What do you think it should go to? So, we had a professional field committee there, which was closely involved there, but we also had professional field sessions around it to reach a wider group.”) or at least stimulating them (H4: “And on a professional level, we went together very well.”). A limited number of directors related innovation and development to putting the standing organization in order. In one case, a director who showed their year plan received feedback, but where was the innovation? (M3: “And I remember very well that I once gave a faculty-wide presentation in which I thought I was giving a reassuring message to everyone. And at that presentation, there was a lecturer who was like, OK, now this is the message, and where is the innovation?”)

A second notable feature was that directors received little support from the institutional organization for their development and renewal activities, although there was sufficient expertise available (S2: “The institutional environment, the policy documents that were available were of a high level. But then policy was not binding or directive. And do you just have almost a complete mandate to relate to it according to your own insights?”). It was noted that the slowness and lack of clarity of institutional decision-making unnecessarily limited the success of the innovation (E3: “Well, and then the way in which leadership is given. Just to name a few things, I have a new study programme, actually a merger of three study programmes, which is still very small, but then it will be half a year before a decision is made about it.”).

It was striking that a similar approach, but without external support sources, was described as very successful in one case (H1: “I noticed the new concept was really successful. That meant that we really had a very high student satisfaction during the first 2 years. And also, that employee satisfaction was very high, and absenteeism decreased.”) but as failed in another case (T1: “At a certain point, the resistance is no longer manageable, and at that moment, you also see that the gentlemen’s agreement between the university of applied sciences and the business community no longer works.”), although the ambition was supported at the highest institutional level. In terms of the latter, the lead time, due to a change of personnel at the higher decision-making levels, clearly played a role.

Truly innovative and more or less disruptive innovation occurred in one case where, based on the research input of a researcher, the educational vision was prescribed and adopted for the entire university of applied sciences over time (E1: “Our educational concept is being introduced in phases. I’ve been to expert meetings, and it’s much more a matter of time. If you look at what most of the discussions are about, what does it mean for our education?”).

Another distinction that became visible was the focus on innovation. In a number of situations, the innovation turned out to be aimed at the content of the curriculum, especially updating the curriculum. In four cases, the update aimed at combining existing programmes

into a few strongly up-to-date programmes, as the connection with the professional field required this. In this relatively limited research, it turned out that two very special educational innovations were involved. At one educational institution, care training was combined with social training, which together organized a new form of practical experience by advising their starting students during openly accessible consultation hours (H2: “HU Healthy & Well Centre, that is in the district. People have the opportunity for an interprofessional introduction, and then we will see what is relevant and what we can offer you. So now it’s in and out with eye measurements or skin consultation or whatever. We want to look much more holistically at the people who come in.”). Another institution was able to combine the innovation demands of a number of large companies by having final-year students from different study programmes and universities of applied sciences work in teams on the research questions (T4: “Are they going to experiment with the companies? They have development and innovation questions, and we connect students to them: a mini hub with students who spend half a year doing a research assignment or completing a graduation assignment.”).

In this study, we looked at how PDs used their resources for innovation within their frameworks as higher education programme managers. The results showed that structuring and bundling were used for innovation regardless of the administrative or innovative orientation of the PDs. The PDs first looked at the internal resources and then stabilized and enriched these resources. Another remarkable result was the leveraging of resources. The administrative-oriented PDs were active in just this area, looking for opportunities, integrating resources and deploying them where possible. By contrast, innovation-oriented PDs looked for success by structuring and bundling resources. In general, we can conclude that these middle managers in higher education looked for resources they could handle and used these whenever possible.

5. Discussion

Much is fixed in higher education, which has a high rule density. Almost everything – price, place, naming, content, etc. – is meticulously monitored and controlled. This is particularly the case at universities of applied sciences because of the attitudes of most lecturers and the intertwining of management and education. So how do we bring about innovation? This is clearly very difficult within the existing environment. Even small incremental innovations quickly run into rules (“it can’t be done,” “it’s not allowed,” “it costs too much,” and “what are you going to do now?”). In practice, it appears that to realize innovation, it is best to set up a new project (e.g. a new course). Old, long-serving teachers and young flamboyant teachers come to life when they are allowed to come up with something new. Content is then enthusiastically created out of the box, contradictions are easily bridged, and cooperation flourishes. It is not surprising that the successful PDs almost all first tried to create their own

space in which they wanted innovation to take place. They then asked for a mandate / freedom from their superiors. Only then did they get to work. They still have to fight back against superstars, but at least the atmosphere is set. There are many examples of new study programmes created in this way, such as the privatization of original tracks/specializations, separate innovation projects, and private–public partnerships, which are carried out either by the university of applied sciences itself or in cooperation with a number of fellow universities of applied sciences.

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Non-formal faculty development. Conceptual considerations and implementation in practice

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Abstract

Non-formal faculty development offerings might reach those lecturers who, for a variety of reasons, are reluctant to attend formal faculty development programs. It can also provide an opportunity to supplement informal workplace learning with evidence-informed knowledge. A centre for teaching and learning at a German university has implemented non-formal learning opportunities through an open learning portal. Lehrblick.de offers lecturers from all departments access to a bilingual, accessible service that provides them with concise, quality-assured content on innovative topics in teaching and learning in higher education, regardless of time or location. With this approach, it reaches nearly 10 times as many lecturers every month as the university's formal faculty development program.

This contribution describes theoretical considerations of non-formal faculty development, its design and implementation in faculty development practice.

Keywords: *Faculty development; non-formal training; open learning portal.*

1. Introduction

In the past 20 years, high quality teaching at universities and thus faculty teaching competencies have become increasingly important. As a consequence, German universities have systematically established Centers for Teaching and Learning that provide various faculty development programs.

2. Formal continued training and development

Typically, Centers for Teaching and Learning offer workshops for faculty development (Centeno García, 2021). In these workshops, participants acquire theoretical and evidence-informed knowledge about teaching, learning, and assessment. Other workshops focus on improving observable teaching skills (e.g. designing slides for academic presentations) or mastering a specific teaching method (e.g. problem-based learning) (Amundsen & Wilson, 2012). During the workshops, experts in faculty development deliver theoretical knowledge based on didactic principles that encourage participants to apply this knowledge outside of the workshops to their own teaching practices.

In recent years, alternative formats for faculty development have been established (Franke, Sekyra & Vöing, 2021). Working groups, peer discussion groups, and other formats are centered around reflecting on one's own teaching style. They aim to impart practical knowledge (e.g. designing laboratory exercises) and tips on how to deal with specific problems (e.g. classroom interruptions). To meet these objectives, these courses are often facilitated by faculty from a variety of domains with extensive teaching experience.

The formats described above are all events lasting a few hours to a few days at a fixed time and location. The courses have clearly defined intended learning outcomes and are anchored in a curriculum.

3. What prevents university instructors from attending workshops

Although the number of faculty development programs has increased both in terms of quantity and quality, Fleischmann, Schroeber & Tuschak (2017) estimate that only 5% to 25% of faculty make use of these offerings. The authors analyzed several studies to identify three main reasons for this reluctance.

(1) They are unaware of the course offerings. Some lecturers are unaware that their university offers faculty development courses. Most likely, they discover it by chance, e.g. by hearing about it from a colleague.

(2) They cannot attend courses. Although many Centers for Teaching and Learning have significantly increased their capacity: Workshop places are limited and tend to fill up quickly.

As a result, some people are simply unable to enroll in these courses. Some lecturers are also unable to participate in those courses due to conflicting class schedules. A second barrier to entry seems to be long-term planning: registration for workshops usually begins 3 to 6 months in advance, and some instructors are reluctant to commit that far ahead of time. Language barriers can also make it difficult for some people to attend courses. The number of international instructors who teach in English and speak little German is on the rise as universities become more international. However, only a handful of faculty developers at German universities are able to offer courses in English.

(3) *They do not want to attend courses.* A final reason is that some educators do not even want to take part in faculty development workshops. They do not want to take time as other academic commitments (e.g. research, committees, networks) take precedence over attending courses. Some instructors also might find the atmosphere uncomfortable and feel that these courses are beneath them. The fear of losing face might prevent them from discussing their own shortcomings with colleagues. Professors are used to being in control, so they might be afraid to give up their authority and status: Participating in faculty development workshops, however, requires them to give up this role and take on the perspective of the participants.

4. Workplace learning

Even though only a small percentage of instructors attend faculty development workshops, does not mean the majority of faculty do not develop their own set of skills. However, for the most part, they do so in an informal setting, directly at workplace (Smith, 2019). In a study by Oleson & Hora (2014), nearly 80% of university instructors reflect on their previous teaching experiences and monitor student reactions. Approximately 20% of instructors use feedback about their teaching performance and 13% discuss their teaching performance with colleagues.

Those informal learning settings, however, run the risk of passing on outdated knowledge or even myths about teaching and learning without reflection. Smith (2019) therefore emphasizes the importance of faculty development to “assure access to research-based knowledge and skills to mediate the potential misconceptions that arise within social networks of varying expertise“ (p.16).

There is strong empirical evidence for both, formal and informal approaches, to be effective in promoting the development of teaching expertise (Myllykoski-Laine et al., 2022; Van Geyte & Hadjianastasis, 2022). Therefore, there is little point in comparing the different approaches (Amundsen & Wilson, 2012). Instead, it is worthwhile to consider which offering may provide the best of both worlds.

5. Non-formal faculty development

5.1. Conceptual considerations

Between these two poles, non-formal education occupies a middle position:

“Like formal education (but unlike informal, incidental or random learning), non-formal education is education that is institutionalised, intentional and planned by an education provider. The defining characteristic of non-formal education is that it is an addition, alternative and/or complement to formal education within the process of lifelong learning of individuals” (UNESCO Institute for Statistics, 2012, p. 11).

Non-formal training opportunities might reach those lecturers who, for a variety of reasons (see section 2), are reluctant to attend formal faculty development programs. It can also provide an opportunity to supplement informal workplace learning with research-based knowledge.

Web-based asynchronous environments seem to be well suited for this purpose. They enable access to information regardless of time or place, and allow for the combination of different media. The content and pedagogical principles must, however, meet the same standards in terms of content and didactic quality as formal training.

5.2. *Lehrblick.de* as an example for non-formal academic development

The Centre for University and Academic Teaching at the University of Regensburg has decided to implement this through an open learning portal (<https://lehrblick.de/en/>). *Lehrblick.de* provides a non-formal educational offer that extends the established formal formats of faculty development (see section 1).

5.2.1. Approach

As to formal workshops, the editorial team at *lehrblick.de* largely relies on three different, valid sources of information when writing articles: Theoretical knowledge, expert knowledge, and practical tips. The different sources of knowledge are reflected in the portal’s individual categories:

(1) *Theoretical knowledge*. A crucial source of evidence-informed knowledge are articles published in peer-reviewed journals. In the Teaching Concepts Section, the current state of research on teaching and learning in higher education is reviewed and discussed. As an example, the article 'blended learning' (Hawelka, 2022) summarizes a meta-analysis on this topic from the Educational Research Review.

(2) *Expert knowledge*. Professors with extensive experience in teaching can be an invaluable resource for their less experienced colleagues. In spite of this, expert knowledge (e.g. from award-winning professors) often goes lost because these experts have too few opportunities

to share their knowledge (Shim & Roth, 2009). In the Teaching Practice Section, instructors from various disciplines present methods and approaches they have found to be successful in practice, not just in theory. In this way, faculty members are able to gain insight into teaching culture beyond the bounds of their usual community of practice. For instance, in an article by Jossberger (2022), the author describes the implementation and benefits of learning journals in seminars.

(3) *Practical Tips*. Even the smallest changes can have a noticeable impact on how lecturers approach learning processes. In the category Teaching Tips, there are a wide variety of tips and tools provided to help instructors make their daily lives easier and to improve teaching performance. For example, in one article on *lehrblick.de*, Bachmaier (2022) provides recommendations on how physical signals can be translated into the digital space.

To ensure that the contributions actually address issues pertinent to developing teaching competence, our selection of topics is guided by the Framework for Teacher Expertise in Higher Education (Van Dijk et al., 2020).

5.2.2. *Didactic and Media Design*

The articles are short stand-alone, usually single-objective units that include text combined with video and graphics. In order to maximize the effects of combining text and images ("multimedia principle"; Mayer, 2021), we follow the basic principles of multimedia design, such as spatial proximity between graphics and text, a reader-friendly design of embedded graphics and diagrams, and a deliberate use of colour.

To reduce extraneous load (Paas & Sweller, 2021), the articles are designed in a way that makes them understandable for the target audience. In order to achieve this, the structure of the texts plays a crucial role: a consistent order of content and concise headings structure them visually as well as linguistically. Reader-friendly layouts with easy-to-read fonts and highlighting of important text components ("signaling principle"; Fiorella & Mayer, 2021) help maintain reading motivation.

Particularly in articles in the Teaching Concepts Section, we take care to adapt the content of the original journals to the readers' knowledge and to always explain technical terms.

5.2.3. *Accessibility*

By using a keyword index, readers can quickly locate articles and a search function makes it possible to easily find specific topics. *Lehrblick.de* is a responsive portal, which means that it is accessible from any internet-enabled device. In order to facilitate access for people with disabilities, alternative text is provided for embedded images and graphics, and transcripts are added to all embedded audio files.

The teaching portal is designed to accommodate bilingual access. About a third of articles are already bilingual, and all articles will be available in English and German starting in May 2023.

5.2.4. Quality assurance

Quality assurance is an essential part of the entire editorial process: The editorial team works with an academic advisory board to select topics for the blog. Authors committed themselves to follow the guidelines for ensuring good academic practice (DFG, 2019) when writing articles. Internal guidelines for content structure and style promote consistent content creation - regardless of whether the contributions are written by members of the editorial team or by guest authors. Prior to publication, all articles are peer-reviewed for form and content.

5.2.5. Use and Reception

The portal has been publishing articles every 14 days since March 2021. Through the University's landing page, various social media channels (especially Twitter, LinkedIn) and RSS feeds, faculty are kept up-to-date on current issues.

An average of approximately 480 lecturers read the posts each month, with up to 580 readers per post. This means that *lehrblick.de* posts reach nearly 10 times as many lecturers every month as the University's formal faculty development program.

6. Conclusion

Lehrblick.de offers lecturers from all departments access to a bilingual, accessible service that provides them with concise, quality-assured content on innovative topics in teaching and learning in higher education, regardless of time or location. Through this non-formal program for faculty development, lecturers who are reluctant to attend formal offerings as well as informal communities of practice get evidence-informed impulses for designing their courses and assessments.

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Teaching olfaction at the time of the 'sensual turn'. The case of Pierre Bénard

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Abstract

Teaching olfaction is changing these days as the olfaction professional world. The 'sensual turn' studied by Howes (2003) reveals the regain of interest in this badly loved sense. We focus on teaching olfaction in higher education with the case of Pierre Bénard: a perfumer, an expert in raw materials, an olfactory manager, and a teacher. This case gives an overview of an unknown field: teaching in olfaction and opens a new research field: education sciences in olfaction. We used a semi-directive interview in a clinical orientation and different exchanges in a cooperative methodology to collect new knowledge transmitted in higher education. By his way of considering olfaction, teaching, and art as a unique way to live, the singular course of Pierre Bénard seems symptomatic of this 'sensual turn'.

Keywords: *already there sensory olfactory; teaching in olfaction; sensual turn.*

1. Introduction

Higher education establishes privileged links with the professional world by preparing students for the world of work. This is the case for olfaction. This teaching was done on the job and in the family for a long time and now has its schools. The Institut Supérieur International du Parfum, de la Cosmétique et de l'Aromatique alimentaire (ISIPCA) was created in 1970 by Jean-Jacques Guerlain, and other prestigious schools have followed: the Ecole Supérieure du Parfum (ESP), Cinquième Sens, Grasse Institute of Perfumery, Montpellier University, etc., not to mention the professional schools that are integrated into the companies in the sector. They train famous noses, and also professionals in detergent and industrial perfumery.

At the same time, interest in this sense is growing. The creation of the Osmothèque¹, a memory of odors, and the magazine "Nez²" bear witness to this, as does the field of contemporary creation in olfaction (Castel, 2018).

We explore the higher education devoted to olfaction by considering this current interest in odors. While some knowledge persists, other knowledge is emerging. What new knowledge related to olfaction is created? What conceptual tools are used? For this, we look at Pierre Bénard: a perfumer-creator, a specialist in natural raw materials, an olfactory scenographer, and a teacher.

2. Theoretical framework

2.1. Olfaction

Olfaction remains a mysterious field. Interest in this field has increased, particularly following the 2004 Nobel Prize of Linda Buck and Richard Axel (Buck & Axel, 1991), which brought to light further research on this sense, often denigrated because of its animal and sexual connotations.

This work is therefore often physicochemical, but the point of view of the human and social sciences is gaining ground, particularly since the 'sensual turn' (Howes, 2003, p.29) of the 1990s, which marks the interest of anthropology in odors: 'sensory perception is a cultural, as well as a physical, act' (Classen, 2010, p.401).

This research focuses on the cultural variability of olfactory perception, the knowledge and skills of cultures, the place and meaning of odors in everyday life, and their significance

¹ The Osmothèque is a perfume conservatory based in Versailles.

² The website auparfum.com, the magazine *Nez* and the publication of books have largely contributed to the popularisation of olfaction. <https://shop.bynez.com/marques/nez/>

(Candau, 2016). Cognitive sciences underline the importance of memory in sensory perception, the first encodings in childhood in cognitive psychology (Schaal *et al.*, 1980; Schaal & Kontar, 1998, Urdapilleta & Dubois, 2003), or sensory categorization processes (Urdapilleta & Dubois, 2003). And we underline an important characteristic of olfaction: its resistance to classifications (Dubois, 2006) and to words, which impacts the teaching of a highly verbal profession.

2.2. Olfaction teaching and clinical orientation

The teaching of olfaction is in this sense an even less well-researched field. Schools are recent, students are few, and companies also train internally. Also, given the financial stakes, discretion is preferred and doors are not easily opened. The sciences of olfaction education are almost nonexistent, some few researches exist in clinical orientation under the hypothesis of the Freudian unconscious.

The case of Marcel (Cadiou, 2021) is the first research in this sense: how does this olfaction trainer in a luxury brand train the saleswomen? In his thesis on the olfactory part of the sensory analysis of wine (2019), Alvarez identifies an already there sensory, a component of the already there, i.e. the latent history of the subject (Combis-Carnus, 2001) which filters the didactic action. And this already there sensory would be common to the teaching of perfumery sales training and the teaching of sommelier training in hotels and restaurants (Cadiou & Alvarez, 2021).

2.3. Teaching: between constructed knowledge and knowledge to be constructed

Teachers of olfaction do not come from the national education system, they generally do not have didactic or pedagogical training and come from the professional world of which they possess the knowledge and know-how. The anatomical-physiological apparatus, the olfactory neuroreceptor system, extraction methods, the composition and facets of odors, etc., are all taught in a more or less stable manner.

Teaching is also a discursive practice of professional know-how. In this sense, with teaching experience, these professionals re-elaborate or construct new knowledge (Vanhule, 2009), that is transmitted.

This meta-professional activity is coupled with a reflexive activity of research-action-creation (Caumon, *et al.* 2016). Here, the knowledge linked to olfaction is also linked to artistic practice: how to construct a perfume, how to smell, and how to take advantage of odorous materials are questions that the aesthetic practice of the professionals has confronted.

3. Research questions and issues

How is olfaction taught in higher education? We aim to give an insight into a poorly documented field. The teaching of olfaction is relatively young and uncommon. This varied knowledge: conceptual, technical, know-how... is established for some, sometimes discussed, and for others still to be constructed. What new knowledge is being constructed and transmitted? On the other hand, we are interested in the subjects as actors of knowledge from the educational sciences in a clinical orientation. We dedicate this text to Pierre Bénard, a teacher (among others) in the world of perfumery.

4. Methodology

Our clinical approach presents a case. This singularity sheds light on the object taught, particularly on the creation of knowledge in this teacher, in an informative and comprehensive approach, and on the intimate and personal way of considering teaching.

Pierre Bénard did not grow up in Grasse, the land of perfume, but in the South-West. He wanted to go to the Beaux-Arts but decided to study biochemistry and during an internship at the Association Asquali, he discovered the world of olfaction.

This association envisages olfaction in a new way: *"they were the pioneers in seeing odors; it is more the world of odors in a way [...] not perfumistic at all"*. It is part of an approach to cultural development, through the vector of smell, and olfactory mediatization.

The internship turns into six years of training with Asquali and he becomes a professional in the sector. Later on, he teaches at the ISIPCA, the ESP, the University of Montpellier, and the Grasse Institute of Perfumery. He teaches in the schools of the profession but also in art, design, fashion, gastronomy, communication, marketing, and engineering schools. Its teaching is organized both face-to-face and remotely. Pierre Bénard is also interested in olfactory awakening and education. He works in nurseries, kindergartens, and colleges, and addresses more vulnerable groups: ULIS and UAM.³

We had several exchanges with Pierre Bénard in various ways. I conducted a semi-structured interview on 14 October 2022, which allowed me to collect the first set of information while letting the speaker follow his train of thought. The extracts are therefore verbatims, proposing a speech, an oral discourse with its syntax twisted by the thread of the subject, bringing out chains of signifiers. In this sense, I am relying on groping speech rather than composed speech.

³ ULIS : Localized school inclusion unit. UAM: UnAccompanied Minors.

On the other hand, we exchanged following this verbatim to collect precise information and, in an afterthought, on martyr texts where Pierre Bénard validates or not the analysis of the comments on the teaching set up by him.

This cooperative methodology seeks to keep transparency in the work of the perfumer and teacher and to give easier access to the world of perfumery and its teaching. This article, therefore, draws on Pierre Bénard's professional, personal, and creative contributions as well as my own, which attempt to think about these from a theoretical perspective in educational sciences and this sensual turn'.

5. The case of Pierre Bénard: olfaction teacher

Pierre Bénard's teaching practice is based on commonly shared knowledge. For example, he starts any training course, whatever the audience, by reflecting on his olfactory system: its anatomical functioning in particular. But we are only interested here in certain innovations in terms of knowledge linked to this teacher.

5.1. Olfactory cone

The representation of odors and perfumes often involves geometry (Cadiou, 2021). In marketing, the perfume is represented by a triangle which is called an olfactory pyramid. It is divided into three parts: top notes, middle notes, and base notes.

Pierre Bénard uses a slightly different schematization: the cone. The three-plane dimension is accentuated, but also a certain movement: seen from above it evokes the drop of water that falls and spreads. The choice of the cone brings the notion of volume, waves, time, and volatility into the perfume, and within its three theoretical times: head, heart, and wake. This conceptual tool further emphasizes the continuity within the diffusing olfactory form and thinks of perfume as an art of space and time.

5.2. Systematic of scents© or "chromatic code"©

There are various types of classifications of scents and perfumes. For example, the first "Classification des Parfums" was produced in 1984 by the French Perfumers' Society and has been reissued several times. Other classifications were created, such as Jean-Noël Jaubert's "Champs des odeurs® ", a method used in olfaction teaching, but also tasting (Dratz, 2001).

Pierre Bénard proposes one: the "Systematic of scents"©, also called "chromatic code"©. It is organized around the origin of the raw materials mentioned and comprises 7 areas: spicy, fruity, floral, herbal, suave, silvan, and animalic. The classification allows us to think in terms of creation by proposing connections between raw materials. Their similarities propose possible replacements while keeping the assemblies specific to a certain classification of perfume: cologne, chypre, fougère, oriental, woody, leathery.

It uses the term area which encompasses both smell and fragrance by uncovering smell/fragrance structure combinations and thus drawing or re-drawing olfactory shapes. The concept of area is of direct professional interest because these combinations offer frameworks and proto-categories for olfactory projects. As an intellectual step, it facilitates the olfactory thinking of (future) professionals.

The work on colors in this classification should also be highlighted. The expression "chromatic code" is also a way of "speaking" about odors by relying on the synesthesia strongly present with the world of odors, the linguistic incapacity to explain odors is replaced by a color/odor equivalence that says something. This equivalence would be based on conventions, also on a choice specific to its author, and it is evocative.

5.3. Sandalwood

Pierre Bénard is also an expert in rare materials, particularly sandalwood. His research work produces knowledge that links material, smell, and perfume. This work is therefore a further step in his work on the systematic of scents. Upstream, Bénard links with sandalwood production.

This work is the result of a collaboration with a company producing high-quality and sustainable Indian and Australian sandalwood.

Pierre Bénard has created a knowledge of the different olfactory interests of the various sandalwoods, according to the species and the part of the trunk: from the heart to the bark. This knowledge is pushed to its creative limits: the formulation of perfumes according to the variety and parts of the various sandalwoods. For example, the sweet and milky side of certain parts and essences forms an interesting combination with gardenia and tuberose.

5.4. Olfactory manager

Pierre Bénard is a perfumer: he creates perfumes, but he is also a manager and olfactory scenographer. He perfumes concerts and streets. This work is technical: creation and development of odorization systems, and artistic: place, volume, intensity, and moment of the smell in a creation.

He developed a work on fluid mechanics which he teaches today. This knowledge concerns the diffusion systems, the technical installations thought in the problematic of air design, that is to say, what is an olfactory space.

It also integrates the basics of olfaction about its communicative and scenographic capacities. It is therefore a field at its dawn, like the olfactory art detached from perfumery (alcoholic intended for the body) which is at its beginning (Froger, 2016; Castel, 2018).

6. Discussion

With the case of Pierre Bénard, we can discuss the types of knowledge transmitted: if some are of course always transmitted, others are transformed and some are completely created. This may be due to the evolution of research and knowledge in olfaction, but also of the professional world.

It is true that the case is a singularity and can not be generalized. Pierre Bénard's work touches on various fields: perfumery, expertise in raw materials, mediation, olfactory management, and, of course, teaching. These various facets are at the origin of new knowledge linked to olfaction. His artistic and professional approach nourishes a singular look at this knowledge and transforms it into a desire to live/teach odors that are part of this 'sensual turn' and participate in the contemporary olfactory art scene.

Moreover, this teaching is also a matter for the actors. Sharing-affect-odor would be intimately linked in him, and this psychic braiding would be inclined to set up a transferential dynamic privileging the teacher/learner relationship. To the question: does teaching make him happy? he answers "yes, very happy", "because I am made happy [...] by the presence of [...] the feedback".

The methodology used is a mixture of journalism and clinical approach which sought to report, in a spirit of transparency, on the often obscure work of olfaction professionals. This point was close to Pierre Bénard's heart. Here again, this hybrid methodological approach would also be symptomatic of the current position of olfaction. We regret not being able to compare with other practices as they are little or not documented, and we are working on it.

7. Conclusion

Research in the teaching of olfaction is a little investigated field. The case of Pierre Bénard gives access to current teaching in higher education: between usual, renewed, and new knowledge. It seems to us symptomatic of the 'sensual turn'. Olfaction is regaining interest and its teaching is opening up new paths crossing the contemporary art scene. His artistic and professional approach nourishes a singular look at this knowledge and transforms it into a desire to live/teach odors that are part of this 'sensual turn' and participate in the contemporary olfactory art scene: *"olfaction is intimately linked to breathing, to the body, to its vital function, to smell is to survive, to live on. In this sense, to smell is to go beyond living"*.

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Internal quality assurance systems in Namibian higher education: Stakeholder perceptions and guidelines for enhancing the system

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Abstract

Namibian higher education institutions (HEIs) have been striving to enhance quality assurance in the last decade. Building internal quality assurance (QA) capacity has been challenging. We explored the perceptions and experiences of internal QA stakeholders. This research is embedded in Margret Archer's social realism theory as a guide to improving internal QA systems. We adopted a case study design based on an interpretive paradigm. Two purposively selected HEIs with university status were selected, and we recruited participants from the universities' population of stakeholders based on their roles. We conducted semi-structured interviews with stakeholders. The findings showed that although both institutions had QA units, the institutions were still facing challenges to attaining effective quality implementation and administration. Challenges to implementing QA include slow implementation of programme changes, mentorship programmes having an overemphasis on early career academics and causing potential mistrust, a lack of financial resources and students' engagement in QA activities.

Keywords: *Internal quality assurance; higher education institutions; quality assurance; quality; stakeholders' perceptions; social realism.*

1. Introduction

Globally, most countries have established units within higher education institutions (HEIs) responsible for ensuring the quality of higher education (HE). However, countries differ in their priorities for implementing quality education. We explored the internal quality assurance (IQA) implementation and administration of two Namibian HEIs. Participants suggested how IQA systems, mechanisms and processes could be improved. According to Kinser (2014), a historical perspective on effective standards emphasises how important it is to embark on business operations. The concept of quality is not a unitary one; definitions are relative to context and judgements. In the same vein, in modern education, the idea of quality affirmation emerged in the HE fraternity as a borrowed concept derived from industrial and commercial settings (Kinser, 2014). Given the variety of views, Goldenberg (2018) emphasises that quality has no unequivocal definition but rather is constructed through consensus and dialogue among the interested parties. Quality in HEIs is a somewhat elusive and complex concept that requires a good regulatory framework that mandates, promotes and ensures quality attainment. Globally, QA has become crucial to the extent that it is no longer an option; but a requirement in the HE fraternity. HE plays a vital role in any country's social and economic development since it produces graduates who are highly qualified for socio-economic development; furthermore, the global mode of living is constantly evolving, and educational systems must keep up to be relevant to their economies (Balogun, Olajide, & Adenagbe, 2022). There is a constant need to find new strategic ways to ensure continuous improvement and accommodate contemporary needs in the HE environment. According to Isaeva et al. (2020), the involvement of all the stakeholders improves the actual quality of education; for instance, students' engagement positively impacts their learning and increases their sense of belonging, building trust and confidence between the institution and the students. In the Namibian context, education was unequal before political independence from the South African colonial regime, and native children attended schools based on their tribes (Ministry of Education and Culture, 1993). At that time, the Namibian education system was designed to strengthen the apartheid system instead of providing the required human resources to ensure equitable economic and social development, and such practice significantly impacted the standard of education offered in Namibia (Katjavivi, 2016). It was fragmented along ethnic lines and racial groups in the Bantu Education System, enforced in Namibia's non-white communities (Katjavivi, 2016). Hence, the unequal system brought about vast discrepancies in the allocation of financial and physical resources and the quality of education offered to those ethnic groups. After independence, the desire to provide quality education for everyone became a necessity. The government started initiating and implementing measures to improve the quality of education, particularly in HEIs. According to Katjavivi (2016), the Namibian government has developed initiatives to improve the quality of education within the policy framework, namely the Education Sector Improvement

Programme (ETSIP). The ETSIP is a medium-term strategic plan aimed at improving quality and efficiency in the education sector. The improvement programme was developed as a remedial framework to enhance the educational weaknesses identified by the Namibian government, such as the unsatisfactory performance of the students, poor quality teaching and untrained teachers (Katjavivi, 2016). ETSIP aimed to align Namibia's vision 2030 with the education system to transform Namibia into an industrialised and knowledge-based society. This vision can only be realised if HE provision is of acceptable quality (Kadhila & Iipumbu, 2019). The Namibian government established statutory Quality Assurance Agencies such as the National Council for Higher Education (NCHE) (HE Act No. 26, 2003 [Government Gazette of the Republic of Namibia, 2003]). The NCHE was launched in November 2005 to promote and coordinate an effective HE system in Namibia and monitor QA mechanisms of HEIs. According to Iipumbu and Kadhila (2020), different countries have established QA mechanisms at institutional and national levels. Hence, quality matters are handled by the Internal Quality Assurance Committee at the institutional level. In contrast, an external QA panel deals with all the national-level matters on quality. IQA committees evaluate various models for ensuring quality, such as institutional audits, programme accreditation, and institutional accreditation. Given this background, it is evident that QA has become a global phenomenon, and Namibian HEIs are finding it challenging to implement well-established QA mechanisms effectively (Iipunge et al., 2020; Kadhila & Iipumbu, 2019). We aimed to explore the perceived effectiveness of IQA implementation and administration in HEIs.

2. Theoretical Framework

The theoretical framework supporting this research is Margaret Archer's (1995) theory of social realism which was employed as an analytical tool to assist us in exploring the state of the IQA in Namibian HEIs in the provision of quality HE. Such a theoretical perspective enabled researchers to conceptualise how QA could improve IQA practices at Namibian HEIs. Archer (1995) distinguishes three interrelated dimensions: structure, agent, and culture, which co-exist in any social set-up. For analytical purposes, these dimensions are isolated; however, in the real world, they are connected. Archer (1995) articulates that studying these dimensions is crucial to understanding how the social setting functions. The structure dimension is associated with material interest, recurring patterns of social behaviours, or differentiating how aspects of society are related (Archer, 1995). Several concepts are related to structure, such as race, gender, social class and education. In the current study, the structural dimension consists of various aspects in place within the HEIs context, such as QA policies, frameworks and regulations, committees responsible for ensuring quality education, and QA divisions. Agents are the individuals such as QA practitioners, students, administrative staff and academics; only through their actions can the

IQA structures be constructed, reconstructed and transformed. Regarding culture, QA units in the Namibian HEIs should be highly valued and composed of dedicated and committed individuals responsible for ensuring quality education within Namibian HEIs and the related policies. It could become obsolete when HE keeps changing, but the IQA remains static (morpho stasis), and these two systems will fail to live up to their purposes. We explored: (i) how stakeholders perceive the effectiveness of the IQA implementation and administration in Namibian HEIs, (ii) how stakeholders perceive the successes and challenges facing Namibian HEIs when implementing and administering the IQA, (iii) how IQA systems of Namibian HEIs could be improved from a stakeholder perspective.

3. Materials and Methods

We conducted a case study based on an interpretive paradigm in two selected HEIs with university status: public and private, and they had established QA units. The sample was purposefully selected to match the criteria of the type of subject under investigation. Semi-structured interviews were conducted, and member checking was done to enhance the study's trustworthiness.

3.1. Sample and Instrument

Participants were purposively selected based on their positions, first-hand experiences and strategic roles regarding the phenomenon under study from the two HEIs (12 participants; 6 from each HEI). The participants were deans of the two faculties in each university since deans are responsible for hosting and managing the quality within their faculties. The QA units and a QA coordinator were selected in each university since they are the custodians of QA and coordinate QA systems and programmes. Moreover, participants from the Student Representative Council were purposively selected to represent the student body since the students are primary beneficiaries of quality education. The interview guide was developed to gain an understanding of the participants' current experiences and perceptions of the IQA systems, mechanisms and processes.

3.2. Data Analysis and Ethical Considerations

Participants' verbatim interviews were recorded and transcribed. Thematic analysis was used for identifying, analysing and reporting themes from the data gathered (Vaismoradi, Turunen, & Bondas, 2013). We enhance the trustworthiness through a special inspection conducted by two researchers who evaluated the findings, interpretations and conclusions. We obtained ethical clearance from all the relevant authorities and institutions involved. All the participants received consent letters, participated voluntarily, and transcripts were anonymised. The findings are presented in the next section based on the emerging themes.

4. Findings

4.1. Slow Implementation of Programme Changes Hinder Advancement and Negatively Impacts Students

Some participants emphasised that courses and programmes are subject to slow change. *“Few programmes become obsolete in our institution when the relevant staff members delay and fail to review it on time and identify the relevant and current programmes that assist in responding to the national needs”* (QA practitioner, HEIA). From participants’ perspectives, the speed of updating courses was insufficient. Participants in both HEIs felt that the departments took too long to implement changes and that slow implementation is a barrier to advancement, negatively impacting students’ employability in the job markets. In the book by Lim (2018) on QA in HE in developing countries, the need for HEIs to absorb new information faster and to apply new processes faster is emphasised.

4.2. Mentorship for QA Purposes: Overemphasis on Early Career Academics and Potential for Mistrust

Mentorship or peer review is a part of the QA of teaching in HEIs (Sachs & Parsell, 2014). Although participants saw the value of mentorship programmes within their HEIs, they pointed out that it reduced the trust between the students and the monitored lecturer (usually early-career academics) *“You may find a supervisor in the faculty that sits in the class where a colleague is teaching and thereafter gives some hints and advice on improving the teaching; however, this brings a problem of trust between a person who is being mentored and students”* (Dean, HEIB), and that it tended to be available only for early-career academics *“Our lecturers’ teaching strategies are being monitored and evaluated by a senior lecturer”* (Student, HEIB). Literature highlights the importance of continuing professional development of all teachers in HEIs (novice or expert), which include peer observation, as there are constant development and rapid changes in education (Ercan & Ivanova, 2020), especially during the fourth industrial revolution. Literature also highlights the issues of mistrust and suspicion that go with peer review but emphasises the need for transparent processes for all to build trust (Sachs & Parsell, 2014).

4.3. Staff shortages, Lack of Adequately Trained Staff and Lack of QA Expertise

A lack of adequately trained staff and QA expertise and a shortage of staff within both HEIs also emerged as a challenge. *“Another challenge is that quality assurance is a new field in Namibian HEIs; there is a lack of expertise in the country because not everybody has formal training in the quality assurance course. Most of our quality assurance practitioners were teachers before, we tend to think we are doing quality assurance, but we are doing it trial and error the way we understand what it is and how it should be”* (QA practitioner, HEIA). *“I think the whole issue of workload, the people who are supposed to review these policies*

are the same people that supposed to carry out other duties, so, it then becomes a bit burdensome” (Dean, HEIA). “Another strength is that we have a quality assurance dedicated team. However, I indicated that one of the challenges is a lack of expertise” (QA practitioner, HEIB). This study indicated that a lack of adequately trained staff and QA expertise and a staff shortage are some challenges that hinder the effective implementation of QA initiatives in Namibian HEIs. The findings of this research agreed with findings from the literature, such as Lim (2018), who found that most universities in sub-Saharan African countries have a shortage of qualified local staff and are forced to employ foreign academics, especially at senior level, to provide the necessary expertise needed.

4.4. QA Progress Hindered by Resistance to Change in the HE Sector

The participants said that a challenge facing Namibian HEIs is resistance to change, which hinders the implementation of QA improvements due to misconceptions about what QA can do for an institution. “Some staff members have annual amnesia, and they must be reminded all the time. So, it is a human factor, the human element in implementing the IQA mechanisms, that create resistance to change. Like all dynamic institutions, resistance from the stakeholders may arise when a new standard has been set. When stakeholders do not comply for various reasons, the IQA mechanism faces a dilemma” (Academic, HEIB). Some QA stakeholders regarded the QA system as a policing strategy. Furthermore, most participants mentioned a lack of support from the top management. “One of the challenges is also a lack of support from top management; sometimes, as a quality assurance division would like to implement some of the new things that we think will add value to the well-being of our institution. However, there is a lack of the senior management leaders’ blessings” (QA practitioner, HEIA). In the book by Lim (2018) on QA in HE in developing countries, it is mentioned that employees of HEIs are not necessarily against continuous quality improvement and changes, but rather, they are “creatures of habit with a natural fear of the unknown” (p. 35). QA management must educate members of the HEI so that QA is perceived as a continuous improvement and maintenance channel. The findings indicate that it is important for the QA stakeholders to develop ownership of the QA system to deal with the negative perceptions about QA systems, mechanisms and processes. Deans of faculties and QA practitioners need to know that QA promotes transparency and accountability of the academic systems instead of policing strategies. At the same time, stakeholders need to know that QA is vital for improving their educational equity and efficiency and supporting the ongoing development of the T&L process.

4.5. Lack of Financial Resources for QA Systems

Some challenges to QA in Namibian institutions, such as a lack of financial resources and budgetary constraints, contribute to ineffective IQA processes (Hoosen, Chetty, & Butcher, 2017). Institutions require sufficient financial resources and planning to support and sustain

institutional activities. Participants pointed out that limited financial resources were their main stumbling block in attaining QA in education. *“Challenges are limited financial resources to cater for all activities in the teaching and learning processes. This will not allow us to do regular visits to other campuses due to financial constraints”* (Dean, HEIB).

4.6. Heavy Workload Reduces Opportunities for QA Implementation

Some participants stated that the heavy workloads of the QA stakeholders could be hindrances in attaining quality education. *“I think the whole issue of workload, the people who are supposed to review these policies are the same people that supposed to carry out other duties, so, it then becomes a bit burdensome”* (Dean, HEIA). Heavy workloads negatively impacting QA practices in HEIs, specifically in developing sub-Saharan African countries, is not new information, as has been published, for example, by Uzhenyu (2015), within a Zimbabwean context and Abe and Mugobo (2021) within a South African context.

4.7. Lack of Technological Resources as a Hindrance to QA Implementation

The participants mentioned a lack of advanced technology as an aspect that emerged from the challenges perceived by QA stakeholders. Internet access plays a major role in the T&L processes, research and community engagement required for quality education. The findings indicated that student participants perceived a need to improve HEIs technology and internet connectivity. *“I would say the poor internet connections in our institution is a big problem for us students because we only do our learning activities in class; we do not have any platforms for doing things online learning or outside classes”* (Student, HEIA). There is a great need to improve their online courses and programmes, particularly during times of crises such as the COVID-19 pandemic. The internet provides access to positive benefits on educational attainment, and it has been utilised as a significant instrument for facilitating effective academic activities in HEIs. However, limited internet connectivity in studies in Namibian HEIs has listed poor internet connectivity as a challenge (Magesa & Josua, 2022). The educational setbacks could have a notably negative impact on students’ academic success since not all the students have access to computers with the internet, which is a concern, particularly during times of crises such as the COVID-19 pandemic.

5. Conclusion and Recommendation

We aimed to explore the experiences and perceptions of the QA stakeholders in Namibian HEIs. It is important to understand stakeholders’ perceptions, experiences, and attitudes involved in facilitating QA systems to determine the roles their experiences and perceptions play in executing that process successfully. This research provides recommendations based on the findings that could improve the Namibian HE QA systems. It is worth noting that the recommendations are somewhat aspirational and would require time and resources. This

research contributes to the crucial debates of IQA in Namibian HEIs and will hopefully provide insights into the future direction of this vigorous topic in Namibian HEIs.

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Lecturer language: EMI students' experiences on first- and second-cycle degrees

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Abstract

Previous research has long focussed on EMI lecturers' English usage as an aspect which might affect lecture comprehension. Fewer studies have directly questioned EMI students about how their lecturers' language competence affects their experiences in the classroom, and while many studies have focused on postgraduate students, less has been said about undergraduates.

We aim to provide further insight into students' views of EMI lecturer discourse by comparing the experiences of undergraduate and postgraduate students, both local and international, at an Italian university. Data for this study were collected from an online semi-structured survey of 128 students.

Findings indicated that it is students' past experience of English-taught courses as well as their familiarity with non-native English accented speech that influences students' opinion of EMI lecturers' language performance and their assessment of intelligibility in the classroom.

The findings will serve to highlight difficulties and critical points for further development and pedagogical application.

Keywords: *English-Medium Instruction; first and second-cycle study; survey; lecturers' language.*

1. Introduction

Since the Bologna process, international courses at non-anglophone universities have increased exponentially. This situation, mirrored the world over, has been accompanied by an increase in research into all aspects of English-Medium Instruction (EMI). Previous research has long focussed on EMI lecturers' English usage as an aspect which might affect lecture comprehension but fewer studies have directly invited EMI students to address the issue of how far their lecturers' language competence affects their experiences in the classroom, and still fewer have compared the experiences of students of first- and second-cycle degree courses in an EMI context.

Past research has suggested that greater experience with EMI might affect lecture comprehension. For example, Clark (2017) investigated the language issues of both Italian and international students on both years of second cycle degree courses¹. While she found differences between Italian and international students as regards evaluation of lecturer language and their own competence, with the latter being harsher in self-evaluation and less critical of NNS lecturers' language competence, she also noted a difference between first-year and second-year students, with the latter being more tolerant of lecturers' English and having fewer problems in comprehension, possibly because their greater experience with EMI made them "able to reflect on the idea that language use is not just a question of the linguistic capacity of one or both parties involved, but an interaction between parties" (Clark, 2017, p. 303).

A specific comparison between the two cycles is particularly relevant for local students embarking on tertiary education in Italy, where students' English language competence, traditionally weak², may have improved since the enforcement in 2014 of the Gelmini Reform (240/2010), obliging Italian secondary schools to offer some English-taught courses following the Content and Language Integrated Learning (CLIL) approach. This would imply that Italian undergraduates are now embarking on university education with greater familiarity with English-taught lessons and possibly better language skills than in the past. However little research has been done to evaluate the effects of this reform.

Our paper aims to provide insights into students' views of lecturer discourse by comparing the experiences of local first- and second-cycle students attending EMI courses at the

¹ Since 2005, the Bologna Agreement has provided European Union countries with a common framework for tertiary education which is based on a three-cycle structure. The first cycle typically lasts 3 years and awards a Bachelor's degree; the second cycle lasts 2 years and awards a Master's degree; the length of the third cycle or doctoral degree may vary across countries.

² According to the EF English Proficiency Index (2022), Italy ranks 24th among European countries as regards general proficiency in English as L2, <https://www.ef.com/wwen/epi/>

University of Bologna (UNIBO). The experiences of international students attending the same courses are included as a benchmark for comparison.

Data for this study were collected via an online semi-structured survey of 128 local and international students attending undergraduate and postgraduate courses. Students were asked about their own English language competence as well as their impression of their Italian lecturers' language competence in English as to what extent this affects the lecturer's intelligibility in the classroom, particularly as regards speech rate, accent, and pronunciation.

Learners' opinions of their EMI lecturers' language competence as well as of their own linguistic ability in English are not the only variables likely to affect learners' perceptions of the degree of intelligibility in the EMI classroom. Kamaşak et al. (2021) also found that students with previous experience of EMI found lecture comprehension easier than those who had none. Local Italian L1 students in general might also find comprehension easier since they share the same NNS English variety with the lecturer (Fraser, 2006).

Students' responses in our study were investigated and compared in relation to their degree cycle: first or second. We also distinguish between Italian L1 and international students.

2. Methodology

Lecturers at UNIBO teaching first- and second-cycle courses in English in Economics or Engineering were contacted as part of a wider project regarding lecture discourse (Johnson & Picciuolo, 2022, 2020; Picciuolo & Johnson, 2020). Permission was asked to contact their students for the purpose of gathering further information. Students choosing to participate completed the survey via Google Forms. Participants were asked to select responses from a preset list, express their agreement on a Likert scale, or give a brief written response.

Table 1 gives information about the students according to degree cycle and origin.

Table 1. Participant numbers according to degree cycle and origin.

	International	Italian	Totals
1st cycle	23	53	76
2nd cycle	20	32	52
Total	43	85	128

We note slightly more first-cycle students overall (56%) than second-cycle (44%). While the L1 of all local students was Italian, a variety of languages was declared by the international students, with 65% of these belonging to one of three broad language sub-groups: Germanic

(e.g. German, English), Balto-Slavic (e.g. Russian, Polish), and Romance (e.g. Spanish, Portuguese).

Students were asked to what extent lecturers' speed of delivery and pronunciation in general interfered with lecture comprehension, and how students coped in such cases. Responses are compared and discussed on the basis of degree cycle, as well as in relation to L1.

3. Findings

3.1. Students' English language competence

While the literature is divided as to what constitutes the ideal requirement for benefitting from courses in EMI (see Hultgren et al., 2022), providing documentation of English language skills at a $\geq B2$ level is still a pre-requisite for admission in many European universities. While most Italian L1 undergraduates declared a higher level than this ($\geq C1$), most Italian L1 second-cycle students declared $\geq B2$. This suggests that the younger Italian undergraduates have been able to benefit from enhanced English teaching including CLIL since enforcement of the Gelmini Reform, thus raising their own language competence closer to international language levels. By way of comparison, a greater proportion of international students (63%) declared a higher overall language competence ($\geq C1$) than Italian L1 students in general (53%).

3.2. Perceptions of lecturer's English language competence

When asked to specify where EMI lecturers should improve their language competence in order to perform effectively in lectures, both Italian L1s and international students indicated pronunciation and oral communication in general, in line with Costa (2017).

3.2.1. Undergraduates

Despite their criticism however, only 12% of local undergraduates had difficulty understanding, though this figure rose to 19% in the case of international students. Some Italian undergraduates reported initial difficulties in comprehension but noted that comprehension improved over time as they became accustomed to the lecturer's speaking style.

Most Italian L1 respondents and international students claimed that speed of delivery did not hinder comprehension, in line with Ackerley's (2017) findings. We suggest that problems are exacerbated the further the students' L1 language family from Italian, with Bangla, Serbian, Bulgarian and Tamil being the L1 of those international students who declared difficulties. We note also a possible lack of tolerance towards NNS on the part of the US native English student, who also claimed that fast speech and distinctive accent impeded

comprehension. Other students mentioned the NNS accent as being problematic, drawing on their experience with NS accents:

Italian's English accent is different from US and understanding it difficult [Persian speaker]
some Profesors using Italian accent when they teach in the class make me difficult to understand, as I used to study in english-american accent during my previous degree.
[Bahasa Indonesian speaker]

Though, as Jenkins (2014) notes, the benefits of a NNS rather than NS English-speaking lecturer are also understood:

Because it doesn't seem different from that which we speak back in my country (unlike in US or UK) [French/English speaker from Cameroon]

In this regard, Derwing and Munro (2015) point out that if the learner is familiar with the accent, s/he will also claim it is more intelligible. This suggests that the degree of accent familiarity might not only be related to the shared L1 of lecturer and learners, but, rather, to the degree of exposure students have had to varieties of English and particular accents.

82% of the international undergraduates said unclear pronunciation interfered with their understanding, with only the Spanish and Portuguese L1 speakers claiming not to have problems. Instead 58% of Italian L1 respondents said unclear pronunciation interfered with their understanding. These results suggest that students who share the same L1 as the lecturer or whose L1 is close to that of the lecturer have an advantage in understanding their lecturers' pronunciation (Bent & Bradlow, 2003).

As regards strategies for coping with pronunciation-related difficulties, most Italian L1 undergraduates would prefer to guess from the context than ask the lecturer directly, suggesting unwillingness to put themselves in the spotlight.

Students were also asked whether they would prefer the lecturer to use more simple language. Past research has shown that NNS lecturers tend to slow down their speech rate and use simpler sentence structures (Flowerdew & Miller, 2005), and this appeared sufficient for the Italian L1 undergraduates, with only 6% wishing for any further simplification. However, 30% of international undergraduates would prefer further simplification. This perhaps depends on the student's own level of English competence, since it was those with a lower level of English who wanted more simplification. However further simplification was also required by the US English native speaker, suggesting that other factors are at play.

3.2.2. *Second-cycle students*

83% of Italian L1 second-cycle students had no difficulty understanding lecturers' pronunciation, and indeed, whatever their L1, these students generally tended to have fewer problems with lecturers' pronunciation. This would suggest that maturity plays a more

important role in students' lecture comprehension in the EMI classroom than shared language or even language competence. Just one international second-cycle student (Pakistan/ English home language) claimed pronunciation was not clear. This finding is in line with previous research by Clark (2017) who found that international students tend to be less critical as regards the quality of their NNS lecturers' English.

As regards strategies for coping with pronunciation-related issues, like undergraduates, Italian second-cycle students were also reluctant to ask the lecturer for clarification but prefer other means. The responses of most international students however show they are more likely to ask their classmates or even the lecturer directly in case of pronunciation problems. This suggests greater confidence due to greater maturity or experience.

40% of international second-cycle students would prefer the lecturer to use more simple language. Most of these students could not rely on similarities between their L1 and Italian to help them, and they also declared lower English competence. It should be remembered in fact that "EMI learners may experience greater language-related challenges according to their English level" (Aiwaza et al., 2020, p. 6), and indeed even a higher level of English proficiency "does not necessarily alleviate all of the challenges that students encounter" (Aiwaza et al., 2020, p. 16).

3.3. *Would students prefer the lecturer to switch to L1?*

Local students are still often the majority in international courses at UNIBO, but only 10% of Italian undergraduates and 21% of Italian second-cycle students would prefer the lecturer to switch to the shared L1 in these cases. The higher percentage in the latter case could be due to the lower language competence of second-cycle students.

4. Discussion and conclusions

Both Italian and international students said their EMI lecturers needed to improve pronunciation. Nevertheless nearly all Italian and most international students claimed that lecturer pronunciation and accent did not interfere with understanding, suggesting that it could be learners' familiarity with the lecturers' speaking style – in terms of speech rate, accented speech and pronunciation – that affects students' perception of their lecturers' language intelligibility. This contrasts with EMI lecturers' perception of their own language skills (Picciuolo & Johnson, 2020), where pronunciation is described as one of their major worries.

Our findings have shown clear distinction between cycles as regards language proficiency, and coping strategies for pronunciation-related issues. As regards language proficiency, Italian undergraduates overall had higher levels than Italian second-cycle students, thus confirming our hypothesis that the Gelmini Reform had led to better language skills among

the younger Italian cohort. In comparison, international students reported a higher English language competence than the Italian students in general. As regards coping strategies, postgraduate students are more willing than undergraduates to ask either their peers or the lecturer directly for clarification. This could be due to their relative maturity when compared to undergraduates, as well as suggesting they feel more at ease with the learning environment of the EMI university classroom. Instead, students' L1 seems to have more influence than degree cycle as regards the desire for simplification, with those international students who could not rely on similarities between their own L1 and the EMI lecturer's L1 requiring further simplification. Second-cycle students in general have fewer problems than undergraduates with understanding due to pronunciation, speed of delivery and accent. As regards undergraduates however, internationals who did not share the lecturer's L1 or did not speak a language close to Italian had greater problem understanding than the locals. Overall, the majority of local students from both cycles would not switch to their L1 suggesting that they appreciate the added value of EMI.

Findings from this study have several pedagogical implications. Prospective undergraduate students, whatever their L1, would benefit more than second-cycle students from a content preparation course to gain familiarity with the English spoken by the local lecturers, while introducing them to their field of study and encouraging them to interact. Preparation courses for both students and lecturers (who also need to gain familiarity with student speech) could therefore also include audio-visual materials delivered in both synchronous and asynchronous formats.

Indeed, although much research has focused on training lecturers to improve their communicative skills in EMI settings, it is worth recalling that students are active participants in learning, and that any action taken in relation to improve comprehension in the EMI classroom should involve students and lecturers alike.

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Learning analytics dashboard to support instructors: a literature review

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Abstract

The purpose of this study is to conduct an evaluation of the literature on learning analytics dashboards in order to address the following research questions: "How do instructors use learning analytics dashboards to send notifications?" and "How can a learning analytics dashboard help students get reminded of the due dates for assignments, quizzes, and exams?". A total of 20 papers were analyzed. Although the majority of them discussed how students utilize dashboards to track their progress or compare their progress with their peers, none of them mentioned how dashboards may be utilized to automatically notify students or send reminders, reducing the amount of work instructors have to do. This can be taken into account when developing a dashboard for learning analytics in the future.

Keywords: *Learning analytics; learning analytics dashboard; learning management system; higher education.*

1. Introduction

Learning Analytics (LA) is a growing field that draws on many different fields of study, such as Data Analytics (DA) and Artificial Intelligence (AI), to support and enhance education (Nouri, 2019). Among the several uses of LA, including supporting learners self-regulated process (Winne et al., 2019), prediction of students' success (Chen et al., 2020), and analysis of students study behaviors (Sher et al., 2022), there are works on Learning Analytics Dashboards (LADs).

LADs can automatically analyze large amounts of data and deliver the results to relevant stakeholders. It consists of "a single display that aggregates several indicators regarding the learner(s), learning process(es), and/or learning context(s) into one or multiple visualizations" (Schwendimann et al., 2016). The stakeholders in this context could be instructors, students, and/or academic advisors. We are particularly interested in understanding how instructors could use LADs to improve feedback and communication with their students. Previous research has demonstrated that instructor feedback positively impacts students' performance both in-person (Baranczyk & Best, 2020) as well as in online classes (Lee, 2020). Considering that, this study aims to answer the following research questions:

RQ1: "How do instructors use learning analytics dashboards to send notifications?"

RQ2: "How can a learning analytics dashboard help students get reminded of the due dates for assignments, quizzes, and exams?"

To answer those research questions, we conducted a literature review of the last five years on learning analytics and learning analytics dashboards.

2. Methodology

We conducted a literature study by searching for and reviewing recent five-year (2018 - 2022) published articles written in English in order to gather the most recent work and identify any limits or prospective future research from those articles. The databases that we used were IEEE Xplore, ACM Digital Library, Wiley Online Library and Google Scholar. These sources were selected because they are known for publishing works related to the learning analytics area. In particular, the ACM Digital Library is the current publisher of the Learning Analytics and Knowledge Conference proceedings.

The keywords used for the search were: "learning analytics" and "learning analytics dashboards". In some cases, the search resulted in a large number of results; the number of total distinct results is not reported because searching different sources returned many repeated results across all searches.

For the search carried on IEEE Xplore, there are 8,073 search results for “learning analytics” and 106 for “learning analytics dashboard.” We skimmed the abstract of those 106 papers and selected five papers which were related to LAD for teachers or students. Most of the other papers were related to other dashboards.

There are over 150,000 results for "learning analytics dashboard" in the ACM digital library. However, among those there were non-learning analytics-related papers because the search also included "learning," "analytics," and "dashboard". We manually screened papers which were relevant to LAD. We went through titles of first 1000 latest results and found that none of them were related to LAD. We have gone through 100 relevant papers because after 100 results there were no papers for LAD. Among the relevant papers, we read 5 papers and skimmed through 10 papers based on the titles. The 10 papers were not included in the total papers we have analyzed because they were not related with LAD for teachers and/or students.

We looked at the first 50 results for the term "learning analytics" in the Wiley Online Library and read the papers and literature reviews among them that were published after 2018 (the previous five years). After that, we read the first 20 results in the Wiley online library for the keyword "learning analytics dashboard". The majority of the results were related to general dashboards and not specifically dashboards related to learning aspects.

When we searched in Google Scholar using keywords “learning analytics” and “learning analytics dashboard” most of the results were the same as which we have already read from IEEE Xplore, ACM Digital Library, Wiley Online Library. So we searched for journals using the phrase “International Journals of Learning Analytics dashboards” over the range 2018 - 2023. We got 16,700 results. From those, we read the first three journal papers presented in the first page results, since we skimmed through the remainder papers in the first page and they weren’t related to learning dashboards.

Besides the database searches, we used the snowball technique and read four papers from the previous papers found. We read all papers and summarized their purposes in order to look for information that would respond our research questions.

3. Results

A total of 20 papers were analyzed. From those, three are literature review papers and 17 were either conferences or journal papers. One literature review paper is in the area of LA and the other two are related to LAD.

3.1. Previous Literature Review on LA and LAD

Ahmad et al. (2022) looked at 161 learning publications to investigate the function of learning design in learning analytics. By offering a reference framework where they suggest potential linkages between learning analytics and learning design, they sought to better align learning design with learning analytics and to demonstrate the prior study and applications of LA indicators and metrics. They discovered that a few learning analytics articles did, in fact, take into account learning design activities for gathering user data. They also identified an ongoing rise in the quantity and quality of indicators, as well as an evolution of these indicators through time.

By leveraging theoretical foundations including human cognition and perception, context awareness, and technology, designers need to have a thorough understanding of how learners see and think in order for LA to be effective (Few, 2009). The degree to which the target objectives of LAD are consistent with the domain metrics used to assess their effectiveness is investigated in a Valle et al. (2021) literature study. Additionally, it states that regardless of the intended target audience, the dashboard's primary purpose is to support learners as end users.

In order to evaluate the influence on teaching and learning, a thorough evaluation of the literature was done on the LADs research that presents empirical evidence. Self-regulated learning has been cited in a number of earlier research reviews as the main area of interest for LADs. The literature on self-regulated learning and how self-regulated learning is supported has, however, received considerably less attention than it deserves. They reviewed empirical data on LADs using Winne and Hadwin's well-known model of self-regulated learning (Winne & Hadwin, 1998) in order to solve this limitation. The findings demonstrated that existing LADs have significant shortcomings in how their evaluation is carried out and reported, are rarely based in learning theory, cannot be proposed to support metacognition, do not provide any information about efficient learning tactics and strategies, and cannot be suggested to support metacognition (Matcha et al., 2020).

3.2. Previous Papers on LA and LAD

From the 17 papers, four were related exclusively to learning analytics. Those will be described first in this section, followed by the description of the 13 papers related to LAD.

In order to comprehend and improve learning, learning analytics makes extensive use of data on learner interactions in digital learning environments. Although measurement is a key component of learning analytics, there hasn't been much study looking at how learning analytics and assessment are related. In order to fully utilize the potential of the connections between learning analytics and assessment, interdisciplinary teams will be required to address task design, analysis of learning progressions, trustworthiness, and fairness, as well

as other pressing scientific and practical challenges and opportunities (Gašević et al., 2022). Concerns about fairness and bias may be advanced by integrating learning analytics and assessment. The amount of study on fairness and bias in learning analytics, much alone in assessment using analytics, is, nevertheless, lacking (Gašević et al., 2022).

The application of learning analytics could help curriculum committees reflect on their curricula. According to Chou et al. (2018), competency-based learning analytics are suggested as a way to analyze competency-based curricula and graduates' academic records of coursework in order to provide systematic evaluation information that could help curriculum committees reflect on curricula, faculty teaching, and student learning. According to Whitelock et al. (2019), in order for future implementations of LA to be successful, it is essential to gauge student expectations of LA services. The authors presented a descriptive instrument to assess students' ideal and anticipated expectations of LA services. They created and validated a descriptive questionnaire that offers a robust and methodologically sound solution to measuring student expectations of LA services using the identified expectation themes (ethics and privacy, agency, intervention, and meaningfulness) and expectation types (ideal and predicted). They found that while some characteristics of LA services may be useful (such as the implementation of early alert systems), they may not be the features that students anticipate (such as LA services created to enhance academic abilities like self-regulated learning).

Ten of 13 LAD papers mentioned giving students feedback to track their development or compare it to peers. Those LADs display data that students need to track their progress, such as grades and how they compare to others, number of times they've read the course materials, and amount of hours spent watching lecture videos.

A paper discussed about the student's ability to get acquainted with the LAD's and focused on helping students practice self-regulated learning (SRL) and to keep track of the learning progress with the help of technologies (Park et al., 2022). Another paper that addressed queries raised by students in virtual breakout rooms did so by creating a dashboard (Stanislav et al., 2021). The design approach consists of: interviews with teachers in which questions were asked to teachers about their current practices while monitoring groups of students. Based on open answers from teachers, an inductive analysis is performed to map the critical challenges they face with the evidence that can be used to address them. Codes emerged through the analysis are grouped thematically. Based on the teachers' questions identified in the previous steps, the most highly ranked questions (i.e., those that address the concerns of the majority of the participants) are explicitly added to the dashboard or LA user interface (Echeverria et al., 2018).

In a study by Wang and Han (2020), LADs are created using process-oriented feedback, providing both visual and textual feedback for various learning processes. A virtual learning

system called iTutor was used for the study. They upgraded iTutor by including LAD to give students process-oriented feedback based on the performance and behavioral data that are automatically recorded during students' learning processes. Students used those visual feedbacks to compare their performance to that of other students.

Rienties et al. (2018) used an Analytics4Action (A4AW) workshop to examine how instructors in a two-hour training tried to make sense of LAD and whether their technology use affected their satisfaction with A4AW. The study found that 89% of participants were pleased with the A4AW program. 68% of participants thought open university LA tools were useful. (i.e., the degree to which teachers believe the use of LAD and visualizations will, for example, improve the quality of their teaching or increase academic retention).

Jaramillo et al. (2022), proposed a dashboard to gather information about students who are suspected of academic dishonesty. The dashboard is composed of information about how students have interacted with the course materials and videos, how many forum posts have been made, how many tests have been turned in, and what was the learner's behavior on a specific day or during a specific lesson.

4. Discussion and Conclusion

We examined learning analytics and learning analytics dashboard papers from the past five years to see whether any answered this paper's research questions. We found out that no papers addressed the research questions. We want to solve this literature gap by designing and implementing a LAD to help instructors improve feedback and communication with students.

According to Bouchrika (2022), learning management systems (LMS) are considered mandatory in higher education and institutions are using them to display course material, assignments, and quizzes in their courses. Professors generally create an announcements section, which will be used by them from time to time to send out announcements. Announcements can be used to convey a wide range of information, including reminders for impending tests, projects, exams, and assignments, as well as information on altered class times. The time spent by professors in keeping track of their students is huge, especially if we consider courses with a large number of students (Hernández-García et al. 2015). Even if the professors use the learning analytics already provided by the LMS there is a considerable number of selections that needs to be done in order for the professor to know if the students did or not did the assignment and which messages to send in each case. By introducing a LAD, which can automatically gather information regarding due dates from assignments and display this information to professors along with a tool to personalize deliver alerts about such deadlines, we aim to reduce the amount of time professors spend on doing such feedback. Through this automation, professors will benefit from the time and effort savings.

This literature review helped us to identify that there is no proposals for a LAD which can help teachers reduce their burden by automating and personalizing student's feedback. So we plan to design a LAD that can send notifications to students automatically by taking the data from the assignments, quizzes, or any other sections included in the course which would address our research questions.

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Which career should I choose? Application of a pre-university vocational guidance platform based on the Ikigai methodology

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Abstract

Choosing a university degree is a crucial decision in a person's life. However, many students have chosen their career without proper counselling. Ikigai refers to a Japanese concept that tries to find a person's purpose. This research explains the implementation and results of an online platform based on the Ikigai methodology. The Ikigai methodology was implemented through a sequential process. A total of 172 schools were surveyed, involving 1,878 students. The predictive phase asked about: what participants study, interests, hobbies, the social causes that motivate them and the future professions they are interested in. Subsequently, an individual graph is generated with scores in 15 subject areas. Based on the reports, the university sends a personalised proposal of possible university degrees to each student by e-mail. The Ikigai methodology is therefore a very useful tool that allows students to improve their self-knowledge and the effectiveness of their decision-making processes, among others.

Keywords: *Ikigai; career counseling; career choice; career guidance programs.*

1. Introduction

Career building has major implications for both the individual and society. An economically sustainable career involves costs during the various stages of education, which should be transformed into an investment and provide benefits by means of the employee's professional activity.

Choosing a career is one of the most difficult tasks students have to confront when completing secondary school, as it will largely determine their plans for the future. At this stage, it is very important for students to receive adequate information about their career path (Ehigbor and Akinlosotu, 2016). Many students have selected their careers without receiving adequate advice from professional services, and this can result in discrepancies between their academic performance, personality, interests and abilities. In order to provide recommendations to students on how to choose the right career, it is important to develop a referral system with which to guide them in their career choices (Razak et al., 2014).

The relevance of providing career guidance to students has been examined extensively in several works (Loan and Van, 2015; Gordon and Steele, 2015; Zunker, 2015). Career guidance counsellors can help individuals who are confronting career challenges (Whiston et al., 2017). Their experience in career development and labor markets allows them to analyze a person's qualifications, experience, strengths and weaknesses from a broad perspective, while taking into account the desired salary, personal hobbies and interests, location, labor market and educational possibilities (Savickas, 2019).

When evaluating career guidance programs, it is relevant to examine the methodologies used to deliver those programs. In this respect, Watts and Sultana (2004) examined the vocational guidance policies of 37 middle-income countries and found that that career guidance services were provided in various formats, such as individually, in groups, face-to-face or remotely (e.g. helplines and internet-based services).

Finally, Whiston et al. (2003) used meta-analytic techniques to compare different forms of intervention (e.g. individual career counselling, career guidance classes) and found that interventions that involved a counsellor were significantly more effective than interventions without a counsellor. In particular, they found that the combination of a computer system and a career guidance counsellor was more effective than allowing people to use only a computerized counselling system.

Technology in the form of websites, social media and apps has now extended the resources available to career counsellors. In this context, this work explains the implementation and results of an online platform based on the Ikigai methodology. More specific, this platform has been used as a vocational guidance tool for pre-university students in a region in Spain.

This project is the result of a strategic partnership between the educational administration and a public university.

2. Theoretical background

2.1. Ikigai and career guidance

Ikigai is a Japanese construct that is concerned with finding one's purpose in life or reason for being. Kondo (2007) states that Ikigai is “*a sense of purpose and willingness; an awareness that one is helping others, a sense that one has something to live for*” and that “this can also be felt when one is being acknowledged by others”. With regard to this conceptualization, Kumano (2006) carried out a principal component analysis and found that the central concepts of Ikigai were life affirmation, goals/dreams, the meaning of existence, a sense of fulfilment and commitment.

Several pieces of research regarding the application of Ikigai to pre-university students have been carried out, and studies have shown that it may be a useful tool with which to help students identify their interests and goals, and plan their future careers (Eller, 2016; Hamzaid et al., 2022).

It is possible to state that the use of Ikigai is helpful for many reasons. It provides the student with a goal to strive for, and something more important than just momentary success to focus on. Alternatively, it could even be used simply as a means to guide oneself toward obtaining a degree or as a form of checklist for the education a student seeks to attain. In this context, while it is not absolutely necessary for one to explore, or even create, one's own Ikigai, it might be useful for students everywhere to look introspectively at why their education is relevant and why they are obtaining it (Eller, 2016).

In the context of career counselling, the Ikigai methodology is frequently represented as a Venn diagram comprising four circles: what you love, what you are good at, what the world needs and what you can get paid for. Finding the Ikigai is, therefore, believed to bring a sense of fulfilment and satisfaction.

3. Method and results

3.1. Methodology

In our work, the Ikigai methodology has been implemented by employing a sequential process in collaboration with secondary school counsellors, as described in Figure 1 (see Figure 1). The students completed 4 questionnaires in the predictive analytics phase, as describe in Table 1 (see Table 1).

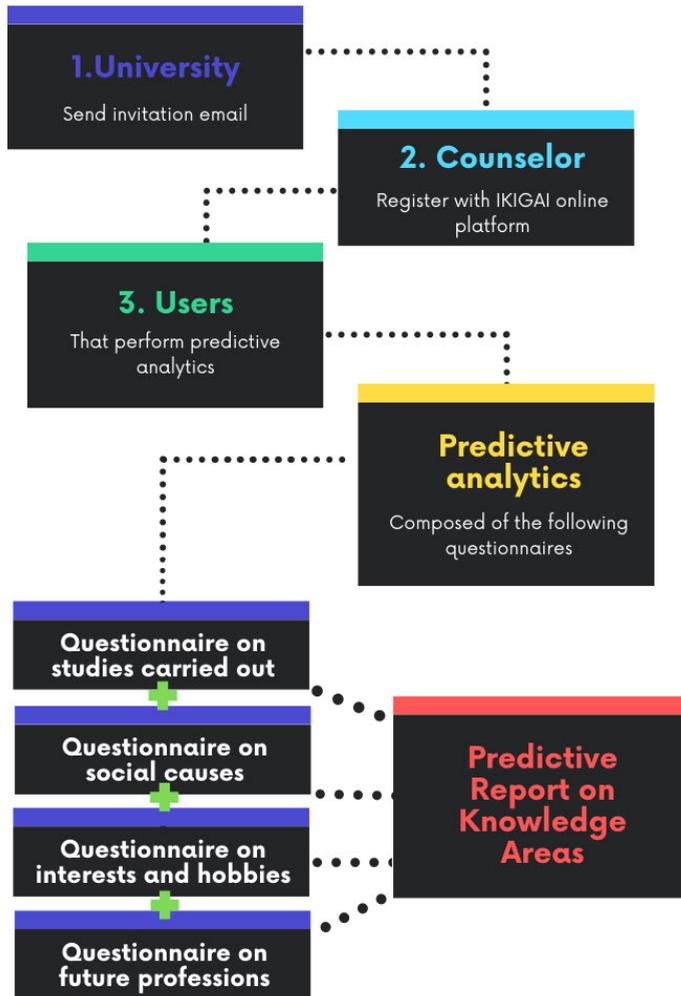


Figure 1. Ikigai implementation process. Source: The authors.

Each of the answers of these 4 questionnaires are linked to one or more of the 17 areas of knowledge that have been established, based on the 5 main branches of knowledge, after a process of research and co-design with specialists in the field of education and guidance. The calculation of the final result is carried out automatically in the tool through a mathematical algorithm that relates all the answers with the different percentage weights of each of the questionnaires and the areas associated with each of the answers, assigning a score from 0 to 100 to each area. These scores are reflected visually in a spider graph and the area or areas of knowledge that have achieved the highest score are presented in a table of vocational suggestions.

Table 1. Description of the questionnaires applied in the predictive analysis phase.

Questionnaire	Description	Question example
Academic Specialisation	Questionnaire regarding what the participants were studying	Choose your current studies or the specialisation that corresponds most closely with them. (limited list of current studies in secondary school and professional education).
What you love and what the world needs	Questionnaire on interests and hobbies that motivate them in their daily life	Studying new languages for fun and not as an imposition. Thinking about the creation of new devices to be licensed and launched on the market
	Questionnaire on social causes that motivate them	Participating in campaigns to help homeless people. Fighting bullying among your classmates.
What they will pay for you (professional life)	Questionnaire concerning future professions of interest to them	Analyzing data using technology. Functioning of the brain in the learning process (neuroeducation).

Source: The authors.

3.2. Results

A total of 172 secondary schools were surveyed, with the participation of 1,878 students. As for the characterisation of the sample, they are all first and second year students in the upper secondary school. Figure 2 shows the percentage of respondents according to the area with the highest score for each of them. It can be seen that Education is the most repeated (54.01%), followed by computer technology (13.95%) (see Figure 2).

After completing the questionnaires, the online platform generates an individualized report for each student called a predictive report. Specifically, a graph is generated with scores related to 15 knowledge areas on a scale of 0 to 100 points. Examples of two students' predictive reports are shown in Figures 3 and 4.

In the case of Student 1 (see Figure 3), the predictive report shows a clear vocational orientation toward the field of computer engineering. As a second possibility, it indicates that this student also has a clear orientation toward marketing and advertising studies. In the case of Student 2 (see Figure 4), the predictive report indicates a clear vocational orientation toward tourism studies, followed by arts and humanities. The predictive report also indicates studies in education as a third vocational alternative.

The university uses the students' reports as the basis on which to create a personalised proposal of possible university degrees that will best suit the vocational profile of the pre-university student. This proposal is then emailed to each individual student.

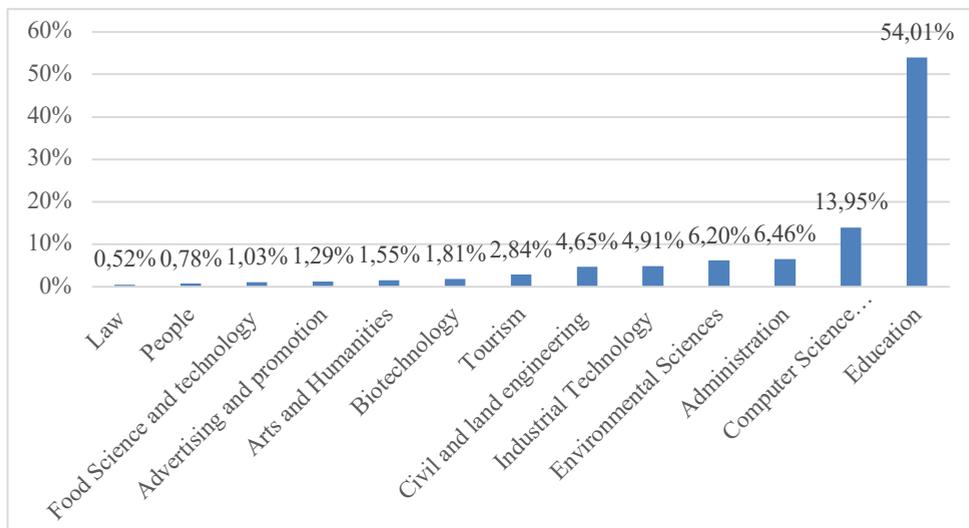


Figure 2. Sample profile according to the preferred area. Source: The authors.

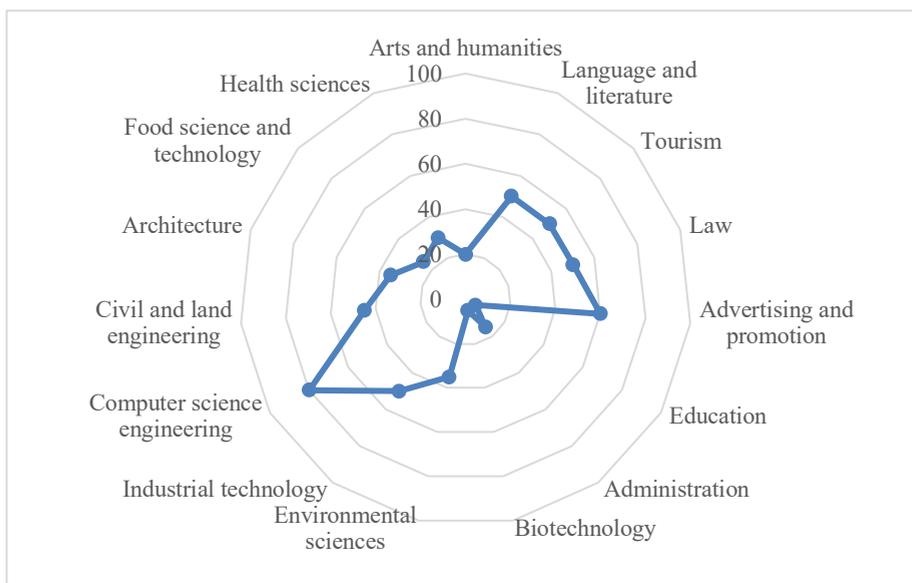


Figure 3. The predictive report of student 1. Source: The authors.

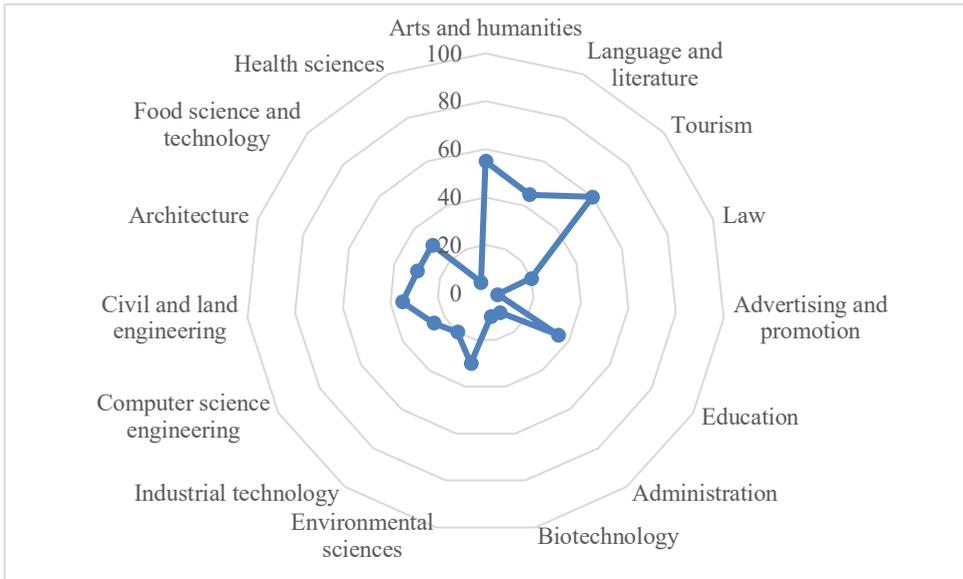


Figure 4. The predictive report of student 2. Source: The authors.

4. Conclusions

The experience gained after applying the Ikigai methodology to the vocational guidance process of secondary school students makes it possible to conclude that it is a very useful and operational tool. It particularly enables students to achieve the following objectives: improve their self-awareness, improve the efficiency of their decision making processes, obtain information of interest concentrated in a single report, obtain a brief and interactive assessment, and achieve immediate results.

Furthermore, the application of the Ikigai methodology provides a number of benefits to secondary school counsellors and improves the effectiveness of their work.. It particularly allows the following objectives to be achieved: (1) carrying out quick analyses that facilitate the counsellors' work, (2) automating part of the guidance work while keeping the importance of their mentoring intact, (3) monitoring progress in real time, (4) obtaining an overview of the students' preferences, and (5) using the data collected to generate statistics.

From the university's point of view, the main problem is that of correctly adapting its provision of degree studies to the vocational profiles proposed by the Ikigai tool. This adaptation requires intensive work that it is difficult to automate. Moreover, the increase in fields of knowledge and specialization planned by the administration in secondary education will imply a compulsory and complex process of readjustment in the areas included in the Ikigai tool.

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Quest-based Gamification in a software development lab course: a case study

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Abstract

Motivation and engagement play a crucial role in student success in a course. Students may lose interest or underestimate courses that tackle non-core learning outcomes to their specific curriculum or program. Gamification, using game elements (e.g., rewards, challenges) in non-game contexts, is one way to motivate and engage students. Some educational courses use project-based learning, where students tackle problems, overcome obstacles, and gain knowledge. Quest-based games are designed as systems of challenges that players must complete to advance and win the game. They were linked with education by applying specific game mechanics to a computing course unit. This paper case studies the application of a quest-based gamification approach in a mandatory software engineering course to boost engagement among higher education students. Results were collected through observational methods and surveying the students, indicating a tendency for higher grades in course years implementing gamification while maintaining satisfactory levels of motivation and engagement.

Keywords: *Gamification; education; quest-based games; software Engineering.*

1. Introduction

Motivation and engagement are crucial factors in determining a student's success in a course. However, students often disengage or undervalue courses they perceive as not central to their curriculum or program. This can negatively impact the achievement and quality of desired learning outcomes. One way of increasing the levels of engagement is through gamification (Alsawaier, 2018).

Gamification involves incorporating elements of games into non-game contexts, as explained by Deterding, Khaled, Nacke, and Dixon (2007), such as education (Tsai, 2016). This can include using rewards and challenges to promote intrinsic and extrinsic motivation, as Surendeleq, Murwa, Yun, and Kim (2014) pointed out.

Based on their contents, specific educational courses adopt a project-based learning strategy. Students engage in problem-solving activities: a series of actions to move from an initial state to a desired end state while overcoming obstacles and building knowledge (Jonassen & Rohrer-Murphy, 1999) (Ward, 2012).

Quest-based games are intentionally built as systems of problem-solving tasks that players must accomplish to progress and ultimately win the game (Howard, 2008). Gameplay activities (completion of specific objectives related to quests) provide a logical narrative structure, determining the story and progression within the game, as stated by Smith, Anderson, Kopleck, Lindblad, Scott, Wardell, and Mateas (2011). Fabricatore and López (2014) linked quest-based games and educational courses by identifying and implementing five patterns of game mechanics in a computing course.

This paper presents a case study where gamification was used to increase the engagement of higher education students in a mandatory informatics engineering-based course unit not perceived as central to the overall curriculum. While revising the syllabus, a quest-based system was applied, entitled “World of LPRO”, following the game mechanics stated by Fabricatore and López (2014)). Results were collected through observational methods and surveying the students. Research aimed at answering the following research questions:

- RQ1. Regarding student engagement, what was the impact of a Quest-based Gamification on student grades?
- RQ2. Regarding student motivation and interest, how do students perceive the Quest-based Gamification approach?

The paper is organised into four additional sections. Section 2 provides context on Quest-based Gamification and outlines the core gameplay patterns. Section 3 showcases the case study, a programming lab course taught in an Electrical and Computer Engineering master's program. Section 4 details the student data collection methodology and presents the results obtained. Finally, Section 5 concludes the paper with final remarks on the study.

2. Adopting Quest-based Gamification

Game mechanics are crucial in determining the player experience, as they are central to the gameplay and must be mastered for success (Fabricatore, 2007). These mechanics make the gameplay appealing and motivating for players (Polaine, 2005). According to Fabricatore and López (2014), quest-based games' core mechanics are divided into five gameplay patterns, as described in Table 1.

Table 1. Quest-based games' patterns of gameplay.

Pattern of Gameplay
<p>Quest structure (QS): Quests consist of: (I) A goal that requires completing specific tasks to meet the victory conditions, together with optional conditions for additional challenges and rewards; (II) The resources or tools needed to achieve the objective and (III) The significance of the quest in terms of progressing in the game. Quests are conveniently described (usually through a thematic narrative) so the player knows the expected outcomes.</p>
<p>Strategic open-endedness (SOE): Quest objectives can be accomplished through multiple strategies, giving players the freedom to "do more" or "do things differently." This enables players to try different methods of play and encourages them to attempt increasingly complex strategies as their skills improve.</p>
<p>Non-linear progression (NLP): Players are usually free to choose when they want to complete a quest. When this is impossible, it is usually because of the quest's narrative or how it connects to other quests. The quest's briefing and debriefing stages provide information about its availability and how it is related to other quests.</p>
<p>Orientation (O): The game provides briefing information through resources such as maps, accessible to the player at any time to aid in decisions about when, how, and what to engage.</p>
<p>Challenge-based reward (CBR): Rewards are typically given according to the principle of "the more you achieve, the more you receive." Meeting the primary victory conditions earns a standard reward. Accomplishing more difficult tasks earns additional rewards, such as extra resources and recognition of increased skill (such as a promotion in the game). In quests involving teamwork, rewards are based on each player's contributions.</p>

Source: adapted from Fabricatore and López (2014).

When applying the gamification approach to the course, although not restricted to these, there was an attempt to enforce all five gameplay patterns. For clarity, when describing a specific gamification element in the next section, the pattern(s) acronym will be annexed between italic box brackets [] (e.g. if an element incorporated the "Challenge-based reward" pattern, the *[CRB]* notation would appear next to it), whenever relevant.

3. Programming Lab: A Case-Study

The presented approach was applied to a programming lab course (LPRO) in the 1st semester of the 4th year of a 5-year Electrical and Computer Engineering integrated master programme (Faculty of Engineering of the University of Porto [FEUP], 2013). Although not central to its core syllabus, LPRO was a mandatory course, and students had basic programming skills from a couple of courses in the 1st year. Its purpose was to endow the students with sufficient software development aptitudes to seamlessly integrate a professional development team.

LPRO's contents encompassed three main topics, namely i) JAVA: Object-Oriented Programming (OOP), using Java as a supporting programming language and JUnit testing; ii) UML: Unified Modeling Language (Kaur & Singh, 2011) for documenting the artefacts of software systems; and iii) PROCESS: Scrum (Rising & Janoff, 2000) for software project management and development. Lectures briefly overviewed the main topics, engaging students in autonomous, self-paced learning. At the lab, teams of students developed a software project (80% of the final grade) and hands-on exercises to consolidate the learning outcomes. 20% of the final grade came from two individual tests.

The World of LPRO setting used a role-playing game-like medieval fantasy narrative where the player character (student) starts as an inexperienced adventurer, clueless about the fine arts of Software Development, and thrives to become a skilful master.

3.1. Main plot

The main plot (Figure 1a) that drives the adventurers comprises three challenges: a main quest, side-quests and trials of passage. To be successful, the student must finish the main quest, complete 3000 XPs (eXperience Points) worth of side-quests and overcome the two trials of passage.



Figure 1. Main Plot elements (on the left); XP Levels (on the right).

Grouped in pairs or triads, adventurers prepare for the main quest by completing side quests. **Side quests [QS]** are small-scale hands-on exercises to develop, improve and enhance student skills, covering the three main topics (five per topic). Some are mandatory (assuring

minimum topic coverage), while others are optional (Figure 2) [O]. Growing in complexity, each side-quest awards the adventurers with XPs [CBR], allowing promotion up a series of levels (Figure 1b) until attaining "Developer" (3000 XPs).

Adventurers can tackle the side-quests in any order they choose [NLP]. However, following the "Path of Enlightenment" [O, CBR] by completing certain side-quests until a specific deadline awards enough extra XP for reaching the final level without needing an extra side-quest.

Trials of passage are two individual tests. The first consists of a mid-course 2-hour unit-test-driven *JAVA* programming challenge, and the second consists of a final course one-hour-long multiple-choice questionnaire covering *UML* and *PROCESS*. Failing one means failing the course.

The **main quest** [QS] is the course-long software development project, where adventurers apply all their attained skills, grouped in a party (team) of four or five. Although having some required outcomes, adventurers are free to tackle the intrinsic challenges as they see fit [SOE].

Level	Topic			
	JAVA	UML	PROCESS	
I	"Here Be Dragons" Basics 100XP	"Here Be Objects" Modelling Basics 100XP	"Pitch the topic" Concepts, Methodologies 100XP	M a n d a t o r y
II	"Dragon's Bane" Classes, Collections, Generics 300XP	"Here Be Classes" Class Diagrams 300XP	"The Vision, The Story and The Enforcer" Phases & Practices 300XP	
III	"The Quest for WYSIWYG" SWING 500XP	"Rules of Conduct" State Diagrams 500XP	"Scrolls of Foresight and Achievement" Artefacts 500XP	
IV	"Row, row, row your boat..." I/O Streams 100XP	"Rules of Trade" Sequence Diagrams 100XP	"The Olde Shop" Supporting Tools 100XP	
V	"Divide & Conquer!" Concurrency, Threads 100XP	"Rules of Engagement" Other Diagrams 100XP	"The Herald's Tale" Emerging Technologies 100XP	

Figure 2. Side-quests schema.

3.2. Rewards and Special Items

As motivators for completing more side-quests (thus further consolidating their skills), adventurers are rewarded with special items [CBR] that will allow for grading bonuses. Here is where "Magic" enters the narrative.

A *Wand* is rewarded if an adventurer completes all five side-quests regarding a specific topic. *Wands* cast magical spells and can be used to compensate for faults or failures on the trials

of passage (Figure 3a). Moreover, adventurers can combine *Wands* into *Staffs* (Figure 3b) for more potent spells, even allowing extra credits on the main quest.



Figure 3. Rewards and Special Items: Wands (on the left); Staffs (on the right).

4. Results

Although starting in 2007, the course had the gamification approach introduced in 2017/2018, lasting for four more occurrences (as of 2021/22, the course's contents were redefined and adapted to a new Master Programme).

Students' final grades data was collected and compared with the equal period before adopting gamification to assess the impact on overall success. To answer RQ1., we considered the quantitative data collected, represented in Figure 4. Final grades tend to improve in gamified course instances (2017/2018 and beyond) compared to non-gamified instances (before 2017/2018).

	No Gamification				Gamification				
Academic Year	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	Histogram
Mean Grade	16,3	15,41	14,65	15,51	16,04	17,03	16,25	16,40	

Figure 4. LPRO final grade average before and after introducing gamification.

Also, students' feedback was surveyed to measure the perceived gamification's effects. The survey (Figure 5) was about the new gamification-like learning experience, where students had to rate statements using a five-point Likert scale: (1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; (5) Strongly agree. They also had room to provide further comments on the course.

Question	1	2	3	4	5	Histogram
Gamification was a good idea.	8,7%	0,0%	8,7%	30,4%	52,2%	
Side-quests were self-paced and tackled non-linearly.	0,0%	4,3%	8,7%	43,5%	43,5%	
Students grouping (parties and packs) was effective.	0,0%	0,0%	13,0%	43,5%	43,5%	
Special Items were good motivators.	0,0%	0,0%	8,7%	13,0%	78,3%	
Side-quests complexity was adequate.	0,0%	0,0%	13,6%	31,8%	54,5%	
Path of Enlightenment fostered on-time deliveries.	8,7%	0,0%	13,0%	26,1%	52,2%	

Figure 5. LPRO student feedback survey results.

Analysing the survey results and answering RQ2., students considered that introducing gamification and following the "Path of Enlightenment" performed well. Also, they considered the system of rewards and special items highly motivating.

However, despite stating that side-quest complexity levels were adequate, they felt the "Path of Enlightenment" was time-consuming and required extra work, thus preferring a more self-paced approach. One critique focused on the lack of direct connection between the reward system and actual weight in the student grade.

Overall, special items were valuable to help low-grade students not to fail the course while enabling high-grade students to improve their final grades further. The fewer Wands needed to pass the trials of passage (in case of borderline failure), the more one could improve the final grade (by combining them into Staffs). One of the most popular (and coveted) items used by students was the *Staff of Divine Development* since it increased by 1 point the main-quest grade (on a grading scale between 0-20), translating into a 0.8-point increase in the final grade (a plausible explanation for the increase in the average grade in gamified instances).

5. Conclusion

This paper applied a quest-based gamification strategy to a non-core mandatory software engineering course. We discussed how gamification can improve student engagement and motivation by linking different quest-based games' core mechanics to the teaching and learning component. Results indicate a tendency for higher grades in course years implementing gamification. Student feedback suggests that the gamified-based course is motivating and gripping while suitable for the assessment components.

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Retail design education. Designing new and reframed learning tools for experience-based learning

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Abstract

The retail industry is a fast-changing sector characterized by innovations' openness to adoption dictated both by technological advancement, supply chain management transformation and consumer behaviour evolution. As an increasingly knowledge-intensive industry, updated retail skills and competencies need to be investigated and improved, promoting new educational and learning approaches.

The paper presents the results of an experience-based learning held within the "Fashion Retail Experience Studio" course at the School of Design of Politecnico di Milano and rooted in a project-based approach. Several learning tools were developed and applied in order to investigate how design can properly manage multi-level and multidisciplinary retail challenges fueling and generating meaningful innovation. A transdisciplinary perspective was also adopted in designing new design learning tools or adapting management, marketing and IT retail tools to enhance design competencies and skills with a holistic approach.

Keywords: *Retail design; retail education; experiential-based learning experience; design learning tools; transdisciplinary perspective.*

1. Introduction to Retail Transformation

A radical transformation has characterised the retail sector over the last twenty years. On the one hand, the progressive dematerialisation of goods and the consolidation of the so-called service economy have mutually fuelled each other, driving the retail transformation from a predominantly product-centric to a service-centric approach (Lusch & Vargo, 2006). Retail, from being primarily focused on goods' transactions, has become capable of catalysing and promoting value co-creation within an interdependent system of service innovation, meaning generation and consumer centrality (Kustrak Korper et al., 2021). On the other hand, technological acceleration has pushed towards a radical change in the economic and social sphere with significant effects on manufacturing and distributive systems and on collective living and behaviours. In particular, new digital channels (social media and web platforms from traditional online channels to the metaverse) and advanced technologies (AR/VR, IoT, advanced 3D modelling technologies, and Digital Twins, AI, etc.) have rapidly entered the production and distribution systems profoundly impacting their processes and operations and multiplying the touch points connecting the consumer with products/services in an experiential and relational continuum (Shankar et al., 2021). The consumer experience is now embedded within a mature omnichannel system that requires a seamless connection in a complex and interwoven system of physical, digital and mixed channels, streamlining and fast-tracking operations and the compliance with consumer expectations (Hoyer et al., 2020). The retail system has thus proven to be a remarkably open and receptive sector to the adoption and promotion of innovation with impacts on business models, supply chain management, and consumer value delivery models (Mostaghel et al., 2022). Moreover, being a highly transformational field, the competence domains involved into the retail system are multiple and constantly redefined their roles, hierarchies and intervention models. Retail design, marketing, management and, more recently, IT converge within a system that requires transdisciplinarity (Iannilli et al., 2019a) and design, in particular, needs to redefine its role and develop new tools and approaches to bring value to the system. In this context, a reflection on retail design education becomes necessary both to frame the new levers that design can use to promote significant retail innovations and explore the most effective competencies and skills that will be relevant in the future.

2. Insights from the Evolution of Retail Education

In light of this changing scenario, the research in retailing is prolific, with multiple scientific researches aiming both at identifying the impacts and areas of application of advanced technologies within retail processes and outlining and conceptualising the sector's innovation trajectories. However, the interest in retail education appears to be more limited (Pantano et al., 2020) and does not have the same spread within all disciplinary fields that nowadays interplay within the retail system. Assuming a disciplinary perspective, marketing education

appear to be the areas that first recognised how the relevance of retail transformations needed updating in terms of both competencies and learning approaches. Grewal et al. (2018) address the issue by examining major changes in retail and consumer landscapes, tying them to changes in retail education. Taking a historical view on retailing education, the authors highlight its past, its present, and the likely future of retailing technologies and education, emphasising how technologies must become an opportunity to enhance active learning. Within the editorial introducing the 2018 special issue “Educating the Retailers of Tomorrow” in the *Journal of Marketing Education*, Roggeveen and Beitelspacher (2018) provide insights on innovative teaching methods, innovative pedagogical tools, and an overview of retailing education. The first two sections, in particular, showcase a variety of educational experiences. On the one hand, they demonstrate the effectiveness of experiential, situated and skill-based learning (Lange et al., 2018; Rhee, 2018), able to provide wins for students, partnering retailers, and faculty when retailing curricula developed cross-functional partnerships with retailers. On the other hand, these experiences demonstrate how innovative pedagogical tools can be incorporated into classrooms to improve students’ knowledge and skills to effectively integrate relevant retail issues (e.g. Mobile Retailing, Corporate Social Responsibility) (Beitelspacher & Rodgers, 2018; Fischbach & Guerrero, 2018). The experiential nature of all the described learning experiences is consistent within the special issue’s articles. This approach results in a student’s active involvement with consequent positive impacts on knowledge advancements through hands-on activities and reflective practices. Similarly, faculty and retailers jointly benefit from exploring contemporary challenges in retailing (Lange et al., 2018) and allowing retailers to reflect on the competencies of young prospective practitioners.

The experience-based learning approach is also crucial from a retail management perspective and, of course, a retail design perspective. Soft skill development, simulated navigation of roles, support in pursuing success, and bridging the gap between textbook and real-world emerge as the main positive outcomes for students in participating in comprehensive course projects exposing them to work with retailers or companies to solve particular issues the firm faces (Jones et al., 2021). Similarly, the need for collaboration in educational curricula between educational institutions, here, in particular, Higher Educational Institutions (HEIs), professionals and retailers, becomes crucial to provide students with up-to-date competencies suited to the changing retail sector. Technology-driven changes, specifically, have rekindled attention to retail education. The technological transformation’s speed indeed imposes a need to provide digital skills (or hard skills). However, it simultaneously requires reinforcing soft skills to understand and fully exploit the potential of new technologies (Woods et al., 2022). This viewpoint has also been adopted by retail design. Research and theoretical conceptualisations in this area are still scarce but sufficient to signal a renewed need both to redefine the role of design in contemporary retail and to investigate the expected competencies of future retail designers. Mainly assuming an interior design perspective,

Quartier et al. (2020) claim a need for a multi-dimensional competence model to frame all the required contemporary competencies (in terms of knowledge, abilities, skills, and attitudes) and to cope with future change dynamically. A set of meta-competences and multi-level retail design competencies was framed, bringing together design, research, socio-cultural studies, communication, branding, marketing, omnichannel and management. This multi-dimensional perspective at the core of the design approach is also mirrored in retail design research and learning experiences, thus both developing HEIs curricula capable of increasing digital literacy in knowledge-intensive and creative sectors harmonising new educational methods (e.g. Massive Open Online Courses MOOCs) within project-based design studios (Iannilli et al., 2019a) and merging transdisciplinary, theoretical and operational knowledge in design and experiential-based learning (Iannilli et al., 2019b).

3. The need of a holistic approach to contemporary retail design

Today, retail design can be considered as a specific transdisciplinary design discipline, which concerns the design of virtual or physical spaces for selling products, services and/or brands to consumers (Quartier et al., 2020). In their works Quartier et al., try to update the list of competencies and skills needed in contemporary retail design, with an eye on both educational and professional finalities. The authors (2017) set the new requirements for the retail designer in the age of phygit, asserting that now more than ever designers should assume a holistic approach and that trans-disciplinary work is necessary to manage the complexity of customer experience. They further argue that the approach to the contemporary retail designers' education path should be aimed at: (i) understanding how digital technologies can be applied and how they work; (ii) ability to generate creative ideas; (iii) ability to think across channels starting from the customer journey and technology integration, considering variables and conditional factors.

Architects' and designers' work is typically characterized by the use of tools. Some meet the coordinative functions as objects of persuasive communication while others help to develop a general understanding of an idea or a task and others still may work as recall of design principles, approaches, methods or open questions. Still, some others help to keep control of the activities and materials while others represent the design decisions to a predetermined level of detail and technical precision (Lança & Loução, 2013). The new directions in retail experience design raise questions about which educational and professional tools need to be integrated in designers' educational path. Firstly, the questions address which tools designers use to generate creative ideas, to think across channels and, to integrate technology. Further, it is to understand how these tools have been modified or need to be updated to be respondent to the new requirements. Furthermore is important to understand how to foster trans-disciplinary work; and facilitate the dialogue and the exchange of ideas and concepts between the different, heterogeneous actors during the customer experience design process. This

discourse is a necessary premise to understanding the motivations underlying this work, which describes the experience in the “Fashion Retail Experience Studio” course held within the Design for the Fashion System master degree - Politecnico di Milano. Building on the strong and established relationship between design and experiential learning theories (Iannilli et al., 2022), several tools were involved in the teaching activities aiming at letting the students gain “some intellectual concepts from the very beginning that become part of a practical activity enriching it” (Dewey J., 1961). The course has been structured following design-project phases, namely: “meta design”, the first project phase including a research and analysis step and an early concept definition step; “concept development”, the phase in which the concept starts to be shaped and its meaning defined; “project definition” is when all the details are defined and the final project is clearly described in all its parts.

The tools map (fig. 1) correlates project phases and project tools, moreover, since retail customer experience design is a transdisciplinary activity, and so are the tools used, a label shows from which discipline each tool originates. It is interesting to notice the presence of some overlapping of labels between the disciplines regarding some of the tools, that is where transdisciplinary and holistic-approach work happens. Even if the map cannot still be considered exhaustive, and has improvement margins, it has been a good starting point in the choice-making process for the tools to use in the course as didactic tools.



Figure 1. Retail Design Experience Tools Map.

4. Fashion Retail Experience Studio – In-class experience

The “Fashion Retail Experience Studio” course addressed in this work dates back at spring 2022, at Politecnico di Milano. It involved sixty-eight international students attending Fashion System mater degree, at their first year of study, a team of four retail experience design professors with strong professional backgrounds and Deutsche Telekom, a telecommunications company, providing solutions for business and corporate customers. The

students, divided into teams of five to six people, were asked to design the concept of a phygital retail experience, able to create innovative and valuable relationships among contemporary consumers and fashion products, services and physical/digital spaces.

The students were guided through the whole course, with frontal lessons and individual in-class activities supported by specific tools, aimed at consolidating key concepts and/or having a first-hand experience in applying them. In the design process, as group work, students were guided to the use of specific tools aimed at clarifying and supporting the organization, creation, communication and discussion of concepts and ideas. For the individual work, the tools used were: the “24h inventory” tool and the “empathy map”. The 24h inventory activity aimed at consolidating the ability to analyse consumers’ habits and preferences. The empathy map, from the marketing field, helps to schematize knowledge about end-users in order to create understanding of user needs in decision-making processes. In the group work, through the design process, the students were supported by the following tools: “research boards”, “scenario moodboard”, “fictional characters”, “personas” “customer journey map”, “storyboard”. In the first project phase of research and analysis, students were asked to organize their research using research boards. This tool was specifically adapted to the course requirements, for helping students at categorizing their research findings on technology applications by specific focuses. “Scenario moodboards” were used to visually describe the first project’s concepts and directions. “Fictional characters” and “personas” were used to understand and describe the ideal customer to whom the project is addressed, by describing lifestyle, personal interests, and tastes, in a schematic and visual way. “Customer journey map” belongs to the concept development phase, and aims at the description of all the steps through which the customers go while approaching the purchasing experience, also considering pre- and post-purchase steps, and possible variations. The “storyboard” tool, also referred to the concept development phase, clarifies the details of “customer journey map”, by the use of a narrative example. Following the briefing agreed with the company involved, the course stopped at concept development phase, since students were not asked to build real-size simulations or actual prototypes of their ideas.

5. Conclusions

Retail designers of the present and next generations need to develop a sharp view on the transformations happening and an extensive set of competencies and skills, which will allow them to understand and operate in the increasing complexity of contemporary retail design and customer experience. In this work a teaching experience is presented, where transdisciplinary tools were designed and/or reframed to help develop a holistic view and comprehension while designing complex phygital retail systems. Withdrawing from related literature, the tools adopted refer to the disciplines involved in retail experience design, namely: the “24h inventory” tool belongs to the realm of social studies on consumption, as

an observation tool; “empathy map”, “fictional characters” and “personas” are part of marketing and user experience design disciplines; “research boards”, “scenario moodboard”, and “storyboard” come from the design realm; “customer journey map” is a interdisciplinary tool used in the collaboration between management, marketing, information-technology and design disciplines. The tools involved in the teaching experience described in this work were specifically aimed at developing the ability to generate creative ideas (“research boards”, “scenario moodboard”, and “storyboard”) and ability to think across channels considering variables and conditional factors (“24h inventory”, “empathy map”, “fictional characters”, “personas”, “customer journey map”). The requirement of understanding how digital technologies can be applied and how they work, was covered during the course as well, with the aid of frontal lessons delivered in the class, desktop and case study research conducted by students. With this work, our contribution lies in gaining a better understanding of how the developments of digitalisation and omni-channel retailing influence the education of (future) retail designers, and of how tools borrowed from professionals’ experience and from different disciplines can be integrated in the learning experience, with the aim of applying a holistic approach to retail experience design. Although improvements can still be applied to future versions of the course, specifically in the development of specific tools related to the aims of the didactic activities, the learning outcomes were satisfying, and the students’ engagement was high.

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Analysis of the feasibility of investment projects in real assets with PBL: a very real experience

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Abstract

This paper studies the application of the PBL methodology in the Corporate Finance I course. The project to be carried out consists of the realization of a report on the feasibility of an investment project for a company that wants to take advantage of a subvention to finance the renovation of the bus fleet towards a more sustainable one. In addition to describing the implementation, this paper analyzes the impact that the introduction of the PBL methodology has in terms of class attendance and participation in the activity and also in the rest of the course. A clear decrease in absenteeism in class and in exams is observed. Moreover, the impact on grades is analyzed, with a significant increase in marks for all the degrees under study. Finally, we interpret the surveys that were passed to the students, showing that the students recognize the value of applying PBL in the subject.

Keywords: *PBL; corporate finance; involvement; qualification; assessment.*

1. Introduction

Project Based Learning (PBL) is an active teaching methodology in which the student learns the concepts of a course by carrying out a project. According to Blank (1997) and Harwell, (1997), the project must be linked to a real-world issue whose purpose is to help the student to learn through cooperative work in search of solutions or answers.

The PBL methodology relies on the active role of the student in the learning process, and the starting point is the realization of a project that they want to carry out (Christie and de Graft, 2017). Students work in groups to identify what they need to learn to solve the project. The teacher's role is to advise, mediate, and collaborate with students. According to Hmelo-Silver (2004), "the objectives of PBL include helping students to develop flexible knowledge, practical problem-solving, learning and collaboration skills, and intrinsic motivation". This way, PBL prepares students more effectively for the future.

Among the advantages of this methodology is the increased motivation and involvement of the students. Thus, Robinson (2013) and Salam et al. (2016), among others, find that the project-based learning approach results in a student-centered environment with higher engagement and motivation. As suggested by Thijs and Verkuyten (2009), the more engaged students are, the more successful they will be in their learning since the lack of motivation and commitment can be barriers to learning if the importance of the work is not clear to the student. A consequence of this higher involvement is the improvement of student scores, as can be seen in Requies et al. (2018) and Abinzano et al. (2022), among others.

This methodology emerged at McMaster University (Hamilton, Canada) in the 1960s to tackle the demotivation of Medicine students. As Servant-Miklosa (2019) points out, that experience eventually became known as 'project-based learning' (PBL) and has since spread throughout the world and not only to medicine but also to a number of fields of education.

Finance is one of the disciplines in which the PBL methodology has been applied. Thus, Young and Legister (2018) apply PBL in the undergraduate subject of International Finance, while Parrado-Martínez and Sánchez-Andújar (2020) apply this methodology to the subject "Finance" of an MBA.

In this paper, we present the application of the PBL methodology in the subject Corporate Finance I of the degree in Business Administration and Management (BA&M) and the double degree in Business Administration and Law (BA&L) of the Public University of Navarre (UPNA). Moreover, we analyze the change in the participation and results of the course with respect to the previous year, in which the traditional methodology with lectures and partial exams was applied, as well as the evaluation of the new methodology. This implementation is part of a project of educational innovation in the Financial Economics area, supported by

the Public University of Navarre, which consisted of the introduction of active methodologies in the four subjects of the field “Basic Finance”.

2. Applying PBL in Corporate Finance I

2.1. Context

Corporate Finance I is one of the four subjects of the Basic Finance field, all of them compulsory, which start in the first year of the Degree in BA&M with Financial Operations. Then, the study of Basic Finance continues in the second year with Financial Markets and Instruments, and ends in the third year with Corporate Finance I in the first semester and Corporate Finance II in the second semester.

The aforementioned Educational Innovation Project started in the academic year 2021/2022 with the implementation of the PBL methodology in Financial Markets and Instruments. Following the success of this implementation and the assessment of its strengths and weaknesses (see Abinzano et al., 2022), it was decided to implement the PBL methodology in Corporate Finance I.

Corporate Finance I is a course in the first semester of the third year of the degree in Business Administration and Management, in three groups, and in the first semester of the fourth year of the double degree in Business Administration and Management and Law, with a single group. This course studies investment in financial assets (Unit 1) and real assets (Unit 2), specifically the evaluation of investment projects. Given the suitability of the PBL methodology, it was decided to implement it in the part dedicated to investment in real assets.

As for the contents taught in the subject prior to the implementation of PBL, Table 1 details the units included in the PBL.

Table 1: Contents of Corporate Finance until academic year 21/22.

UNIT 1: INVESTMENT IN FINANCIAL ASSETS. THE VALUATION OF RISK
1. PORTFOLIO THEORY
2. THE FINANCIAL ASSET PRICING MODEL (CAPM)

UNIT 2: INVESTMENT IN REAL ASSETS
3. INVESTMENT DECISIONS IN A CERTAINTY ENVIRONMENT (I): STAND-ALONE INVESTMENT
4. INVESTMENT DECISIONS IN A CERTAINTY ENVIRONMENT (II): INVESTMENT MANAGEMENT
5. INVESTMENT DECISIONS IN A RISK ENVIRONMENT

Both Unit 1 and Unit 2 were taught until 2021/2022 year with lectures, computer practices, partial tests, and a final exam. The former evaluation can be found in Table 2.

Table 2: Former assessment system.

Assessment system	Weight	Character
Final written exam covering the knowledge acquired.	60%	Recoverable
	Minimum mark: 5/10	
Individual theoretical-practical test of Unit 1	15%	Non-recov.
Individual theoretical-practical test of Unit 2	15%	Non-recov.
Group practices in the computer room	10%	Non-recov.

2.2. The project

In order to better engage students in PBL, it was decided to start the course with the real asset investment part, i.e., to invert the order of Units 1 and 2. The content of the former Unit 2 was mostly taught with the PBL methodology, with the exception of some issues, which were taught using the traditional methodology after finishing the project.

Following the steps necessary to build a project that ensures correct learning, suggested by Blank (1997), Harwell (1997), and Dickinson et al. (1998), among others, the project was defined as follows. The project consists of the preparation of a financial feasibility study report for the acquisition of a low-carbon bus by the Navarre company Sociedad de Automóviles Río Alhama S.A. (ARASA) in order to take advantage of the aid of the Government of Navarre within the Spanish aids published in the BOE on November 16, 2021, for the transformation of the passenger transport fleet. The product to be submitted is the report that our consultancy would deliver to the company. This report is composed of a pdf document (6 pages and annexes) and an Excel file with all the calculations and analysis.

The students must carry out the project through the completion of three versions, 0, 1 and 2. For this purpose, the work is established in seven weeks, organized as shown in Table 3.

Table 3: Organización by weeks of the PBL.

Week	Resultado de aprendizaje
1	Presentation, group formation, puzzle, distribution of topics, individual study.
2	Work in groups of specialists. Exercise resolution, individual study.
3	Work in groups of specialists. Exercise resolution, self-assessment.
4	Clarification of doubts. Beginning of Version 0.
5	Presentation and delivery of Version 0. Individual extensions and distribution. Incorporation of the extensions to Version 0.
6	Presentation and delivery of Version 1
7	Presentation and delivery of Version 2. Final individual exercise + basic knowledge test.

The students were organized into groups of three and each member was a specialist in one of the pieces of the puzzle shown in Table 4. Through the virtual platform, the material for each of these pieces was provided, consisting of notes, some basic exercises, and some more in-

depth exercises. In addition, the competing groups had to carry out a more extensive case similar to the project evaluation.

Table 4: Distribution of contents through the puzzle.

Puzzle piece	Contents
A	Initial investment and cost of capital
B	Cash-flow calculation
C	Decision criteria

The assessment of the full course is shown in Table 5.

Table 5: Current assessment of the subject Corporate Finance I.

	Weight	Method of Assessment	Character
		On-time delivery (20% PBL)	Non-recoverable
		Version 1 of the project (15% PBL)	Non-recoverable
Unit1 (PBL)	50%	Version 2 of the project (30% PBL)	Non-recoverable
		Individual exercise (15% PBL)	Non-recoverable
		Test of basic knowledge (20% PBL)	Recoverable
Unit 2	50%	Exam	Recoverable

As for the evaluation of the versions of the project, the students have the rubric of the versions at their disposal from the beginning of the course, so that they can take into account the contents under evaluation and, if necessary, the punctuation.

3. Results

3.1. Students' involvement

In line with the results obtained by Robinson (2013) for laboratory Science students, and by Salam et al. (2016) for ICT students, we obtain that student involvement improves considerably with the introduction of PBL in the course. On the one hand, class attendance in the four groups analyzed was practically 100% during the time in which the project that addresses Unit 1 is being developed, with a drop of approximately 30% when switching to the traditional methodology in Unit 2. On the other hand, participation in exams was higher compared to participation in the evaluation in the previous course. In Table 6 we appreciate that for the BA&M groups, the participation in the unit studied with PBL is higher in the course where the PBL methodology is applied, and also the participation in the whole course.

In addition, we notice that the increase in participation is higher for the part seen with PBL than for the whole course. In the case of the double degree in BA&L, there are no differences, since participation was total before applying this methodology, which is in line with the results obtained for these two groups in Abinzano and Gonzalez (2015).

Table 6: Students' non-attendance before and after PBL.

Group	2021/2022			2022/2023		
	Students	Non-attendance		Students	Non-attendance	
		Former Unit 1	Whole		PBL	Whole
BA&M	155	14.19%	1.94%	170	1.76%	1.18%
BA&L	29	0.00%	0.00%	21	0.00%	0.00%
All the groups	184	11.96%	1.63%	191	1.57%	1.05%

3.2. Qualifications

In terms of scores, Table 7 also shows a considerable improvement with the implementation of the PBL.

Table 7: Mean and standard deviation of marks before and after PBL.

Group	2021/2022				2022/2023			
	Unit 1 (former Unit 2)		Whole subject		Unit 1 with PBL		Whole Subject	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
BA&M	4.8305	1.9024	5.1171	1.8860	7.3050	1.2880	6.2385	1.3890
BA&L	7.3401	1.7051	7.2688	1.4916	8.9350	0.3770	8.6108	1.2011
All the groups	5.2797	2.1018	5.5303	2.0049	7.4870	1.3241	6.5694	1.5353

While the mean for the overall group of Unit 1 (former Unit 2) was 5.2797 before implementing the PBL, with the implementation it rises to 7.4870, this difference being significant at 1%. In addition, the standard deviation has also been reduced. As for the overall results of the course, the mean has also increased by more than one point out of 10, and with lower dispersion. Individually, we can see that although the involvement has not changed for the students of the double degree (see Table 6), their achievement, measured by their marks, has changed, which implies a better use of active methodologies by the students. These results are consistent with the ones obtained by Requies et al. (2018) and Abinzano et al. (2022).

3.3. Students' survey

After finishing Unit 1, we passed to the students a survey with different questions, in order to know their opinion and thus to detect possible problems to be fixed. Table 8 shows the aggregate responses to some of the questions.

Table 8: Results from the survey of all the groups.

	Not at all	A little	Quite a lot	To a large extent
To what extent do you think PBL outperforms traditional teaching as a learning method?	5.93%	24.58%	46.61%	22.88%
To what extent do you think that PBL has helped you learn about the evaluation of investment projects?	0.85%	22.03%	49.15%	27.97%
To what extent do you think that PBL has allowed you to get in touch with the financial reality of companies?	3.39%	20.34%	55.93%	20.34%
	Yes	No		
Would you recommend the PBL methodology in university studies?	80.51%	19.49%		

We observe that students recognize the additional contribution of PBL, and most of them would recommend the methodology.

3.4. Feasibility of the idea

We must emphasize that the idea of the project was very well received by the students, as it was something identifiable as real. In fact, a few days after the end of the PBL activity, a story appeared in the press about the launch of new electric bus lines from the company analyzed. In addition, the characteristics of the investment to be made by the company were easy to understand for the students, as it is a sector they know closely as the users they are.

4. Conclusions

In this paper, we describe the application of the PBL methodology to the part of investment projects of the Corporate Finance I course. In addition, we analyze the impact of this implementation in terms of class attendance, and participation in exams, resulting in a reduction in the number of absences. Moreover, we analyze the effect on marks, observing a significant increase in scores for all the degrees studied, not only at the PBL level, but also with effects on the entire course. Finally, we interpret the surveys and find the contribution of PBL valuable and that students would recommend this methodology for other courses.

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A framework for developing mathematical tasks for automatic formative assessment in higher education

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Abstract

Mathematics education in STEM studies poses a challenge that students must practice the methods they learn to use them accurately. The mapping of teaching exercises is an important step towards creating a more engaging, interactive learning experience for students. An automatic assessment system can support such a process and help overcome obstacles towards a better learning environment for students. Developing effective support in form of high-level mathematical tasks for this type of assessment is challenging and requires careful consideration of the goals, objectives, and content of the task. With this paper, we aim to provide practical insights and references for teachers looking to develop various mathematical tasks that can provide meaningful feedback and support learning, while taking into account the limitations of automatic assessment in higher education. Additionally, this paper addresses the possibilities and challenges that arise in this educational process and provides examples of different applications.

Keywords: *Automatic assessment; e-learning methodology; innovative teaching; algorithmic randomization; STEM education.*

1. Introduction

The integration of technology into education has brought numerous benefits to the teaching and learning process. Computer-Assisted Instruction (CAI) has been shown to have a positive impact on student achievement and attitude in general as well as in higher education, but its effect size has been limited, see Kulik and Kulik (1991), Schmid et al. (2014). The effects' average size for achievement as reported by these meta-analyses ranges between 0.26 and 0.27 and therefore remains medium-low throughout the decades. Kulik and Kulik (1991) identify the developments of CAI at higher education levels to be less successful than those in elementary and secondary schools, whereas Schmid et al. (2014) identified subject matter as the most influential predictor of effectiveness and noted that the effects of technology-use were higher in non-STEM subjects.

In order to address these findings and reinforce the potential of technology-enhanced learning environments, it is important to understand the benefits and limitations of various instructional tools and assessment methods.

One such method that has gained popularity in recent years is Automatic Formative Assessment (AFA), which has the potential to support higher student achievement. Automatic assessment can be used to provide individual real-time feedback to students, allowing for an immediate response and helping to create a more engaging and interactive learning experience, addressing the conclusion of Schmid et al. (2014) that “learning is best supported when the student is engaged in active, meaningful exercises via technological tools that provide cognitive support” (p. 285).

Schmid et al. (2014) define cognitive support as “the category which encompasses various technologies that enable, facilitate, and support learning by providing cognitive tools” (p. 274). The development of effective cognitive support in form of high-level mathematical tasks for AFA is challenging and requires careful consideration of the goals, objectives, and content of the task. For example, an automatic assessment system which does not provide automatic grading beyond algebraic expressions constrains the type of tasks that can be developed. In order to maintain the benefits of AFA while still allowing for a wide selection of tasks, the teacher must, as Fisher (2006) warned, assume the role of an agent of change.

To support this role, this paper explores the development of mathematical tasks for AFA in higher education and presents a framework for its adaptation and optimization. Through this framework, we aim to provide practical insights and references for lecturers looking to develop various high-level applied mathematical tasks. By emphasizing the goal of achieving comparable difficulty for exam tasks and maximizing the randomization potential for exercise tasks, this framework helps to create meaningful feedback for students and supports their learning process, while taking into account the limitations of automatic assessment.

2. Exploring the Potential of Automatic Assessment Systems to Enhance Math Learning

According to the literature, an effective way to study mathematics at the university level is through active learning, i.e., independent solving of mathematical problems and hands-on contact with mathematical methods, see Rosenthal (1995). The challenge for teachers is to create a learning environment that enables students to solve these problems on their own and is suitable to guide and support them throughout the semester to achieve the goals of the course.

Automatic Assessment Systems (AAS) describe computer-aided applications that provide information on mathematical tasks and automatically evaluate student responses. AAS offer a conveniently accessible platform through which students can receive learning materials as well as grading and feedback services (Ihantola, Ahoniemi, Karavirta, & Seppälä, 2010).

As discussed by Barana, Marchisio, and Sacchet (2021), high-quality interactive feedback has a particularly positive effect on students, helping to improve their performance and support them in class preparation. Teachers are supported in the creation of learning materials by AAS, as these programs provide tools for the randomization of tasks, thus continuously offering new learning materials to students, as noted in the findings of Ihantola et al. (2010).

In the following subsections, we will present approaches that support the process of task development for AAS, specifically, Möbius (formerly known as Maple T.A.).

2.1. Enhancing Mathematical Tasks through Randomization

Randomization is a powerful tool that can be used to create a wide variety of mathematical objects, such as numbers, vectors, and matrices.

In Möbius, the generation of randomized variables is accomplished through the use of Maple commands. These commands offer the possibility to assign certain properties to the variables, such as restricting a parameter to be in a certain range or specifying the shape of the matrix. For example, `rand(1..10)` restricts a random number to be within the range of 1 to 10. Similarly, `LinearAlgebra[RandomMatrix](3,3, generator=-3..3, shape=diagonal)` generates a 3x3 matrix with random integer entries on its diagonal, ranging from -3 to 3. Using such Maple commands, available in libraries for Möbius, improves the precision of developed examples, allowing for more specific yet versatile tasks.

Furthermore, the possibility of drawing from a pool of predefined variables enables the randomization of text by assigning single words up to entire sentences to these variables. Consequently, the same assignment provides different tasks for the students at different attempts; for instance, specifying on continuity of rational functions or on the differentiability of logarithmic functions.

It is important to note that while the randomization approach introduces variability, it does not necessarily guarantee the comparability or solvability of the tasks. This topic will be explored in more detail in Section 3.

2.2. Enhancing Grading of Mathematical Expressions

Another essential component of any AAS is grading student responses. In Möbius, the computer algebra system Maple is utilized to efficiently and reliably grade equivalent algebraic expressions. Nonetheless, grading any other types of mathematical expressions, such as trigonometric equations, intervals, and general solution of linear systems, is an area of difficulty. To overcome this and enhance the grading functionalities, custom grading codes are developed.

A sustainable solution to manage and grade these more complex mathematical expressions conveniently would be to compile the custom grading codes in form of a library. Handily, Möbius supports the integration of Maple libraries through the repository in their so-called Maple-graded question types, allowing for more effective integration of the self-developed Maple procedures. When writing procedures, incorporating functionalities such as grading with partial credit can provide more finely-tuned feedback on the task level. This kind of grading system offers a more precise way to score a question than default scoring methods, allowing for a more nuanced understanding of a student's knowledge and skill. As an example, Figure 1 shows a problem of an under-determined system of linear equations, where the student is tasked with determining the general solution.

Let $A \cdot \mathbf{x} = \mathbf{b}$ be a linear system of equations with $\mathbf{x} \in \mathbb{R}^3$ given by

$$A \cdot \mathbf{x} = \begin{pmatrix} 2 & -2 & 1 & 3 \\ 4 & -4 & 8 & 6 \\ 2 & -2 & 1 & 3 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{pmatrix} = \begin{pmatrix} 1 \\ 8 \\ 1 \end{pmatrix}.$$

Determine the general solution \mathbf{x} of the

$\mathbf{x} =$ 

Partially Correct

Your Answer: $s*[1,1,0,0] + t*[-3,0,0,2]$

Correct Answer: $\begin{pmatrix} s_2 \\ s_2 \\ 0 \\ 0 \end{pmatrix} + \begin{pmatrix} -\frac{3}{2} s_4 \\ 0 \\ 0 \\ s_4 \end{pmatrix} + \begin{pmatrix} 0 \\ 0 \\ 1 \\ 0 \end{pmatrix}$

Figure 1. Example of Möbius question with an illustrated partial-credit evaluation in the response area of the answer field.

In this case, the provided answer is incomplete since a particular solution is missing. Typically, this would result in the response being marked incorrect; however, instead of a full deduction, partial credit is awarded.

The library allows for a more efficient and consistent approach to grading, as the same grading code can easily be reused. It can also serve as a basis for a custom grading system incorporating further functionalities and design choices, which can go as far as optimizing the library for custom syntax. In turn, this allows teachers to focus on other quality aspects of their tasks.

Furthermore, the library concept can be extended to randomization as well. Zimmermann et al. (2010) provide a concrete example of library implementation to improve the grading and randomization aspect of AAS. This publication was the starting point of the development of customized grading and randomization libraries for the AAS Möbius at TU Wien. These libraries enabled greater flexibility in designing mathematical tasks and opened new possibilities for their creation, further emphasizing the importance of custom grading and randomization as enhancement methods in designing mathematical tasks.

3. Task Differentiation Based on Use Case Scenario

AAS can be used to provide teaching material for students, as well as for examinations. These different use case scenarios require specific adaptations and considerations in the implementation of the tasks. We propose a differentiation of tasks based on their respective use cases and discuss them in the following subsections.

3.1. Exercise Tasks or Encouraging Learning and Proficiency through Practice

By using randomization with a wide range of possible parameters, lecturers can provide a large variety of examples for students to study and practice the required skills and abilities. The difficulty of a task might vary due to the parameters, which is desirable in practice scenarios as students learn to master the same skill on different levels of complexity.

According to Barana et al. (2021), “interactive feedback can be effective for the development of Mathematical knowledge ... ” (p. 17) and is more elaborate than simple right or wrong feedback. It should consist of an instructive feedback guide to engage students to solve mathematical problems after failed attempts, see Marchisio et al. (2020). With this in mind and in line with Leikin's (2014) definition of the mathematical challenge as a mathematical difficulty that a person is motivated to overcome, we further endorse the use of so-called adaptive questions.

Möbius offers a predefined adaptive question type that incorporates randomization capabilities and an automated grading system, similar to standard questions. However, it also

guides students to the correct path for solving the given problem after a predefined maximum number of unsuccessful attempts. After an initial failure, the difficulty of the problem is reduced and dissected into smaller and simpler sub-problems and the students' answers in this adaptive section are graded. Depending on the correctness of the answer, more hints or instructions are given. The next problem definition to achieve the correct solution is displayed accordingly. Therefore, an adapted path to the solution of the mathematical problem is provided.

Although the proposed steps are one of usually many possible solution paths and the level of individualization and allowed creativity is limited, adaptive assignments offer students valuable first-level support when tackling tasks. Another valuable feature of adaptive assignments is that individual intermediate steps change in accordance with the initial problem, therefore every student receives a personalized guide at every attempt.

3.2. Exam Tasks or Ensuring Fairness and Consistency in Assessment

Using AAS during examinations provides the possibility to conduct exams in locations other than lecture halls. Before the global COVID-19 pandemic, this feature may not have seemed necessary; however, it is now indispensable. Stowell and Bennett (2010) report that students' anxiety can be reduced when having the opportunity of taking online exams compared to exams in classrooms or lecture halls. Additionally, AAS tests can be used to provide feedback to students away from regular exams, for example in preparation for a midterm or final test that counts towards the final grade.

Providing mathematical assignments via AAS during exams prevents students from copying solutions from neighboring students during in-person exams as well as exchanging solutions via messaging services such as WhatsApp during online exams due to randomized and thus, individualized exercises. Therefore, e-learning examinations enhance the credibility of exam results, since they address security concerns such as identifying students with their work and threats of cheating, see Karim and Shukur (2016).

However, the high variability of possible values and texts in questions poses difficulties for teachers since unwanted problematic realizations of the randomization cannot be easily prevented when using standardized randomizing Maple functionalities. Especially in exam situations, undefined values which cause the overall task to become unsolvable need to be prevented. An exemplary problematic realization would be the difference of two parameters in the denominator of a term leading to division by zero if equality is not manually excluded.

Above all, the comparability of the tasks also must remain given for reasons of fairness.

Teachers can use the same task repeatedly in exam situations since the randomization guarantees different values for each attempt. By drawing from a pool of predefined variables, cheating can still be minimized, and tasks can be reused in future exams without greatly

increasing the effort required to create them. For instance, consider a task in which a student is asked to compute eigenvalues and eigenvectors of a given matrix. In this case, the *switch* command can be used to randomly select from a predefined set of matrices that impose an equivalent level of difficulty to the task's given context.

Furthermore, Sangwin (2013) suggests using reverse engineering as an advanced approach to address the challenge of comparable task difficulty in exam situations, while also allowing for greater task versatility.

4. Discussion

With the proposed framework, we are addressing the comparatively low effectiveness of technology use in STEM subjects. In doing so, we focus on advancing the process of development of various tasks relevant to applied mathematics in higher education. We also emphasize the need to differentiate and adapt tasks according to their specific use cases. Automatic assessment of tasks which are more relevant to pure mathematics, e.g. proof examples, require different approaches and are out of the scope of this framework.

Nonetheless, AAS pose a suitable tool for lecturers to provide learning material for students. Conveniently, AAS, such as Möbius, can be integrated, e.g., into Moodle courses easily because of their Learning Tools Inoperability (LTI). Feedback from students in the various courses showed that the pool of examples as learning material was particularly praised. Before incorporating course material for AAS, teachers need to take into careful consideration the responsibility, time and effort involved. Contrary to static questions on paper, computer-algorithmic questions with incorporated randomization are more susceptible to errors as malfunctions can occur on several parts of the questions. Apart from undefined solutions originating from randomized variables, errors concerning grading algorithms or the display of variables in the text of the questions need to be addressed. One solution, we presented in this contribution, is to create custom libraries with advanced grading and randomization algorithms, as they can be reused conveniently. As a result, the possibilities of task design have advanced leading to higher engagement rates of students.

The benefits and challenges of AAS in conjunction with examinations were also discussed. In this context, the issue of available resources needs to be addressed, as students must access the exam using a computer. To prevent discrimination against certain social groups, the infrastructure and technical equipment of the university or educational building must be reviewed beforehand by lecturers to ensure access to all students. Furthermore, universities need to review their facilities providing such infrastructure.

Over the past few years, the development of randomization and grading libraries has been advanced and the related approach of designing examples has been improved and optimized

to address specialized tasks in the areas of analysis and linear algebra. A future goal is to analyze assignments and exams in one course simultaneously, providing detailed statistical correlation between them. With this statistical analysis, we plan to identify questions with a high potential for incorrect answers and adapt the framework to better meet the needs of students.

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Insights from a transgender student in the EFL classroom: from individual perspective to institutional change

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Abstract

Among other minority groups, the trans community is systematically repressed by a hegemonic heteronormativity. In the English as a Foreign Language (EFL) teaching area, the perspective of this collective is equally absent. This study aims at gaining insight from a transgender student on his impact and perception within the EFL classroom to make secondary-school EFL contexts more inclusive regarding transgender. An exploratory case study constituted the basis of this article via an open interview with a transgender student. By exposing him to input stereotyping gender and marginalizing the trans community, their perception of the danger of the LGBTQIA+ community beyond the classroom was elicited. Different measures were discussed as potential improvements whose implementation could ensure safer environments and a more inclusive teaching experience. Further research could obtain insight beyond the trans community to assess the awareness and compromise towards the collective from individuals who are not part of it.

Keywords: *EFL textbooks, transgender, inclusive education, heteronormativity, positioning theory.*

1. Introduction

Striving for survival has been a primary urge within the human species leading to numerous conflicts throughout history. In dominating one community over another, not only does life prevail, but also other aspects entailing the foundations upon which societies are constructed: language, culture, and ideology, to name a few (van Dijke & Poppe, 2006). If today there is an aggressive spirit of making the trans community visible, it may have been summoned by the apparently complete triumph of its antithesis. This collective has been protractedly repressed by a hegemonic cisheteronormativity; nonetheless, recent accounts are evidencing a readjustment in most ideologies across cultures, aiming at increasing the visibility of the lesbian, gay, bisexual, trans, queer, intersexual, and asexual (LGBTQIA+) collective (Currier, 2012; see also Chen et al., 2023). The limitedness of representing this community in the field of English as a Foreign Language (EFL) leads to the purpose of this study. Together with a literature review and proposal of improvements that can be made in the EFL teaching area, a case study approach has been followed through an online open interview conducted with a member of a trans community itself so as to elicit areas of improvement within the EFL learning field.

2. Theoretical background

2.1. Power dynamics and investment

Catering for the needs of queer learners and asking questions about how classroom materials should be tailored to their profiles are issues that the field does not accustom itself to address (Kappra & Vandrick, 2006). Along with these concerns interweave the notions of power dynamics and learner investment. If identities are perceived as sites of struggle based on relations of imposing or submitting forces, and they are inscribed in discourse practices within a particular domain, it is because of this inseparable connection that texts are reflective of underlying systems of beliefs of varying typologies (Fairclough, 1995).

The tripartite model of investment is orchestrated through the interrelation of the following elements: identity, capital, and ideology. Following the emergence of the field of applied linguistics, the notion of identity has been discussed following a poststructuralist approach. Under this theory, identity is envisioned as “the attempt to differentiate and integrate a sense of self along different social and personal dimensions such as gender, age, race, occupation, gangs, socio-economic status, ethnicity, class, nation-states, or regional territory” (Bamberg, 2012, p. 1) and characterized by being “fluid, multiple, diverse, dynamic, varied, shifting, subject to change and contradictory” (Kouhpaenejad & Gholaminejad, 2014, p. 200). To claim a particular identity involves facing three dilemmas, mainly the “sameness of a sense of self over time in the face of constant change,” the “uniqueness of the individual vis-à-vis

others faced with being the same as everyone else,” and “the construction of agency as constituted by the self and the world,” posits Bamberg (2012, p. 1).

2.2. Positioning theory

From the interrelation between identity and ideology, the positioning theory is developed. This theory was approached by Davies and Harré (1990), who understood it as “the discursive process whereby selves are located in conversations as observably and subjectively coherent participants in jointly produced storylines” (p. 48). When a speaker positions themselves and other partakers in a given interaction, the following dimensions are taken into account: the words chosen by the speaker are inevitably synecdochic to the way the participant perceives the world; participants may not be aware of these assumptions nor the power of what they invoke particular ways of being, therefore downplaying the importance of what is said; the variation from speaker to speaker when interpreting these positionings depending on a wide range of factors; the positions created are the cumulative fragments of a lived autobiography rather than a linear non-contradictory one; and the positions may be perceived as “roles” or shifts in power, access, or blocking of access to features related to identity (p. 49).

2.3. EFL materials and ideology

So far, research has shown that students are fully capable to engage in LGBTQ+-related issues and content as these are inscribed in their daily lives, either by identifying as members of that community, having LGBTQ+ acquaintances, or through encounters in popular media (Day et al., 2019). As revealed by Moore in some of his studies (2013, 2016), among other issues, this was illustrated in how desirable it was for Japanese men to be able to perform a gay identity and find a welcoming community to acquire English in a motivating way. Furthermore, he also highlighted the dangers that could originate if critical reflection is not promoted by recognizing the conflicted nature of LGBTQ+ individuals within the classroom. Developing literacy in a language learning environment is as paramount as acquiring any other skill. However, when presenting students with different resources, teachers tend to dismiss LGBTQIA+-related topics within their methodologies (Pawelczyk, 2022). On this issue, Paiz (2015) suggested that it can lead to a “perpetuation of a heteronormative discourse in the classroom, which can be seen as detrimental to the learners and instructors in the class” (p. 78).

As seen in this literature review, although attempts have been made to widen the visibility of the LGBTQIA+ spectrum in the (E)FL teaching field, the vindication has not reached its objectives. Since the cisheteronormative system is not likely to be redesigned more inclusively, improvements can be made from other areas. For this study, the ideas aforementioned are adapted to a case study conducted with a transgender male student, who will reflect upon his own perception of the EFL context, the way his environment positions

him, and the improvements that can be made to ensure a more inclusive educational experience.

3. Method

The previous literature review leads to the purpose of this study, which is twofold: first, to gain insight from a transgender student on the impact and perception he has in the EFL classroom; second, to suggest ways in which secondary-school EFL contexts can become more inclusive regarding transgender issues. These objectives result from an area that has not been addressed in the literature review, viz. the opportunity to shed light on the topic of trans-visibility from the community itself with the expectation of knowing more realistically what the situation is, and what can be done to improve it. The Research Questions (RQs) which will be commented on in the Results and discussion section are the following:

- RQ1: How does a transgender language learner perceive trans-visibility and inclusion in the EFL classroom?
- RQ2: What steps can be taken to widen trans-visibility and inclusion on an institutional scope beyond the EFL subject?

3.1. Participant

One participant was selected for the procedure of this study, whose identity will remain anonymous by referring to them with the pseudonym of X. He identifies as a male transgender who is currently undertaking a Bachelor of Arts in a public university and combines their studies with extra English lessons at an official school of languages. The selection process was followed without the application of any inclusion or exclusion criteria.

3.2. Research instrument

For this study, an open interview was designed as the research instrument, which was divided into three main sections. These sections consisted in obtaining information about the student's vision of trans-related issues, exposing him to input regarding views on transgender issues in the EFL classroom, and proposing different measures to take action and make a difference to gain visibility of the LGBTQIA+ community at an institutional level.

3.3. Data collection and procedure

In order to meet this paper's objectives, Yin's approach to case studies (1984) was followed to opt for an exploratory case study. This type of analysis constituted the basis to design the interview which was carried out via online means (i.e. Google Meet). The interview was recorded so that active listenership would not become an issue in the process of asking questions to the student and to avoid excessive reliance on field notes. It must be noted that

the interview has been translated from Spanish into English and labeled with an “Excerpt” subheading with the corresponding numbering. If needed, some comments have been added and signaled through italic typography and in square brackets. One intervention in particular was implemented which consisted in searching for examples of how dominant ideologies were imprinted in EFL textbooks so that the interviewee felt comfortable enough to share his thoughts on it.

4. Results and discussion

4.1. *Transgender language student’s perception of trans-visibility and inclusion in the EFL classroom*

The first section of the interview was centered around obtaining data about Steven’s perception of himself and his environment. The results related to RQ1 (How does a transgender language learner perceive trans-visibility and inclusion in the EFL classroom?) indicate that he exerts a neutral attitude about how his condition is portrayed and included in the EFL classroom, in the sense that his environment, the instructor, and the written materials do not seem to impede his performance as a foreign language student.

Excerpt 1:

No, the truth is that since I got enrolled in this course, I have been feeling quite comfortable with my group mates and I have not found it difficult to socialize with everyone else.

The next step in the study consisted in reviewing EFL materials to comment on how gender diversity is represented in the Foreign Language Learning (FLL) classroom. From the beginning, the interviewee realized he had not reflected upon this issue, as he considered that he had other interests when he was taking part in the FL classroom.

Excerpt 5:

Every student after all has their interests when learning a language, and I have to admit that I have completely left out this crucial part [*referring to the inscription of ideologies into the materials made available for students*], not only for me, you know, but also for the younger generations.

As seen in the literature review, the role of the instructor in the classroom context is as paramount as the materials used as a means for the presentation of the TL community to the students. In X’s words, deciding on the types of materials is a responsibility that ought to be assumed by the instructors themselves, but making this seemingly objective and ideology-free decision can become challenging when the teacher is already a product of that ideology, therefore biasing the selection process:

Excerpt 7:

Whom do these decisions rely on? The English department? Then it should be them who ought to decide what materials are most fitting to meet the requirements of the class and which ones to discard [...] Although that could be troublesome because sometimes you do not really know if these textbooks are coming across as sexist, homophobic, transphobic and stuff, or let me rephrase that, sometimes you do not know if they are hiding a discriminatory ideology underneath.

The previous excerpt confirms X's acknowledgment of the role of other points of view to make the EFL classroom more inclusive. He also seems to be aware of the fact that curricula are not impartial in the ideologies they manifest, which can become a challenge when deciding on the type of materials that are presented to students.

4.2 Potential measures to widen LGBTQIA+ perspective and inclusion at the institutional level

After covering the previous items, the last section of the interview was devoted to proposing a series of actions that could be taken to increase the visibility of the LGBTQIA+ community at a more institutional level (*RQ2: What steps can be taken to widen trans-visibility and inclusion on an institutional scope beyond the EFL subject?*). In order to approach this last section of the interview, X shared the following comment about classroom materials:

Excerpt 9:

What I sincerely believe should be done is a systematic review of the English subject materials to see which areas are deficient -such as the exclusionary discourse rooted in the materials themselves- and therefore need to be reviewed, and from there start working to improve not the form of the materials, but the content.

The interviewee assured that not only should the scope of the topical areas of the units be broadened in EFL textbooks, but it should be extended to other relevant issues. What seems to be implied in Excerpt 9 is that curricular materials tend to explore different identities for language learners, but there may be a reinforcement of a particular discourse, (*viz.* heteronormativity).

Even though X does not currently feel threatened or unsafe in their classroom environment, he is aware that this may not be the case for every trans individual, hence the following action. To ensure a safe environment, as this privilege is not always granted to minority groups, institutions should become part of the inclusivity process by raising the corresponding awareness through different campaigns, like making LGBTQIA+-related workshops, organizing seminars, and promoting more tolerant attitudes towards those who are discriminated against daily. Referring to the literature review, these implementations may

not take place unless there is an active intention from the perspective of the instructors to redirect those materials whose perspectives might reify a particular ideology.

Following the previous idea, gender diversity was another aspect highlighted by X which was suggested to be promoted among students to keep on widening the scope and reach those non-conforming positions which oppose the traditional binary division of gender:

Excerpt 11:

Another thing I would consider when implementing all these things in the classroom materials is the gender spectrum. Ever since they [referring to the students] learn how to walk, they just do not care about gender roles, which is something they learn over the years as society includes them. So, although there might be a heteronormative discourse overruling and suppressing everything else, these materials should bring these topics up so that students may engage in interactive debates to make something useful out of those English lessons that often ignore these issues.

Once more, X mentions the issue of inclusivity concerning gender diversity and how the cisheteronormative ideology persists in today's society. Excerpt 11 reveals his awareness of how heterosexuality is presented as the only accepted sexual identity, confirming the previous findings of the literature review (Paiz, 2015), but despite the presumed dominance of this sexuality, he favors the position of including gender-related topics in the classroom and designing activities that allow for students to discuss openly on these topics. The aforementioned measures would go in line with the literature review's evidence that catering for the needs of queer learners and adapting classroom materials to their profiles is a question that is not frequently addressed in the teaching field (Kappa & Vandrick, 2006).

5. Conclusion

The purpose of this paper was to explain the circumstances of a transgender student in terms of his impact and perception of the EFL classroom as well as suggest ways through which inclusivity regarding transgender issues could be widened. Through an open interview, more information has been drawn from a member of the trans community itself, which can pave the way for a chain of changes toward realistic inclusivity. The implications of this study are centered on the pedagogical domain, specifically written materials, and the role of the instructors. Potential areas of improvement include those with dated underlying ideologies which can potentially become harmful for minority groups and contents that can be dynamized and presented as real-world issues.

It must be clarified that the current study has its limitations, as a case study may not have provided representative evidence to draw the conclusions stated in the article. However, it has served as a platform for a hidden voice to express his views regarding the transgender

community in the current EFL education system. Further studies could broaden the scope of the current paper and conduct different interventions to larger groups of students, gain a more representative insight of the status quo of transgender outside the community, and get a glimpse of their attitudes towards the collective and the role and/or degree of implication they believe they should have. Ultimately, the aim is to ensure safe environments where the learning experience of each individual is not hindered by the dominance of oppressive ideological forces.

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English for engineering: intercultural formal letter writing

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Abstract

Writing is a productive skill highly addressed in the ESP classroom. Students learning a foreign language have to learn how to create accurate structured texts with organised ideas to convey relevant meaning. The aim of this study is to analyse and categorize written mistakes produced by 1st cycle foreign students from different nationalities (i.e.: Romanian, Moroccan and Bulgarian) in the English for Engineering module at a Spanish university. The objective is to examine written language accuracy in formal letter writing such as enquiring and complaint letters, to detect any intercultural interference as to mother-tongue influence and other language varieties in the learning of curricular and linguistic knowledge. We believe that studies such as the one presented here allow teachers to provide students with written corrective feedback which may have a positive impact on students' writing skills (Li, 2000), in this case, foreign students enrolled in an ESP module at a Spanish university.

Keywords: *Formal writing; ESP; written corrective feedback, intercultural interference.*

1. Introduction

Writing is a productive skill highly addressed in the ESP classroom. Students learning a foreign language have to learn how to create accurate structured texts with organised ideas to convey relevant meaning. Written production is a preferred and demanded task in class to assess language learning progress since it is one of the most widespread forms to record students' performances (Whittaker et al. 2011). Other language elements that are of interest in the ESP classroom have to do with language accuracy, creativity, and corrective feedback. Some studies have analysed written corrective feedback from British spelling samples to be able to describe the lexico-grammatical errors committed by students for the assessment of their written outcomes (Bellés-Calvera & Bellés-Fortuño, 2018; Zhang, 2011). Error analysis and later correction is fundamental for the systematic study of the learner's language (Corder, 1981), benefiting all participants in the learning process, that is, teachers, students and researchers.

The aim of this study is to analyse and categorize written mistakes produced by 1st cycle foreign students from different nationalities (i.e.: Romanian, Moroccan and Bulgarian) in the English for Engineering module at a Spanish university. The objective is to examine written language accuracy in formal letter writing such as enquiring and complaint letters, to detect any intercultural interference as to mother-tongue influence and other language varieties in the learning of curricular and linguistic knowledge.

In this pilot study, an initial number of ten texts have been analysed and corrected to provide a classification of errors committed by foreign students attending the English for Engineering module at a Spanish university. Spell-checker software and Grammarly (2009) have been used to spot mistakes. Errors such as: "I would be fine with removing shipping coste", "and for this se need tour" "un cash" "this are my informations", "will safe you money", "we would spend knowing what your options are to make the payment" or "standarts" have been detected among a range of different error typologies. Some of the errors encountered may have been originated by intercultural language interference, considering the foreign students mother tongue is other than Spanish or English. Wrong order choice, grammatical correlations or lexical errors are the most recurrent ones. The classification of errors generated in this study and committed by intercultural students is later compared with the typology of common errors produced by Spanish learners of English as a foreign language with the aim of generating a number of written corrective feedback strategies, namely direct feedback, indirect feedback, or reformulation among others (Ellis, 2009).

2. Methodology

To carry out this study we have gathered a selection of 10 texts corresponding to 67 writing assignments of formal letters. The formal letter writing is a task the students participating in

the study need to accomplish in the practical section of the subject (1st year Mechanical Engineering Degree). Specifically, the selected writing assignments consisted of an evaluated compulsory task included in the curriculum of the subject “English for Engineering”. The formal letters had to follow the structure and topic of ‘inquiry letter’ and ‘letter of complaint’. The instructions and standardization of ‘inquiry’ and ‘complaint’ formal letters are explained in the subject. Students have to hand in the letters as part of the final subject evaluation.

2.1. Participants

The participants taking place in this study are 1st year Mechanical Engineering students enrolled in their ESP English for engineering module at a Spanish university. A total number of 67 undergraduate students writing assignments were gathered, 62 of them were male and 5 female. As for their nationalities, their origin countries varied: Spain, Romanian, Moroccan and Bulgarian, being Spanish the majority of them (see Table 1).

Table 1. Participants.

Participants		
	Gender	Nationality
	62 male	60 Spanish
	5 female	5 Moroccan
		1 Bulgarian
		1 Romania
TOTAL	67	67

The identity of students has been protected and the writings analysed in this study have been anonymised for a more objective analysis.

2.2. Materials and tools

The corpus of ten formal letters used in this study was analysed in search of different basic errors. To do so a previous error classification model was considered (Bellés-Calvera & Bellés-Fortuño, 2018). Aside from that, a spell-checker software and Grammarly (2009) have been also used to detect those errors. This classification model included errors such as: Lexical, grammatical or spelling errors as well as wrong order choice. As to grammatical errors Bellés-Calvera and Bellés-Fortuño include “verb tense, subject-verb agreement, fragments, word order and punctuation” (2018:110). Regarding lexical errors, these include: “articles, nouns, pronouns, verbs, adjectives, prepositions, word choice and spelling” (Bellés-Calvera & Bellés-Fortuño, 2018: 110).

Table 2. Errors classification model (Bellés-Calvera & Bellés-Fortuño, 2018).

Grammatical errors	Lexical error
<i>Subject-verb agreement</i>	<i>Spelling</i>
<i>Punctuation</i>	<i>Capitalisation</i>
<i>Fragment</i>	<i>Prepositions</i>
<i>Verb tense</i>	<i>Word choice</i>
<i>Word order</i>	<i>Adverbs</i>
	<i>Pronouns</i>
	<i>Articles</i>
	<i>Verbs</i>
	<i>Nouns</i>

This previous classification (Table 2) was initially used to analyse the corpus of this study in order to detect and classify the students' errors found. However, a closer look at the writings revealed that some of the categories included in the classification model were not found in the corpus. The relevant results are presented in the following section.

3. Results and conclusions

In this section, the results from students' writing performance on the formal letter task are analysed and discussed. Therefore, a classification of students' grammatical and lexical errors has been generated, based on the classification from the study carried out by Bellés-Calvera & Bellés-Fortuño (2018). The errors have been analysed according to their frequency of occurrence and the percentage over the total number of grammatical or lexical errors and lastly, in Table 3 below, some examples from each type of error have also been provided.

The analysis of 10 samples of formal letters led us to the identification of students' most commonly committed errors. A difference in the use of grammar and lexis can be observed amid the Mechanical Engineering students. Grammatical errors embraced verb tense, subject-verb agreement, fragments, word order and punctuation, while lexical errors included articles, nouns, pronouns, verbs, adjectives, prepositions, word choice and spelling.

From the results it can be observed that the greatest difficulties for the participants lie on punctuation, fragment, spelling, word choice and verbs. Fragment errors are understood as unfinished utterances as well as with grammatically and lexically incorrect utterances as a

whole. Nonetheless, it should be stressed that both grammatical and lexical categories show similar tendencies in the sense that students commit nearly the same percentage of errors.

Table 3 below shows the most common grammatical errors committed by the participants of this study. Surprisingly, the most frequently-made error types correspond to punctuation (30,5%) followed by fragments (10%). On the other hand, the number of errors is considerably lower when it comes to word order (4,3%), and subject-verb agreement (2%).

Table 3. Grammatical errors: Frequency, percentage and examples.

Grammatical errors	Frequency	Percentage	Examples
Subject-verb agreement	2	8,7%	“...and this are my information”
Punctuation	7	30,5 %	“I look forward to hearing from you soon! Yours sincerely
Fragment	10	43,5%	“After five years of close I need a good discount”
Verb tense	5	13,04%	“We would like to knowing”
Wrong word	2	8,7	“We would spend knowing what your options are to make make the payment”
Total	23		

Focusing on lexical errors, it can be noticed that the most prominent error is that of spelling (32,7%). Another category to be highlighted is the failure of students to select verbs (16,3%) and the choice of words (14,3%). In the same line, prepositions (10,2%) are often substituted by other prepositions or adverbs.

Some of the errors encountered have been originated by intercultural language interference, since for some of the participants Spanish is not their mother tongue. Henceforth, most grammatical and lexical errors -which are the two major errors typologies-, may have a connection with the intercultural language interference. Lexical (spelling with a 32,7%), grammatical correlations (punctuation with a 30,5%) followed by fragments (10%) are the most recurrent ones. The classification of errors generated in this study and committed by

intercultural students is later compared with the typology of common errors produced by Spanish learners of English as a foreign language with the aim of generating a number of written corrective feedback strategies, namely direct feedback, indirect feedback, or reformulation among others (Ellis 2009).

Table 4. Lexical errors: Frequency, percentage and examples.

Lexical error	Frequency	Percentage	Examples
Spelling	16	32,7 %	“The consignment of plugs was succesfully sent to you adress”.
Capitalisation	5	10,2%	“Thank you for you letter of 12 november..”
Prepositions	5	10,2%	“payment of delivery” “payment un cash”
Word choice	7	14,3%	“If you want we can send you one show, you can test it” “that will safe you money” “On all prime order”
Adverbs	4	8,2%	“Also the procomo400 has raised our standarts...”
Pronouns	3	6,12%	“We write you regarding the consignment for their company” “We would spend knowing what your options are...”
Verbs	8	16,3%	“What kind of discount could you give me for stays and keep you in mind for next purchases”.
Nouns	1	2,04%	“the possibility of upgradation”
Articles	1	2,04%	“I need a available good discount”
Total	49		

Up until this point, one can construe that first year university students, and in this specific case, Mechanical Engineering students in their English module, have not been trained on the proper use of punctuation symbols in previous years at high school. English and other foreign language codes have many differences in the way punctuation symbols are used, that is to say, the usage of commas and semi-colon or colon in combination with cohesive markers. For this reason, more specific training on punctuation symbols may be convenient for first year university students. Furthermore, the participants of this study have also displayed errors in spelling and wrong verb choice, hence, more training on these aspects should then be implemented in the classroom syllabuses.

We believe that studies such as the one presented here allow teachers to provide students with written corrective feedback which may have a positive impact on students' writing skills (Li, 2000). In this case, foreign students enrolled in an ESP module at a Spanish university. Thus, detecting and indexing these intercultural errors to create classifications of identified wrong uses of literary translations or language correspondences in order to later explain them in class would definitely support students in their FL learning process.

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The explicit teaching of vocabulary in French L2: theoretical models, teaching practices and experimental itineraries

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Abstract

This contribution presents the results of a recent experimental research aimed at investigating the potential of explicit teaching of French L2 vocabulary in the university context of Langues pour Spécialistes d'Autres Disciplines (LANSAD) in Italy. After introducing the research background, the tools, methodologies and teaching materials are outlined. The qualitative and quantitative evaluation of the results obtained from an experimental test (ET) is then presented. The test consisted of four tâches concerning the identification and use of paraphrastic rules, the analysis of lexical relations through the use of LF and a written production on one of the specialised topics addressed during the course (with the use of LU and PU) in order to measure the students' acquisition of metalexical knowledge, as well as their ability to spontaneously and correctly use PU in specialised communication. Finally, the results that emerged during the experimental course are outlined, with reference to the significance of the tools and methodologies tested and the promotion of teaching activities focusing on the explicit teaching of vocabulary even in areas such as LANSAD.

Keywords: *Explicit vocabulary teaching; LANSAD context; French L2; paraphrase; lexical functions.*

1. Introduction: theoretical premises and research aims

In recent years, the development of lexical competence in L2 learning processes has gained considerable importance in the field of linguistic research, fostering a multi-voiced dialogue between different fields of investigation, such as lexicology, terminology, educational linguistics, corpus linguistics and foreign language teaching. According to the descriptors of the Common European Framework of Reference for Languages (CEFRL), a B2 level learner should have “a good lexical repertoire related to his field and to many general topics” (CoE 2020: 143). He/she should also be able to “vary formulation to avoid excessive repetition [...]; understand and use a large proportion of the vocabulary related to his or her specialist field; [...] insert appropriate words/signs in most contexts in a fairly systematic way” (CoE 2020: 143). However, recent studies on lexical competence and its combinatorial properties (better defined as “phraseological competence”¹) have shown that learners at both intermediate and advanced levels have significant lexical deficits, especially with regard to the use of locutional and idiomatic phraseological units (PU) of low and/or medium frequency (Hamel *et al.* 2007; Tsedryk *et al.* 2019). In order to avoid linguistic errors, learners often resort to the mechanisms of substitution and repetition, relying on a very high frequency general lexicon (use of the hypernym → *poisson*, instead of the hyponym → *requin, loup de mer*) and making excessive use of simple locutions, sometimes generated by L1 linguistic interference (i.e. *avec tout le cœur* rather than *de tout mon cœur*; *profit manqué* instead of *manque à gagner*). In addition to the possible interferences with the mother tongue, further elements come into play in the process of learning the lexicon of an L2: the time needed to store new LU, the ability to reuse them spontaneously and correctly according to the various communicative contexts, motivation and, lastly, the use and experimentation of didactic tools, methodologies and materials produced *ad hoc* according to the learners’ linguistic and educational needs. One need only think of the approaches adopted for the teaching of Français sur Objectifs Spécifiques (FOS) at university level (Raus *et al.* 2020) or of the methodologies employed in the area of “Langues pour Spécialistes D’Autres Disciplines” (LANSAD) (Chaplier *et al.* 2019). In these contexts, a purely thematic approach (Binon *et al.* 2004) is usually preferred for teaching vocabulary through activities based on the creation and mnemonic learning of lists of names, inventories and specialised glossaries taken from textbooks, paper and electronic dictionaries, thesauri, digital corpora, etc. The result of this approach is undoubtedly the expansion of encyclopaedic knowledge relating to a domain, but the development of knowledge and lexical skills associated with the function of LU within a specialised discourse is compromised. Therefore, there is the risk of moving from the specificity of a lexicon in its technical-scientific and professional use to the likely aseptic labelling of world objects in specialised communicative situations. According to the

¹ Although the CEFRL makes no reference whatsoever to the notion of “phraseological competence”, there are numerous references to the concept of “paraphrase”. For theoretical insights into the concept of ‘phraseological competence’, please refer to the studies by González-Rey (2016).

attentional model suggested by Picoche (1992) and the theoretical framework of Meaning-Text Theory (MTT) and Explanatory Combinatorial Dictionary (ECD) (Mel'čuk *et al.* 1995), the aforementioned problems can be solved, at least in part, through theoretical-applicative didactic paths centred on the explicit teaching of the lexicon. More specifically, this approach emphasises the explanation of theoretical notions, the description of lexical structures and reasoned exercises in reformulation and written production, with the help of two purely linguistic tools: lexical functions (LF)² and paraphrase rules.

In the light of the above-mentioned theoretical linguistic models, which have possible didactic implications, this contribution presents the results of a recent experimental research aimed at investigating the potential of the explicit teaching of French L2 vocabulary in the university context of LANSAD in Italy. More specifically, the experimentation took place in a French language course aimed at Italian-speaking students of Bachelor's Degree Programmes in Statistics and Business Management Sciences at the University of Naples Parthenope. The objective of the experimentation was dual: on the one hand, it fostered the development of basic lexical and metalexical skills through theoretical-applicative, reasoned and structured training of the main concepts of ECD and through reformulation, paraphrase and written production exercises; on the other hand, it taught students the effective use of dictionaries and other lexical resources, such as corpora or other lexical databases for the study of specialised lexicons related to the dominant disciplines of their study paths. After introducing the research background and the minimum language requirements (§ 2.1.), the tools, methodologies and teaching materials characterising the operational protocol of the theoretical-applicative training are outlined (§ 2.2). The qualitative and quantitative evaluation of the results emerging from an experimental test (ET) is then presented (§ 2.3.). The test consisted of four *tâches* concerning the identification and use of the paraphrastic rules, the analysis of paradigmatic lexical relations and collocations through the use of LF, and a written production on one of the specialized macro-themes tackled during the course (with the compulsory use of the LU and PU studied), in order to measure the students' acquisition of metalexical knowledge, as well as their ability to spontaneously and correctly use PU in specialized communicative contexts. Lastly, some of the main themes dealt with during the experimental course are outlined, with particular reference to the significance of the tools and methodologies tested and the promotion of teaching activities focused on the explicit teaching of vocabulary even in areas such as LANSAD.

² In the context of LF, the term "function" is used in its mathematical sense, as emerges from the following technical definition, which we have translated: "From a formal point of view, a Lexical Function *f* is a function that associates with a given expression *L* – the *argument*, or *base*, of the function *f* – a set (*L*) of expressions – the value of the function *f* – that express, in relation to *L*, a specific meaning associated with *f*" (Mel'čuk *et al.* 2021: 75). For more on the concept of FL, please refer to a recent study by Mel'čuk et Polguère (2021).

2. Didactic experimentation

2.1. The context: target group and language requirements

The experimentation was carried out during the second semester of the academic year 2021/2022, as part of the course in French Language Skills. The course was divided into two modules of 36 hours each for a total of 72 hours and aimed at Italian-speaking students of the Bachelor's Degree Programmes in International Business Management and Statistics of the University of Naples Parthenope. These are two professional training courses that aim, on the one hand, to train specialists capable of governing the internationalisation processes of companies and marketing policies and, on the other, to qualify future statisticians and analysts in the management of big data in a corporate context, through mathematical-computational methods and new information technologies. Within the curriculum of the two above-mentioned degree programmes, particular attention is paid to the teaching of foreign languages, whose macro-objectives include the attainment of at least a B2+ level of the CEFRL and a methodological basis for learning the specialised languages of the various disciplines studied over the three-year period. With regard to the above-mentioned teaching programme, the contents and objectives were designed for a particularly numerous ($n= 300$ students in total, among which 196 attending lectures) and markedly heterogeneous class, as far as their French language knowledge and skills are concerned. An analysis of the numerical data shows that 20% of the students hold a C1 level DALF language certificate; 55% hold the B2 level EsaBac and/or EsaBac Techno Italian-French upper secondary school dual diploma; 15% claim to hold a B1 level DELF certificate and, lastly, 10% claim to have studied French at lower and upper secondary school but do not hold any language certificate.

2.2. The operational protocol: methodologies, tools and teaching materials

As outlined above, the course was divided into two modules of 36 hours each. During the first module entitled “The Language System of the French Language”, basic knowledge was provided on the phonetic, morphosyntactic and lexical aspects of a B2+ level of French according to the CERFL. The topics covered ranged from the revision of various grammatical aspects of the analysis of the main syntactic, lexical and phrasal structures, and the study of the major writing and specialised communication strategies representative of three professional sectors, including international trade, blue economy and environmental sustainability in the marine environment.

In the second module entitled “Lexicology, specialised lexicography and digital literacy”, a detailed, albeit introductory, path was provided on the various word formation processes from a contrastive perspective (Italian/French), thus directing learners to the study of specialised languages as well as the traits differentiating them from the general language in their lexical, terminological, pragmatic and translation aspects, with the aid of digital tools such as corpora,

online databases and term extractors. A series of introductory seminars aimed at learning the basic metalexical notions, such as lexeme, vocabulary, LU, PU, as well as their interconnection with terminological studies (L’Homme 2020; Bonadonna 2020) was also proposed. Referring to the actantial model proposed by Picoche and to the overall theoretical background of ECD, a clear examination of the main syntagmatic and paradigmatic lexical relations through the use of LF as well as of the concepts of semantic actant, collocation (base+collocate) and locution was presented. Through a brief summary of the various types of LF, a wide range of criteria to classify them (idiomaticity, non-compositionality, semantic-conceptual transparency/opacity, polylexicality and fixity) was illustrated and, in addition, the difficulties faced by those studying them were outlined. Depending on the perspective one takes, it is possible to encounter terms that differ in the various languages and traditions of phraseological studies. An attempt has therefore been made to offer as schematic a view of the main PU as possible, based on the classification proposed by Mel’čuk (2013). With regard to the basic theoretical aspects concerning reformulation operations, the definitions of sense, semantic equivalence and paraphrase were commented upon, preferring the criteria of lexico-syntactic paraphrase and focusing especially on the lexical criteria of synonym, antonym and converse substitution. Once the seminar training was completed, a practical activity was designed to link the aforementioned paraphrastic processes to the more general operations of text composition, in order to encourage students to use the vocabulary studied in their written productions. Starting from two short expository texts on two very topical subjects, such as the internationalisation and business organisation sector and the marine bioeconomy for the correct business management of marine protected areas, the students were asked to reformulate some parts and fill in the blanks, using appropriate collocations and/or phrases with the help of dictionaries and open access digital terminology databases (*GDT*, *TERMIUM Plus*, *FranceTerme*, *TLFI*, *DES*, *IATE* and *LOTTERRE*). In addition, they were shown the importance and usefulness of lexical resources such as *Spiderlex (RL-fr)* and *IdiomSearch*, as well as some linguistic corpora (*frTenTen20*, *TermiTH* and *ScienQuest*) to identify PU through the use of the “co-occurrences” or “word combination” entry, as well as to analyse their frequency and linguistic properties from context. At this stage, ways of searching for and modelling lexical relations through the use of LF were defined. Particular interest was paid to certain paradigmatic relations (hypernymy, hyponymy, synonymy, antonymy, conversion, syntactic derivation and semantic derivation). As far as syntagmatic LF (or collocations) are concerned, one adjectival FL expressing intensity, two adverbial LF representing place and medium and, lastly, two verbal LF composed of a supporting verb and a realisation verb were selected³. The choice of the aforementioned LF is to be correlated to their potential didactic value in the class context under investigation, assuming that it would have been undoubtedly easier for learners to understand the above formalisms through

³ https://drive.google.com/file/d/1-8me2ZwTltePliXp6LnkfE5sgh329d3/view?usp=share_link

examples relating to nouns, actions, agents and places related to the specialised domains of their interest. Although brief, this theoretical-applicative examination proved particularly useful from a didactic point of view: on the one hand, it contributed to the students' mastering of metalinguistic language; on the other hand, the paraphrasing and reformulation exercises enabled them to learn how to organise the syntactic structures of a sentence (becoming aware of their errors and self-correcting), to explore some of the paradigmatic and syntagmatic relations between several LU belonging to the lexicons studied and, lastly, to develop a good metalexical competence.

2.3. The experimental test (ET): activity design and results

In order for the learners to familiarise with both the theoretical and methodological concepts outlined so far, an experimental test (ET) lasting 4 hours (2+2) was proposed, consisting of four tests concerning the identification (ET1) and use (ET2) of the paraphrastic rules examined. The aim of the test was to verify the acquisition of lexical knowledge and skills; the analysis of paradigmatic lexical relations and collocations through the use of LF (ET3) and a written production (ET4) involving the use of the LU and PU studied, with the aim of proving their correct use in written text production. The first test included an exercise consisting in the identification of the rules of paraphrasing (syntactic and/or lexico-syntactic) in four pairs of sentences, which were given a maximum point of 4⁴. By way of example, for the pair of sentences (1a. *Les températures de l'eau de mer montent considérablement*; 1b. *Les températures de l'eau de mer connaissent une forte hausse*), the paraphrase is based on the equivalence between the verb *monter* and the equivalent lexico-syntactic structure involving the noun of *monter*, i.e. its nominalisation – S0(*monter*)=*hausse* – preceded by the corresponding supporting verb: *connaître*. In this case, it is a lexico-syntactic paraphrase since there is not only a lexical substitution, but also a modification of the syntactic construction of the sentence. In contrast, in the pair of sentences (2a. *L'économie bleue garantit la sécurité alimentaire sur le marché mondial*; 2b. *La sécurité alimentaire sur le marché Mondial est garantie par l'économie bleue*), only a syntactic transformation from active to passive sentence was made, without any lexical change. Students were then asked to rephrase six sentences of one point each, using the criteria of synonymous, antonymic and conversive substitution (ET2)⁵. The results of the ET1 total averages show that the concept of paraphrasing was well understood by the majority of the students with a minimal percentage difference between correct identification of syntactic paraphrasing criteria (75%) and lexico-syntactic paraphrasing criteria (73%), while approximately 27% failed the test due to lack of adequate metalexical knowledge and skills. The scores obtained for ET2 confirm almost the same success rates as ET1: around 74% of the students were able to rephrase the sentences in the test, except for 27% of the participants who experienced problems. From a

⁴ https://drive.google.com/file/d/1gUGmiN8eHOCbOBuMKLDyQ9OFZsf2y6Jc/view?usp=share_link

⁵ https://drive.google.com/file/d/1DVAzf-q1ZzUpZtBWLLL1LGP4nWsZMJdH/view?usp=share_link

more detailed analysis of the data collected, one could hypothesise that these shortcomings can be traced back to elements such as non attendance of classes (most of the students, in fact, work), a lower language level than the other members of the class and difficulties in metalinguistic thinking starting from one's mother tongue. As regards usage, the total number of reformulations produced by the students is 19, among which 6 are synonymic substitutions, 3 antonymic substitutions, 2 collocations, 1 locution and 7 cases of non-total semantic equivalence which, instead of being evaluated as errors, we preferred to consider as quasi-synonyms. In the second part of ET, we focused on the recognition of paradigmatic lexical relations, collocations and/or locutions (ET3). After having submitted a list⁶ of LU and PU to the students they were asked to identify the paradigmatic relations by means of LF and, in the case of LU composed of more than one element, to indicate the type of phraseme (between locution or collocation). We were not asked to carry out a detailed linguistic analysis, but rather to make a distinction between locution and collocation, illustrating, in summary, that – by way of example – PU *payer quelqu'un en monnaie de singe* is a locution because its meaning is not compositional; while *chimie verte* (AB) is a collocation because it is composed of the base *chimie* (A) freely chosen by the speaker for its meaning and the collocate *verte* (B) which expresses the meaning of the expression, i.e. a concept of chemistry that aims to promote sustainable approaches to chemical industry by eliminating the use of hazardous procedures and substances. Test ET3 was undoubtedly the most successful compared to all the others: 80% of the class was able to identify the lexical relations and classify the proposed PU, except for 20% of the participants who misinterpreted the above concepts in several examples and only answered correctly in four cases (*économie bleue*, *chimie verte*, *pollution sonore*, *aire marine protégée*). Lastly, the last activity consisted of a free production (ET4) on one of the macro-themes tackled during the course, with the necessary usage of LU and PU correctly, among those belonging to the specialized lexico-semantic fields studied in the class. The ET4 results were also particularly interesting. The average total score for written production was 78%, which corresponds more or less to the average of the ET3 results on metalexical knowledge. 17 out of the 30 points awarded for correct answers were for examples of LU and PU studied in class and reused, consisting mostly of collocations – adjectival type (Bon: *énergie verte*, *chimie verte*; *économie bleue*; AntiBon: *marché noir*), verbal type (Real: *defender/sauver/préserver/détruire/polluer/nuire à l'environnement*; Oper: *pratiquer une politique soutenable*, *mener un audit*, etc.) – and a few locutions ($n=4$) (*col blanc*, *voie maritime*, *marché réglementé*, *agrobusiness mondial*, *obstacle commercial*, etc.).

⁶ https://drive.google.com/file/d/1cRuZlrewqd11T50Y1l6Bib6RfpUVIG65/view?usp=share_link

3. Conclusions

The ET results suggest that students have acquired good metalexical skills. More than 70% of the participants benefited from the explicit teaching of the lexicon and from the exercises to identify paraphrastic rules (ET1) and lexical relations with the help of LF (ET3), as well as from the resources made available, through which the learners learnt to search for information on the combinatorial properties of the lexicon. As far as the use of LU and PU is concerned, it was high in both *tâches* (ET2 and ET4): more than 70% of the correct answers contained examples of LU and PU. The percentages were on average higher in written production (ET4: 78%) than in paraphrasing (ET2: 74%). This result can be explained as a consequence of the fact that the reformulation exercise presented more constraints due to the search for synonymic expressions and patterns to follow, unlike ET4 whose only constraint was the use of LU and/or PU studied in class. With regard to collocation patterns, it was found that the “supporting verb+noun” pattern was more frequent in the rephrasing exercise, while the “noun+adjective” pattern was more frequently used in written production. As for the locutions, the percentage of use remained very low in both tests, a result that was expected for two reasons: due to their non-compositionality, learners found it difficult to translate and use them; moreover, more attention was given to collocations than to locutions in class. Even for the weaker learners and/or those with a scarce knowledge of lexical resources, cognitive effort was noted during the paraphrase and production exercises: for example, rephrasing or the use of compound collocations with inexact collocates caught our attention. The fact that a learner used an incorrect support verb highlights the need to teach broader syntactic structures in order to include the corresponding support verb in a noun phrase, especially if its use is limited to one or two verbs or well-defined syntactic patterns.

The theoretical and methodological reflections and empirical data outlined here allow us to state that the explicit and structured teaching of L2 vocabulary, combined with numerous reformulation and lexical network identification exercises, can contribute to the enhancement of the various lexico-syntactic constructions – and, more generally, to the development of metalexical competence – albeit with varying success rates. Although the choice of linguistic modelling tools tested may, at first sight, seem ambitious for a university context such as ours, we believe that even an audience of non-specialists in language sciences can benefit greatly from this approach. Promoting explicit and reasoned vocabulary training in French L2 aimed at specialists in other disciplines at university level appears, therefore, necessary both for the maintenance of the French language in the specialist fields and the quality of linguistic exchanges – oral and/or written – between technicians and experts in the field. However, it is necessary to ensure the creation of manuals and pedagogical-didactic tools for teaching/learning the lexicon in the LANSAD sector.

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Mathematics in economic and business science: how to reach the top without a pathway

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Abstract

The level of mathematical knowledge with which students enter Economics and Business Administration Degrees varies according to the Baccalaureate pathway taken. The Zone of Real Development of students coming from the Social Sciences Baccalaureate differs from the Necessary Zone of Real Development for the correct acquisition of academic competences, which is close to that developed in the Scientific-Technological pathway.

In order to characterise the existing mathematical deficit, a quantitative and perceptive analysis of the mathematical deficiencies of new students in those Degrees coming from the Social Sciences pathway is proposed. The results allow the identification of various areas where training deficiencies exist, which are corroborated by the students' perception.

To solve them, the creation of a virtual platform that identifies, in a personalised way, the deficiencies of each student is proposed. Through guided gamification, the complementary course would allow students to reach the Necessary Real Development Zone before starting University.

Keywords: *Mathematics, economics, business, digital innovation project.*

1. Introduction

The White Paper on the Bachelor's Degree in Economics and Business Administration prepared by the National Agency for Quality Assessment and Accreditation (ANECA, 2005) states that one of the chief problems of the current design of the degrees in this branch is "the inadequate training in mathematics of this Baccalaureate (Social Sciences) compared to that which will be required at the University" due to the existing divergences between the mathematical curricular content of both pathways. Furthermore, it points out that "the content in this subject should be the same as in the Scientific-Technological Baccalaureate".

Although the White Paper was published almost two decades ago, neither successive educational laws nor the adaptation to undergraduate studies that took place with Spain's entry into the European Higher Education Area (EHEA) have managed to solve these deficiencies, making Mathematics one of the most failed subjects in the first year of Economics and Business degrees and, consequently, students have to cope with higher-level subjects (e.g., Economic Analysis, Finance, Statistics, Econometrics) without the required mathematical basis (Anderson et al., 1994; Swope & Schmitt, 2006; Kara et al., 2009).

The mathematical deficit observed can be corroborated in various articles such as Adillón et al. (2013) and Carrillo Fernández et al. (2016), which detail the differences between the mathematical knowledge acquired during the Secondary Education stage depending on the type of Baccalaureate studied. In this regard, articles such as Opstad (2018) show that this is a widespread problem in other European countries, such as Norway, for example.

The main objective of this study is to determine whether the subject of Mathematics taken by students in the Social Sciences pathway of the Spanish Baccalaureate provides an adequate mathematical basis to take and pass the subject of Economics and Business Administration degrees to which it leads, considering the mathematical level with which they enter university and their perception after having taken the university subject.

Therefore, in accordance with Vygotsky (1978), the aim is to characterise the Zone of Real Development (ZRD) of students entering university and to evaluate it with respect to the Necessary Zone of Real Development (NZRD) required for the correct acquisition of university competences, with the purpose of detecting the existence of conceptual deficiencies that prevent the appropriate learning of new knowledge.

2. Methodology

The study consists of two clearly differentiated parts. On the one hand, mathematical aspects are analysed by means of a level test that quantifies the knowledge with which the students of Economics and Business Administration degrees of the Public University of Navarre (UPNA) enter university studies. On the other hand, the perception of the level of

mathematics they have and the demand and adequacy of the level in the Social Sciences pathway of the Spanish Baccalaureate to study university degrees is evaluated.

2.1. Evaluation of mathematical knowledge according to access type

Firstly, an evaluation of the mathematical knowledge acquired by students entering the degrees in Economics and Business Administration during their time in Secondary Education in the Spanish Education System is proposed. To accomplish this, new students were subjected to a compulsory multiple-choice test on the first day of the academic year 2022/23, in order to obtain an objective assessment of the mathematical level with which they access the university and to observe whether this level is sufficient to satisfactorily complete the mathematics subjects of both degrees.

The questionnaire consists of eight control questions, which were used to characterise the entry profile of each student (e.g., access model, Mathematics subject taken in the baccalaureate, average access mark), and eight mathematical questions on various basic aspects of algebra and calculus that should be mastered, as these are the basis for the subjects of both degrees, for instance: a simplification of a radical fraction by means of notable equalities (Q1) or a 2×2 matrix multiplication (Q8).

2.2. Evaluation of student perception

Secondly, an evaluation of the students' perception of the mathematics subject in the first semester of the Economics and Business Administration degrees is proposed, with the aim of analysing the students' feelings before and during this subject, as well as detecting any possible difficulties encountered.

This information is obtained through the previous survey and with an additional voluntary survey that students can fill out on the virtual platform of the subject from the last day of the semester. On this occasion, the survey consists of fourteen questions, where the first four questions correspond to control questions and the last ten are focused on obtaining the students' perception of the subject, both in relation to the subject taken and to the level of mathematical knowledge with which they have entered the university.

3. Results

In order to carry out the analysis of mathematical knowledge in university entrance and the students' perception, the responses of 299 and 164 students, respectively, are evaluated. Both questionnaires were conducted in an unpaired manner to ensure the anonymous nature of the responses and the difference between the number of responses to the questionnaires is due to the mandatory and voluntary basis of each of them.

3.1. Analysis of mathematical knowledge by access type

As can be seen in *Table 1*, 87% of the people surveyed got five questions or less right, out of the eight questions answered. These results obtained in the initial questionnaire are considerably poor, especially bearing in mind that the eight questions assessed are about basic mathematical concepts that are essential for the correct acquisition of the competences corresponding to university subjects.

Table 1. Distribution of hits in the initial survey.

Number Right Answer	0	1	2	3	4	5	6	7	8
Student Percentage	1%	9%	14%	20%	21%	21%	7%	5%	1%

Analogously, as shown in *Figure 1*, evaluating the results obtained in each of the questions, only two of the eight answers (Q6 and Q8) are correctly answered by three out of every four students surveyed. In this sense, relevant mathematical deficiencies are found in questions Q2, Q3, Q4, and Q5, as, more than just having a low rate of correct answers (less than 40%), the percentage of wrong answers is higher than the correct answers, which implies that not only have they not acquired this knowledge but also they use it wrongly and based on inadequate mathematical criteria.

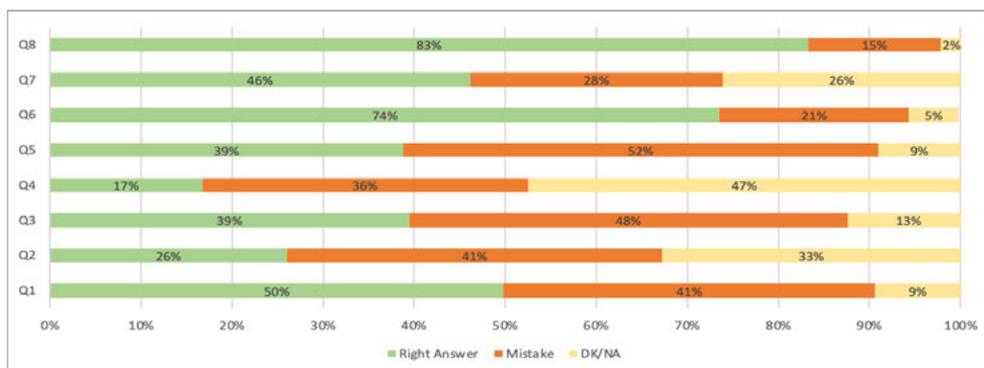


Figure 1. Overall distribution of answers per question.

The lack of mathematical knowledge is more evident when the answers obtained from students coming from the Scientific-Technological Baccalaureate (STB) and the Social Sciences Baccalaureate (SCB) are differentiated, as can be seen in *Figure 2*.

Although it is obvious that students coming from the STB branches have mathematical deficiencies in the knowledge relating to questions Q2 and Q4 (*Figure 3*), they enter with much more complete training and much closer to the minimum knowledge required for the correct acquisition of university contents in those degrees. However, the entry profile of

students coming from the Social Sciences pathway shows highly notable deficiencies in practically all the basic aspects required.

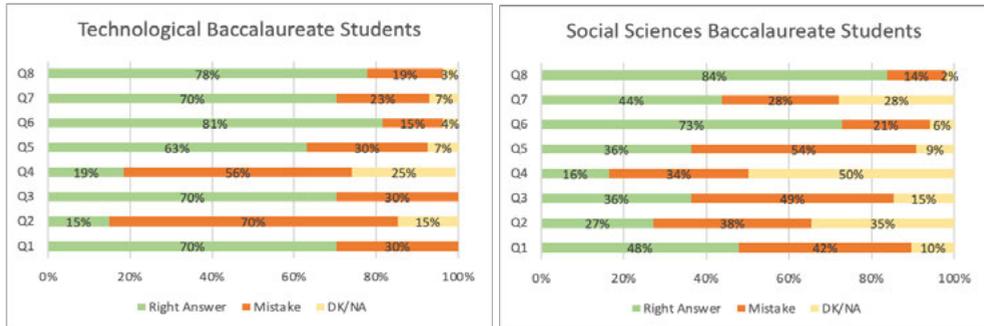


Figure 2. Distribution of answers by question and entry profile.

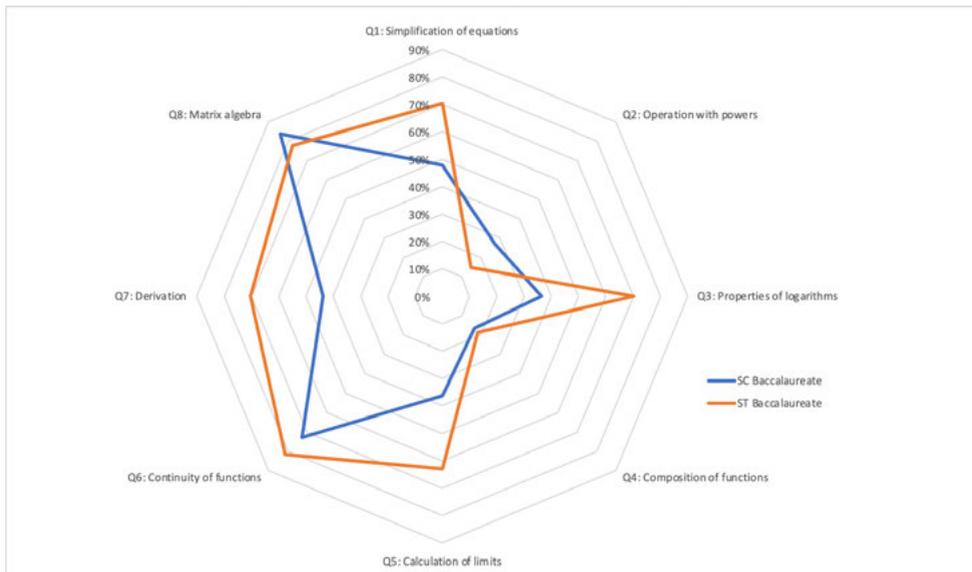


Figure 3. Comparison of mathematical knowledge according to entry profile.

Finally, in order to corroborate that the difference in knowledge between students with different income profiles is statistically significant and that it is not the result of the difference in the number of surveys answered by one group and the other (27 and 272, respectively), a Welch's t-test was performed, with which the hypothesis corresponding to the existence of equality of means between samples can be accepted or rejected; in other words, that mathematical knowledge in both income profiles is identical.

Considering that the *p-value* obtained in the test is 0.00136, lower than the limit marked by the significance level α , the null hypothesis is rejected and the existence of significant differences between the levels of the mathematical knowledge of both profiles is confirmed. Therefore, this result shows that the mathematics of the STB generates more competent and

related profiles than those of the SCB for an adequate understanding of mathematics and the acquisition of the competences of those degrees.

3.2. Analysis of student perception

Student perception is studied, both in relation to their level of knowledge on entering university and in relation to the overall perception of their learning at the end of the Mathematics lessons in the first semester at university, before taking Mathematics exam.

Firstly, analysing the data displayed in *Figure 4*, more than 90% consider their mathematical base to be between adequate and satisfactory. However, these perceptive data contrast completely with the results obtained in the previously analysed questionnaire.

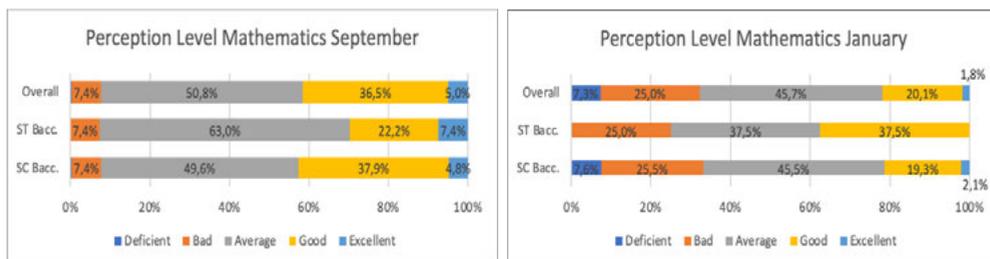


Figure 4. Students' perceptions of their level of mathematics at university entrance.

Nevertheless, at the end of the Mathematics subject, the percentage of students who consider their mathematical base to be between adequate and satisfactory is approximately 30% lower.

In any case, according to the results obtained in the perception survey, there is a large majority of students who consider that they enter university with notable deficiencies in mathematics, as pointed out in *Figure 5*. Students identify the existence of a structural deficit in mathematics training in the Baccalaureate: 69% of them consider that it is essential to improve the level of mathematics in Secondary Education specialisations leading to degrees in Business Administration and Economics and 63% consider that the introduction of a complementary course to cover the shortcomings detected between the exit-level from Secondary Education and the entry-level required for those degrees would be positive.

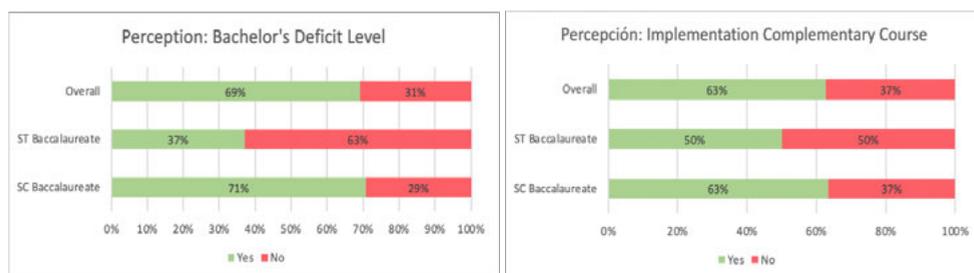


Figure 5. Student Perception of the suitability of access level and the need to implement a complementary course.

In both cases, there is a notable difference in perception depending on the entry profile. While the answers of students who have studied the SCB show a need to improve the level of the Mathematics subject in their speciality and the opinion of implementing the complementary course prevails, with 71% and 63% of positive responses respectively, students in the STB speciality do not consider such a structural deficit in the training received in the mathematics of their speciality nor so essential the implementation of the complementary course.

4. Discussion

The results obtained highlight the existence of significant differences between the level of mathematical knowledge acquired in the STB and that of SCB, in line with previous academic literature (Adillón et al., 2013; Carrillo Fernández et al., 2016). In this sense, the STB provides a considerably more appropriate mathematical basis for entry to Business Administration and Economics degrees, which should not be the case, given that the recommended Baccalaureate for these degrees is that of Social Sciences.

Precisely, students coming from this pathway are aware of the existence of a mathematical deficit in their Baccalaureate modality. This lack of basic training affects all university subjects based on mathematics, as mentioned before (Anderson et al., 1994; Swope & Schmitt, 2006; Kara et al., 2009); thus, corroborating the existence of a difference between the current ZRD and the NZRD (Vigotsky, 1978). In fact, this may be a key reason for the worrying failure and no-show rates in the first year, and even for the high drop-out rates.

This problem is hard to address. The ideal situation for this type of students would be to give them the opportunity to take both SCB and STB Mathematics in the Social Sciences pathway, as a modality and optional subjects, respectively. Unfortunately, this is not possible in most Spanish schools due to organizational reasons. Therefore, the recommended solution to the problem would be to be able to choose STB mathematics as a subject of modality within the Social Sciences pathway, a matter that the current legislation does not consider.

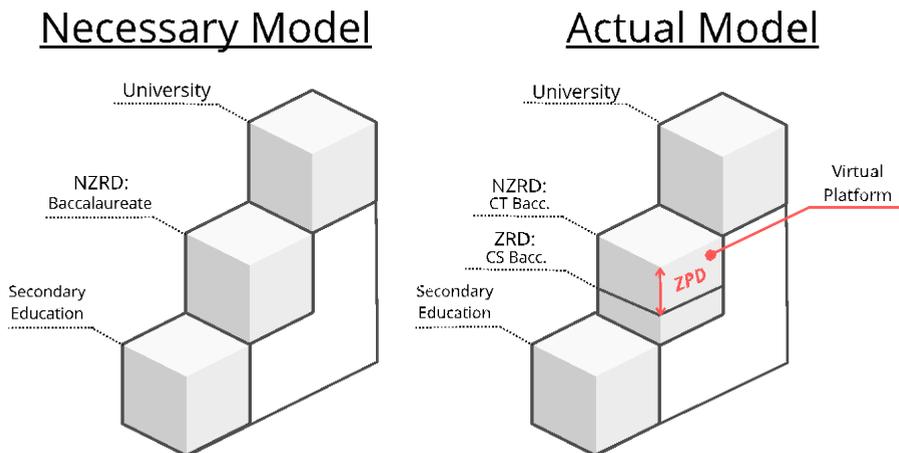


Figure 6. Necessary and current model of the students' Zone of Proximal Development.

Until the education system solves the training problem detected, it is recommended to alleviate this deficit through a virtual platform that allows students to reach the NZRD in a guided manner, prior to the start of the first-year university subjects. In this way, depending on the individual ZRD of each student, characterised progressively as they answer the check questions of each concept to be reinforced in the course, the tool will generate a personalised Zone of Proximal Development (ZPD); that is, an individualised and guided complementary course, which, depending on the deficiencies observed, will lead each student to the target NZRD, as can be seen in *Figure 6*.

This recommendation is in line with what was observed in the carried-out survey: students, especially those coming from the SCB, are clearly in favour of implementing a virtual platform to cover their conceptual deficiencies. The development of this complementary course at the UPNA, which is the next step of current research, is subordinated to the educational innovation project *Digital Gamification to address pre-university mathematical training deficiencies in students of Economics and Business Degrees* of the UPNA.

Finally, note that the study was performed in a single year and exclusively with UPNA students. It would be interesting to carry out this study over a larger number of academic years, as well as in other universities.

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The role of education in fostering entrepreneurial intentions among business students

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Abstract

Entrepreneurial intention is a critical aspect of the creation of new businesses and the development of an entrepreneurial culture. It is considered to be the strongest predictor of an individual's behavior towards entrepreneurship. The present study aims to examine the role of education in promoting entrepreneurial intentions among business students and understand how educational programs, initiatives and experiences can impact the development of an entrepreneurial mindset. The study was conducted using focus group discussions to gather views and attitudes of individuals. The results suggest that in order to cultivate entrepreneurial intentions among business students, education must provide exposure to successful entrepreneurs, encourage hands-on experience, offer entrepreneurship-focused classes and workshops, provide access to funding and mentorship, foster a supportive and inclusive environment, emphasize the development of critical thinking and problem-solving skills, and encourage continuous learning. The findings of this research provide valuable insights for educators, policymakers, and stakeholders to enhance entrepreneurial education and foster a supportive environment for the development of entrepreneurial skills and mindsets among business students.

Keywords: *Entrepreneurial intention; business education; leadership skills; business students.*

1. Introduction and theoretical background

Entrepreneurs are instrumental in fostering innovation and boosting economic expansion in the current volatile business landscape. Entrepreneurship is an important skill that students can learn from universities, which can help them create their own businesses and contribute to the economy. Universities play a crucial role in preparing students for the future. Exploring what drives students perceived as potential entrepreneurs to engage in entrepreneurial pursuits has been a widely studied topic for over three decades (Dragin *et al.*, 2022). Surveys suggest that between 15% and 20% of students who participate in the Minicompany Programme in secondary school will later start their own company, a figure that is about three to five times that for the general population (Jenner, 2012). It means universities should become more entrepreneurial (Gibb *et al.*, 2013). This not only creates new jobs and contributes to economic growth, but also provides students with a sense of autonomy and independence.

It cannot be denied that entrepreneurship is a dream of many people. An entrepreneurial dream can exist for a person regardless of their current business success, opportunities, desires or hopes of becoming an entrepreneur (Li *et al.*, 2022). An individual who associates their professional identity with unfulfilled values, will not simply forget about them, but instead, continually strive to remember them and explore ways to make these values a reality (Obodaru, 2017). Research indicates that many individuals fail to achieve their entrepreneurial dream due to a lack of business knowledge or fear of risk-taking. Despite this, the unfulfilled dream does not fade away and may eventually turn into a feasible intention for the future (Berg *et al.*, 2010).

Own business gives a person a certain independence and autonomy and allows him to prove to himself and others what he is capable of.

2. Entrepreneurial intention in the aspect of entrepreneurial culture

Entrepreneurial intention is a crucial aspect in the formation of new companies and the development of an entrepreneurial culture, yet existing literature primarily addresses the challenges faced by entrepreneurs during the start-up and implementation phase, neglecting research on the identification of Entrepreneurial Intention. Entrepreneurial intentions refer to the desire and willingness to start a new business venture. Business students, as future business leaders, are potential entrepreneurs who can contribute significantly to the economy. It will also improve economic factors, which will positively affect the working environment in Latvia (Saksonova & Jansone, 2021). Thus, it is essential to foster entrepreneurial intentions among them.

Testing Entrepreneurial intention using university students is appropriate as it can inform education policies, particularly those related to entrepreneurship education, and have implications for those responsible for creating support programs in this area. Several studies have targeted business and engineering university students as potential entrepreneurs (Liñán *et al.*, 2011). According to the 2021/2022 data of the Central Statistics Bureau of Latvia on higher education in Latvia, the highest number of enrolments is still found in Social sciences, business and law, with 26.1 thousand, or one third of the total number of enrolments (CSB, 2022).

The proportional distribution of bachelor's level graduates by thematic groups of education reflects the distribution of students in these groups. The largest group of graduates are those who studied in the "Social sciences, commercial sciences, and law" thematic group. In a survey of young people in Latvia, 63% expressed a desire to become entrepreneurs who employ others, 8% preferred entrepreneurship in a family business, 16% preferred self-employment, while only 12% chose the status of an employee (MES, 2015). Studies in Latvia indicate that over half (52%) of Latvian residents have considered starting their own business, showing that entrepreneurship is a highly popular employment option. However, few have actually put their ideas into action, with only 14% of those who have considered starting a business actually doing so. It's worth noting that in recent years, residents have become more likely to consider starting a business; in 2012, this figure was 37% (DNB, 2015).

Intention is the strongest predictor of an individual's behavior (Ajzen, 1991). Entrepreneurial intention refers to an individual's belief and plan to start a business in the near future (O'Reilly *et al.*, 1991) and create new and competitive innovations (Batraga *et al.*, 2019).

Scientific literature suggests that people's self-perception is complex and constantly evolving, rather than simple and constant (Caza *et al.*, 2018). The likelihood of starting a business is influenced by attitudes towards the potential outcomes and the perceived risks and benefits.

Multiple studies on the motivations for entrepreneurship have confirmed that there is no direct correlation between external environmental factors and entrepreneurial activity. Instead, external factors are seen as merely providing a more favorable environment for entrepreneurship, serving as a "trigger" rather than a direct cause (Janse van Rensburg & Tjano, 2020). The likelihood of choosing entrepreneurship as a career is significantly impacted not only by external factors such as incentives, but also by personal values and orientation. Personal values refer to the beliefs and principles that guide an individual's behavior and decision making.

3. Strengthening of identity in the studies process

Research indicates that while young business management graduates exhibit strong decision-making skills, they often lack the comprehensive management abilities needed to effectively handle the numerous critical factors involved in problem solving (Ding et al., 2020). Several scholars (Gould & Voelker, 2010; Jones & Lavallee, 2009) have identified leadership as an important life skill for young people to develop and that all young people have the potential to be leaders. Researchers have argued that intentionally offering young people leadership roles can help them develop quality-of-life skills such as communication and decision-making (Shaikh *et al.*, 2019).

Based on the evidence presented, it appears that there is a need for young business management graduates to develop comprehensive management abilities beyond strong decision-making skills. This could be achieved by intentionally offering them leadership roles to develop quality-of-life skills such as communication and decision-making.

4. Methods. Research design

The objective of this research is to understand how educational programs, initiatives and experiences can impact the development of entrepreneurial mindset and encourage students to pursue entrepreneurial careers. The study aims to provide valuable insights and recommendations for educators to enhance the entrepreneurial education and foster a supportive environment for the development of entrepreneurial mindsets among business students. The focus group discussions were conducted to find out the views and attitudes of individuals. In addition, focus groups are an appropriate method for constructivist studies. The study was conducted on 84 business management students from the "Social sciences, commercial law and law" group, who were recruited from a specific course on business management. It consisted of 5 focus group discussions. The participants were recruited using of convenience sampling method. The sample was chosen based on the relevance of students' academic background to the research question and because they had already demonstrated a commitment to studying business-related topics.

5. Data collection

The discussions covered three main topics: the impact of the academic environment on the students' identification with entrepreneurship, factors promoting or hindering the realization of entrepreneurial intentions, and solutions to the intrapersonal conflict faced by business students in realizing their entrepreneurial goals.

The research results are summarized through content citations, highlighting the key factors in fostering Entrepreneurial intention among business students. When discussing the number

of times issues/outcomes were identified in a focus group discussion, Table 1 indicates how many times certain topics or issues were mentioned or discussed by the participants. This provides an indication of the frequency and importance of certain issues or topics within the group, and can also help identify areas where there is consensus or disagreement among participants.

Table 1. Focus group results.

General Theme	Specific Issue/Outcome	Number of Times Issues/Outcomes Were Identified
The impact of the academic environment on the students' identification with entrepreneurship	Practical experience	36
	Mentorship	32
	Entrepreneurial education/training	32
	Networking opportunities	24
	Curriculum design	21
	Research opportunities	18
	Entrepreneurial ecosystem	18
Total outcomes identified by groups		181
Factors promoting or hindering the realization of entrepreneurial intentions	Self-efficacy beliefs	28
	Fear of failure	26
	Perceived barriers	26
	Personal circumstances	23
	Lack of knowledge/experience	17
Positive attitude/mindset	13	
Total outcomes identified by groups		133
Solutions to the intrapersonal conflict faced by business students in realizing their entrepreneurial goals.	Goal-setting	24
	Established decision-making style	24
	Pressure to pursue traditional careers	21
	Personal development	18
	Action planning	16
	Mindset shift	16
	Resilience building	8
Total outcomes identified by groups		127

The results of the study show that business students may lack hands-on experience in entrepreneurship, making it difficult for them to understand the realities of starting and running a business. Content citations, e.g., *incorporating more practical tasks that foster business thinking or business simulation games into the study process would be beneficial*. Many business students may not have access to an entrepreneurial ecosystem that can help them understand the benefits and challenges of starting a business. Content citations, e.g., *It helped me a lot to change my thinking from "what would I like to do?" to "what problem could I solve?" ... ; not to perceive studies as an obligation, but as an opportunity*. One of the important problems revealed by the research is that business students may struggle to find experienced mentors who can guide and support them as they develop their entrepreneurial ideas. Business students may lack a comprehensive understanding of the various business

models and strategies necessary for success in entrepreneurship. Content citations, e.g., *practical experience and hands-on learning can be just as valuable as formal education. By starting small and gaining experience through internships, side projects, or even by starting our own businesses, we can gain a deeper understanding of the various business models and strategies that are most effective; a limited knowledge of business models and strategies should not deter us from pursuing entrepreneurship.*

Also, focus group participants emphasized that they feel pressure from friends, family, or society to pursue traditional career paths, which deter them from pursuing entrepreneurship. Business students, who are the future entrepreneurs, often face intrapersonal conflicts while realizing their entrepreneurial intentions. These conflicts arise from within the individual and can lead to a barrier in realizing their entrepreneurial intentions.

6. Conclusion and implications

Summarizing the results of the interviews, it can be concluded that not only lack of finance, but also lack of creative ideas, insecurity and competition - these are just some of the reasons that prospective, young entrepreneurs, having doubts about starting their own business, should replace with purposefulness, confidence and daring. Intrapersonal conflict refers to the conflicting thoughts, feelings, and behaviors that arise within an individual. In the context of entrepreneurial intention, these conflicts can arise from various internal factors such as self-doubt, fear of failure, lack of confidence, and uncertainty about the future. The intrapersonal conflict faced by business students can significantly impact their entrepreneurial intentions. The fear of failure can lead to a lack of motivation, which can result in students giving up on their entrepreneurial aspirations.

Since many behaviors create performance difficulties that limit volitional control, it is useful to pay increased attention to promoting students' self-control abilities. An individual's control over behavior can be influenced by his learned decision-making style. It refers to the approach or method of decision-making that an individual has developed through past experiences and learning. These decision-making styles can be influenced by factors such as personality, values, and cognitive biases. Business decision-making is a complex process that involves choosing the best course of action among several alternatives. It is important to include in the study process the evaluation of various situations for developing critical thinking. Experience is a very important factor in the business intent aspect. Two types of business experience can be distinguished: experience gained before starting a business and experience gained during the course of business. Previous experience is very valuable in terms of business intent.

The research findings suggest that in order to foster entrepreneurial intentions among business students, the incorporation of specific actions into the study process is crucial. These

actions comprise the following: Providing exposure to accomplished entrepreneurs and their stories, which encompasses both triumphs and setbacks, to prompt students' identification with entrepreneurship - an influential catalyst for the commencement of new businesses. Furthermore, hands-on experience via project-based or business incubator activities can aid in the realization of delayed professional identity and self-expectations, as focusing on unrealized identities tends to create a strong desire for them (Lyubomirsky et al., 2010). Additionally, the provision of courses or workshops focusing on creativity is the preliminary step toward innovative thinking.

The identification of an individual's entrepreneurial intention is a critical task, as it aligns with activities that have the potential to create significant value for both the individual and society, fostering job creation and innovative breakthroughs. Concurrently, based on the principle of sustainability, it is also essential to identify decision-making models that enable effective resolution of intrapersonal conflicts. Such models play a key role in enhancing psychological and mental resilience of individuals, thereby reinforcing their capacity to confront challenges in a sustainable manner. Fostering a culture of continuous learning and encourage students to seek out new knowledge and skills to help them grow as entrepreneurs. Entrepreneurship is an important skill that universities can impart to students, helping them create new businesses and contribute to the economy.

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The learning motives of business students and postponement

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Abstract

This paper examines the motives of students' program and specialization choice on the example of business students in TalTech, Estonia. The program applies postponement strategy – students choose between five specializations of more direct vocational relevance during their second year. This study aims to distinguish extrinsic and intrinsic motivation factors of students who have weighed their specialization choice for longer from students who have made that decision in an earlier phase.

The findings suggest that the level of intrinsic learning motivation is not significantly different between the two groups. However, an earlier decision indicates that the student is more specialization-driven, whereas the postponement approach is connected to a generalist / entrepreneurial profile. This proposes that when a programme targets cross-functional skills and entrepreneurial spirit development, the postponement strategy is recommended as a motivational tool. To a degree, postponement brings about benefits and being undecided should not be treated as a weakness.

Keywords: *Business school; undergraduate studies; career choice motives, learning motivation, postponement, intrinsic motivation.*

1. Introduction

Student learning motivation and motives of career choices are not only diverse in a static moment but also possibly significantly changing over time, both before starting college as well as during undergraduate years. Therefore, on a personal level, there is a lot on the stake if one needs to make this decision in relative haste somewhere around the final stages of secondary education. Luckily, in modern business education, this risk is often lowered by program design that expects students to do multiple step-by-step choices instead, for example starting a broad-based business program initially, then choosing a specialization branch and later as well as alongside facing a wide pool of elective courses or modules. Learning business in this way builds a T-shaped profile: a sum of a birds-eye view augmented with deeper, often more functional and specialization-specific competences. In such configuration, it often makes sense to decouple the specialization choice from the initial choice of starting university studies. Simply put, such postponement allows additional first year experiences to drive students towards a more enriched perspective to allow more meaningful choices as well as build confidence.

Motivation has received considerable attention over the past two decades. Central to this debate is self-determination theory, which differentiates between two types of motivation: intrinsic and extrinsic (Ryan & Deci, 2000; Ryan & Deci, 2017; Ryan & Deci, 2020). While there is a plethora of factors that can possibly impact the student learning motivation and principal career choices, they can be broadly viewed in the same framework, defined by whether the factor is mostly controlled by some external power or actor that applies pressure through punishments and rewards, or is instead coming from inside the person and is more carried by the enjoyment of the process rather than any desired outcome. In the context of career choice motives, some factors are connected to principal expectations to outcomes, such as the perceived value of competences, range of accessible jobs, wages, lifestyle, reputation, or even having proved oneself to the society. Such points are relatively common themes in the marketing communication of business schools aimed at prospective students. Rather more intrinsic would be factors such as a program matching with personal interests, hobbies, personal development goals and even with character traits.

Ideally, one could expect the freshman year to boost both extrinsic as well as intrinsic motivation of students, which would result in a more analytical decision. However, for a section of students, the postponement opportunity is irrelevant altogether as they have already committed in their hearts to a specialization earlier, some even before entering the program. This by itself would suggest a higher degree of intrinsic motivation. However, it can also be viewed as a potential risk in hindsight. Our study observes the perceived motives of program and specialization choice of business students as perceived amidst their studies, contrasting the “predetermined” and “postponed” student segments. The aim of the study is to understand the differences in motives of choosing a career and to evaluate the favor or disfavor of postponing the specialization decision. The paper includes some brief comments on

motivation aspects relevant for business student career choice. We then present the methodology of our study and limitations. The findings allow debate on the preferable model of student choice from the viewpoint of program management.

2. Literature review

According to the self-determination theory, amotivation (lack of competence and value, nonrelevance) and intrinsic motivation (interest, enjoyment, satisfaction) are the two ends of a spectrum. In between resides extrinsic motivation consisting of four regulatory styles: external regulation (external rewards or punishments), introjection (approval from others and self), identification (personal importance, valuing, goals) and integration (consistency of identifications) (Ryan & Deci, 2020).

The activity is intrinsically motivated when it's purposeful, creates interest and provides satisfaction (Laran & Janiszewski, 2011; Wasserman & Wasserman, 2020). According to self-determination theory, autonomy, competence and relatedness are needed to satisfy persons' basic needs and create the environment for personal growth and integration (Ryan & Deci, 2020). Extrinsic motivation is characteristic of a situation when the activity itself is less important than its social or material consequences (Fischer et al., 2019). The stronger the extrinsic motivation, the smaller the effort undertaken (Ryan & Deci, 2000). People can, however, have simultaneously multiple motivations for their actions (Ryan & Deci, 2020).

Students' study and career motivation can be also studied in the intrinsic and extrinsic motivation framework (Kornijenko, 2022; Akosah-Twumasi et al., 2018). Extrinsic motivation is related to more shallow study methods, while intrinsic motivation is characteristic more of a deep study (Lucas & Meyer, 2005). The former is driven by external factors necessary to get the grade or fulfil the exam requirements, while the latter leads to understanding the study content, engaging actively and critically with it, in order to solve problems and implement new ideas, and find associations with existing knowledge (Duff & McKinstry, 2007). Study motivation is not fixed, but can change over time, influenced by the person, situation and important others (Boström & Bostedt, 2020).

According to Iacovou et al. (2011), there are five main work attributes: promotion potential, type of work (interesting, challenging), safety at work, remuneration and co-workers. In terms of youths' career motivation, Akosah-Twumasi et al. (2018) have found the extrinsic factors to include financial remuneration, job security, professional prestige and job accessibility; and the intrinsic factors to consist of personal interests, self-efficacy, outcome expectations and professional development opportunities. For business students, their career is mainly related to three factors: earning money for personal needs, self-fulfillment and growth, and making one's dreams come true (Frankowska et al. 2015). In choosing business as a field of study, the strongest motives are personal interests, but also compatibility with one's lifestyle and talents (Loorits, 2022).

In addition to internal and external motivators, family members, teachers and peers can impact youth's career decision-making. According to Polenova et al. (2018), students indicated parental influence on a specific career choice. Moreover, Akosah-Twumasi et al. (2018) reported that interpersonal factors and emergent bicultural influence play a role in career choice and that parental influences can be significant in collectivist cultural settings.

3. Research methods

The study employed quantitative research design. Data was collected from undergraduate business students of TalTech, Estonia with an online survey in early 2022. The Business program is characterized as a broad foundation to business, where students choose between five specializations on their second year: finance, entrepreneurship and management, logistics and supply chain, accounting and business intelligence, and marketing. Still, roughly $\frac{2}{3}$ of the program is shared across specialization branches. The questions had roots in previous studies on study and career motivation (Ryan & Deci, 2000, 2020; Akosah-Twumasi et al. 2018). The survey included demographic profile, evaluation of motives for students' initial choice of a program and of their specialization, and the time of the latter choice. The choice motives were evaluated on a 5-point Likert scale [strongly disagree; strongly agree]. The timing of the decision provided choice between five options, which were later condensed into two categories: "predetermined" (choice made before studies or during the first semester), and "postponed" (from second semester up until the last moment on the third).

The study population was a cohort of 2020 intake with 113 students. 69 responses were received (61%), 75% female, average age 21. Two respondents were excluded due to incompleteness. The response rates were comparable across gender and across specializations – the data is representative of both genders and we could not identify any major sample bias (other than the most typical "lowly motivated subjects might not respond"). Data was analysed with Spearman's and Wilcoxon correlation analysis and linear regression, conducted by SPSS v.28.

4. Results

The survey was firstly validated with exploratory factor analysis, yielding three factors: intrinsic, extrinsic and interpersonal. Table 1 demonstrates factor loadings exceeding 0.4 (Hair et al., 2009). Cronbach's alpha shows the internal consistency of the study. The reliability estimates of scaled items ranged [0.63 to 0.82]. Table 1 includes 13 motives, while eight others in the original survey were omitted, following the result of factor analysis. This paper could not fit some of auxiliary and more specific data, but the authors are willing to share it on demand. Table 2 indicates the means of the three motivational factors (extrinsic motivation, intrinsic motivation, interpersonal factor), according to the independent sample Mann-Whitney test.

Table 1. Mean and standard deviation of the scale items.

	Mean	SD	Factor loading	Cronbach's Alpha
Intrinsic factor				
I am interested in the topic area	4.19	1.02	0.886	0.824
I aim to develop my entrepreneurial skills	3.88	0.90	0.794	
I aim to be a part of social and business network	3.96	1.02	0.765	
I can combine my future job with my hobby	3.54	1.11	0.699	
My vision is to become an entrepreneur	3.37	1.22	0.637	
The curriculum is attractive and suitable for me	4.51	0.59	0.563	
Extrinsic factor				
The university and program are modern and practical	4.49	0.59	0.781	0.633
I think TalTech School of Business and Governance offers the best business education in Estonia	4.01	0.79	0.687	
Graduating the program is a way to prove my worth to the society	3.45	0.99	0.633	
The program has positive public reputation	3.67	0.94	0.615	
Ability to make money	3.88	0.90	0.415	
Interpersonal factor				
Parents	2.45	1.26	0.835	0.706
Friends and peers	2.33	1.15	0.783	

Source: authors' calculations

Surprisingly, most motives did not vary between predetermined and postponed groups. Seemingly slightly, but statistically insignificantly, the postponed group leaned towards a stronger motive of broad career perspective, whereas the predetermined group was more motivated by “relevant specialization available”, which suggests that the predetermined group have a slight leaning towards seeing themselves as specialists, while generalism appeals to the postponed group, as they were also, on average, more inspired by entrepreneurship. This also contributes to why overall intrinsic motivation is slightly higher in the postponed group. It can be seen as modest positive feedback to the faculty – arguably the entire learning process is now more meaningful.

The data showed that the postponed group is slightly more motivated by wages. It can be interpreted that the students more driven by future wages would indeed postpone their decision, as such direct pragmatism would allow a more calculated decision. However, for both groups, it was a secondary motif. The overall extrinsic component was slightly lower in postponed group because of such pattern of other extrinsic elements. Between the two groups, one difference was in the interpersonal factor - the influence of parents and friends had played a stronger role in the predetermined group and less so in the postponed. This was expected, but the overall low position of interpersonal factor alongside other elements was a bit surprising. Still, this is in line with previous studies (Akosah-Twumasi et al., 2018), considering high level of individualism in local cultural context.

Table 2. Differences in the mean scores for choice motives.

Factor	Career decision	Mean	Mean difference	p-value
Extrinsic	Predetermined group	3.88	0.15	0.292
	Postponed choice group	3.73		
Intrinsic	Predetermined group	3.84	-0.06	0.766
	Postponed choice group	3.90		
Interpersonal	Predetermined group	2.61	0.52*	0.084
	Postponed choice group	2.09		

Note: * significant difference at the 0.1 level.

Source: authors' calculations

Table 3 provides the results of the correlation analysis. There is a strong positive correlation between intrinsic and extrinsic factors for a “predetermined” group of students (choice made before or during the first semester), which is not the case for postponed group. Furthermore, there is negative correlation between intrinsic and interpersonal factors for postponed group.

Table 3. Spearman’s correlation for career decision-making and motivation factors.

		Intrinsic factor	Extrinsic factor	Interpersonal factor
Postponed choice group	Intrinsic	1		
	Extrinsic	0.077	1	
	Interpersonal	-.382**	0.037	1
Predetermined group	Intrinsic	1		
	Extrinsic	.559***	1	
	Interpersonal	0.101	0.218	1

Note: *** correlation is significant at the 0.01 level; ** correlation is significant at the 0.05 level.

Source: authors' calculations

Furthermore, it appears worthwhile to mention that the learning motives were rather similar across specialization options. The data indicated minor differences for local reasons (such as certain specializations having higher reputation perhaps because of visibility of local faculty activities). In addition, the motifs of societal contribution and being attracted by rapid development of the area applies to logistics students more than for other branches, but still the overall role of these motifs is secondary. In comparing the specialization choice with the timing aspect, there was only one significant finding – the share of marketing students in the

predetermined group stood out from the overall sample. We speculate it is a result of various local education landscape reasons, as different specializations have different supply patterns.

Not only were the motives of choice similar across specializations, but also various other specializations were showing to be still rather close “in competition” in terms of their overall attractiveness. While we had assumed that giving students time to weigh their options makes it a clear choice for most, the data indicated that for most students, there is at least one other option almost similarly favorable. While it is positive in the sense that all options are seen worthy to be considered (suggesting there are no major local quality bottlenecks) it is also a sign that students (at least on their second year of studies) are still diverse mostly in similar ways between specializations. Even though many colleagues in academia might feel that there are clearly “students better-suited for marketing” and others for finance or accounting, the individual choices of students seem mostly to disregard such stereotypes.

5. Discussion and conclusion

One possible conclusion is that postponement does not significantly boost overall motivation because locally our faculty is not good enough. Still, fortunately, there is no significant motivational decline, suggesting we are at least managing to avoid student discouragement. As the average scores of more favorable motives (from faculty viewpoint) appear moderate-to-high, they don't indicate a major alarm. Postponement as a motivational strategy appears a sound suggestion for business programs. Even if not significantly impacting student motivation, it appears relevant as supporting student satisfaction. Ideally it could also boost both extrinsic and intrinsic motivation. We still recommend business programs to increase the number of elective courses as well as other ways of meaningful choices. This wouldn't be even mainly for vocational reasons (such as to better cater for the direct needs of labor market), but for expecting the students to further practice self-reflection based decision-making, which we see as a key foundation of modern entrepreneurship competence.

In conclusion, a balanced mix of student motivation appears most desirable. If intrinsic motivation is lacking, the student might be treating the effort input as qualifier – just enough to cross a certain threshold. Extrinsic motivation should not be treated as a substitute for intrinsic, rather than complementary. One aim of the faculty would be to ensure that students would continuously develop a stronger perception of relevance of each and every topic area. Coupling that with practicing ongoing self-evaluation would be a way to create a machine that further refines the elements of relevance towards the level of individual identification. Finally, we propose that a driving force of this machine ought to be curiosity, the role of which is sometimes underestimated in faculty teaching practice. A teacher should never give up aiming to spark and fuel student curiosity with aims to develop this into a habit. This might be perhaps even more important than any formulated learning outcome of a program.

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Online Repository for Facilitating Teaching and Learning of Undergraduate Statistical Modeling Tools

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Abstract

This paper presents an online repository created for facilitating teaching and learning statistical modeling tools at the undergraduate level. Statistical models and modeling techniques have always been considered the backbone in data analysis and statistical learning. Over the past decade, teaching of such topics has also gained an increasing attention in the undergraduate statistics and data science curricula. The developed online repository aims at improving the teaching and learning of statistical modeling tools in various undergraduate statistical modeling courses. We present the four core components of the repository, showcase some of its functionalities, and exhibit available resources online. Through our informal assessments after incorporating the online repository into our classrooms, our students seemed to have a uniformly better understanding of the related concepts and methods, which was reflected during the in-class discussions as well as in the subsequent tests in the courses.

Keywords: *Interactive web applications; linear regression; online repository; statistical models.*

1. Introduction

Statistical models play a vital role in data analysis and have been applied to an abundance of practical problems (Cox, 1990). Teaching statistical modeling tools with an emphasis on regression analysis has always been an essential part of the undergraduate statistics education. In the American Statistical Association report on Curriculum Guidelines for Undergraduate Programs in Statistical Science (Horton et al., 2014), statistical modeling, including regression analysis, has been identified as one of the core topics in undergraduate statistics curriculum. Moreover, in the current Guidelines for Assessment and Instruction in Statistics Education (Carver et al., 2016), learning and using statistical models is listed as one of the important learning goals, even for introductory statistics. Here the goal is not only to ensure students' mastery of the general knowledge of statistical models, but also to facilitate the development of students' statistical maturity, which serves as a crucial building block for them to acquire some more advanced topics in their statistics curriculum. Given the rapid development and growing interest of data science over the past decade, regression analysis has also been universally recognized and widely adopted as a central component in the data science curriculum (De Veaux et al., 2017; Donoghue et al., 2020).

Even though students often get exposed to the topic of (simple) linear regression in a first course in statistics, such as introductory statistics, taking some more advanced modeling courses is necessary to fill them in the technical details, expose them to other modeling techniques, introduce them to inferential procedures of different models, and improve their computational skills through the use of certain statistical software or programming languages. These more advanced courses in statistical modeling are especially vital for students who are considering pursuing a graduate degree in statistics or a related field. Most undergraduate programs in the US offer applied statistics modeling courses in addition to introductory statistics. Although slightly different in content, such courses often require students to have certain mathematical background, and their prerequisites usually include calculus or linear algebra. The mathematical components of such courses further solidify students' understanding of the fundamental concepts and properties of various statistical models. However, at the same time, they may unfortunately place a barrier in the learning process for students with a relatively weaker quantitative background, especially for underrepresented minorities, first-generation college students, students of color, and indigenous students. Consequently, those students may feel discouraged from further pursuing statistics or a field in STEM in general.

When teaching abstract or challenging concepts, it is a common practice for statistics educators to take advantage of visualization in order to break each concept into several pieces of information for ease of understanding. It is also crucial to connect each concept with real-world applications through concrete yet interesting examples. Some recent pedagogical efforts on this front often involve active learning (Gelman and Nolan, 2017; Green et al.,

2018; Cai and Wang, 2020) and interactive web applications (Tintle et al., 2020). Although the use of those applications saves students from undertaking the hard coding of simulations, there are only a small number of such online applications available for teaching or learning statistical modeling at the undergraduate level.

Another important learning goal we often emphasize in our classrooms is the introduction and clarification of formal inferential procedures of statistical models. Since the true population model is not observable, one of the critical steps in the modeling process is to draw conclusions of the true model based on its sample estimate. This procedure is referred to as statistical inference. Due to a lack of mathematical preparations for some students, one of the challenges in teaching such concepts is to convey the fundamental idea behind statistical inference and explain intuitively why a certain distribution is assumed in each of the inferential procedures. To overcome this hurdle, one popular approach nowadays is to adopt the so-called simulation-based inferential procedures (Tintle et al., 2018; Hildreth et al., 2018). There are a number of statistics textbooks with an emphasis on simulation-based methods, especially for introductory statistics (Tintle et al., 2020). However, there seems to be insufficient resources available that are thoughtfully designed for more advanced modeling topics in statistics.

Given all the challenges discussed above, we believe that there is a pressing need to develop an online repository to engage students in active learning, help students build connections and identify differences between various modeling tools, as well as to incorporate simulation-based inference into the teaching of statistical modeling at the undergraduate level. In what follows, we will detail the components of our designed online repository.

2. Components of the Proposed Repository

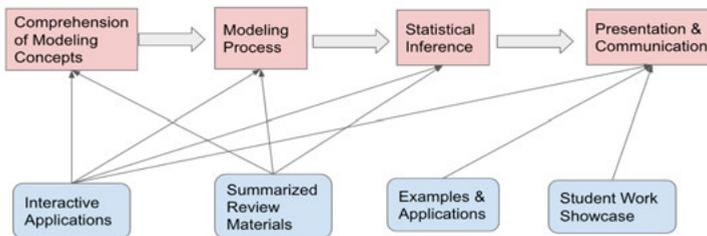


Figure 1: Overview of the four components in the repository.

Figure 1 presents the four core components of our designed online repository, namely, Comprehension of Modeling Concepts, Modeling Process, Statistical Inference, and Presentation and Communication. In the following, we will provide more details for each of these four components.

2.1. Comprehension of Modeling Concepts

The objective of the first component, Comprehension of Modeling Concepts, is to facilitate the introduction of statistical models, discuss important elements and assumptions of each model, and demonstrate the differences and similarities between a statistical model that describes the relationship of variables in the target population and the corresponding fitted model estimated based on a sample of data drawn from the population.

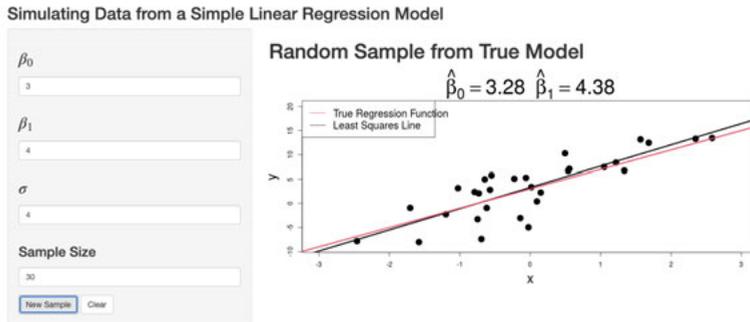


Figure 2. Example of an interactive application for simple linear regression.

Interactive web-based applications can well meet this objective. Over the past several years, we have been working on developing a number of interactive applications for our statistics modeling courses, using the R Shiny package (R Core Team, 2022). For example, Figure 2 showcases one application we created when first introducing the simple linear regression model in our classes. In this application, users can input values of the true parameters of the model, and then generate a random sample of data based on the underlying true model. Given the simulated data set, the estimated regression coefficients, $\widehat{\beta}_0$ and $\widehat{\beta}_1$, obtained by the Ordinary Least Squares Criterion are displayed on top of the scatterplot. Moreover, both the true regression line and the estimated regression line are presented in the plot to clarify the difference between the population relationship and its corresponding sample estimate.

A set of thoughtfully designed interactive applications are available in the first component of our online repository, ranging from topics on multiple linear regression, analysis of variance (ANOVA) models, logistic regression, receiver operating characteristic (ROC) curve, to support vector classifiers. We plan to continue our efforts in this direction, and develop more interactive tools that are useful for teaching and learning more challenging concepts in statistical modeling.

2.2. Modeling Process

The second component of our repository focuses on providing more details of the modeling process of a given model. It provides students with a road map of mastering different

modeling tools in a more systematic way and aims at enhancing students' understanding of various statistical modeling techniques.

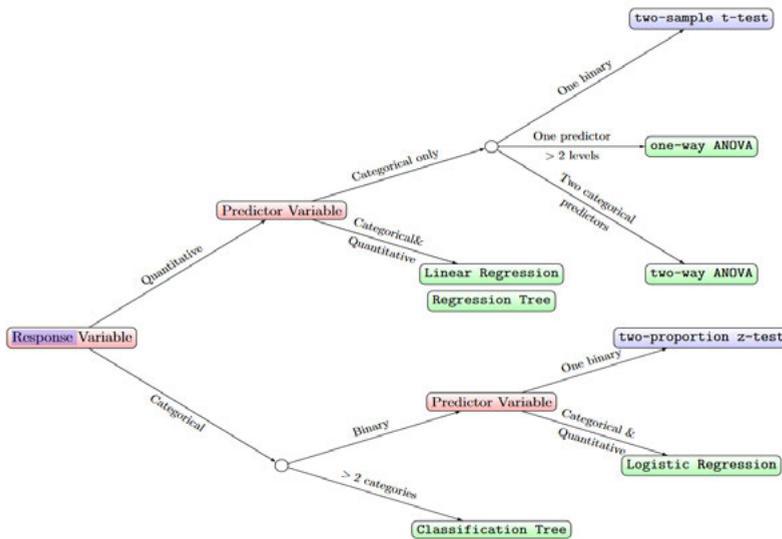


Figure 3. Diagram used to identify a proper statistical model.

The Modeling Process component includes an overview of various types of statistical models, typically introduced at the undergraduate level. Students start with a diagram, as displayed in Figure 3. By following the diagram, students are guided through the process of selecting an appropriate model given a real data set and some research question of interest. In addition, the diagram is interactive, i.e. each model is linked to a module, where students can further explore and review some relevant concepts for the selected model.

In order to illustrate the order, connection, and cyclic nature between steps of the modeling process, we designed another diagram to reflect the modeling steps in a sequential manner. The diagram also offers a head-to-toe comparison between different models. With the help of the hyperlink feature, when selecting one of the models the user will be directed to a new web page that presents the comparison across various models. For example, Table 1 presents an example that compares multiple linear regression model, two-way ANOVA model, and multiple logistic regression model. By comparing these models side by side, it is easy for students to recognize that linear regression and ANOVA models share similar model assumptions, while linear regression and logistic regression have more in common in their formulations, as both relate the (transformed) mean response with a linear combination of predictors.

Table 1. Sample Comparisons of Different Models.

	Linear Regression	ANOVA	Logistic Regression
Model	$Y = \beta_0 + \beta_1 X_1 + \dots + \beta_k X_k + \epsilon$ <ul style="list-style-type: none"> • model linear relationship; predict the value of Y • Y is quantitative • X_j is either quantitative or categorical (e.g. indicator) • error: $\epsilon \sim N(0, \sigma)$, independent • k=number of predictors 	$Y = \mu_j + \epsilon = \mu + \alpha_i + \beta_j + \epsilon$ <ul style="list-style-type: none"> • comparing means across combinations of factor levels • Y is quantitative • factors are categorical • error: $\epsilon \sim N(0, \sigma)$, independent • I, J=number of levels for each factor 	$\log \frac{\pi}{1-\pi} = \beta_0 + \beta_1 X_1 + \dots + \beta_k X_k$ <ul style="list-style-type: none"> • adjusted relationship that predicts the probability of $Y = 1$ • Y binary; $\pi = P(Y = 1)$ • X_j's are either categorical or quantitative • no explicit error term • k=number of predictors

2.3. Statistical Inference

Over the past decade, simulation-based inference has gained much attention and become a popular approach for introducing statistical inferential tools to undergraduate students. However, most existing work and interactive applications were built for introductory statistics. To bridge the gap, we construct the following modules in order under the Statistical Inference section in our repository: Module 1. Sampling distribution and computing p-value for a hypothesis test of the population mean based on a simulation; Module 2. Commonly used distributions and their properties; Module 3. Sampling variation and inference for model parameters and predictions; Module 4. Other simulation-based methods and their applications to statistical models.

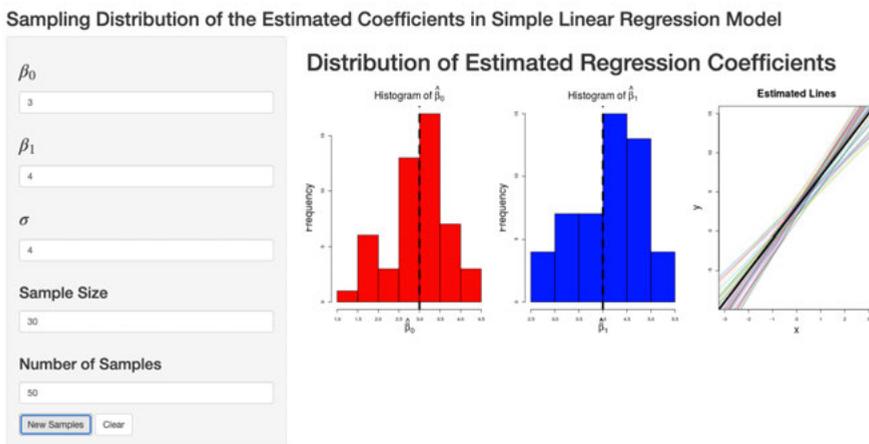


Figure 4. Sample Applications of Statistical Inference.

As an example, Figure 4 presents one of the developed interactive applications for Module 3. It visualizes the variability of the estimated coefficients in a simple linear regression model, which also echoes back to the application displayed in Figure 2. By increasing the sample size as well as the number of samples drawn from the true model, the histogram will display

a distributional shape that is approaching a bell-shaped curve. This observation naturally guides students to the topic of hypothesis testing of model parameters.

2.4. Presentation and Communication

One of the important learning goals for a statistical modeling course is to improve students' communication skill in delivering statistical results to a broad audience across different disciplines. This skill is usually honed by having students work on a course project, give a oral presentation, and/or complete a written project report. We have noticed from our previous teaching experience that some students have limited prior experience in working on data analysis projects, such as students who are not traditionally well represented in the STEM fields. Hence, they often face more challenges during the completion of such class assignments.

To overcome this issue, we offer useful resources in our repository on how to present statistical results and write a professional project report. We include useful tips on best practices and related literature. Moreover, with our former students' permission, we created a library that showcases past students' work (e.g., papers or presentation videos).

3. Summary and Conclusion

In this paper, we discussed an online repository designed for teaching and learning statistical modeling tools at the undergraduate level. In particular, we presented the four core components of the repository and showcased some examples among its functionalities. We anticipate that the four components in our repository will complement each other to engage students in the classroom, facilitate their understanding, and make the learning of statistical modeling more enjoyable and effective. Through our informal assessments when integrating some of the applications in the repository to our own classes, we received uniformly positive feedback from our students. Furthermore, by incorporating the online repository over the past semesters, our students seemed to have a generally better understanding of the related concepts and methods, which was reflected during the in-class discussions as well as in the subsequent tests of the courses. We plan to continue our efforts in this direction, enriching the available tools and web applications in the online repository. In addition, we hope to make the repository publicly available in the near future so that it can benefit the broader statistics and data science education community across the globe. As a future project, we plan to conduct formal analysis on the feedback received from students and educators who have experimented the developed online repository.

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The MILAGE LEARN+ app on higher education

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Abstract

This paper presents the use of the MILAGE LEARN+ app in Higher Education, which takes advantage of gamification to motivate students and implements a self and peer assessment scheme. There are tasks with three different levels of difficulty to include all students. Teachers are responsible for producing assignments which once done are uploaded to MILAGE LEARN+ app, thus making them available to students. When students solve tasks they have immediate feedback, with the solution available with criteria for assessment and an educational video that explains the task solution, which can be revisited as many times as needed for the student to learn. MILAGE LEARN+ is available for free and can be used for face to face, online, blended or flipped learning. Its use in Higher Education shows that it promotes pedagogical differentiation and increases the autonomy of students.

Keywords: *Gamification; self and peer assessment; m-learning; pedagogical differentiation; autonomy.*

1. Introduction

The MILAGE LEARN+ app was developed by the University of Algarve, with the initial objective to improve the learning of mathematics in elementary and secondary schools in Portugal. This project was also implemented in Spain, Germany, Norway, Turkey and Cyprus. After this period this tool start to be used in other disciplines such as, biology, languages, etc. (Figueiredo, Bidarra, González-Pérez, & Godejord, 2017; Figueiredo, Godejord, & Rodrigues, 2016).

This app is available for free on Windows and OSX computers as well as iOS and Android devices which to take advantage of a wide availability of mobile devices that students carry with them.

Mobile devices give students flexibility and individualization of their learning experiences, as well as allow them to expand the time spent learning outside the classroom. This offers a great opportunity for teachers and students to take advantage of technologies to facilitate learning. It is important to note that these students are the generation of digital games and social networks. They are no longer the same for whom the education system was designed a few decades ago. A generation whose expectations are different from those that preceded it.

The MILAGE LEARN+ app uses features of games to motivate students and implements an approach with a self and peer assessment that promotes pedagogical differentiation and increases the autonomy of students.

This paper presents several examples about the use of the MILAGE LEARN+ app for learning on Higher Education.

2. The MILAGE LEARN + app

MILAGE LEARN+ was conceived as a game where the players are students and the main goal is to solve tasks uploaded by the teacher (Figure 1). These tasks are grouped in subchapters and chapters and this organization makes MILAGE LEARN+ structurally similar to a task book.

After login into the app, the game start, with the following steps:

1. Student select the “game” (task).
2. Find the game solution (solve the task).
3. Submit the solution.
4. Self-assessment of the task solution submitted based on the criteria for assessment.

5. Watch the educational video explaining the task solution if needed for better understanding of the task.
6. Peer-assessment of a colleague's solution.

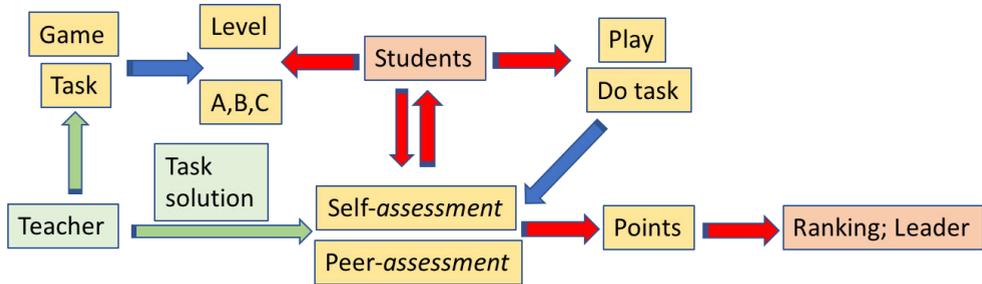


Figure 1. App MILAGE LEARN+ functioning/usage diagram.

In case of a multiple choice task, after the student selects his option, the app automatically identifies it as correct or wrong

In case of an open question task, the student need to solve the task using a pen and paper and after with a mobile device takes a photo and upload it to the server. In this case, the MILAGE LEARN+ app combines the analog and technology. It is also possible to submit the answer using the keyboard.

After submitting the answer, the student gets the access to the instructions for self-assessment. In this way, the student gets immediate feedback and understands if what was done was correctly or not and feeds forward to know what to do to improve. At the same time the student can see small video with the solution.

Thus, the student can study solving exercises or review the course content while evaluating his work or the work done by a colleague.

Inclusion of self and peer assessment contributes to promoting formative learning, learners' independence and taking responsibility for the learning process.

3. Gamification Learning Scenario

Gamification is defined as the incorporation of game mechanics in other situations, with the aim of increasing motivation in a given product or service, facilitating behaviors that promote learning (Hsu, Chang, & Lee, 2013).

In the game it is possible for each player to choose their own path and choose different levels of difficulty according to their abilities, which ensures fun and new learning in case of corrective feedback (Chen, 2007).

The use of educational games allows the student to put in practice contents and ideas that are topics of a certain area of knowledge. Chairs(Winter, Wentzel, & Ahluwalia, 2016), Chirality-2(Jones, Spichkova, & Spencer, 2018) and Nomenclature Bets(Silva Júnior et al., 2018) are examples of applications for teaching chemistry based on gamification.

The MILAGE LEARN+ implements a gamification scheme, which is being used in teaching/learning "Organic Chemistry" course, where gamification is a used strand. This subject, organic chemistry, has been classified by the students as difficult to understand, which leads to a high failure rate in its curricular units.

The objective of this work is using gamification elements from App MILAGE LEARN+, to motivate the learning of this area of knowledge, promote autonomous work and facilitate fixation concepts through self and peer assessment.

The practice involving App MILAGE LEARN+ was carrying out organic chemistry tasks to do outside of the class and after there is a discussion in the class. These reinforce learning the concepts. The topics involved were, mechanisms of reaction, stereochemistry and structure of compounds. MILAGE LEARN+ works like a task book and is structured in chapters and subchapters with exercise sheets. This approach follows the strategy described above. The teacher uploads the tasks including the solutions with criteria for assessment and the student solves the tasks using the app MILAGE LEARN+ app (Figure 2).

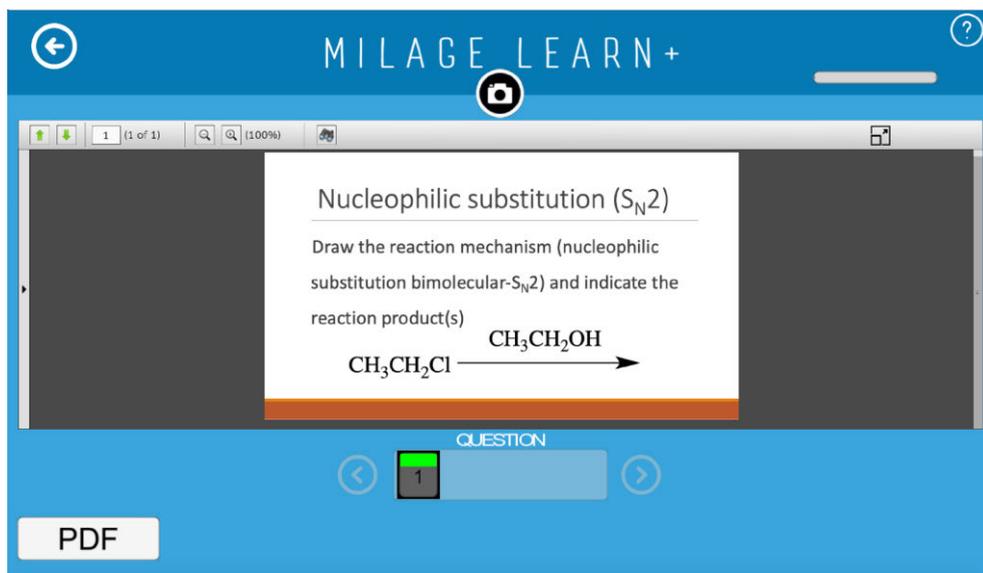


Figure 2. Students use the App MILAGE LEARN+ to solve tasks.

4. Class Discussion Scenario

MILAGE LEARN+ allows the application of active learning strategies, which aim to focus on the student in the creation of new knowledge, with the teacher as a facilitator of this process. The pedagogical practice of the “System Analysis and Design” (SAD) course aims to promote new ways of reasoning to students in order to facilitate the application of acquired knowledge, and aims to:

- Active learning in the classroom (through MILAGE) and outside the classroom (through a problem-based learning scenario)
- Plurality of points of view.
- The use of devices with network access to replace notebooks and the blackboard, incorporating technologies into everyday classroom life.

The SAD course encompasses theoretical and practical classes. Theoretical classes last one hour, taught twice a week. The content is provided in two 15-minute segments, alternating with tasks on the topics taught, using the MILAGE LEARN+ app. In this application, the statement of the task is presented and the students submit their solution. After submission, the student is able to view the video explaining the solution and self-assess its solution using the criteria instructions for self-assessment provided by the teacher. Upon completing the self-assessment, the student can proceed with the assessment of a peer’s solution (randomly assigned by the application) using the same instructions for assessment. Students accumulate points by self and peer assessment taking advantage of the gamification to motivate students and promoting autonomy with the self and peer scheme implemented in the MILAGE LEARN+ app.

In practical classes, tasks are carried out to reinforce the knowledge acquired in theoretical classes and in preparation for class discussion learning scenarios. In this context, the application is used in a different way, with the aim of discussing the various submitted solutions in the classroom. The teacher does not upload videos with detailed solutions to the MILAGE LEARN+ app, but criteria and good practices to apply in the solution. Figure 3 shows the tasks performed during this process:

1. Students submit solutions in groups using the MILAGE LEARN+ app.
2. Teacher shows all the student solutions.
3. Student groups discuss solutions.
4. At the end the teacher comments.

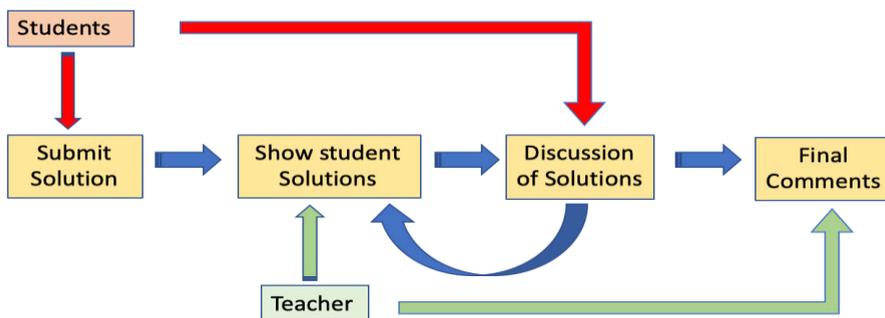


Figure 3. Class discussion learning process using the MILAGE LEARN+ app.

5. Evaluation and results

The practice of using the MILAGE LEARN app was measured through an online questionnaire with students attending the “Organic Chemistry”, consisting of the following questions:

1. Are points results important?
2. Is the existence of leaderboard score motivating?
3. Doing the tasks as part of the game makes learning more fun?
4. Carrying out the tasks helps to understand the theory?
5. Carrying out the tasks motivates students to study the theory?
6. Self-assessment of the tasks helps to understand the solution?
7. Evaluating colleagues' tasks helps to understand the solution?

These questions aimed to assess the influence of the various gamification elements introduced in pedagogical practice through MILAGE i.e. the importance of points and the ranking of students as well as performing and correcting exercises as part of a game. The students had, as answer options, a 4-point Likert ordinal scale: (1) Totally Disagree, (2) Partially Disagree, (3) Partially Agree, (4) Totally Agree. Results are illustrated in figures 4.a and 4.b. The former shows the results of questions 1-3, and figure 4.b shows the results for questions 4-7.

The analysis of the 48 answers to the questionnaire shows how the majority of the students totally or partially agreed with all the questions asked. In this sense, it is possible to conclude that the gamification elements significantly contributed to the motivation of the students and to the understanding of both the theoretical contents and the practical tasks.

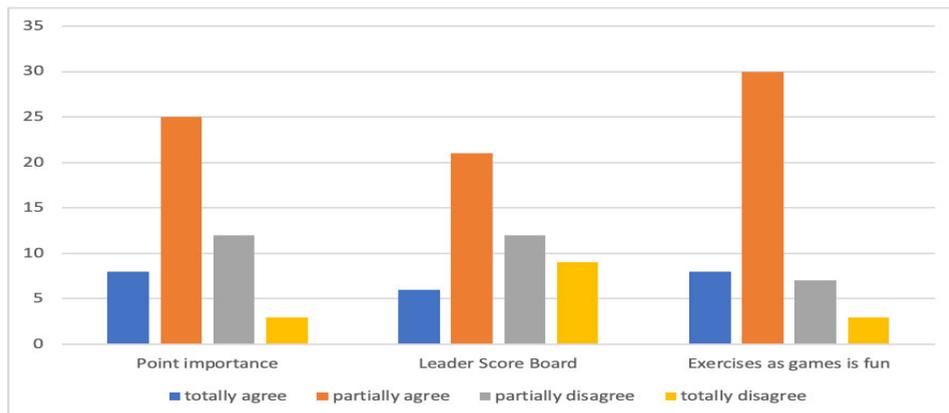


Figure 4a. Results of questions 1-3 of the gamification evaluation questionnaire with the MILAGE LEARN+ App. The Y axis represents the number of responses obtained from a maximum of 48 respondents.

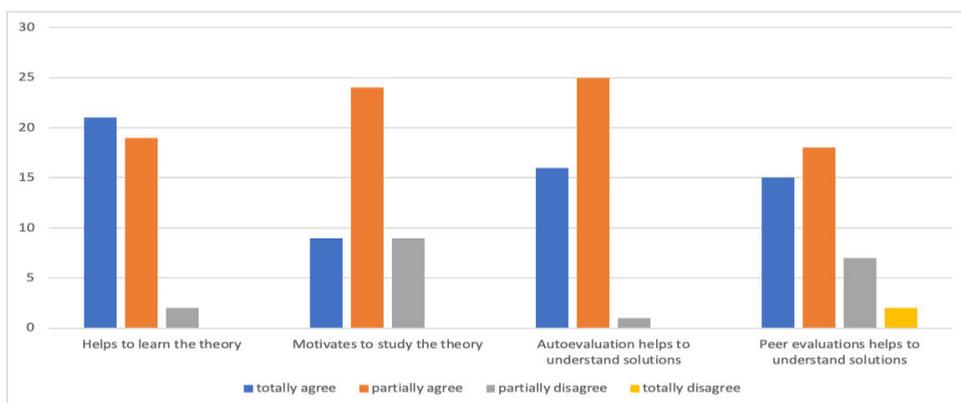


Figure 4b. Results of questions 4-7 of the gamification evaluation questionnaire with the MILAGE LEARN+ App. The Y axis represents the number of responses obtained from a maximum of 48 respondents.

However, it was observed that the degree of agreement was variable, with question (6) "Self-assessment of the tasks helps to understand the solution" the one that obtained the highest agreement (97.62%) and question (2) "Self-assessment as an aid to understanding the solution with the lowest agreement (56.25%). It should be noted that in terms of the different game activities, there was greater agreement on the value of carrying out the tasks than on the value of the evaluation activities.

6. Conclusions

This paper shows the use of the MILAGE LEARN+ app to implement gamification and class discussion scenarios on Higher Education explored for the teaching of "Organic Chemistry" and "System Analysis and Design" courses.

The main element for analyzing the results is the appreciation of the MILAGE LEARN+ application by the students, which, being positive, motivated the teachers to continue with this teaching approach by applying the MILAGE LEARN+ app.

After analyzing the questionnaires, it can be seen that the appreciation on the part of the students was, in general, quite positive. From the perspective of teachers, active learning strategies were applied extensively. Gamification motivated students for the learning. Carrying out activities centered on students allowed promoting the autonomous exploration of solutions and the ability to explain them. Strategies such as self-assessment and peer assessment promoted the development of their critical thinking capabilities and autonomy.

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Leveraging AI to instruct architecture students on circular design techniques and life cycle assessment

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Abstract

The aim of this study is to examine the use of AI as a tool for educating architecture students in circular design principles and life cycle assessment (LCA). A theoretical research approach is proposed to identify current challenges and solutions, and to provide insightful predictions and explanations from various perspectives. The paper emphasises the importance of sustainability in architecture education and assesses the difficulties of teaching circular design and LCA, and how AI can simplify the process. The role of AI in promoting cradle-to-cradle thinking in the design stage is demonstrated through the use of a standard LCA framework to make the assessment process more accessible to students. Key factors such as the building's climatic zone, location, type, service life, energy consumption and CO₂ emissions are considered part of the system boundary. The study concludes with limitations, recommendations, and guidelines for architecture students.

Keywords: *Artificial intelligence (AI); circular design techniques; life cycle assessment (LCA); sustainability education; cradle-to-cradle thinking; environmental impact factors.*

1. Introduction

In recent years, the architecture profession has been facing the challenge of creating buildings that are not only aesthetically pleasing but also environmentally responsible. Circular design techniques and life cycle assessment (LCA) are two key approaches that aim to promote sustainable design practices, by reducing waste and maximising resource efficiency throughout the lifecycle of a building (Eberhardt, Birkved, & Birgisdottir, 2022; Trusty & Horst, 2002). However, despite their importance, these concepts are often not taught in depth in traditional architecture education, leaving students with limited exposure to their practical applications (Gomes, da Silva, & Kowaltowski, 2022).

Artificial intelligence (AI) has the potential to bridge this gap, by providing students with interactive, data-driven tools that help them to understand the principles and benefits of circular design and life cycle thinking. AI-based educational tools can simulate the impacts of different design choices on the environment and help students to evaluate their designs from a life cycle perspective, in real-time. This type of feedback can be instrumental in promoting the adoption of circular design techniques and life cycle thinking in architecture education, by providing students with a deeper understanding of the trade-offs and opportunities associated with different design choices (Ewa; Gilner, Adam; Galuszka, & Tomasz Grychowski, 2019).

The aim of this study is to address the following questions:

- Why is the inclusion of LCA and circular design strategies in architecture education important and what makes it challenging?
- How can AI be utilized to streamline the implementation of LCA and circular design techniques in architecture education?

Then, the possibility of the development of a method that allows architecture students to easily apply the logic of LCA and circular design strategies at the early design stage is discussed.

2. Why is the inclusion of Life Cycle Assessment and Circular design strategies in architecture education important and what makes it challenging?

The inclusion of LCA in architecture education is important because it equips future architects with the tools and knowledge necessary to create sustainable and environmentally conscious buildings. LCA is a method for evaluating the environmental impact of a product, building, or system over its entire life cycle, from raw material extraction to disposal. This allows architects to consider the environmental impact of their designs and make informed decisions that minimize harm to the environment (Fnais et al., 2022). Circular design strategies, on the other hand, promote the idea of closed-loop systems, where waste is reduced

and resources are conserved. These strategies encourage architects to design buildings that can be easily disassembled, recycled, and repurposed, reducing the amount of waste generated and contributing to a more sustainable future (Attia & Al-Obaidy, 2021).

However, incorporating these principles into architecture education can be challenging for several reasons. Firstly, the complexity of building LCA, as it involves multiple interrelated parameters, makes it difficult for students to base decisions on during their design process. The difficulty of LCA application is related to various areas. Performing LCA requires a significant amount of data and expertise, including well-defined building plans, inventory assessment of materials, and knowledge of production and demolition processes. The environmental impact assessment also faces difficulties such as non-standardized material production and limited access to information about environmental impacts of the production and manufacturing of construction materials plus the actual process of construction and demolition (Ramesh, Prakash, & Shukla, 2012). Furthermore, embodied energy and equivalent carbon emissions can vary due to the energy mix, transformation processes, efficiency of the industrial and economic system of the country, and the variability of these factors over time (Sartori & Hestnes, 2007), making it challenging to make informed decisions. Previous studies on life cycle energy requirements have also shown that a material's performance can vary in different situations. It is crucial to make decisions from a life cycle perspective that does not worsen the overall environmental impact, even if they reduce it for one stage. Previous studies on life cycle energy requirements (Crawford, 2011; Utama & Gheewala, 2009) have shown that the performance of a material or assembly can vary based on the context in which it is used. For example, a material with low initial embodied energy may not necessarily have low life cycle energy. The lack of generalizable design principles and the use of different assumptions, databases, and analysis methods in LCA studies further complicate the application of LCA in architecture education.

LCA and circular design require a multidisciplinary approach, involving expertise from fields such as engineering, materials science, and environmental science. This can make it difficult for architecture schools to provide the necessary training and resources to students. Despite these challenges, the benefits of incorporating LCA and circular design into architecture education far outweigh the difficulties, as they equip future architects with the knowledge and skills necessary to create a more sustainable future.

3. How can AI be utilized to streamline the implementation of Life Cycle Assessment and Circular design techniques in architecture education?

Large Language Models (LLMs) are powerful machine-learning models that have been trained on vast amounts of text data, allowing them to understand and generate human-like language (Devlin, Chang, Lee, & Toutanova, 2018). They have many applications, including

data retrieval and educational use cases. In data retrieval, LLMs can be used to extract information from large databases, such as medical records or legal documents. They can also assist in chatbots, customer service, and search engines by understanding natural language queries and providing relevant responses. In education, LLMs can facilitate personalized learning experiences by generating customized quizzes, exercises, and feedback based on student responses (Brown et al., 2020). However, despite the significant potential of these AI models there is no application report in the field of architecture education. AI has the potential to revolutionize the way LCA and circular design techniques are implemented in architecture education. These techniques play a critical role in ensuring that buildings are designed and constructed in a sustainable and environmentally responsible manner. However, their implementation can be complex, time-consuming, and challenging for students. In this article, several ways that AI can be utilized to streamline the implementation of LCA and circular design techniques in architecture education are discussed (Gomes et al., 2022; Ji, Lee, & Yi, 2021).

Automated Data Collection: LCA requires a significant amount of data collection and analysis, including information on embodied energy, carbon emissions, and other environmental impacts of building materials, products, and systems. AI can automate this process by collecting data from various sources and processing it in a way that is fast and accurate. This can reduce the time and effort required for manual data collection, allowing students to focus on the analysis and interpretation of the results.

Predictive Modelling: AI algorithms can be trained to predict the environmental impact of different building materials, systems, and assemblies. This can help students to make informed decisions about the materials and systems they use in their designs, based on the predicted environmental impact. Predictive modelling can also be used to optimize the design based on specific sustainability and environmental criteria, allowing students to find the most sustainable and circular design solutions.

Optimization: Optimization is a critical component of circular design and LCA. AI can be used to optimize the design based on specific sustainability and environmental criteria, such as embodied energy, carbon emissions, and waste reduction. AI can be used to optimize product designs for circularity, by identifying opportunities for materials reuse, repair, and recycling. This can help students to find the most sustainable and circular design solutions and understand the trade-offs involved in different design decisions.

Visualization: The results of LCA and circular design analysis can be complex and difficult to interpret for students. AI can be used to visualize and communicate these results in a way that is accessible and intuitive, improving students' understanding of the concepts. This can include visualizations of the environmental impact of different building materials, systems, and assemblies, as well as visualizations of the circular design process and its outcomes.

(Abioye et al., 2021; E. Gilner, A. Galuszka, & T. Grychowski, 2019; Ji et al., 2021; Oluleye, Chan, & Antwi-Afari, 2023; Xue et al., 2021).

In conclusion, AI has the potential to revolutionize the way LCA and circular design techniques are implemented in architecture education. By automating data collection, enabling predictive modelling, optimizing designs, and improving visualization, AI can make these techniques more efficient, effective, and accessible for students. As a result, architecture students will be better equipped to design and construct buildings that are sustainable and environmentally responsible.

4. Methodology: Leveraging AI to instruct architecture students on circular design techniques and LCA

The methodology of this study leverages a theoretical model to examine the potential of AI in educating architecture students on circular design techniques and LCA. The research process involves analysing the current challenges and solutions in this field, exploring various perspectives, and providing explanations, predictions, and proposed solutions.

To achieve this, the study aims to:

- Minimize data requirements and identify the most effective parameters with the greatest potential for impact
- Define a system boundary that is specific to each building, limiting the criteria for LCA
- Offer recommendations and rules of thumb for environmentally friendly design decisions based on the results of previous LCA studies.

In this study, a Knowledge-based System (KBS) was utilized to introduce a method for application of simplified LCA by architecture students. KBS is a computer system that leverages various forms of AI for problem-solving across different domains. It consists of a database of expert knowledge that is tailored for specific queries, along with learning and justifications capabilities. The system provides data and information from multiple sources and is designed to support human decision-making through the use of knowledge-based techniques. To simplify usage of the KBS system for students we propose to integrate a Large Language Model (LLM) such as chat-gpt3-turbo (Ouyang et al., 2022) with KBS. The LLM model can assist in processing student queries and questions in natural language, which can be challenging for traditional KBSs. By leveraging the LLM's ability to understand context and generate relevant responses, the KBS can provide more accurate and tailored results to student queries which have always proven to be very difficult and time consuming for the students to grasp. several implementations for such a system have been proposed (Izcard & Grave, 2020; Izcard et al., 2022; Khattab et al., 2022). In this study we will adapt the method proposed by (Yao et al., 2022).

The tool is structured into three main parts: inputs, system functions, and outputs. The inputs section requires essential information about the building to be inputted, such as climate, location, building type, and building lifetime, to investigate the most effective parameters on the building's life cycle environmental performance (Tabrizi & Brambilla, 2019). System functions are made up of a basic tool that utilizes KBS, which contains rules specific to the domain. This enables the system to generate outputs based on the user's inputs, helping students make more environmentally conscious decisions at the early stages of the design process with minimal time, effort, and cost.

Outputs from the system provide recommendations for design and material selection decisions for the building's envelope structure, which are expected to minimise the building's life cycle environmental impact. These recommendations are generated in different groups like one for window design and the other for solid envelope design, based on the specific conditions of each building that the user inputs into the system (Figure 1).

In conclusion, the KBS-designed LCA method serves as a valuable resource for architecture students, as it simplifies the process of understanding the complexities of circular design techniques and LCA. The tool's outputs provide a foundation for thinking through problems and understanding the life cycle of a building, from cradle to cradle.

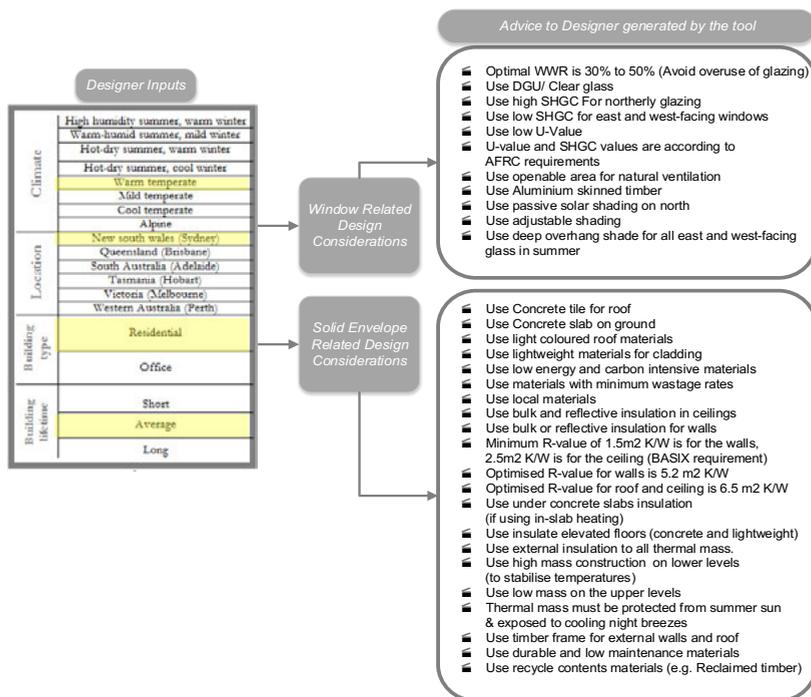


Figure 1. Inputs and outputs sample for a hypothetical case study in Sydney. Source: (Tabrizi & Brambilla, 2019).

5. Conclusions and future research

The research aims to shed light on how AI can facilitate the integration of cradle-to-cradle thinking into the design process of architecture students. The study aims to enhance the instruction of LCA to architecture students by combining the standard LCA framework with the power of AI. The research highlights the importance of considering sustainability in architecture education and the challenges faced in teaching these concepts to students. The use of AI in this context can simplify the process of sustainability education and provide a quick early analysis of the building's life cycle environmental performance. The method aims to overcome the difficulties faced by architecture students in understanding and applying LCA, and provides a means for them to perform assessments and make informed decisions on their designs. The output of this method helps students understand the environmental impact of their design decisions and supports them in optimizing environmental performance through multiple dimensions while considering the specific conditions of each building. The immediate next step that this research team is going to take is to apply this theoretical model on a real case study to investigate the applicability of this proposed model.

Future research will progress to the user studies and implementation of the proposed method to the teaching and learning process. This stage of the project will systematically evaluate the benefits and limitations when applied in the context of higher architectural education for architecture. A series of 1–2-day workshops will be run at the University of Sydney – School of Architecture, Design and Planning targeting architecture students as a test population.

A follow up offshoot of this study will aim to evaluate the benefits and implementation methods of educational AI for conceptual design in architecture. This AI application will focus on qualitative aspects of design thinking to accompany quantitative assessments of the proposed AI for LCA. This holistic approach of using AI for both quantitative and qualitative aspects of design solutions will allow to create a more informed feedback loop, allowing learners to assess multiple parameters at the same time.

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When a test-taking strategy is better? An approach from the paradigm of scheduling under explorable uncertainty

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Abstract

In this article, we adopt the paradigm of scheduling under explorable uncertainty to explore test-taking strategies to solve standardized tests in terms of maximizing the correct questions answered. From this approach, a test taker considers a number of questions and has the possibility to read in order to obtain the difficulty of the question. Later, he/she has the option, for example, to answer the question or to skip the one that seemed difficult and read the next question in the test. Specifically, we state the problem definition by considering two test-taking strategies, formulate and implement a mathematical model, and generate computational experiments in order to determine the dominance of one strategy over another. The results show that the dominance depends directly on the design of the test and the maximum time to perform it, so knowing these parameters allow us to provide algorithmic insights to address this problem.

Keywords: *Test-taking strategies; scheduling; standardized test; optimization.*

1. Introduction

In the education setting, there are different types of standardized tests. These consider a wide range of knowledge from the foreign language proficiency tests (e.g., Test of English as a Foreign Language (TOEFL), Test of English for International Communication (TOEIC), among others) to the mandatory admission test such as the Graduate Management Admission Test (GMAT) in the United States of America or the Prueba de Acceso a la Educación Superior (PAES) in Chile (DEMRE, 2023), whose results define the position in the admission ranking of the university degree to be studied. In general, the students prepare to take these standardized tests over many months, attending some specialized courses where several test-taking strategy recommendations are provided to achieve the best possible result. In particular, a test-taking strategy from a scheduling point of view distinguishes a series of decisions to be made by the test-taker in sequence when faced with the questions in an assessment. For instance, the test-taker would read and answer all the questions in order of appearance or only answer the questions if he/she is sure of the correct answer. Considering that assessments typically have a limited time frame for completion, the choice of test-taking strategy can significantly impact the test results. Rapidly skipping challenging questions may allow test-takers to attempt more questions and answer the easier ones first. Still, it may also require them to revisit the skipped questions later, thus increasing the overall test completion time. Therefore, there exists a threshold where it may be more advantageous to respond immediately, regardless of the difficulty of the questions, rather than postponing difficult questions and answering easier ones first.

In literature, several studies have been carried out in different areas. In psychology, most of the strategies have been studied before taking the test in order to reduce the anxiety of the students (Theobald, Breitwieser, & Brod, 2022), and it has been found that the application of these, in conjunction with the application of other strategies has a direct correlation with student achievement in college (Viet, 2022). From a practical perspective, classic books such as "Test-Taking Strategies" (Kesselman-Turkel & Peterson, 1981) expose in a practical way several strategies for different types of tests, such as strategies for multiple-choice tests, true-false tests, matching tests, vocabulary tests, number tests, etc. However, the choice of these strategies is vaguely explained. Finally, from an algorithmic point of view, the decision of which question to answer first can be studied as a problem of allocating limited resources to tasks over time such as (Wang & Zhang, 2006), which presents an iterative mathematical model applied to a general case as well as a theoretical framework using nonlinear optimization, considering a probabilistic perspective previously known by the test-taker.

In this paper, we adopt the paradigm of scheduling under explorable uncertainty (Retsef, Magnanti, & Shaposhnik, 2018) (Dürr, Erlebach, Megow, & Meißner, 2020) (Dufossé, Dürr, Nadal, Trystram, & Vásquez, 2022) to explore test strategies to solve standardized tests and to analyze under what circumstances the application of these strategies will generate an

optimal result. From this approach, a test-taker considers a number of questions (set of parameters) and has the possibility to read (to make a query) in order to obtain the difficulty of the question. Later, he/she has the option, for instance, to answer the question or to skip the one that seemed difficult and read the next question in the test. Clearly, a compromise has to be found between the number of questions to be skipped and the test result obtained. Formally, we state the problem definition by considering two test strategies, formulate and implement a mathematical optimization model and generate computational experiments in order to determine dominance properties of the strategies to obtain the best test result.

2. Problem definition and formulations

2.1. Problem description

Consider a test with N questions, of which $M \leq N$ are easy questions, and $N-M$ are hard questions. P is defined as the set of questions $\{1, \dots, N\}$ where each question $i \in P$ has a reading time r_i and an answer time p_i . Each question appears in the test follows a particular sequence S , e.g., $S := \{h, h, e, h, e, e, \dots, h\}$, where h denote the hard questions and e the easy questions. These questions are differentiated by their resolution time, where the time to answer a hard question p_h will be longer than the time to answer an easy question p_e . Additionally, there is a deadline \bar{d} to finish the test. We assume that the test-taker will know the number of total questions (N) and the easy questions (M) in the test.

We consider two test strategies for answering the test, which are described below:

- Read and answer (RA) strategy: This test-taking strategy consists of reading and answering the question immediately, regardless of the difficulty of the question.
- Read, skip, and answer (RSA) strategy: This test-taking strategy consists of reading in an exploratory way and analyzing the difficulty of the question. If the question is easy, it is answered immediately, but if it is hard, then it is skipped and answered once all the easy questions have been answered. Skip one question $i \in \{1, \dots, N\}$ has an associated time cost ℓ_i which will consist of re-reading the hard question before answering it.

This problem aims to study the best strategy to answer as many questions as possible into the deadline \bar{d} . The choice of a strategy when facing a test can drastically affect the result. This result depends on several factors; the test design is the most important to consider (such as sequence, read, response, and re-read times), and the second factor is the deadline to perform it.

2.2. Dominance

We define the dominance of strategy A over strategy B, when under certain conditions, strategy A implies a better result than strategy B in terms of test results, i.e., more questions are correctly answered. To illustrate the situation, we consider a reading time ($r_i = r = 1$) and a re-reading time ($l_i = l = 1$) to be equivalent to one time slot, the response times for the hard question (p_h) and the easy question (p_e) equals to 7 and 2 time slots, respectively; and the test sequence given by $S = \{h, e\}$. Figure 1 shows that in the case of a deadline \bar{d} of four slots of time. On the one hand, if the RA strategy is used, no question will be answered because it will answer the hard question in the first instance, whose resolution time is longer than the deadline. On the other hand, if the RSA strategy is used, one question can be answered because the first question must have been skipped, and the easy question will have been read and answered. In this case, the RSA strategy dominates RA strategy. In a similar way, Figure 2 shows the case of a deadline \bar{d} of ten slots, where the RA strategy will dominate with two questions answered over the RSA strategy, which will have only managed to answer a single question.

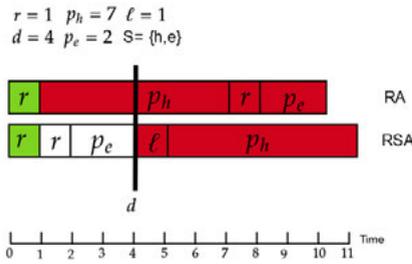


Figure 1. Example of dominance RSA over RA.

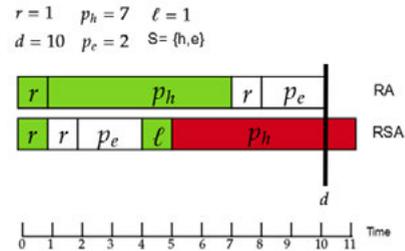


Figure 2. Example of dominance RA over RSA.

2.3. Mathematical formulation

The problem can be formulated as *integer linear programming*. We adopt a upper bound on the time to perform the test given by $K = \sum_{i=1}^{|\mathcal{P}|} r_i + p_i + l_i$. Consequently, we discretize the time into K unit time slots. We then define three sets of binary decision variables: $X_{i,t}$ which is equal to 1 if the reading of question i starts at time t and 0 otherwise; $Y_{i,t}$ which is equal to 1 if the answering of question i starts at time t and 0 otherwise; and $Z_{i,t}$ which is equal to 1 if the re-reading of question i starts at time t and 0 otherwise. The problem can be set as follows:

$$\begin{aligned}
 & [Max] \sum_{i=1}^{|\mathcal{P}|} \sum_{t=1}^{\bar{d}-p_i+1} Y_{i,t} & (1) & \quad X_{i,t} = 0, \forall i \in \mathcal{P}, \forall t \in [K - r_i + 1, K] & (2) \\
 & Y_{i,t} = 0, \forall i \in \mathcal{P}, \forall t \in [K - p_i + 1, K] & (3) & \quad Z_{i,t} = 0, \forall i \in \mathcal{P}, \forall t \in [K - \ell_i + 1, K] & (4)
 \end{aligned}$$

$$\sum_{t=1}^K X_{i,t} \leq 1, \quad \forall i \in \mathcal{P} \quad (5)$$

$$\sum_{t=1}^K Y_{i,t} \leq 1, \quad \forall i \in \mathcal{P} \quad (6)$$

$$\sum_{t=1}^K Z_{i,t} \leq 1, \quad \forall i \in \mathcal{P} \quad (7)$$

$$X_{i,t} = 1, \quad i = 1, \quad t = 1 \quad (8)$$

$$\sum_{i=1}^{|\mathcal{P}|} \left(\sum_{t=\max\{k-p_i,0\}}^{k-1} Y_{i,t} + \sum_{t=\max\{k-r_i,0\}}^{k-1} X_{i,t} + \sum_{t=\max\{k-\ell_i,0\}}^{k-1} Z_{i,t} \right) \leq 1, \quad K = 1 \quad (9)$$

$$\sum_{i=1}^{|\mathcal{P}|} \left(\sum_{t=\max\{k-p_i,0\}}^{k-1} Y_{i,t} + \sum_{t=\max\{k-r_i,0\}}^{k-1} X_{i,t} + \sum_{t=\max\{k-\ell_i,0\}}^{k-1} Z_{i,t} \right) \geq \sum_{i=1}^{|\mathcal{P}|} \left(\sum_{t=\max\{k-p_i,0\}}^{k-1} Y_{i,t} + \sum_{t=\max\{k-r_i,0\}}^{k-1} X_{i,t} + \sum_{t=\max\{k-\ell_i,0\}}^{k-1} Z_{i,t} \right), \quad \forall k \in K \quad (10)$$

$$X_{i+1,t} \leq \sum_{k=1}^t X_{i,k}, \quad \forall i \in \mathcal{P} - 1, \forall t \in K \quad (11)$$

$$Z_{i,t} \leq \sum_{k=1}^t X_{i,k}, \quad \forall i \in \mathcal{P}, \quad \forall t \in K \quad (12)$$

$$Z_{i,t} \leq Y_{i,t+\ell_i}, \quad \forall i \in \mathcal{P}, \quad \forall t \in K - \ell_i \quad (13)$$

$$1 - X_{i,t} \geq \sum_{k=1}^t Y_{i,k}, \quad \forall i \in \mathcal{P}, \forall t \in K \quad (14)$$

$$1 - X_{i,t} \geq \sum_{k=1}^t X_{i+1,k}, \quad \forall i \in \mathcal{P} - 1, \forall t \in K \quad (15)$$

$$\sum_{t=1}^K ((t + r_i) \cdot X_{i,t}) \leq \bar{d}, \quad \forall i \in \mathcal{P} \quad (16)$$

$$\sum_{t=1}^K ((t + p_i) \cdot Y_{i,t}) \leq \bar{d}, \quad \forall i \in \mathcal{P} \quad (16)$$

$$\sum_{t=1}^K ((t + \ell_i) \cdot Z_{i,t}) \leq \bar{d}, \quad \forall i \in \mathcal{P} \quad (18)$$

$$\sum_{t=1}^K t \cdot Y_{i,t} - \sum_{t=1}^K ((t + r_i) \cdot X_{i,t}) \leq 1 + M \cdot \left(\sum_{t=1}^K Z_{i,t} \right), \quad \forall i \in \mathcal{P} \quad (19)$$

2.4. Implementation and computational experiments

The mathematical formulation described above was implemented computationally using Python 3.9.16. The Pyomo package was used for implementation and the Gurobi solver 10.0 was used for solving. For the computational experiments were performed on a 3-question test. To perform the analysis, the parameters were set to $r_i = \ell_i = 1$. For each test, a grid of values for the response times of each question will be made. This grid will have a lower limit of 1 time slot and an upper limit of 6 time slots. The value of the response time for difficult questions will be a function of the value of the response time for easy questions. e.g. If the answer time for the easy question is 1, the answer time for the difficult questions will be 2, 3, 4, 5 and 6 time slots. In turn, the deadline will be varied, for each of the cases described

above, the deadline will be decreasing. In addition, the value \bar{d} will be generated as an upper bound, this will have a value of 24 time slots, this will be calculated by using the following expression: $\bar{d} = \sum_{i=1}^3 r_i + p_i + l_i$ where all the questions will be difficult. Therefore the number of instances to solve will be of $2^3 \cdot 5 \cdot 4 \cdot 3 \cdot 2 = 960$.

3. Results

In the generation of instances for their respective analysis, all possible test sequences were considered, that is, 2^3 possible combinations. These combinations are: $\{\{h,h,e\}; \{e,e,e\}; \{h,e,e\}; \{h,h,e\}; \{e,e,h\}; \{e,h,h\}; \{e,h,e\}; \{h,e,h\}\}$. Since it is assumed that the test-taker will know the number of questions and the sequence of the test, 5 instances will be discarded, since the RA strategy will dominate over RSA strategy regardless of the deadline. For example, if the test sequence is $\{e,e,e\}$ there will be no difficult question to skip so the RSA strategy will not exist. On the other hand, if the sequence is $\{h,h,h\}$ the use of the RSA strategy would not be logical, since knowing the sequence of the test, the use of this strategy would generate the additional cost of re-reading.

3.1. Sequential analysis $\{h,e,h\}$

It was found that the use of the strategies studied is indifferent if the deadline is less than $\min\{r + p_h, 2r + p_e\}$ since the time to solve the test will not be enough to answer the first question, so the use of one or the other strategy will lead to the same result, not answering any question. On the other hand, we suppose the use of one strategy is indifferent to the other when the time is more than enough to perform the test in its entirety so that if the deadline is greater than $4r + p_e + 2p_h$ no strategy will dominate over the other. Note that when facing the sequence $\{h,e\}$, one strategy will dominate over the other, according to the values of p_h and p_e , if the test deadline is between the values $\min\{r + p_h, 2r + p_e\}$ and $\max\{r + p_h, 2r + p_e\}$. Thus, if $p_h > r + p_e$ the RSA strategy will dominate over RA strategy, otherwise, if $p_h < r + p_e$ the RA strategy will dominate over RSA strategy. Finally, if the test-taker is facing the last question of the test, and his deadline is between the values $3 + p_e + 2p_h$ and $4 + p_e + 2p_h$, the dominant strategy will be the RA strategy.

3.2. Sequential analysis $\{e,h,e\}$

The result was that the use of the strategies studied is indifferent if the deadline is less than $\min\{2r + p_e + p_h, 3r + 2p_e\}$ since the test resolution time will be sufficient to answer the first question, that is, the easy question (facing an easy question does not require the use of a strategy) but it will not be sufficient to answer the next question. On the other hand, the use of one strategy will be indifferent to the other is when the time is more than enough to perform the test in its entirety, so if the deadline is greater than $4r + 2p_e + p_h$ no strategy will

dominate over the other. If the test deadline is between the values $\min\{2r + p_e + p_h, 3r + 2p_e\}$ and $\max\{2r + p_e + p_h, 3r + 2p_e\}$ one strategy will dominate over the other according to the values of p_h and p_e . If $p_h > r + p_e$ the RSA strategy will dominate over RA strategy, on the other hand if $p_h < r + p_e$ the RA strategy will dominate over RSA strategy. Finally, if the test-taker is facing the last question of the test, and its deadline is between the values $3 + 2p_e + p_h$ and $4 + 2p_e + p_h$ the dominant strategy will be the RA strategy.

3.3. Sequential analysis {h,e,e}

The result was that the use of the strategies studied is indifferent if the deadline is less than $\min\{r + p_h, 2r + p_e\}$ since the test resolution time will not be enough to answer the first question, so that the use of one or the other strategy will lead to the same result, not answering any question. In addition, the use of one strategy will be indifferent to the other is when the time is more than enough to perform the test in its entirety, so if the deadline is greater than $4r + 2p_e + p_h$ no strategy will dominate over the other. If the test deadline is between the values $\min\{r + p_h, 2r + p_e\}$ and $\max\{r + p_h, 2r + p_e\}$ one strategy will dominate over the other according to the values of p_h and p_e . If $p_h > r + p_e$ the RSA strategy will dominate over RA strategy, on the other hand if $p_h < r + p_e$ the RA strategy will dominate over RSA strategy. Finally, if the test taker is facing the last question of the test, and its deadline is between the values $3 + 2p_e + p_h$ and $4 + 2p_e + p_h$ the dominant strategy will be the RA strategy. Note that in the tests performed similarities were found in the analysis, these similarities were found when the sequence (S) of the test is {h,e}. Figure 3 shows a graphical summary of what was described above.

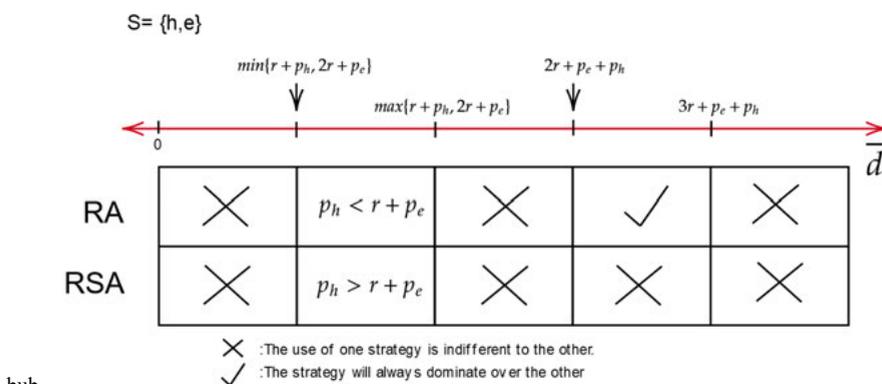


Figure 3. Summary table of dominance.

4. Conclusion and future works

Previous research has focused on practical use with the objective of finding strategies to perform different types of tests, while in the area of psychology, various strategies have been investigated with the objective of reducing stress and anxiety when facing a test. However, these studies have not been approached from the algorithms, mathematics, and optimization viewpoints. This study generated a mathematical scheduling model that generated a standardized test with the objective of applying the strategies found in the literature in order to find dominance properties. By performing several instances of a standardized three-question test, it was concluded that one strategy would dominate over the other depending on the parameters and design of the test. In particular, we observe that the use of one strategy over the other will be indifferent if the maximum time to perform the test is not enough to answer the first question or if the maximum time is more than enough to answer the whole test. Finally, we show that the RA strategy will always dominate over the RSA strategy when the last question of the test is asked. Studying these dominance properties can provide a guide for test-takers to tackle standardized tests and obtain an expected result. For future works, we leave open the problem with a sequence and number of unknown questions by the test-taker, or where each question could have weights or a probability of error, increasing the difficulty of the problem to be studied.

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Microcredentials: an opportunity towards the digital transformation

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Abstract

This communication aims to present one of the online courses included in the Microcredentials portfolio of the Universidade Aberta, in Portugal. We start by presenting a framework of the European guidelines on Microcredentials, defining its main characteristics, namely highlighting its advantages in the context of reskilling or upskilling with a view to its applicability in the labor sector. Following the guidelines of the Portuguese Ministry of Higher Education, and specific EU funding under the Impulso Adultos programme, a proposal for a Microcredential in Digital and Distance Learning was conceptualized and developed for teachers' training, with more than 1200 teachers already involved. An evaluation carried out through a survey delivered to trainees shows very positive results in all items evaluated, with strong emphasis on the transferability and applicability of the knowledge acquired to work contexts.

These results show that this course, developed within the scope of Microcredentials, broadly meets the needs of reskilling and upskilling, which are increasingly important in the adaptability of adults to the new challenges that digital transformation implies.

Keywords: *Microcredentials; distance and digital education; digital transformations; lifelong learning; higher education.*

1. Introduction

Working contexts and conditions are changing rapidly, and some studies indicate that over the course of a year, between 20% to 70% of the population change jobs or even occupations in response to the new challenges posed by technological and environmental transition (Bakhshi et al. 2017; OECD, 2012). This panorama leads to the rapid mismatch between initial formal training, defined on the basis of a set of pre-defined assumptions which are not very flexible in nature and the skills required for the professional role. Therefore, there is a pressing need for a constant renewal of existing training and the promotion of continuous learning to acquire, adjust and update knowledge and skills.

It is in this context of rapid changes in professional skills and the urgent need for training that Microcredentials have been mentioned as an educational strategy with potential to meet the needs of professional qualification and requalification in the European and national space (Kato, Galán-Muros & Weko, 2020; European Commission, 2020; MCTES, 2020).

The Recovery and Resilience Plan (PRR) in Portugal outlines post-covid objectives for the training and requalification of the labor sector, with a focus on promoting digital transition in companies and institutions and requalifying a significant portion of their workforce. Some of the specific goals of this plan include:

- Providing digital skills training to 800,000 individuals, with personalized training plans and online resources.
- Supporting the digitalization and requalification of public administration.
- Establishing programs, “schools”, and “alliances” for higher education training in partnership with employers, including post-graduate diplomas and masters.
- Promote the digital transition in companies by retraining 36,000 workers.

By achieving these objectives, Portugal aims to enhance the competitiveness of its labor sector, boost economic growth, and prepare its workforce for the digital age demands.

The purpose of this paper is to gather approaches and main characteristics of the so-called Microcredentials and place them in the context of the training practices of Universidade Aberta, the public distance learning university in Portugal, which follows an internationally validated digital distance learning methodology supported by the UAb Virtual Pedagogical Model (UAb-VPM) (Pereira et al. 2007; Mendes et al, 2019).

2. The main concept

A Microcredential is a certificate of short-term learning, formal or informal, which is regarded as strategic by the European Commission to achieve its European Skills Agenda. The European Commission (EC) has sought to discuss, within the scope of a number of

projects, the definition of Microcredentials and to identify the challenges and opportunities in this area. According to the EC, Microcredentials are:

... the record of the learning outcomes that a learner has acquired following a small volume of learning. These learning outcomes will have been assessed against transparent and clearly defined criteria. Learning experiences leading to Microcredentials are designed to provide the learner with specific knowledge, skills and competences that respond to societal, personal, cultural or labor market needs. Microcredentials are owned by the learner, can be shared and are portable. They may be stand-alone or combined into larger credentials. They are underpinned by quality assurance following agreed standards in the relevant sector or area of activity (European Council, 2022).

The European Union definition, largely shared by other authors (Brown, et a. 2021; Wheelahan and Moodie, 2021) promotes the discussion of a tacit recognition of the accomplishment of a learning outcome from a short learning experience developed in a formal or informal learning context. This recognition usually comes in the aftermath of responding to existing societal, personal, cultural, or labor market needs. According to the EC, these needs typically originate from unexpected or conjunctural challenges projected by technological or environmental transition. Microcredits can be offered on a stand-alone basis or offered in conjunction with others (stackable) but must be guided by limited benchmarks respected by the corresponding sector, be it the educational or business sector.

Regarding the context where the training takes place, although it was initially born in online contexts, particularly through MOOCs and short courses held in distance learning platforms such as Coursera or Futurelearn, the EC recommends that Microcredentials can be offered in various educational environments such as face-to-face, online, hybrid or blended-learning environments, or even in a work context. Regarding the entities that provide the training, initially the need to adapt to the ECTS system led to an almost inevitable association with higher education institutions. The last recommendation (European Council, 2022) opens the possibility of Microcredentials having the involvement of other institutions such as Vocational and Lifelong Learning Agencies or industry federations with training academies. The need for the existence of a transversal unit of measurement such as the ECTS in order to be used as a legal framework for evaluating the workload of the trainee/student during the training period was made more flexible by no longer being included as mandatory by the commission, and therefore, giving each member-state room to define its own legal framework. Regardless of this European guiding document it is important to identify the existence of Microcredentials in the Anglo-Saxon higher education space, in particular in the United States, Australia, Canada, and more recently also in the United Kingdom.

The working group on Microcredentials, supported by the European Commission, published a report in December 2020, addressing the need to define Microcredentials in a single format

and shared by its member states. Later, in 2022, the Council of the European Union adopted the European Commission Recommendation on Microcredentials as a European strategy for lifelong learning and employability. The Recommendation seeks to support the development, implementation and recognition of Microcredentials across institutions, companies and sectors. In this joint approach, member states are responsible for informing the European Commission on appropriate measures to adopt the recommendations by December 2023. The recommendations point to the need for member states to:

- Develop an ecosystem of microcredentials, including promoting the creation of new microcredentials, encouraging the development of microcredentials in formal and informal contexts, promoting the quality and transparency of Microcredentials and fostering the development of partnerships between educational institutions and social partners, employers and industry, innovation and research centers and local and national authorities.
- Realize the potential of Microcredentials by integrating them into existing offers and training, reaching a wider and more varied type of learners, including disadvantaged and vulnerable groups, and integrate Microcredentials into employment and labor market support policies.

This type of training can complement traditional learning and teaching by better enabling students to acquire high-level skills. This process of Microcredentials, should also facilitate access to a new type of learners (European Commission, 2020) or allow the return of former students into higher education in a perspective of professional requalification. The strategy foresees that by 2030, 60 % of all European adults undergo in training every year.

Microcredentials allow for opportunities to diversify learning and improve education through shorter courses, extending the qualifications that each person already has.

In addition, Microcredentials can be grouped into subjects, being the proof of the learning acquired and their certificates do not correspond to a full degree as, for example, the degree that is obtained in a bachelor's, master's or doctorate.

For a good streamlining of the certificates awarded, it will be necessary to adopt a single, transversal digital system that allows any university or employer to verify the information elements of each certificate. This also means that secure access to the data must be ensured, and they must also be verifiable free of charge. Transparency tools and processes are related to the transparency of qualifications (the European Qualifications Framework); quality assurance in higher education; credits for learning achieved; recognition of prior learning and validation of non-formal and informal learning; lifelong learning and career management. The European Council (2022) recommends Europass as the Digital Credentials Infrastructure that could eventually facilitate the issuing, sharing and storage of all forms of learning in a digital format, including Microcredentials.

3. Microcredentials at Univ. Aberta

Since 2009, Universidade Aberta (UAb) has been investing in Lifelong Learning (LLL) for the personal and professional training of adult learners, offering a wide range of courses, from short courses, with one or two ECTS, to post-graduation courses typically involving from 30 to 60 ECTS. Since the development of this strategy, more than 13,000 people have obtained certification in the various Lifelong Learning courses that have been offered at UAb. For these participants, these courses have the advantage that they are usually more applicable to their professional areas, less time-consuming and usually require less personal, financial and professional investment.

The offer of LLL courses at UAb has become recognized within and outside its community, as a natural and intrinsic situation to its own way of presenting itself. The model of online distance learning, applied mostly in asynchronous format, has a wide capacity and applicability among the target audience that is distributed across all regions of the national territory and abroad with various schedule commitments, which means that this type of education allows temporal and spatial flexibility suitable for students with personal and professional limitations (in Portugal, distance learning is regulated by the decree-law 133/2019).

Lifelong Learning at UAb organizes the offer of a diverse set of courses in several areas. These courses have been offered in a logic of providing their learners with a set of professional and personal skills that allow them to quickly achieve their goals by linking them with other formal and non-formal learning that they already have or will acquire.

Thus, it can be stated that, unlike other HEIs, inside and outside Portugal, that have never had short courses on offer, the UAb pathway prepared the institution to start offering microcredentials, both as a conceptual and a recognition point of view. For the UAb, the concept linked to Microcredentials implementation corresponds to a natural and desired path to follow, because the strategic importance that this educational model has for the adult learners is recognized. As a natural result, the existing relations with the European Association for Distance Teaching Universities two European funded projects related to Microcredentials, and with other higher education institutions members of this association, were stepping stones that lead to UAb being perceived by the sector as a national reference entity for this area and as a "trusted provider" for the recognition of training offer and issuing of Microcredentials. Furthermore, the Impulso Adultos (Adult Impulse) programme, boosted the existing offer in Microcredentials leading UAb to set a target of training circa 6,000 adults from 2022 to 2025.

3.1. Perspectives and Proposals

For the implementation of Microcredentials, some strategic areas of knowledge that are already present in short courses at UAb and that have potential in various learning paths have been established.

The Microcredentials were thus composed of training "packages" containing short-term training courses (from 1 to 6 ECTS). At the UAb, Microcredentials are usually designed from scratch or re-adapted from existing training courses. They are designed and developed in the context of reskilling or upskilling having an applicable character in the workplace. Although not mandatory, it is recommended to work with partner institutions in the development of the training offers, particularly partners that represent the sector where learning outcomes developed can be applied.

The partnership can be a joint scientific work (planning of activities, identification of content and training objectives) or the identification of competences to be acquired (need analyses). Regardless of the model chosen, the institution has not considered strategic the use of existing courses, in particular, the use of course units from existing formal study programmes that allow stackability (Bozkurt & Brown, 2021), i.e. the possibility of joining a set of Microcredentials with the aim of forming a single piece that provides a degree or a postgraduate diploma.

Regardless of the solution used, at UAb, Microcredentials training courses should always include an element of assessment of the learning outcomes to prove that they are clearly met. The learner can create their UAb Microcredentials portfolio whenever they finish the training courses in which they are involved.

3.2. Distance and digital learning training modules - examples

UAb has already prepared about 20 training courses leading to Microcredentials which include courses from 1 to 6 ECTS. For the sake of this communication, we will present the Distance and Digital Education training course which is aimed at teachers of primary, secondary and higher education in the education system in Portugal. To obtain a Microcredit in Distance and Digital Education (DDE), participants need to undertake a 3 modules course, with 4 ECTS and a duration of 4 months. This course enables teachers to design and monitor a distance learning unit of a study programme/course and has been in offer since 2021, leading to the certification of about 1200 higher education teachers. Its structure integrates the following modules:

- E-activities in Course Design in DDE (1ECTS)
- Digital Teaching in Network (1ECTS)
- UC Project in Digital Environment (2ECTS)

The main objectives of this Microcredential, are:

- To reflect about pedagogical practice in Digital Distance Education contexts.
- Analyze communication and interaction processes in digital educational contexts.
- Mobilize relevant pedagogical strategies, namely at the level of activity design for digital educational contexts.
- Conceive, design and develop a programme unit project for DDE.
- Design and develop e-activities for DDE environments.
- Select appropriate educational resources according to the context and the target population.
- Select digital assessment instruments according to the nature and pedagogical contexts.

This training provides informed answers to the problems teachers encounter in their teaching practice in an online context and gives them the possibility to evaluate the effectiveness of innovations in order to contribute to a successful digital education. According to UAB's Virtual Pedagogical Model the asynchronous methodology allows flexibility in participation and in the learning path, highly appreciated by students because they adapt learning to their own pace. Another methodological aspect that we highlight is the assessment, where both self-assessment and peer-assessment are strongly articulated with the course assessment.

4. Final remarks

At the end of each module all trainees are asked to respond to a survey of satisfaction with questions about the structure and performance of the course, as well as aspects related to the quality of the course, such as resources, activities, tools used, and the perceived self-performance of each trainee.

The outcomes of the evaluation conducted to the participants have been overwhelmingly positive, with notable success in the self-performance category. There was a unanimous agreement among participants in their involvement with the proposed activities, collaboration, and exchange of knowledge. Furthermore, the acquired knowledge and collaborative processes were deemed easily transferable and applicable to each trainee's respective work contexts. Although being an online course, the flexibility and the organization of the course allowed the majority of the participants to have success in achieving the learning outcomes. The course allowed three ending points – participants could leave after each module being recognized with nano-credits related to the specific modules they successfully completed. Notwithstanding, circa 50% of the participants finished all three modules of the course and have been able to apply what they learnt in their own practice.

The results show that this short course developed at Universidade Aberta within the scope of Microcredentials fits the concept and objectives for which it was created, i.e., it responds positively to the immediate needs of reskilling and upskilling in a work context.

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Fostering cooperation between lecturers and TLC staff to improve digital teaching. Experiences with a pool of discipline-specific experts

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Abstract

The necessity of discipline-specific teaching method skills of lecturers is exacerbated by a partly insufficient cooperation between lecturers and media-didactic staff in Teaching and Learning Centers (TLC). This paper aims to illustrate how this lack of cooperation between lecturers and media-didactic experts can be solved by a team of discipline-specific experts skilled in media-didactic methods. Due to their knowledge of the discipline-specific communication cultures these discipline-specific experts build a “bridge” in cooperation between lecturers and media-didactic experts as well as technical staff. Experiences gathered with the TLC of the University of Applied Sciences Fulda show that the discipline-specific experts support lecturers by fostering particularly informal cooperation between them and media-didactic experts or technical staff. Therefore, the pool of discipline-specific experts is a new and innovative way to support lecturers in acquiring discipline-specific digital teaching skills, fostering discourse on teaching practices and further developing digital teaching.

Keywords: *Cooperation; digital teaching; discourse on teaching; digital skills.*

1. We Need a Closer Cooperation Between Lecturers and Staff of TLCs!

During the COVID-19 pandemic, most university lecturers all over the world had to move abruptly towards “online education”. The rapid start of such digital education brought not only challenges for lecturers, students and staff of Teaching and Learning Centers (TLCs), it also fostered digitalization in teaching and learning. Lecturers had to perform in online classrooms by applying digital skills. Students had to adapt to digital, often unfamiliar learning spaces and necessarily acquired new learning skills. Universities were forced to advance their infrastructures and organization (Perez-Sanagustin et al., 2022). Particularly TLCs had to develop support in online teaching methods for digital spaces.

Since March 2020, a transformation towards the digitization of the university system has started, and the question of the sustainability of these changes has emerged. In this context, staff of TLCs play a key role as they enable lecturers and students to adapt to continuous changes in education by explaining digital tools and teaching skills to them. Within this process, e-learning and media-didactic experts are particularly important as they can support lecturers in developing courses, in trying out teaching methods or technologies (Karcher & Nunn, 2021). In short: TLCs support lecturers in acquiring digital teaching skills.

Despite the urgent support needed in the past two years of the COVID-19 pandemic, still too many lecturers do not see the necessity of cooperating with the TLCs staff or consider the central services to be too little related to the teaching methods in their discipline. Even lecturers who have been eager to acquire digital teaching skills are becoming less interested in furthering their digital teaching in cooperation with media-didactic experts at TLCs. This raises the question as to how to foster and/or maintain cooperation between lecturers and media-didactic experts in TLCs for a sustainable development of teaching skills.

Cooperation is essential for the following illustrations. In essence cooperation (lat. co together, opera tasks, work) between humans is the purposeful interaction of two or more persons, groups or systems with a common interest. It is an intentional and planned way of working together and by processes of mutual agreement on specific goals. It can be both formal, in the case of existing structures or obligations, and informal, when there are no rules in place (Pastoors & Ebert 2019). In terms of the “homo heterogeneous”, cooperation is particularly understood here as a pursuing of longterm goals and acting sustainably (Rogall & 2015). In line with Kubrick (2001), it is seen as an unfolding process of interaction which can be better understood by interrelating the four perspectives “subject- or task-related”, “social”, “organizing” and “communicative”. These perspectives illuminate the dynamics of shared practices evolving into a shared collective culture with formal and informal communication and collaboration.

This paper argues that a cooperation between lecturers, media-didactic and technical staff in TLCs may be fostered by implementing a team of discipline-specific experts who know the

department culture and discourse on teaching in their discipline. This sort of cooperation will be illustrated by insights into the project *Developing Online Formats Together - Innovative and Sustainable* (GO-IN), University of Applied Sciences Fulda (HFD), which aims to foster such a cooperation by a pool of discipline-specific experts. First, there will be an illustration of the necessity of enhanced cooperation between the TLC and the departments. (2) This is followed by an overview of GO-IN (3). In a next step, examples of support by discipline-specific experts are provided (4), the *informal group discussions* (4.1.) and the *adaptation of teaching material* (4.2). Finally, the experiences are discussed (5).

2. The Necessity of Enhanced Cooperation between the TLC *Dienstleistungen Lehre und Studium* and the Departments at the University of Applied Sciences Fulda

At the University of Applied Sciences Fulda (HFD), there are currently around 730 employees and 9,700 students with diverse educational backgrounds, personal and professional biographies. The HFD unites a variety of disciplines and has eight departments with their own cultures of communication: Applied Computer Science (AI), Electrical Engineering and Information Technology (ET), Food Technology (LT), Oecotrophology (OE), Health Science (GW), Social and Cultural Sciences (SK), Social Work Science (PG), Business Science (W). Students and lecturers are supported by the media-didactic experts in the TLC of the HFD, the *Dienstleistungen Lehre und Studium* (DLS). This variety of disciplines and diversity of students is a strength of the HFD, but it entails challenges. These challenges in digital teaching were addressed by DLS. Since 2005, lecturers have been supported in media-didactic teaching and technical support by a central e-learning service and a cooperation project of many universities ("Digitally Supported Teaching and Learning - digLL").

Despite HFD's support services, teaching during the COVID-19 pandemic has brought inconsistent development in digital teaching with regard to methods, tools and didactics across the departments. The strengths and weaknesses of the HFD in digital teaching were identified in the evaluation of the online semester 2020/21 (Kraft, Merkator & Pohl, 2021). The evaluation included students (N=1.834) and lecturers (N=288). Data collection was conducted via questionnaire survey and analysis by means of descriptive statistics. The results revealed that there was good technical support, but partly problems in choosing appropriate didactic methods among lecturers due to the overload of options. Therefore, the identified key challenge was to address discipline-specific support and foster cooperation and discourse about digital teaching methods between lecturers and DLS staff. The lack of formal as well as informal cooperation between TLCs and departments in order to foster teaching is not a new challenge. At the HFD, improving digital teaching through cooperation is the focus of the GO-IN project, which is described in the following chapter.

3. The Project GO-IN and the Concept of the Pool of Discipline-specific experts

GO-IN is a project across disciplines; it is centrally managed by the Vice President for Teaching and Learning and coordinated in DLS. It has the goal to identify existing digital teaching practices which were developed during the COVID-19 pandemic. Lecturers are particularly supported in adapting the digital teaching concepts identified and apply them in a more developed way in their own teaching. The project has five pillars. First, a pool of discipline-specific experts, with one expert from each discipline. Second, a professorial advisory council, including one professor from each department. Third, discourse space(s), which are spaces for discussions about digital teaching. Fourth, development of teaching and learning labs and fifth, producing teaching, learning and assessment materials. The “heart” of the GO-IN-project is the pool of experts skilled in digital teaching methods and tools who have a background in a certain discipline. The so called discipline-specific experts of this pool foster particularly informal cooperation between lecturers and media-didactic experts or DLS staff by building a “bridge” of communication. Once established, informal cooperations sometimes transform into formal cooperation structures (see Figure 1).

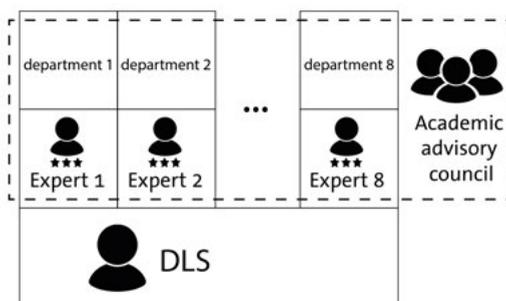


Figure 1. Supported by the academic advisory council, eight discipline-specific experts build a bridge in cooperation between the departments and DLS staff. Figure from: Christian Stickel (2023).

They support lecturers in developing a teaching concept, adapting certain teaching practices or choosing an appropriate teaching tool. They are supported by media-didactic experts and other technical staff in DLS as well as a professor from their discipline, who is a member of the advisory council of the department, which forms the second pillar. The third pillar is the discourse space(s) where the discipline-specific experts initiate communication about digital teaching and learning by identifying discipline-specific needs in digital teaching methods. They foster discourse about teaching and learning built on their knowledge about which methods are preferred in the different disciplines. Furthermore, they bring together lecturers within and across departments who are interested in the same teaching method(s) or digital tool(s). With regard to the fourth pillar, development of teaching and learning labs, this supports the departments in bringing together lecturers with the suitable person in DLS who can support them in the design and application of innovative, digital-driven labs and the

related teaching methods in these new labs. They also establish cooperation between DLS and the lecturers in regard to technical support for teaching settings. As part of the fifth pillar, the discipline-specific experts support lecturers in producing teaching, learning and assessment material by developing and creating these materials with media producers in DLS.

4. Discipline-Specific Experts at Work: Two Examples

Based on the GO-IN project outline and the role of discipline-specific experts within the project, the following examples illustrate informal (and formal) cooperation in practice. The first example, the *informal group discussions*, addresses the question of how informal cooperation with lecturers enhances a discourse about challenges in digital teaching and enables tailor-made solutions. The second example, the *adaptation of teaching material*, addresses how discipline-specific experts foster the adaptation of digital learning material within and across departments by informal cooperation activities.

4.1. Informal Group Discussions

At the beginning of GO-IN, *informal group discussions* facilitated contacting lecturers and establishing easy-going and non-obligatory regular meetings, the discourse spaces. The *informal group discussions* enable the identification of good ongoing digital teaching practices and prevailing challenges at the HFD. In five departments (AI, GW, LT, Oe, SK), the discipline-specific experts fostered contact with nearly all lecturers in different ways, depending on communication structure and culture in a department. In the departments AI, LT, SK contact was established by the discipline-specific experts. In the department GW, the discipline-specific expert began to participate in an existing formal discourse space. In the department Oe, the best way to invite lecturers seemed to be an invitation by the member of the advisory council. Despite the different ways of contacting lecturers for *informal group discussions*, this led to two key developments: Firstly, they revealed good digital teaching practices as well as challenges and, secondly, they initiated and established regular discourse about teaching and learning between lecturers, discipline-specific experts and the DLS staff. These discourse spaces are diverse and aligned to the communication culture in the discipline and department.

In the department AI, the discourse space *eLA (eLearning & Lehre-Austausch)* was implemented. There is an open discussion between professors and all other lecturers about teaching digitization as well as applying digital methods and tools. The discipline-specific expert coordinates and moderates the discourse space. Due to their sound knowledge in teaching, they are able to pick up teaching examples that may be relevant for many lecturers, applying KI in teaching.

The department GW already had the formal discourse space *AG Qualität der Lehre* for discussion of teaching. Professors and lecturers participate here, treating varying topics related to teaching and contributed to by participants. The discipline-specific expert gains insight into good and challenging teaching examples and identifies particularly sustainable structures of a discussion format which might not have been known before outside the department.

Even though there is no specific title for discourse spaces in the department LT, the exchange about teaching is conducted regularly in two kinds of discourse spaces, one for professors and one for all other lecturers. Both discourse spaces are initiated by the discipline-specific expert. At the beginning of some meetings, the discipline-specific expert, accompanied by a lecturer, provides example(s) of a good digital teaching pattern (According to Kohls (2009) patterns are schemes that document proven solutions in an easily accessible, practical form.). This input is followed by discussions on the topic presented. The discipline-specific experts deliver information and foster the discussion as they transmit their knowledge on teaching methods in the communication culture of the department.

The department Oe also has no title for its discourse space, although such a space is initiated regularly by the discipline-specific expert for interested lecturers. The participants are professors and lecturers alike. The discipline-specific expert always presents patterns first in a moodle course before an open exchange about the information presented starts. The discourse is moderated by the discipline-specific expert. Hence, the discussions rely on their knowledge about the teaching practice in the discipline.

Derived partly from the experience gained in the other departments and partly from extensive *informal group discussion*, the department SK has just started to implement a discourse space. Initiated by the discipline-specific expert, professors and all other lecturers will participate in this discourse space together. This discourse space was already implemented once by the department Oe and following meetings for discussions are planned. At this first meeting, the discipline-specific expert presented a pattern which was discussed afterwards.

4.2. Adaptation of Teaching Material.

The *adaptation of teaching material* became particularly feasible after a well established informal and partly developed formal cooperation between lecturers and discipline-specific experts (as well as DLS staff) , which started to consolidate. The central goal of developing digital teaching material is to provide templates which can be slightly modified and easily applied by lecturers of all departments. Several templates for teaching, learning and exams have already been developed in cooperation with lecturers, discipline-specific experts and media producers.

A favourite template among lecturers is the digital learning template *escape game*. It was developed to foster digitally assisted in-depth learning in class – virtual and in presence. The idea for a learning unit with an *escape game* was proposed by a professor in the department of LT. She herself did not have the time to compile such a template and was not sufficiently skilled in media production. She asked the discipline-specific expert for assistance and the latter in turn contacted one of the media producers in DLS. During the development of the *escape game* by the media producers, the discipline-specific expert regularly presented the evolving versions to the professor in order to tune them to the professor's needs. Together they designed two *escape games*. In a meeting of the pool of discipline-specific experts, the participants discussed how *escape games* may be adapted for other courses. The solution was to design an *escape game* template. Accordingly, the discipline-specific expert, the media producer and five student assistants developed a template.

After the *escape game* template had been tested in a teaching course, the professor, supported by the discipline-specific expert, shared her experiences with other professors in the LT department. In particular, they presented it in the discourse space for professors described above. The template was further presented in discourse spaces of four other departments (Oe, AI, GW, SK). There, the discipline-specific expert from these respective departments explained and presented the template, which led to new cooperations between lecturers and media-producers. In the department Oe, the template has already been adapted to other in-depth learning units in class. It has already been integrated into the course's teaching concept. In AI the implementation has started. The other two departments have declared a high interest in using the *escape game* template.

5. Reflections on Experiences with the Pool of Discipline-Specific Experts

The development of digital teaching and learning in the last two years was shaped by necessities during the COVID-19 pandemic. Due to the support in digital teaching, the role of TLCs changed and gained greater influence. TLC staff, whether media-didactic experts or technical staff such as media producers, were particularly requested for solutions to technical challenges, less for digital teaching methods and the development of digital teaching skills. In this regard there is often still a lack of cooperation between lecturers looking for discipline-specific teaching methods and media-didactic experts.

As the “heart” of the the GO-IN project of the HFD, the pool of discipline-specific experts fosters digital teaching and learning by enhancing the cooperation between the departments and the DLS media-didactic experts, media producers or other technical staff. The discipline-specific experts particularly initiate informal cooperations which sometimes segued into formal cooperation structures. The experiences revealed that such a pool of discipline-specific experts can build a ‘bridge’ between DLS staff by bringing in the knowledge about

the practiced communication culture of a department and the understanding of the relevant teaching and learning methods in a specific discipline. However, the experiences in both examples also demonstrate that formal cooperation by professorial support is highly significant.

In a nutshell, the discipline-specific experts are aligned to the communication culture in the department and as a pool of experts, they are therefore able to foster the cooperation between lecturers of all departments and the DLS staff. Such an increase in personnel of the mid-level staff of a university in discipline-specific consulting may therefore lead to sustainable discourse and improvement in digital teaching and learning.

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(Digitally) transforming education in a large university

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Abstract

The world is changing faster than ever and so is the context of higher education. Students need to develop an agile mindset and corresponding generic skills for the flexible workplace that awaits them and the many societal challenges they face. Pedagogical and technological change can no longer be postponed by higher education institutes. However, this (digital) transformation is not an easy task.

This paper elaborates on the process of digital and educational transformation at KU Leuven (Belgium), one of Europe's oldest and largest research-based universities, from a meta-perspective. Through several examples, challenges and opportunities to trigger a shift in workforce, technology and culture are explained. The applied network-based model of educational development, pedagogical action research project methodology and informal initiatives definitely play a crucial role.

Keywords: *Digital transformation; higher education; management; pedagogical action research; cultural change.*

1. Introduction

The world is changing faster than ever and so is the context of higher education. Students of today are not the same as students of yesterday or tomorrow, having different life, study and career aspirations (Barhate, Dirani, 2022). At the same time, when manoeuvring through this ever evolving society and work field, our ‘Generation Z’ students are expected to demonstrate a fair amount of flexibility, with an attitude and generic skills set to match (Williams et al., 2023). This was exaggerated and accelerated by the COVID-19 pandemic. Universities aim to equip their students for this agile mindset with competences needed for a lifetime career in this volatile, uncertain, complex, and ambiguous (VUCA) world, rather than traditional content. They feel the urge for a learning evolution and “the development of updated and agile curricula in [...] higher education” as stated by the World Economic Forum (2016) and become VUCA Universities as described by Korsakova (2020): validated, unique, complementary, attractive. For this, a significant educational reform is necessary, which is underpinned by several authors (e.g. Draskovic et al., 2020; Pup & Filep, 2021; Jackson & Konczos Szombathelyi, 2022). However, this seems to be a very challenging ambition that occupies higher education institutions worldwide. Moreover, where the rapid change in educational technology offers tremendous opportunities to address the changing needs of students, it also adds a complex digital component to educational transformation.

Change management and finding ways to consolidate results remain the most important challenges in this process. Brooks and McCormack (2020) indeed state that full (digital) transformation towards sustainable future-proof higher education requires shifts at different levels: cultural change, workforce change and technology change.

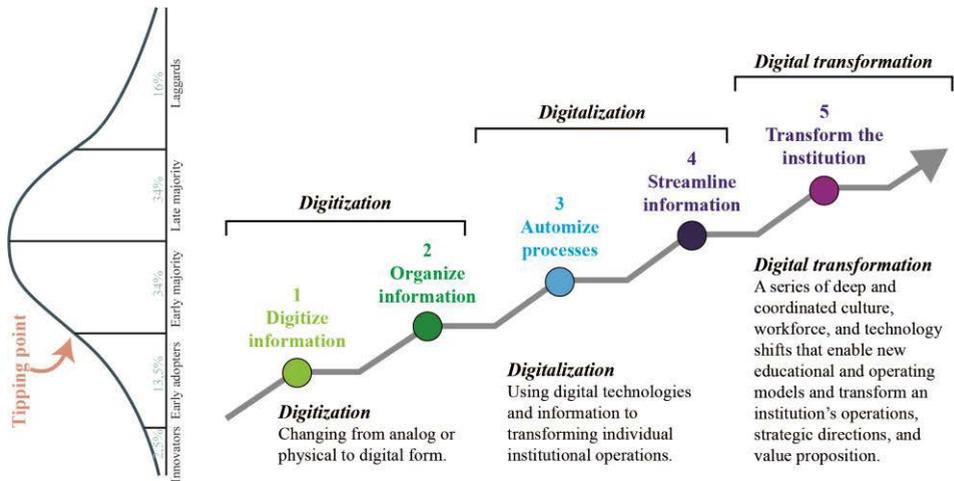


Figure 1. Digital transformation in higher education related to Roger's diffusion of innovation.

Sources: Brooks & McCormack (2020), Rogers (2003).

Figure 1 shows how this transformation is related to Roger's diffusion of innovation (Rogers, 2003), evolving from a small group of innovators towards involving a majority of stakeholders. This paper elaborates on the process of digital and educational transformation at KU Leuven (Belgium), one of Europe's oldest and largest research-based universities, from a meta-perspective.

2. Methodology

2.1. Workforce change: network-based model of educational development and innovation

Peeters (2022) describes the dynamic model of discipline-specific educational development at KU Leuven to implement centrally set policy priorities regarding educational innovation, hereby ensuring alignment with bottom-up initiatives and translation to faculty contexts. In this model, educational developers and an increasing number of educational technologists at different levels are closely interrelated and all play an important role: at the faculty, group (cluster of faculties) and university-wide (Figure 2). Peeters (2022) focuses on several group-wide collaborative projects within the Group of Science, Engineering and Technology (SET Group) on topics such as multicampus education, virtual mobility, MOOCs for Credit, learning analytics, teaching assistant training and collaborative learning spaces. Additionally, the launch of a SET Advisory Board Educational Innovation is mentioned as a way to allow dialogue between vicedeans, other staff and students, increasing information exchange on initiatives at different levels. In this context also communities of practice originate as typical bottom-up approaches that are known to have a powerful effect on learning and teaching in universities (Wenger-Traynor & Wenger-Traynor, 2015).

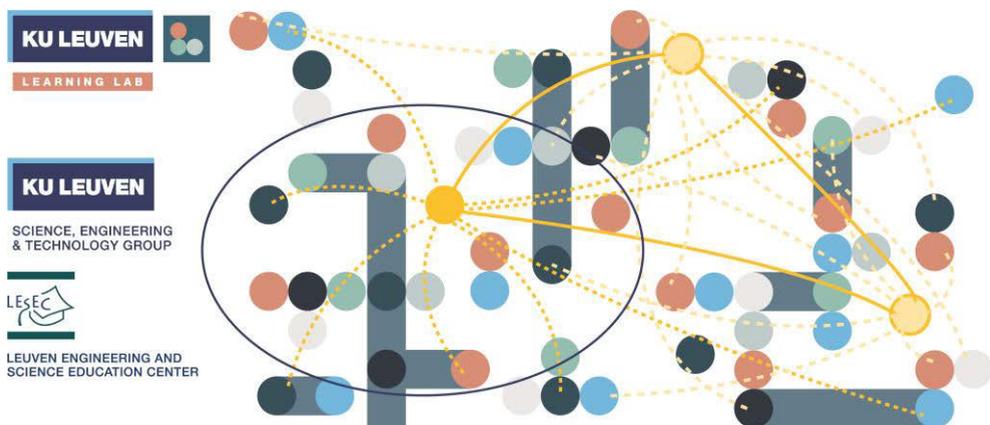


Figure 2. KU Leuven Learning Lab as a university-wide networking structure, involving educational developers and technologists at different levels. The yellow dots represent project managers at the intermediate Group level, other dots are staff members at the faculty and university level. The blue circle represents the Group of Science, Engineering and Technology, in which LESEC operates as an additional network. Source: Peeters (2022).

The Leuven Engineering and Science Education Centre (LESEC), a research centre grouping disciplinary teaching staff and educational developers in STEAM (Science, Technology, Engineering, Architecture and Mathematics) with a focus on educational research and practice, and KU Leuven Learning Lab (KULLL), a university-wide networking structure, play a crucial role herein.

2.2. Technology change: project-based approach including pedagogical action research

KU Leuven generally uses a project-based approach to allow defining clear goals that translate the university's vision on 'Going Digital' into concrete output, leading to implementation and consolidation of results. Particular attention is given to the development of transversal axes across study programmes related to expected (lifelong learning) competences and international developments. All projects are intertwined with digital transformation and many aim for a full implementation of technology. Principles of pedagogical action research are applied in order to address real issues, modify practice as well as contribute to theoretical knowledge. Hereby the cycle of observe - plan - act - reflect is followed (Norton, 2009). Projects typically start small-scale, while tracking down and involving the innovators. By making benefits visible through small-scale pilot studies the group of early adopters is then expanded. Innovators may apply regularly for internal funding to start such pilots, selection is done by a commission that links ideas to university wide strategic aims. Consequently, the most successful projects in terms of positive evaluation by involved students and teaching staff upscale towards being suitable for larger groups of stakeholders, thus creating an early majority past the tipping point described by Rogers (2003) (Figure 1). Principles of Sociocracy 3.0 (S3) are applied, which is an open source framework of patterns and practices to collaborate more effectively in multidisciplinary non-hierarchically structured teams (Priest & Bockelbrinck, 2017).

2.3. Cultural change: informal initiatives

Additionally to the more formal projects, several informal initiatives trigger cultural change from the inside. For instance, members of the research centre LESEC have organized meet-up events called 'When ideas...' since 2021 on topics such as learning analytics, learning spaces, effectiveness in education, digital transformation, lifelong learning and flexible curricula, assessment ... Interested colleagues join these informal sessions to reflect and discuss out-of-the-box, leaving comfort zones and sharing passion. Think-Pair-Share is used as a cooperative discussion strategy, starting from a concrete question, as it is shown to be effective to stimulate critical thinking and promote group participation (e.g. Deore & Arora, 2022). In some cases a 'When ideas' session leads to the reactivation of former projects, concrete actions or publications in the LESEC news letter, hereby reaching more stakeholders. Innovation and change is thus triggered bottom-up.

3. Results and discussion

Initiatives and projects within the networking structure of educational innovation at KU Leuven have shown to be effective in certain ways to facilitate aspects of (digital) transformation. Especially workforce change and technology change are triggered, for instance by breaking through hierarchical structures, involving different roles collaboratively, hiring educational technologists, implementing blended learning including adaptive learning paths, applying learning analytics ... However, challenges become more visible in this process and are mainly related to resistance to cultural change, expressed by resistance at all levels to adapt traditional teaching and learning methods and organization. In other words, resistance to cultural change acts as a catalyst of resistance to workforce and technology change as well.

Based on some concrete exemplary cases and experiences this paper discusses both successes and pitfalls related to the used methodologies.

3.1. Example: network-based LESEC team 'Education Z'

LESEC organizes its research, development and innovation in several themes based on the expertise, experience and interest of members. For each theme a team of LESEC members is formed, whereby one member performs the role of coordinator and several subthemes are defined in co-creation. The theme 'Education Z' focuses on creating learning experiences for generation Z students that encourage them to become 'global citizens' with the necessary knowledge, skills and motivation to thrive in their future career path and beyond. Global competencies, active learning, collaborative learning spaces, online learning and assessment, teams across borders and generation Z are current subthemes. In about four meetings a year the team discusses insights from different perspectives about the ideal learning environments, learning formats and assessment. This initiates more formal cooperation and actions e.g. by setting up a master's thesis or other project together, or by organizing quantitative and qualitative data collection as a team.

This example shows that a network-based approach such as LESEC truly triggers exchange and cooperation across boundaries. The fact that stakeholders with different backgrounds and functions, but with common interests, are brought together induces initiatives that would otherwise not originate or would be much smaller scale and less interdisciplinary. However, the meso- and meta-level perspective also complicates certain processes. For instance, the idea arose to start-up a co-creation project with students but it seemed unfeasible to do this as a mutual initiative. Instead, several small-scale projects will run within different sub-themes and Education Z will bring results together.

3.2. Example: towards implementing learning analytics with a collaborative project

One of the group-wide educational innovation projects of the SET Group concerns using generated data by online learning material for increasing the efficiency and effectiveness of learning (Tubbax & Peeters, 2023). In close collaboration with different stakeholders at all levels of university, data are collected, analyzed and interpreted in order to give motivational and action-oriented feedback to didactic teams. It soon became clear that the process of making learning analytics scalable and sustainable is closely related to the digital transformation of education at KU Leuven. The simultaneous migration towards a new Learning Management System (LMS) made this symbiosis even more visible. However, it seems very hard to convince a larger group than the innovators of the advantages of learning analytics.

This example shows that a technology shift towards implementing learning analytics is challenging but feasible, as long as all relevant stakeholders are involved. This is possible within the framework of a project. However, expanding the group of actual users to an early majority requires a slow and gentle process of repeated PDCA-cycles and action research techniques. The tipping point in Figure 1 between early adopters and early majority, or ‘chasm’ as already described by Moore (1991), definitely is the biggest challenge. Generating sufficient ‘proof’ for a ‘proof of concept’ is key to convince more stakeholders, while a clear governance and policy is necessary to specify the framework. Tubbax & Peeters (2023) further elaborate on this.

3.3. Example: learning spaces ‘ninja’ action to trigger cultural change

During a LESEC ‘When ideas...’ session on learning spaces in February 2022, the idea arose to not wait for new high-level collaborative learning spaces to be developed, but to change a traditional seminar room into a low-level active learning classroom simply by moving furniture to a group-work arrangement. The ambition was to break the vicious circle described by Peeters & Binnard (2018): the lack of use of innovative teaching practices reduces the demand for new and flexible rooms, which reinforces the traditional habits of teachers. This ‘ninja’ action bypassed KU Leuven procedures, but by organizing a close follow-up of didactical teams through information charts and a local contact person, the plan worked. Locally, lecturers are now asking for a second, similar active learning classroom. Centrally, this is picked up by the involved stakeholders and triggers structural change in available learning spaces.

This example shows that an informal brainstorm session can induce disruptive bottom-up change, causing a complex interplay between different levels involved, leading to related top-down actions. Informal actions can thus help to lower resistance to cultural change. However, effects remain prone to the goodwill of a few innovators and need time.

4. Conclusions

Higher education can no longer avoid a disruptive innovation due to the emergence of online learning as well as the evolved expectations of society concerning skills and attitude of graduated students (Christensen & Eyring, 2011). However, this paper confirms that (digital) transformation in a higher education institution is a challenging process and shares some insights from KU Leuven (Belgium). Several examples show that a workforce and technology change can be induced by a coordinated, project-based approach in which different levels are involved and coordinated. Pedagogical action research is a valuable method to feed practice as well as theory. However, a culture change is most difficult and requires more than a project-based approach. After all, people, cooperation and willingness to change became more important than following a plan. The combination of bottom-up and top-down initiatives in one continuous PDCA-cycle is crucial, aiming for mutual goals. The world is changing faster than ever and so should the context of higher education.

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Enhancing online teaching: addressing the challenges faced by early-career academics at Vietnam National University, Hanoi

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Abstract

The Covid-19 pandemic has posed significant challenges to teaching staff at universities, particularly in the realm of online teaching. This study evaluates the challenges faced by early-career academics at Vietnam National University, Hanoi (VNU) in adapting to online teaching. A survey of 804 lecturers at VNU reveals that while they recognize the advantages of online teaching and hold a favorable perspective towards it, they face challenges related to proficiency in using new teaching technologies and learner motivation. Based on the findings, this study proposes some recommendations for early-career academics at VNU to address these challenges and enhance their online teaching.

Keywords: *Online teaching; online learning; educational technologies; quality assurance; higher education; professional development.*

1. Introduction

The advancement of science and technology has had a tremendously positive impact on various aspects of society and holds a significant role in various fields with practical applications. Technology has greatly benefited education by providing easy access to academic resources, textbooks, and research materials online, eliminating the need for physical libraries. Research indicates that online teaching and learning are increasingly perceived positively (Thai & Tran, 2022). At the VNU, which encompasses 34 units including 9 member universities, 3 affiliated schools, and 3 training centers, diversity is a hallmark characteristic among its learners, who possess varying characteristics, needs, perceptions, and concerns. Despite the growing use of technology and active teaching methods at VNU, there is a lack of extensive research studies with a sufficient number of subjects to accurately determine the impact of technology on active learning among learners. Given the aforementioned reasons, this research aims at identifying the current status and those challenges that early-career lecturers deal with in teaching online at VNU, and proposing some solutions to help improve the quality of online instruction. The research employed a quantitative data analysis approach, utilizing a sample of 804 responses from VNU educators. The analysis took into account various factors including gender, teaching field, teaching seniority, educational level, the country where the highest degree was obtained, and the faculty unit at VNU.

2. Literature review

The literature on online teaching suggests that incorporating technology into teaching activities has various benefits, but limited in-depth investigations into the quality of online teaching have been conducted. Online teaching involves instructional activities facilitated through technology platforms in an online environment, differing from traditional, in-person teaching in physical classrooms. Globally, research on active learning and the integration of educational technology in teaching has been extensive, with a majority of studies being empirical or qualitative in nature and focusing on specific training areas. Studies have been conducted to enhance online teaching, with some utilizing analytical methods to clarify the nature of online teaching activities in schools, while others have employed meta-analyses to explore the impact of technology on students' learning in online classes. For instance, research has shown that technology creates a more positive learning experience compared to non-technology use (Le et al, 2022; Muhtadi, 2013; Tamim et al., 2011; Thai & Tran, 2022).

Studies indicate that technology has a generally positive impact on learning, with students finding it appealing compared to traditional materials. However, selective and strategic use of technology is necessary to avoid distractions and ensure effective collaborative learning in online environments. Traditional classroom settings may be more effective for certain

tasks compared to distance learning. Additionally, integrating technology effectively into the learning process may require significant investments in infrastructure and resources. Technology in online teaching can enhance student interaction during initial stages, collaborative activities, and post-classroom learning. It can also improve teaching effectiveness, increase access to global students, offer flexible scheduling, reduce costs, and decrease environmental pollution. Studies have shown increased student scores in the first year of implementation. However, limitations of technology in education include increased opportunities for cheating, decreased attention span, imagination, and thinking ability among students, as well as increased time, cost, and health-related burdens for lecturers. (McLaren et al., 2022; Raja & Nagasubramani, 2018; Viorica-Torii & Carmen, 2013; Wang, 2020).

The enhancement of online education quality necessitates the implementation of robust training programs and knowledge dissemination initiatives for instructors and students. This entails upgrading IT infrastructure, improving students' IT competency, and providing training for educational leaders and instructors on modern teaching techniques, scientific and technical innovations, and digital technology in education (Le & Truong, 2020; Thai & Tran, 2022). Further research is warranted to gain a comprehensive understanding of the challenges associated with integrating technology in online teaching and its impact on training quality. Evidence-based solutions are required to enhance educators' skills, improve students' learning outcomes, and address the dearth of studies in this domain. In this regard, VNU has formulated guidelines to ensure high-quality online training that aligns with the quality assurance requirements of the Government of Vietnam and VNU. These guidelines encompass various aspects, including teaching content, teaching and learning activities, testing and assessment, technical infrastructure, and learning resources, providing an effective framework for the implementation of online teaching activities.

3. Research Methods

Data used in the study was collected through an online survey for new faculty members when they participated in a training program on “New Teaching Methods and Application of Information Technology in Teaching for Lecturers at VNU” from 2021 to 2022. The total number of questionnaires collected was 903, after eliminating any disqualified responses, the data collected from 804 faculty members were analyzed to address the research topics. The survey data was processed and analyzed using Microsoft Excel and SPSS software.

In terms of the sample structure, the research team conducted a classification based on several demographic variables including gender, field of teaching, teaching seniority, level of education, country where the lecturer obtained their highest degree, and unit. Analysis of the gender distribution in the sample revealed that the proportion of female participants (67.9%) was more than twice that of male participants (32.1%). In relation to teaching seniority,

17.4% of the lecturers had 3-5 years of experience, 43.8% had 1-3 years of experience, 30% had 6 months to 1 year of experience, and 8.8% had less than 6 months of experience. With regard to education level, more than half of the lecturers held a Master's degree (50.6%), while 38.3% held a Ph.D. degree, and the remaining 11.1% held a Bachelor's degree. In terms of the country where the highest education degree was obtained, 62.6% of the lecturers obtained their highest degree in Vietnam, 34.1% obtained it abroad, and the remaining 3.3% provided invalid responses (see Figure 1 below).

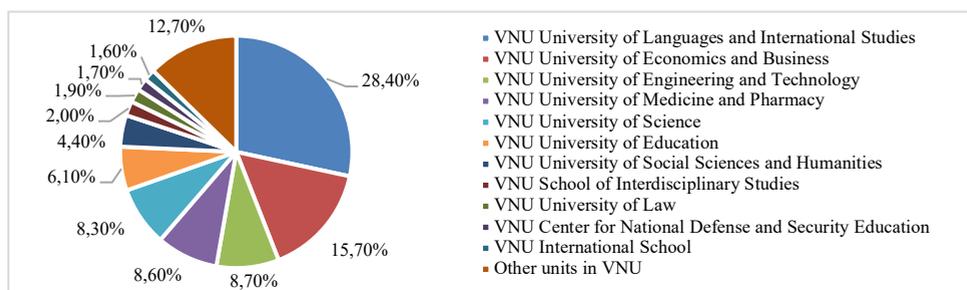


Figure 1: Description of the sample in units.

4. Online teaching at VNU: the current situation and challenges

The findings of this study reveal that although lecturers are aware of the advantages of online teaching and express willingness to utilize this mode of instruction, they encounter challenges related to their proficiency in using new teaching technologies and learner motivation. The results of the research provide insights into how instructors utilize tools for online teaching, their awareness of online teaching, and the challenges they encounter when working with students in a virtual environment.

First of all, Table 1 shows how lecturers use teaching online tools in their work.

The research used Yes/No questions to gather information from instructors. The survey results indicate that video conferencing, social media, online video, online quizzes, and mobile applications are the most frequently utilized tools by lecturers, with over 60% of them employing these tools. These tools were also frequently utilized during the COVID-19 pandemic when teaching and learning had to be entirely conducted online. However, some other tools such as peer review tools and ePortfolios, are underutilized with less than 10% of the surveyed lecturers using these tools in their classrooms. Another tool deemed necessary for teaching, especially in online or blended teaching, is the learning management system (LMS), which has not gained widespread popularity among lecturers at VNU. Only 41.7% of lecturers reported using this tool during their teaching. This may be due to the recent development of VNU's LMS system and its lack of synchronization with the information of

all training units, making it difficult for lecturers of some units to access and understand how to use the system with their modules.

Table 1. Frequency of using tools/software in online teaching by lecturers.

Tool/software has used for online teaching	Frequency	Percent	Tool/software has used for online teaching	Frequency	Percent
Video conferencing	645	80.2%	Online interactive activities	339	42.2%
Social media	583	72.5%	LMS	335	41.7%
Online video	540	67.2%	Wikis	121	15.0%
Online Quizzes	535	66.5%	Blogs	103	12.8%
Mobile application	507	63.1%	Courses from eBooks or iTunes	88	10.9%
Online discussion forum	374	46.5%	Peer review tools	58	7.2%
Online collaboration tools	357	44.4%	ePortfolios	31	3.9%

Furthermore, the lecturers affiliated with VNU exhibit a clear understanding of the advantages associated with delivering courses online. In addition to comprehending the benefits offered by online teaching, the teaching staff demonstrates preparedness in terms of their practical skills and teaching methods, as elucidated in the subsequent table:

Table 2: The awareness and practices in online teaching for lecturers.

Items	Frequency	Percent
I understand the benefits of using technology in teaching so I can make informed decisions about when and where to use technology in my teaching	777	96.7%
I know how to evaluate the online teaching activities and tasks that I have/will be implementing	686	85.3%
I've been exploring new technologies to integrate into my teaching and feel it's appropriate and doable	639	79.5%
I am sure about which learning activity or task is best for online teaching	635	79.0%
I feel that learners are more interested in learning when technologies are integrated in my teaching activities, which encourages me to try applying new technology to teaching activities	612	76.1%
Online teaching is right for me	590	73.4%
I have a clear understanding of classroom assessment requirements when transitioning to an online teaching context	573	71.3%

The results of the survey indicate that a high percentage of the 777 surveyed lecturers (96.7%) expressed their understanding of the benefits of online teaching and their proficiency in utilizing technology in their teaching activities. Likewise, 666 lecturers (85.3%) reported having the ability to evaluate online teaching activities and tasks, while 639 (79.5%) claimed to have successfully integrated new teaching tools into their instruction. Furthermore, 612 lecturers (76.1%) noted that the use of technology in teaching was more motivating for both themselves and their learners, and 590 (73.4%) considered online teaching as a suitable approach for themselves. These results indicate the willingness of lecturers to adopt new technologies in their teaching, however, the successful implementation of such technologies is still hindered by certain challenges. The survey findings highlight certain problems that have impeded the lecturers in effectively integrating technology into their teaching activities.

Finally, many challenges in teaching online have been faced by teaching staff, as follows:

Table 3: Challenges for teachers in online teaching.

Challenges	Frequency	Percent
My ability to access and use online technologies is not good	447	55.6%
Learners lack interest and interest in my online lectures	390	48.5%
I'm not sure if the learning outcomes in online teaching are the same as those in face-to-face teaching	362	45.0%
Lack of support on mechanisms and policies from VNU and training institutions	344	42.8%
I don't know how to properly search for and use online content or resources	300	37.3%
I don't have a good understanding of effective pedagogical methods in online teaching	282	35.1%
It took me too long to prepare for the online lesson	278	34.6%

The survey results indicate that a substantial proportion of faculty members encounter difficulties when implementing online teaching methods. Specifically, 55.6% of the lecturers reported challenges in accessing and utilizing online technologies. The attitude of learners also posed a challenge for 48.5% of the lecturers in successfully implementing online teaching methods. Additionally, a lack of experience in online teaching (45% respondents) and insufficient support from VNU regarding policies and mechanisms (42.8% respondents) are significant barriers to the implementation of online teaching methods by the faculty. It is evident that while the lecturers at VNU have embraced the use of new technology, support from the university and active participation from learners are critical factors for the successful implementation of these teaching methods and technologies. The collaboration between

schools, lecturers, and learners will be instrumental in ensuring the success of teaching innovations and improving the quality of learning experiences for learners.

5. Recommendations to improve the quality of online teaching

In light of the aforementioned findings, the research suggests three levels of implementation to address the challenges encountered by early-career lecturers in online teaching, as follows:

At VNU level, it is recommended that guidelines, regulations, and mechanisms be developed to facilitate the implementation of online and blended teaching practices across all member institutions. This could include the development of comprehensive guidelines and regulations that outline the best practices for online and blended instruction, as well as the establishment of mechanisms to monitor and evaluate the effectiveness of these practices. Additionally, it is suggested that regular seminars and professional development workshops be conducted to support faculty in acquiring the necessary skills and knowledge to effectively utilize methods and tools for online and blended instruction. These initiatives could provide faculty with the necessary resources and support to enhance their competency in online teaching and ensure the quality of instruction in the online and blended learning environments.

At VNU's member institution level, it is suggested to implement regulations and guidelines specifically tailored for online and blended learning, with a particular focus on new faculty members. These regulations and guidelines could provide a framework for new faculty members to effectively engage in online and blended teaching practices, and could include incentives to encourage their active participation in adopting innovative teaching methods and educational technologies. Additionally, it is recommended that VNU's member institutions establish mechanisms for monitoring and assessing the teaching activities of early-career lecturers, with the aim of improving the quality of instruction. This could involve regular evaluations of online teaching performance and feedback to help lecturers enhance their teaching practices. Furthermore, it is crucial to establish a technical team with expertise in educational technologies to provide support and guidance to new and novice instructors in utilizing new teaching methods and technologies effectively. This could include offering training programs, workshops, and ongoing technical assistance to ensure that faculty members are equipped with the necessary skills and knowledge to effectively integrate technology into their teaching practices.

At the individual level, it is encouraged for lecturers to actively engage in continuous professional development opportunities to acquire and apply innovative teaching methods and technologies in their instructional practices. This could include participation in training sessions, seminars, and workshops that focus on the advancement of modern teaching methods and technologies. Moreover, it is recommended that instructors introduce the teaching methods and technologies they plan to utilize in advance to their students, and

encourage students to familiarize themselves with these tools. Gathering feedback from students on the effectiveness of these methods and technologies can provide valuable insights for instructors to refine their teaching practices. In addition, lecturers should engage in regular self-reflection and evaluation of their teaching activities to promptly identify areas for improvement and strive to enhance the overall quality of instruction. This could involve critically examining instructional strategies, student engagement, and learning outcomes, and making adjustments as needed to optimize the learning experience for students.

6. Conclusion

The integration of technology in online teaching has brought a multitude of benefits to early-career academics in their pedagogical pursuits, and a majority of these lecturers are cognizant of these advantages. Nonetheless, each lecturer still encounters at least one challenge (the challenges of slacking proficiency in the utilization of new teaching technologies and the lack of motivation among learners pose difficulties for online teaching) when delivering their lessons online. To enhance the quality of online teaching for early-career academics at VNU, it is imperative to have a coordinated effort from both the management and the educators themselves. The management should establish appropriate policies for implementation, support, and supervision to create an optimal environment for online teaching. Additionally, the VNU Center for Teaching Excellence should play a proactive role in supporting and encouraging early-career academics to actively explore and incorporate innovative teaching methods into their online teaching practices.

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Steps towards enabling health professionals through future skills

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Abstract

Education in healthcare must enable professionals to work in the health sector for as long and as fulfilled as possible. Yet, new requirements are constantly arising in the health sector, which continuously change the required competences, e.g. due to new technological possibilities and increasing interdisciplinarity. Several challenges arise: education in healthcare needs awareness of required competences and their rapid change. At the same time, addressing them in education presupposes an in-depth understanding of what they actually are.

To tackle these issues, a teaching concept was developed that builds on self-reflection of to-be professionals in healthcare. This concept includes characterizing typical professional situations and deducing required (future) competences for mastering these situations.

Beyond rising awareness to future skills, applying this teaching concept also yields data that support a better understanding of required competences and their importance across professions. A case study resulted in initial competence profiles for several professions in healthcare.

Keywords: *Future skills; teacher education; health; vocational education; competence assessment; self reflection.*

1. Introduction

Societies are getting older and health is a key aspect for maintaining quality of life. Education in the health sector must enable health professionals to work as long and as fulfilled as possible. In addition, requirements constantly evolve through megatrends such as digital transformation, thus continuously changing the required competences of professionals, e.g. due to new technological possibilities and increasing multidisciplinary. So-called future skills are gaining importance. Consequently, already the training of professionals and trainees must pay attention to these future skills. In this context, student teachers play a central role, as they must already address these future competences in the training of future professionals for sustainably and permanently securing health care in an ageing society. To aggravate things, the competences required in the future may not even be known yet. In particular, this holds true for those of health professionals and their teachers.

The central research questions are derived from these considerations: What are relevant future skills in health professions? How can student teachers be supported in addressing future skills in their classes?

This paper contributes to answering these research questions through a teaching concept that addresses both aspects jointly: student teachers are encouraged to increase their awareness of future skills, while the future skills they identify shed a light on relevant competences for health professions. The resulting documents will be analysed applying Grounded Theory (Glaser & Strauss, 2009) to develop health competence profiles. As it turns out, competence profiles have a high overlap across various professions in the health sector, yet emphasis on specific competences differs largely between professions and several competences are specific to particular professions.

The paper clarifies terminology and underlying concepts, before section 3 gives an overview of the learning approach which serves two functions: collection of data on health future skills, and making future skills explicit for future health teachers. Section 4 presents and discusses some of the results of applying the concept. Section 5 provides a scientific underpinning of the teaching concept. Section 6 summarizes the paper and gives an outlook to future work.

2. Clarification of terms: Competences and Future Skills

At present, there are hardly any systematic and methodologically sound studies on what future competences do exactly mean, especially since they may differ significantly depending on the field and region, e.g. between software professionals require and nurses or social workers (Sedelmaier & Landes, 2015).

The concept of competence as such has been used in social and educational sciences for more than 50 years, but is still very fuzzy and partly contradictory (Klieme & Hartig, 2007), thus

it is theory-relative (Erpenbeck & Rosenstiel, 2003). The starting point for discussions on the concept of competence in educational science is the triad of social, self, and subject competence introduced by Roth (1971). This triad is also reflected in Weinert's general, cross-cutting concept of key competences (2001). Similarly, Erpenbeck (2003) distinguishes four competence classes that can be broken down into a variety of sub-competences.

Various models agree that competences are a dispositional concept. They are tied to a person, are based on personal characteristics (Erpenbeck & Rosenstiel, 2003), and aim at self-organized action. Competences "are founded by knowledge, constituted by values and attitudes, dispositional as abilities, consolidated by experience, and realized on the basis of will or motives" (Maag Merki, 2009, p. 494). For Rhein and Kruse (2011, p. 80), the core theoretical idea is that "it is the specific inter-play of knowledge, skills, abilities, personal characteristics, experiences, and motivational structures {...} that constitute a competence, without it being possible to reduce it to its individual components, although the description of competences must always draw on these building blocks".

Competence is manifested in performance (Arnold, 2002, p. 31), which is interpreted situationally or subject-specifically in almost all concepts of competence (Klieme & Hartig, 2007). This suggests that action competence is not only person-specific, but also situation-specific and thus occupation-specific. Consequently, each occupational profile requires its own competence profile, including general generic, occupational generic, and subject-specific competences (cf. e.g. (Maag Merki, 2004)). Thus, competence profiles are not easily transferable to other job profiles due to their subject-specificity.

The term "future competences" is difficult since competences as such are oriented towards future challenges, without need for the word "future" to express this (Ehlers, 2020). Yet, all definitions agree that competences are occupation-specific and continue to gain importance. Future competences are often still unknown in detail, which is also true in healthcare.

3. Learning and Teaching Approach

Our learning concept for student teachers integrates identifying and understanding future competences of health professionals in a self-reflexion task which aids both research questions: qualitative data on required future competences of health professionals and teachers are collected, while student teachers reflect on future skills and their integration in their own classes later on. This is accomplished as outlined subsequently.

3.1. *Intended learning outcomes*

The learning approach focusses on three intended learning outcomes: First, student teachers are aware of the importance of future skills. Second, student teachers are capable of recognizing future skills and, third, of developing ideas how to address future skills in their classes.

Furthermore, we collect data for deriving a competence profile for health professionals through qualitative research methods in three steps:

- a. As a prerequisite, an understanding needs to be gained of how career reality in health is changing and which competences will be required in future.
- b. How can we gain awareness at future teachers about the competences and the changing of the competences? How can we support student teachers to address these potentially changing future competences in their classes?
- c. In parallel, collected data are analysed by the instructor in order to derive a competence profile for health professionals and their teachers.

3.2. Learning Approach

To that end, two exercises are used.

Exercise A: Characterize everyday professional situations

In order to introduce student teachers to the task, they are requested to describe everyday professional situations and a typical working day including current and future tasks. These descriptions should be profession-specific (e.g. for nursing, emergency medical services, or surgical technology). Results are shared within the course for mutual inspiration.

Exercise B: Describe required (future) competences

Based on these typical professional situations and tasks, students shall then derive competences that they currently need and will also need in the future for mastering the described professional situations well. Attention should be paid to both professional and multidisciplinary competences. It is important to develop “thick” descriptions and not just catchwords in order to gain a detailed understanding of the competences. Furthermore, students should focus on whether and how the required competences might change in the future. Students work individually on these competence descriptions and hand their results in to the instructor.

3.3. Competence Descriptions for Systematic Self-Reflection

The instructor merges the resulting competence descriptions occupation-specifically using a qualitative research approach that follows grounded theory (Glaser & Strauss, 2009). The aim is to identify central competences, elaborate occupational specifics, and present them in comprehensible, in-depth competence profiles. These competence profiles are the basis for evaluating them in a competence assessment approach (CAT), which is intended to support students' self-reflection in a goal-oriented way (Sedelmaier & Landes, 2014).

In CAT, the superordinate subject-specific and interdisciplinary competences are arranged on three competence levels. Concrete partial competences are derived from each of these, which form the basis for a systematic and repeatable self-assessment. Furthermore, CAT can

also be used to draw conclusions about the success of a particular teaching-learning concept with regard to the achievement of the competence goals.

4. Results

This teaching approach has been implemented as a case study in an introductory course in pedagogy of a part-time bachelor program of vocational education in healthcare at SRH Wilhelm Loehe university. It trains future vocational teachers in healthcare. The case study resulted in 21 student documents specifying future skills in healthcare. 4 out of these 21 documents dealt with nursing-specific future skills, 4 with those for surgical assistants, 5 documents focused on the emergency medical services, and 8 took the perspective of healthcare teachers. Documents were analyzed following Grounded Theory (Glaser & Strauss, 2009) and coded with a total of 593 codes which were grouped into clusters (see fig. 1 and 2).

4.1. Competence Profiles in Health Professions

In addition to technical and functional competencies (Rauner, 2011), empathy as well as a structured approach and the ability to quickly grasp and link complex situations are of particular importance in the healthcare sector. Another core competence is the ability to deal with diverse stakeholders, such as multidisciplinary cooperation with other medical staff or patients, relatives, or police and fire departments, etc. (see fig. 1, in german). Of particular importance, especially for surgical assistants, is direct self-reflection and recognizing one's own limits, while for emergency paramedics communicative aspects and for nurses empathy are particular focal points.



Figure 1. Word Cloud of Future Skills for Health Professionals (in german).

4.2. Future Competences for Teachers in Health Education

Fig. 2 shows future competences which teachers in health education need. Though most of these competences are also contained in fig. 1, different emphasis can be observed: Teachers focus on methodological competences and the use of digital media in the learning process. They see a special need for supporting pupils' learning. Furthermore, they exhibit a higher openness for learning. On the other hand, empathy has different detailed aspects, and communication skills are less important for them.



Figure 2. Word Cloud of Future Competences of Teachers in Health Education.

5. Scientific Basis

In the learning context, competence profiles reflect the teaching-learning goals to be achieved. In pedagogy, it is generally accepted that transparent teaching goals and the negotiation of or agreement on the teaching-learning goals significantly aids learning success (Arnold & Erpenbeck, 2014). Numerous didactic concepts emphasise the importance of competence profiles for planning and implementing learning processes (Arnold, 2015; Rhein & Kruse, 2011). The necessity of formulating goals is also undisputed in pedagogy (Mager, 1992). For this purpose, we made our student teachers reflect on future competences of their health profession and of their role as a teacher for these professions. This approach clarified the intended learning outcomes for both teachers themselves and their subsequent pupils.

6. Conclusion and future work

Education in healthcare must enable professionals to work in the health sector for as long and as fulfilled as possible. Yet, new requirements are constantly arising, which are continuously changing the required competences of healthcare professionals. Consequently, education in healthcare needs to be aware of required competences and their rapid change, while addressing them in education presupposes an in-depth understanding of what they really are.

To that end, a teaching concept was developed that largely builds on self-reflection of to-be teachers in healthcare. In particular by characterizing typical professional situations and deducing required (actual or future) competences for mastering these situations. A first implementation of the approach as a case study resulted in material from 21 students which was analysed using Grounded Theory, resulting in 593 detailed codes. Clustering the data from the 21 documents reveals competence profiles that have a large overlap in terms of common competences, yet with different emphasis across professions. At the same time, rising awareness with respect to future skills could be observed among student teachers.

By going through this learning concept, future health teachers get first ideas how to address future skills in their classes later on. They could learn from models and get methodological inspirations for their own classes. The learning approach reminded them of the importance of learning goals, their explicit discussion with learners and the function and effectivity of self-reflexion. These aspects are helpful for student teachers.

Next steps will include the collection of more data to consolidate the initial findings from the case study. Results will be compared to further competences profiles, e.g. from technical disciplines like Software Engineering. Some main differences in the competences profiles will be highlighted in order to (further) develop domain-specific learning approaches and subject matter didactics.

Then, the teaching concepts will be elaborated further in order to enable future teachers to recognise future competences and address them in their classroom. Here competence assessment is an important aspect. A common assessment approach is self-reflection, which is seen as a central aspect for learning (Henschel, 2019; Kauffeld, Reinecke, & Hennecke, 2009). Self-reflection is often implemented via learning diaries, but systematic, generalizable evaluation is rare. This is where CAT (Sedelmaier & Landes, 2014) provides a connecting bracket with its underlying competence profile. In addition, the detailed competence descriptions are used as a basis for competence self-assessment with CAT. For this purpose, the code categories are first used as concretizations in the competence model. From this, statements can be derived from the individual statements of the interviewees in the research documents, which enable a self-assessment of the students with regard to competence development. These statements are collected in a questionnaire which can be mirrored to intended learning outcomes of the course. The questionnaire is handed over to students to support self-reflexion with regard to specific health future skills.

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“Map ourselves through Digital Storytelling”: pedagogical tool to develop self-knowledge skills in advanced practice psychiatric-mental health nursing

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Abstract

By creating digital stories people are encouraged to reminisce about events with an impact on their life and personal and professional development. This paper aims to determine nurses' perspectives regarding a pedagogical tool – Digital StoryTelling (DST). Our qualitative study design used video focus groups involving 20 master's students in mental health nursing during the academic year 2020/2021. Students highlighted the creative content of digital stories and their potential to develop self-awareness, socio-emotional regulation and interpersonal relationships. The scarce digital literacy and the difficulty in putting emotion in the content of the stories stood out as the main barriers. Thus, a more individualized follow-up will be necessary to help students. Further research may benefit from exploring how the DST tool can assist a more diverse group of users.

Keywords: *Digital stories; self-care; nurses; self-awareness; learning strategy.*

1. Introduction

Telling stories is a way to disseminate information, and is a form of learning that calls for sharing and reflection on what has been lived. Digital StoryTelling (DST) has been used as a pedagogical strategy in different populations (children, elderly, students, and ill people), educational contexts (primary, secondary, and higher education), and therapeutic settings (Home Care for the elderly, Palliative Care, Mental Rehabilitation Units) (Mojtahedzadeh, et al., 2021). A recent systematic review by Moreau et al. (2018) reaffirms the power of the co-creation of digital stories in the training of health professionals, with a positive impact on creative and reflective learning.

DST can broadly perpetuate the knowledge and sharing of the individual's lived experience, either in archives for later viewing or through dissemination on digital platforms. The use of DST combines first-person narrative with the use of multimedia (images, sounds, animation) to produce a short video (3 to 5 minutes). In an era of people-centered care and increasing pressure on care providers, particularly nurses, digital stories can have a positive effect in the education and self-care behaviors of health professionals (Jáuregui-Lobera et al., 2020; Laranjeira et al., 2021). According to Lambert and Hessler (2018), the development of DST can be achieved through 7 stages, namely:

1. Start with an idea - Story cycle - writing the narrative. The cycle has a symbolic meaning representing trust, integrity, and eternity. Participation in a group of students and teachers helps to choose the theme and determine the story: What story do I want to tell? What do I want the story to tell? What do I want to convey with the story? – The student’s experiential content is shared in a group, replicating the traditional environment of “storytelling” and can start from a theme of their own or one suggested by the teaching team based on real cases, or common themes of the team (team-based learning);
2. Dramatic question - Select the emotions to share in the story - this step helps to identify emotions in the narrative and to raise awareness of the emotions that you want to share and include in the story;
3. “Finding the moment” and shaping the narrative – After identifying the theme and the story, it is necessary to choose the scene and respective dramatic tension created with the story. The moments of dramatic change and tension are the most impactful on the audience;
4. Visualizing the story – involves choosing the images that best convey the explicit and implicit message of the story. It involves the student putting himself in the other's shoes and perceiving how the scenes can have a more significant impact on the target audience;
5. Listening to the story – allows one to see the advantage of using the voice and the emotion it conveys. The student chooses to use their voice or that of others to convey authenticity to the narrated story;

6. Composition of the story using software – ensuring the combination of the various elements of the story (voice, background sound, music, images) to maintain the sense of the narrative;

7. Sharing the story – carried out with the group, the school community, and the target audience for whom it is intended, on the internet. Sharing will be all the richer when it is carried out and contextualized with the target audience.

During the story cycle, students are encouraged to reminisce about rescue stories with an impact on their life and personal and professional development. The self-reflection and the impact of their behavior on others will determine the assessment of how these situations can contribute to the construction of desirable professional behavior. Reflecting upon the action during the DST's different stages can potentiate the development of metacognition skills.

1.1. Development of DST-Map approach

Regarding the innovation and creativity of training processes centered on students and with a high potential for applicability in curricular flexibility, DST can be used as a pedagogical strategy in the training of future health professionals and the advanced training of health professionals, based on a low-complexity digital tool with high sustainability.

Its application can be enhanced with the re-creation of pedagogical environments, by adapting spaces for the simulation of informal scenarios, and using video recording and high-fidelity reproduction. In this sense, the communication laboratory was adapted with material resources that allow the approximation of the current space to informal settings, with the possibility of carrying out audiovisual recordings and autoscropy. Evidence shows that the realism of high-fidelity scenarios promotes the development of clinical reasoning, clinical competence, confidence, the integration of theory into clinical practice and the identification of learning needs (Hanshaw & Dickerson, 2020). The use of video recording allows the review of interactions during the story cycle, particularly the fleeting and non-repeatable events that, in sharing, would very likely escape direct observation. Video recording enhances learning by facilitating the emotional distance necessary for the reflective analysis of the recorded material, which is very common in highly complex contexts.

This pedagogical tool has the following learning outcomes/educational objectives:

- Develop critical-reflexive self-analysis skills and potential for change;
- Develop narrative and reflective writing skills through the construction of the story script;
- Develop instrumental skills within the scope of digital literacy;
- Contribute to the consolidation of students' soft skills, particularly teamwork, emotional competence and creativity.

1.2. Aim

This paper aims to determine nurses’ perspectives regarding a pedagogical tool – DST-Map – which gives voice to those involved in the teaching-learning process in order to contribute to self-knowledge and foster self-care behaviors.

2. Method

2.1. Study design

A descriptive qualitative study using online Focus Group Discussion (FGD) was performed to gather information on students’ perceptions of DST. The Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist was used to report the study.

2.2. Participants

In the academic year (2020/2021), a purposive sampling strategy was used to enroll 20 master’s students in mental health nursing from the School of Health Sciences of Polytechnic of Leiria (Portugal). Two FGDs were run (13 in the first group and 7 in the second group) using Krueger and Casey’s (2015) methodological framework. Participants were selected in accordance with the following inclusion criteria: (1) be a registered nurse enrolled in the curricular unit "Personal Development and Therapeutic Communication", part of the Mental Health Nursing master’s program; (2) can communicate in Portuguese; and (3) consent to participate in an FGD. We excluded participants who had no access to any electronic device to join the online interview.

2.3. Procedures

The online FGD sessions took place over two months (from February 2021 to March 2021) using the videoconferencing application Zoom. The duration of FGDs lasted between 70 and 90 minutes. All FGDs were moderated by a clinical nurse and a nurse educator with a Ph.D. degree and experience in conducting qualitative studies. Informed consent was obtained at the start of each FGD. The focus group interview guide was based on the Gibbs reflexive cycle (an integral part of reflexive analyses) (Li et al., 2020) and included three main questions: a) What was your impression of the digital stories?; b) How has DST influenced how you see yourself?; c) What did you feel/learn when you executed your DST? Probing and supplementary questions were also asked.

The FG sessions were recorded with the participant’s permission and then transcribed for a more efficient analysis of the discussion content and answers. Data analysis was performed using the conventional content analysis method according to the procedure proposed by Elo and Kyngas (2008). This method proposes three stages: open coding, creating categories, and abstracting for data analysis. All the FG interviews were transcribed and imported into

WebQDA qualitative software program for data management. The findings were reviewed by co-authors (researcher triangulation) to legitimately capture the essence of the findings.

3. Findings

The mean age of participants was 37 years (SD=9.2). Most of the focus group participants were female. All participants had more than two years of nursing experience. The analysis of the FGDs resulted in two main categories “Potentialities of DST” and “Barriers associated with DST”.

Theme 1 - Potentialities of DST

The possibility of developing active strategies such as DST allowed for exploring the creativity of the participants: “This strategy was very different (*out of the box*), I had never imagined that the creative potential was so great” (FGD2). Additionally, there were numerous reports highlighting the contributions of DST in the development of self-awareness, self-reflection, and self-knowledge, essential components for the development of specialized skills in Mental Health and Psychiatric Nursing. FGD1: “Understanding our emotions, we can be more attentive to the emotions of others”; “I became more aware of my potential and limitations”. FGD2: “The moments of self-analysis contributed to my personal development”; “Looking back, I realize some of my reactions at the time I lived that story”.

At the same time, participants verbalized DST’s contribution to strengthening interpersonal relationships with peers, and also to socio-emotional regulation. FGD1: “We can express ourselves and express our feelings”; “Developing DST allowed us to explore the emotional dimension of the facts, and that helps us achieve greater well-being. Sometimes, tackling sensitive topics awakens experiences that I thought I had resolved.”. FGD2: “The cycle of stories was useful to get to know my colleagues better and thus understand their attitudes and behavior.”

The possibility of preserving history in time was mentioned by participants as a way of ensuring its legacy for others: “That story was not only an academic work but also a kind of legacy that I left for my children and for my family” (FGD1); “through my story, I was able to honor a person who was very important in my life” (FGD2).

The potential of DST also makes it possible to develop skills that allow nurses to deal with the therapeutic impasses that often arise in contact with people with mental illness: “I became more sensitive to transferential impasses in my relationship with patients”, “I understand better the difficulty of sharing what we feel and how much it sometimes affects therapeutic relationships” (FGD1).

Theme 2 - Barriers associated with DST

During the FGD, several participants were unaware of the DST strategy, which caused them anxiety in the initial phase of choosing the story: “The first impact was really the need to expose something from the private sphere to the group of people who were strangers” (FGD1); “as it was a pedagogical strategy that I didn’t know about, it caused me fear and anxiety” (FGD2). On the other hand, the participants highlighted the lack of digital skills in the operationalization of the stories, which led to high consumption of time and resources for their realization. FGD1: “The biggest challenge stemmed from my difficulty in using digital tools” and “I’m not info-excluded, but having to use digital resources to build the story was time-consuming, I even had to buy a program to help me with the DST”. FGD2: “I felt many limitations in the construction of the final product, due to the lack of technical and digital competence”, and “I realized that not everything that exists on the internet can be used”.

Several participants also mentioned the difficulty in selecting stories to share with their peers, either because of the fear of exposure to others: “I felt uncomfortable and even uncomfortable, knowing that I was going to share a story of my life” (FGD1); either because of the difficulty of putting emotional content and affective tone in the stories “transmitting emotion in the construction of my DST was the biggest challenge” (FGD1), “we are not used to exploring emotions in an open way, and when we do that it creates fears”, “I had difficulty identifying a significant experience that could be shared” (FGD2). This is because events that arouse emotions tend to be remembered more easily than neutral events devoid of emotions.

4. Discussion

Given the rising complexity of the health care system in which nurses are needed to work, educating future nurses capable of providing better quality care has become critical. Assessment by competencies aims to verify the student’s ability to manage concrete situations. The focus is not merely on the specific task, but also on the strategies for solving problems, mobilizing and articulating the resources that the student needs. These resources are related to the domains of knowledge (knowledge of facts and concepts), knowing how to do (mastery of skills and abilities), and knowing how to be (attitudinal posture and mastery of situational relationships) (Panchenko, 2021).

Similarly to previous research, the DST tool was highly valued by the participants (Henrickson et al., 2022). However, participants considered that more time was needed to deepen and improve this methodology in the resource production phase, in order to fill small gaps that were detected. Possibly, a more individualized follow-up would be necessary, helping the students, case by case.

Based on our findings, education, and learning using DST can become extraordinarily transformative and emancipating, through empathy, openness to experience, and a positive orientation toward life (Laranjeira et al., 2021). Teaching the languages of images and

promoting critical readers of these images is an increasingly current challenge, as we move towards a digital world, with audiovisual technology capable of creating virtual visual scenarios, where the line that separates the mental image from the real one is very tenuous. Learning is constructing meaning; meaning is what makes experience comprehensible and coherent. Learning is a process through which meaning is attributed, starting from the experiences and knowledge already acquired; it is a re-interpretation of an experience. Making meaning is a fundamental element of adult learning (Panchenko, 2021).

DST contributes to understanding the learning process. Its purpose is to help professionals become critically reflective and to participate more fully in discourse and action. Given the effectiveness of digital storytelling, the educational application of this method is recommended to improve social and emotional competencies among mental health nurses. While the DST tool is a technique to enhance the learning processes in higher education, it is also a strategy for enabling digital literacy. Finding audio or images with great symbolism, especially in free services covered by Creative Commons licenses, requires time, patience, and knowledge to refine searches (Hwang et al., 2023). This is a process that requires dedication and persistence, in an attempt to find the ideal resource, which has the ability to convey feelings, emotions, and the desired message. Finally, the almost generalized idea that everything that exists on the Internet can be used is a frequent mistake. While it possible to download content in the most diverse ways, the diversity of licenses means that not all content is free to use.

5. Final remarks

DST is a robust and exciting methodology that allows for capturing, sharing, and preserving stories. This path implies a break with some paradigms of traditional pedagogy, often too closed in on itself. It is necessary to create openness and flexibility for informal learning, which the vast majority of students today acquire through different technologies. The recognition that these new technological and didactic skills are an essential ally to exploring new ways of promoting the teaching/learning process and dynamizing new virtual learning environments will have to be done naturally and not as an obligation enforced by technological evolution. This study was performed only in a single higher education institution and needs to be implemented on a broader scale. Further research may benefit from exploring how the needs of more diverse groups of users could be met through the DST tool.

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Competency-based education advances in Higher Education in Health

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Abstract

INTRODUCTION. The incorporation of digital technology to rehabilitation settings requires competency-based education advances in Higher Education in Health or in life-long training. AIM. This work aimed at developing knowledge in digital rehabilitation, exploring competences in Digital Rehabilitation in higher education teachers, students, and professionals, and creating pedagogical tools for them. A consortium of higher education teachers from 5 European countries (DIRENE consortium) designed and piloted a project in higher education studies from health and social care. METHODS. This was a multicentre study that was performed through mixed methodology. RESULTS. Digital competences in students, teachers, and professionals were found. Digital content was created: a handbook and a module on digital rehabilitation study. CONCLUSION. Assessing Competency-based education advances in Higher Education in Health is an essential need for the design and development of educational methods and for enhancing the use of digital technologies in the rehabilitation practice.

Keywords: *Digital rehabilitation; competences; higher education; teachers; students; internationalization.*

1. Introduction

Global need for rehabilitation is increasing due to population aging and increases in chronic health conditions, among other causes (WHO, 2022). The World Health Organization estimates that by 2050 over 2 billion people globally will need one or more assistive device at some point in their lives (WHO, 2021). Therefore, the need for cost-effective services and solutions for rehabilitation is evident. Digital transformation provides many opportunities, however many rehabilitation service providers and healthcare professionals in Europe and elsewhere, struggle using the new digital opportunities (Brunner et al, 2018). The rehabilitation sector was strongly hit by the COVID-19 pandemic (Heiskanen et al, 2021). Part of the challenges faced by the rehabilitation sector include the lack of technical knowledge, capacities, and didactical competencies in the application of digital rehabilitation (Longhini et al, 2022; Mikkonen et al, 2018). One of the main identified challenges in the adaption of new digital opportunities, was the access to relevant and evidence-based knowledge of which solutions to use to include digital rehabilitation into the scope of services provided (Davies et al, 2022; Redecker et al, 2017). Another identified challenge was the general competence and capability of rehabilitation workforce to design use cases, with the users, for the existing digital solutions and for the different emerging technologies (Jarva et al, 2022; Seeman et al, 2023).

Transnational cooperation in higher education offers an opportunity to create innovative teaching and learning experiences, developing competences on scale to ensure access to diverse digital knowledge in rehabilitation (Nezaha et al, 2020). That is the reason why we created and finished the project, “Competences for the new era of user-driven digital rehabilitation” (DIRENE): it addressed the emerging challenges brought by Covid-19 and the need for the development of digital rehabilitation (DR) through higher education, according to competence and practice to build the resilience of future rehabilitation systems.

2. Aims of the work

The overall objective of this project was to contribute towards the resilience of rehabilitation systems through the development of DR competences of teachers, students and working life professionals. The specific objectives of the project included: 1) developing knowledge in DR for teachers, students, and professionals for competence development in DR and, 2) increasing learning opportunities in DR through theory and evidence-based practice.

These objectives were achieved through active global cooperation and international networking between universities from Finland, Spain, Austria, Germany, and Greece.

Different stakeholders were widely invited to contribute to the development work, including partners outside Europe, who offered new expertise and reverse learning opportunities.

3. Methods

This was a multicenter European study that was applied across different DR disciplines. To proportionate a multilevel perspective, a previous scoping review was done, and two different studies were performed.

Firstly, a quantitative study was done to create a pilot questionnaire on competences for DR. After the feedback, the questionnaire was refined and improved in writing and comprehension. Definitive questionnaire was utterly completed by rehabilitation educators, students, and professionals of the 5 countries.

Secondly, a qualitative, explorative, transversal research design was conducted. This methodology was specifically used to have a basic descriptive qualitative approach about learning needs related to DR, and barriers and facilitators to DR education. To do so, different focus groups were conducted from different roles (healthcare professionals, health sciences teachers and students)

4. Results

These objectives were achieved through developed Discussion papers, Framework, open pedagogical Handbook and a study Module with open on-line learning materials for the use of identified target groups in Europe and beyond.

The applied and empirical findings of interest to higher education professionals, students, and professionals for competence development in digital rehabilitation were:

- a. From the scoping review:
 - Information collected on digital technologies for rehabilitation: data are in press
- b. From the analysis through mixed methodology:
 - Digital competence and training needs analysed through mixed methodology: quantitative and qualitative research (see table 1 and 2)
 - Sources of information developed: Open pedagogical Handbook for teachers, trainers and the working life addressing the creation of on-line/virtual learning material on DR based on mobile technologies, considering the variety of learners needs in global contexts, considering clients, students and the current and future working life professionals (“Handbook Mobile Education & Training of Digital Rehabilitation Competencies”)
 - An e-learning module on DR study module (10 ECTS cr) and open mobile learning course (2 ECTS cr) on DR developed and implemented that is accessible across the target groups and countries (“Introducción a la RHB Digital Rehabilitation”)

Table 1. Digital Rehabilitation competence levels (mean and standard deviation) in educators, students and rehabilitation professionals. *p<0.05.

Competence domain	Educators	Students	Rehabilitation professionals
<i>Information and data literacy</i>	3.71 (0.76)	3.43 (0.75)*	3,59 (0.82)
<i>Communication and collaboration</i>	3.46 (0.81)	3.33 (0.76)	3,35 (0.82)
<i>Digital content creation</i>	3.13 (0.80)	2.94 (0.82)	2.96 (0.97)
<i>Safety</i>	3.09 (1.14)	3.16 (0.92)	3.12 (1.03)
<i>Problem solving</i>	2.90 (0.91)	2.96 (0.81)	2.92 (0.95)
<i>Specific competences for rehabilitation</i>	3.22 (1.11)	3.01 (0.98)	3.24 (0.99)

Table 2. Learning needs on DR identified by the participants in the focus groups.

Learning needs	Knowledge/skills required	
Digital competencies	eHealth literacy	Searching and selecting reliable sources of information about health issues.
	Communication skills	Specific communication skills when using technology-driven communication in rehabilitation.
	Technical skills	Ability to use digital technologies in rehabilitation.
Ethics and regulation	Confidentiality	
	Responsibilities	
	Legal framework for application of digital technologies in rehabilitation	Knowledge about the policies for the use of DR (data protection, coverage/ reimbursement of costs for the healthcare professional and for the user)
Specific DR knowledge/skills	Areas/fields of application of DR	Knowing the field of applications of DR and recognizing the value for the user. This includes being able to identify the benefits and barriers of DR based on the needs of the user.

Findings and conclusions will be published in a format of discussion papers and distributed widely through the networks of program partners and target groups. The findings are also summarized into the following tables.

Results will be widely disseminated through websites, social media, multiplier events and through new open learning opportunities. Directly, the project engages around 300 rehabilitation experts in Europe. Indirectly, through dissemination and data collection activities, it is expected that over thousand people will be contributing to final outcomes.

4. Conclusions

We have produced various intangible and tangible results leading to the achievement of the objectives. The transfer and impact of the project results influence higher education in rehabilitation fields. As the demand and need for rehabilitation continues to increase during a time of uncertainty, client-centered and cost-effective solutions are needed without compromising clients rights and rehabilitation processes, while ensuring the access to skills development for students, professionals and educators.

The participant higher education teachers and experts (in rehabilitation) will improve and update their professional and pedagogical competencies. They will acquire new knowledge and skills related to the digitalization of rehabilitation and especially in mobile solutions in rehabilitation. Students (bachelor and master students as target groups and end users) will develop their digital and professionals' competencies, learn about the various opportunities in rehabilitation and on the applicability of competences according to various client groups and needs. Health professionals (as target groups and end users) will gain new knowledge on the possibilities of digitalization in their everyday work. They will improve their digital and professional competences and the ability to apply and implement new technologies to the rehabilitation processes based on person-centred needs, specially with the digital content created in this project (the handbook and the e-learning course on digital rehabilitation).

Partners in the project (EU and Africa) will enhance the quality and excellence of the education. They also will be able to provide highly competitive education and to develop rehabilitation curricula through digitalization utilizing the international network.

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Myth-busters at work: development of engineering identity and employability through student research

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Abstract

For many (aspiring) engineering students, the prevalent image of engineering identity is still unilaterally dominated by technical skills. This bias serves not only to dissuade female prospective students but also to erode student motivation for non-technical courses such as communication and other employability skills. As an unfortunate result, also for the employer, many starting engineers experience a gap between their own and the workplace's expectations. This paper reports on a didactic approach that has the students actively research the workplace realities, and more particularly the importance of communication skills as perceived by professional engineers. On the basis of their own, partly self-directed research efforts, students uniformly conclude that communication skills are in fact of great importance for engineers. The indisputable scientific evidence, both quantitative and qualitative, that they gather themselves turns out to be a powerful incentive for students to recalibrate their understanding of engineering identity.

Keywords: *Engineering education; professional identity; employability; engineering curriculum; communication.*

1. Introduction

The field of engineering is notoriously diverse, allowing for myriad career options across multiple domains and in several positions. Yet, at the core of what the engineering identity is still all too often perceived to be is a surprisingly unilateral insistence on technical skills, culminating in a stereotypical representation known as the engineering “nerd myth” (Beder, 1998; Brunhaver et al., 2018). This essentially masculine myth, disregarding the many social dimensions integral to engineering, serves to discourage women from identifying with a career in engineering (Faulkner, 2007). Another harmful consequence of this myth is that engineering students tend to experience a lack of motivation for course topics that are non-technical, such as communication and teamwork skills, the importance of which for employability has nevertheless been underscored emphatically in, for instance, the Future of Jobs Report by the World Economic Forum (2020). The gap between expectations and the first real-life experiences in the engineering workplace, as described by researchers across several economies (Dias, 2011; Kövesi & Kalman, 2020), has led many young engineers to switch jobs within the first six months of employment (KU Leuven, Antwerpen, et al., 2016), leaving both the engineer and the employer, who has invested in recruitment and training, with a sense of frustration and disappointment (Trevelyan, 2019).

The development of an engineering identity that is based on a sound and more nuanced understanding of the realities of the workplace, is positive for both motivation (Frymier & Shulman, 1995; Hock et al., 2006) as well as for employability and job satisfaction (De Coen et al., 2018; Yorke, 2006). Increasingly, universities recognize the importance of bringing engineering students into contact with the workplace; however, these interventions often have an incidental character, functioning as curricular add-ons (e.g. a company visit or a one-day shadowing internship) that fail to integrate meaningfully with the core curriculum. Moreover, these interventions tend to position students in the passive role of observers. This paper reports on an alternative approach, in which the students become active, in-depth researchers of the workplace realities - with a focus on the importance of communication skills, in this particular case - and report on their findings in a written paper as part of a designated course in the curriculum. The proposition is that this approach helps students build a well-informed understanding of workplace expectations and a more accurate sense of their future professional selves, while simultaneously developing important engineering competencies such as research and writing skills.

2. Methods

This section describes the setup of the second bachelor course “Statistics+”, which is part of the curriculum of industrial engineering education of the joint program of KU Leuven and U Hasselt at Campus Diepenbeek. As part of this course, students are asked to investigate

whether communication skills are important for professional engineers, and if so, which skills are primarily important. Students are encouraged to explore several qualitative approaches (e.g., interviews with engineers, focus groups, and literature reviews) facultatively in conjunction with a mandatory quantitative approach in the form of a survey, which is uniform for all students. The pivot of this survey is a questionnaire developed by the teaching staff using Google Forms, which students are invited to send via e-mail to professional engineers in their wider circle of acquaintances. Since 2012, when this approach was initiated, 2430 engineers have completed the questionnaire. Data are collected in Excel and consequently analyzed, also using various statistical tools, by students. On the basis of the findings of their qualitative and quantitative research endeavors, students write an academically formatted paper answering the main research question – are communication skills important for engineers? – and a self-composed additional research question focusing on specific communication skills and/or correlations with the sector of employment, position, age, gender, or size of the company. This additional research question allows students to invest their personal interests and career plans in their research projects. Students interested in construction engineering, for instance, could investigate which foreign languages are most important in that sector. Throughout the process, students are supported in classes focusing on, on the one hand, statistics, and on the other hand, research and writing skills.

This paper also reports on a small-scale survey, based on a questionnaire sent to 72 students who took the course Statistics+ in the autumn of 2022. The questionnaire evaluated whether the approach was successful in achieving its didactic goals. The questionnaire was completed by 36 students.

3. Results and discussion

The (unsurprising) answer to the main research question that students arrive at is that professional engineers indeed perceive communication skills to be very important. With very few exceptions, students report that their qualitative research efforts, typically interviews, mainly serve to reemphasize the fundamental points that the questionnaire results make quite definitively: that engineers, on average, spend a significant portion of their workday communicating (Fig. 1) and that they perceive their communication skills to have a very significant impact on their career path (Fig. 2).

Of course, it is not these conclusions in themselves that are the crux of the matter, but rather the fact that the students themselves reach them on the basis of largely self-directed research. In fact, many students end up arguing for the inclusion of more communication classes in the curriculum based on this evidence. Alternatively, they may offer valid and useful suggestions for new communication topics to be included in the curriculum or for fine-tuning specific

curricular pathways in function of domain-specific sectors. The two examples below are included to demonstrate the potential of the student papers for curricular optimization.

- a. In a 2021 student paper, students studied the recent evolution of the perceived importance of virtual meetings (VMs) compared to face-to-face (F2F) communication (Fig. 3)¹. They concluded that the COVID-19 pandemic served to accelerate an already incipient trend towards an increasing use of virtual meetings, while this rise did not detract from the importance of face-to-face communications.² These students remarked, and quite astutely so, that in our current curriculum, classes on oral communication (e.g. meeting, negotiation, and presentation skills) are restricted to face-to-face settings while such activities are likely to play out quite differently in virtual settings (e.g. diminishing impact of body language). They recommended that the communication classes should include a focus on virtual environments in the future. Teaching staff is currently developing course materials to follow up on that suggestion.
- b. In another paper, students investigated the relationship between the perceived necessity of mastering certain foreign languages and some common sectors of employment for engineers (construction, electromechanical sector, chemistry, and electronics-ICT). As Fig. 4 demonstrates, English is by far the most important foreign language in all sectors³. French is generally speaking the second most important language, with a marked outlier in construction engineering. In the electromechanical engineering sector, however, German is the second most needed foreign language. On the basis of these findings, the students recommended that English should be a compulsory class for all specialisations in the engineering program at our Faculty; that French should be compulsory for students in construction engineering; that German should be compulsory for students in electromechanical engineering; and that French, German and a proficiency training course in English should be elective courses for all students in the master's degree. These findings were discussed with the curriculum designers of the Faculty, who proceeded to change the curriculum accordingly.

¹ The question relating to virtual meetings was added to the questionnaire in 2015.

² In the updated graph shown here, including the 2022 results, the perceived importance of virtual meetings seems to be decreasing again, very tentatively suggesting that the COVID-19 conditions may have been a stronger driver for the rise than other factors (ecology, mobility, cost benefits...). Of course, this remains to be confirmed by data and research in the coming years.

³ Fig. 4 shows the graph updated on the basis of the most recent survey results.

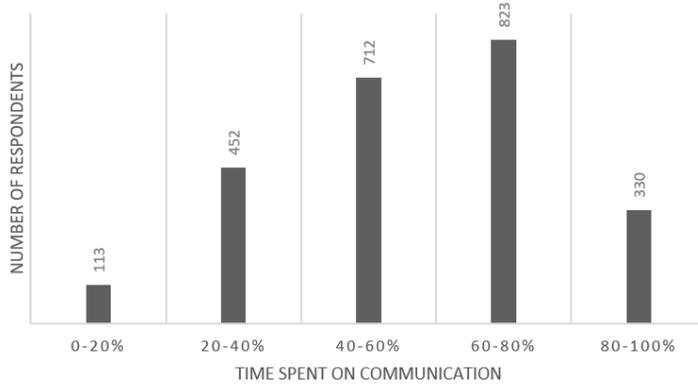


Figure 1. Time spent on communication in an average work day (questionnaire results).

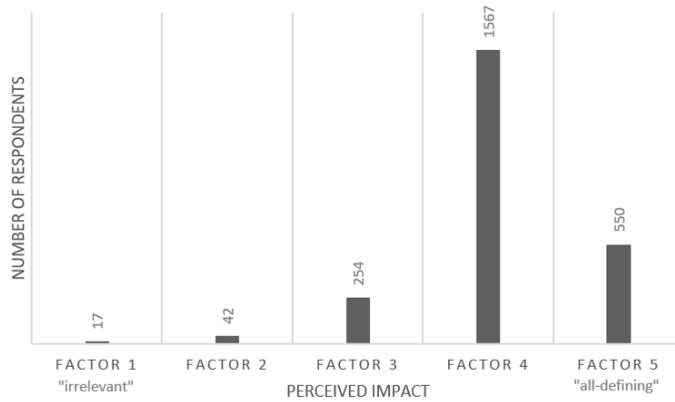


Figure 2. Perceived impact of communication skills on career path (questionnaire results).

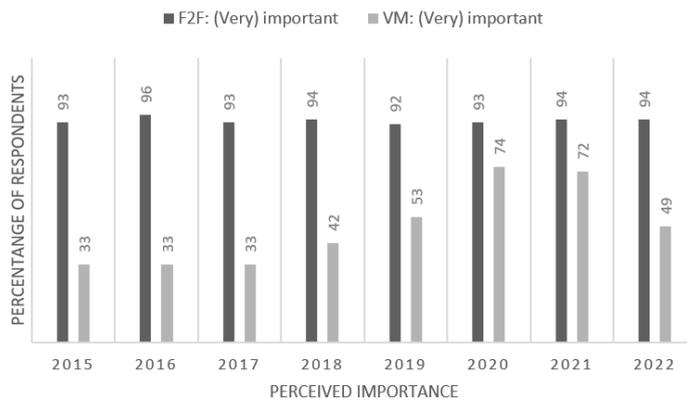


Figure 3. Perceived importance of face-to-face communication and virtual meetings.

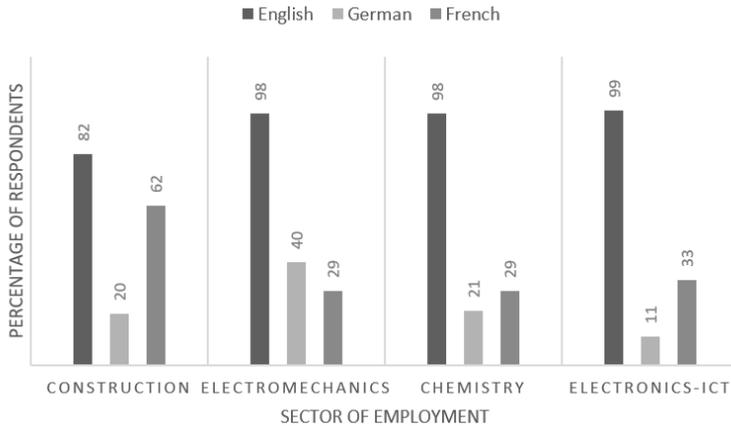


Figure 4. Perceived necessity of foreign languages for engineers in different sectors of employment.

In January 2023, upon completion of the course, the students were invited to complete a questionnaire that aimed to evaluate the effectiveness of the described didactic approach. The response rate was 50%, with 36 responding students out of 72. Figures 5, 6, 7 and 8 show some of the results of the questionnaire, which used a five-point Likert scale for agreement.

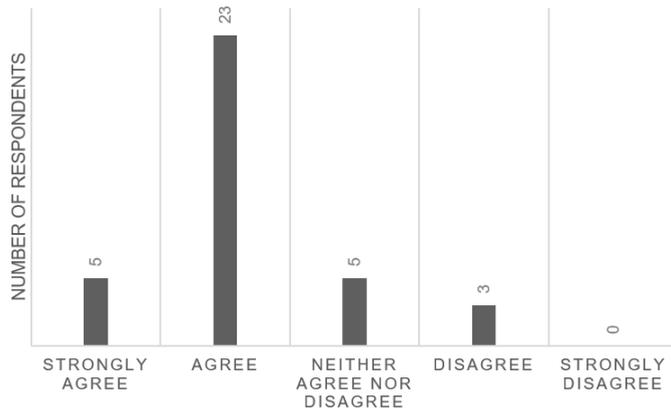


Figure 5. “By doing this research, I have been able to establish ‘with my own eyes’ that communication skills are important for engineers”.

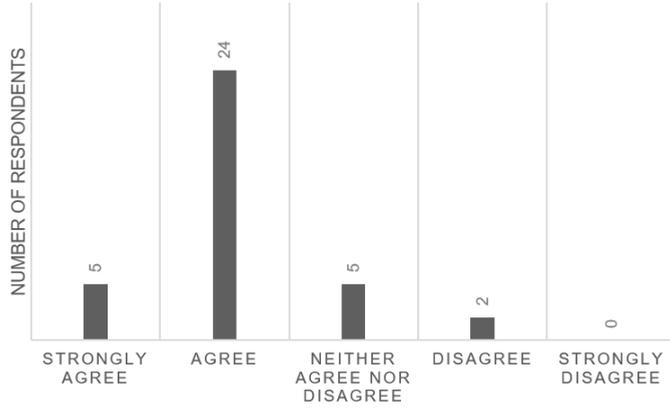


Figure 6. “During this course, I have improved my research skills”.

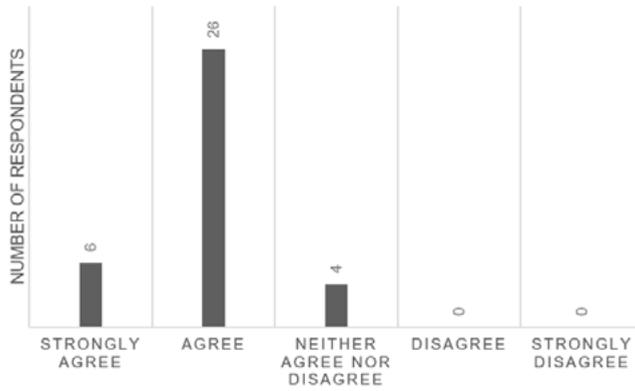


Figure 7. “During this course, I have developed my writing skills”.

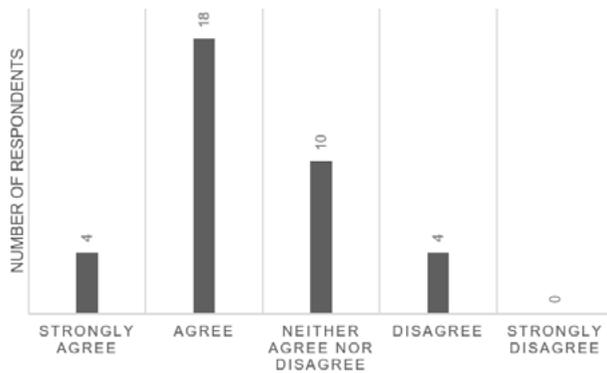


Figure 8. “During this course, I have improved my understanding of the engineering professional identity”.

From these figures, it seems fair to conclude that the approach was largely successful in achieving its didactic targets.

4. Conclusion

To develop a strong sense of engineering identity, students need to have a sound understanding of the lived realities of the workplace. Interventions based on observation are certainly preferable to stereotypes and hearsay, but arguably, an even more potent way to bust misleading and exclusionary myths about “the engineer” is to have students themselves research the workplace and workplace expectations. Moreover, this approach allows for an integration of this process of identity formation in the core curriculum as students can simultaneously be taught vital engineering and employability skills such as research skills, writing skills and even – in this particular case – statistics.

The approach described in this paper can be easily modified to fit the needs, concerns and curricular goals of other fields of higher education, just as easily as it can be modified to include other employability skills besides communication skills, such as teamwork skills, leadership, life-long learning, creativity, problem-solving skills... A teacher design team interested in this approach could ponder the following questions as a starting point: Which misconceptions may exist among students about their future professional selves? Which course in the curriculum could accommodate a student-driven research project in this aspect of professional identity? Which didactic approach can maximize the interplay between research project activities and other curricular goals? How can the approach allow the personal interests of the students to co-define their research trajectory? Developing such a course certainly requires significant effort, but it may well end up benefiting the students, the teaching staff and the workplace all at once.

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Development and piloting of a micro-credential programme in research ethics and integrity leadership – an example from Estonia

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Abstract

Micro-credentials are an emerging format of lifelong learning supporting competence-development as well as deepening knowledge in the field. Still, there is little research on implementing and sustaining micro-credentials in higher education. The current paper aims to share experiences of development and piloting of a micro-credential programme for a specific target group in Estonia. The criteria for setting up a micro-credential programme as well as initial lessons learned are outlined. Experience indicates that it takes some time and sharing best practices to develop the programmes into a feasible form of education. In case a programme is developed for a very specific target group and no degree programme exists in the field, several tailor-made solutions must be invented. By sharing best practices, developing and testing new formats will make micro-credential programmes more effective.

Keywords: *Micro-credentials; programme development; lifelong learning.*

1. Introduction

Micro-credentials, or micro-degrees, are a new addition in the lifelong learning possibilities and are avidly supported by the European Union (EU) (EU, 2021b). The new European Skill Agenda (EU, 2021a) proposes using short-term training formats to provide swift and flexible ways for people to deepen their knowledge and obtain new skills. A common EU approach to micro-credentials was also established (EU, 2021b) to ensure alignment and transferability among EU higher education (HE) institutions.

Similarly, Estonian Education Strategy 2021–2035 (MER, 2021) establishes that more flexible and integrative options for continuing education should be provided, so all major HE institutions offer various micro-credential programmes. In 2022–2023 academic year three major universities in Estonia offer over 120 micro-credential programmes (Adamson, 2022) (in addition to programmes offered by other HE institutions). Following European Commission recommendations and national education strategies, micro-credentials are accredited in credit points following ECTS (European Credit Transfer and Accumulation System) which can then be used to complete modules in different degree levels and be transferrable into different European universities (that follow the Bologna System) (EU, 2021b; McGreal & Olcott Jr, 2022). Universities state that micro-credentials provide an option to integrate general skills as well as competencies of specific fields, the format is more flexible and provides opportunities for requalification and upscaling (Adamson, 2022). Generally, micro-credentials contribute to a more qualified workforce as well as a more educated society.

Still, as micro-credentials are an emerging format of lifelong learning, there is little research on implementing and sustaining micro-credentials in higher education (Selvaratnam & Sankey, 2021). The current paper aims to share experiences of development and piloting of a micro-credential programme for a specific target group in Estonia. First, the background of the programme is introduced. Then, the description of the development process and the piloting phase are provided. To conclude, lessons learned and recommendations are outlined to support development and implementation of micro-credential programmes in Europe.

2. Need for research ethics and integrity leadership

HE institutions struggle with various issues pertaining to research ethics and integrity (REI), e.g., increased competition, pressure to publish, technological advances that enable plagiarism (Mustajoki & Mustajoki, 2017; Hyytinen & Löfström, 2017). This calls for a systematic approach towards REI and its implementation (Bertram Gallant, 2011). HE institutions have reacted to this need by setting up ethics committees, designating research integrity officers, data management officers and delegating other individuals to create and implement REI infrastructure (Wright & Schneider, 2010; Bertram Gallant, 2011). Usually,

the REI-related tasks are just added to the designated people with no additional training (or receiving a few short training sessions), degrees in REI are not common. The question is: how to prepare REI leaders who would “build the culture of integrity in HE institutions by creating an environment where everyone can and will make ethical decisions”? (Tammeleht, Löffström & Rodríguez-Triana, 2022).

In 2017 a new national code of conduct for research integrity was developed and the document was approved in Estonia by all research institutions. The named document, in addition to outlining the responsibilities of researchers, also stipulates the responsibilities of research institutions in ensuring the REI infrastructure (Hea Teadustava, 2017). The need for a more structured and systematic programme for educating REI leaders became urgent as research institutions had limited levels of readiness for implementing the national code of conduct. As a response, a micro-credential programme was set up by one university with expertise in ethics.

2.1. Development of the micro-credential programme

As there was no degree programme to educate REI leaders, and a very specific target group was kept in mind, a new programme was designed to fulfill the gap. The REI leadership micro-credential programme was named *Academic and Research Integrity: from theory to practice*. The aim of the programme is to prepare experts who could solve various REI issues in their field and institution, and who would be ready to guide others.

The target group for the programme are people who have at least a bachelor's degree and who are already active in research and teaching in a research institution, especially on topics connected with REI. Participants should be ready to apply the acquired knowledge in their own institution by training others, advising on issues pertaining to REI and setting up REI infrastructure.

The volume of micro-credential programme is 24 ECTS and lasts for two semesters. The university provides micro-credential programmes to learners for a tuition fee. As for the second semester tailored courses had to be developed for the target group (as there is no existing degree programme about REI leadership), the price became slightly higher than the average credit point price in the department. Still, the overall cost of the entire programme is significantly lower than, for instance, in law, business or media.

Flexible timetables are also recommended by the university guidelines. The participants of micro-credential programmes are expected to attend courses with degree students. Since the participants of micro-credential programmes are usually individuals who work full time and can devote a limited amount of time on travelling and attending lectures, the university advises using session- or web-based learning formats.

2.2. Description of the learning process of the programme

The micro-credentials programme started with a full seminar day where we met the participants face-to-face. At this first meeting, we got to know the learners and their expectations for the programme. There was an introduction of contact persons, lecturers responsible for the courses and learning aids (e.g., library, databases, ethics website, online learning environment). Participants were also given a detailed overview of the autumn semester schedule (see below) and the conditions for completing the courses.

ACADEMIC AND RESEARCH ETHICS: FROM THEORY TO PRACTICE Autumn semester schedule			
SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
05.09 at 11.00–16.00 Micro-credential seminar day	03.10 at 16.15–17.45 CTA 5. lecture	03.11 at 18.15–19.45 BE 4. seminar	15.12 at 14.15–17.45 RI final seminars
05.09 at 16.15–17.45 CTA 1. lecture	10.10 at 16.15–17.45 CTA 1. seminar	07.11 at 16.15–17.45 CTA 6. lecture	ADDITIONAL INFO Critical Thinking and Argumentation Lectures and seminars take place face to face. Participation in lectures and seminars is not mandatory, recordings are in Moodle (from previous years). Basics of Ethics Seminars take place online and are mandatory, it is possible to compensate absences by submitting written work. In addition, video lectures are pre-recorded in Moodle. Research Integrity: Framework Requirements, Values and Principles of Action Seminars take place online and are mandatory, it is possible to compensate two absences by submitting a written work. In addition, video lectures are pre-recorded in Moodle.
08.09 at 14.15–15.00 RI introduction	13.10 at 14.15–17.45 RI 3. seminar	10.11 at 14.15–17.45 RI 5. seminar	
12.09 at 16.15–17.45 CTA 2. lecture	13.10 at 18.15–19.45 BE 2. seminar	10.11 at 18.15–19.45 BE 5. seminar	
15.09 at 14.15–17.45 RI 1. seminar	17.10 at 16.15–17.45 CTA 2. seminar	14.11 at 16.15–17.45 CTA 7. lecture	
19.09 at 16.15–17.45 CTA 3. lecture	24.10 at 16.15–17.45 CTA 3. seminar	21.11 at 16.15–17.45 CTA 8. lecture	
22.09 at 18.15–19.45 BE 1. seminar	27.10 at 14.15–17.45 RI 4. seminar	24.11 at 14.15–17.45 RI 6. seminar	
26.09 at 16.15–17.45 CTA 4. lecture	27.10 at 18.15–19.45 BE 3. seminar	24.11 at 18.15–19.45 BE 6. seminar	
29.09 at 14.15–17.45 RI 2. seminar	31.10 at 16.15–17.45 CTA 4. seminar		

Figure 1. Autumn semester schedule.

In the autumn semester, learners had to complete three courses (12 ECTS in total): “Critical thinking and argumentation”, “Basics of ethics” and “Research integrity: framework, requirements, values and principles of action” (see Figure 1).

All courses were structured in such a way that the final grade was formed continuously during the semester, which means that learners had to constantly keep up with the course topics, read the materials provided, participate in seminars, and solve homework assignments. The final grade for all the courses was differentiated (from “A” to “F”).

In two of those courses (“Basics of ethics” and “Research integrity”) there were pre-recorded video lectures in addition to online seminars that were compulsory to attend. But there was also a possibility to compensate the absence from the seminar by submitting a written task. In the course called “Critical thinking and argumentation” there were face-to-face seminars but the attendance in these was not compulsory, since there were also recorded video seminars from previous years.

Each of the course had a separate webpage where all important information about the course was presented: completion conditions, schedule, instructions, additional materials, links to

join video seminars, communication forums and forums for posting independent works. In addition, we created a separate general webpage for the micro-credentials programme. We added communication forums there, through which we could share information with the learners, and they could ask questions from us. There was also a place for learning diaries where we posted a task for each week, to help the learners keep up with their courses and combine the knowledge that they had gathered in different courses. Once a month, online information sessions were also held. These were designed to convey information, listen to learners' concerns, increase their motivation, and help them in the learning process.

In spring, learners must complete two courses (12 ECTS in total): “Ethics in an organization” and “Workplace applications of practical ethics”. During spring semester, all seminars will take place face-to-face, and for this we have planned one full day of seminars every month (see Figure 2). On each seminar day (except for the last one), we will have three seminars and lunch together, during which it is possible to discuss issues related to the micro-credentials programme as well as to discuss ethical issues in a broader sense.

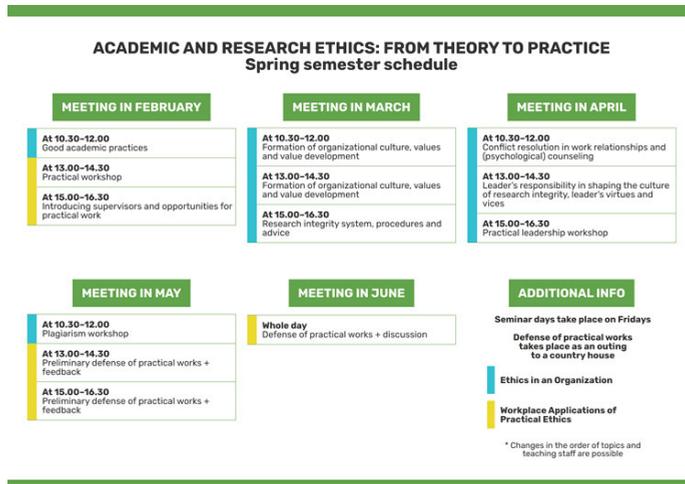


Figure 2. Spring semester schedule.

In the course called "Workplace applications of practical ethics", learners choose a supervisor at the beginning of the semester and during the course every learner will develop one element of the ethics infrastructure with the help of the supervisor.

In the subject "Ethics in an organization", seminars with various experts in the field take place on every seminar day. Between the seminars, learners must independently read the materials and make posts in the self-reflection diary. The final grade for both spring courses is non-differentiating (“pass” or “fail”).

We have planned the very last seminar day of the programme as an outing to a country house in a beautiful place of nature. There, learners are going to defend the last version of their projects and will receive feedback from both supervisors and fellow learners. This will be followed by a discussion round about the study-experience and how to implement and disseminate knowledge obtained from the programme.

3. Initial lessons learned

The initial lessons learned were compiled when the first half of the micro-credential programme had ended. The programme coordinator compiled feedback from learners (N=8), lecturers (N=6), the programme head and other collaborators. The feedback was fed into the development of the second half of the programme.

As the university guidelines encourage micro-credential learners to participate in the courses already provided by degree programmes, this format was indeed followed. It was convenient to incorporate additional learners into existing courses and they adapted relatively smoothly. As the micro-credential learners had already at least graduate degrees (some even professors in their field) and obtained quite significant work experience, they contributed significantly to discussions during seminars and thus helped other learners gain valuable insights to various ethical topics.

Nevertheless, there were also some drawbacks. Firstly, the set timetables were inflexible and thus not convenient for micro-credential learners. They would have preferred fewer fixed meetings but more intensive seminars when the meetings took place. Secondly, some learners did not feel comfortable about learning together with undergraduate students and being treated similarly to them. Namely, teaching undergraduate students need more structuring in their studies, more fixed tasks and deadlines to keep up with their studies; their time-management skills may still be limited. This format of teaching may not be suitable for independent learners like the ones participating in micro-credential programmes. In addition, already existing courses may have many participants and the individual needs of more mature learners may remain unnoticed. Moreover, it may be difficult to adapt to the student's role and unfamiliar disciplines.

To alleviate the emerged issues, the lecturers of the existing courses were approached, and agreements were made to support micro-credential learners. They would still cover the same material but would get more flexibility in submitting their assignments. Organising regular meetings to discuss learning and emotional issues were also perceived well by the learners. Monthly online meetings gave them a chance to voice their concerns, share emotions and support each other. Also, the programme team spent extensive hours in supporting the programme participants. Many toyed with the idea of quitting the programme, the main

reason being the huge workload (studies and work-related responsibilities), but by the end of the meeting everyone decided to continue with their studies.

The programme team saw another potential reason for not quitting – the programme is not for free, and the studies were mostly financed by the participants' employers. Thus, they had taken the responsibility to finalise the programme. In addition to the certificate, the participants would present a practical REI element to their institution/employer.

As a response to the lessons learned the courses for the second semester were designed from the perspective of the micro-credential programme learners. They expressed a need to have fewer meetings but then coming together for a full day. Thus, monthly seminar days were organised. The time in-between the meetings would be devoted to individual reading and compiling the practical final assignment of the programme (with more personal supervision). Still, this kind of tailor-made approach is more time-consuming and expensive for the organising institution. One solution to compensate for the expenses is to make the micro-credential courses available for a wider public (e.g., through the Open Academy).

4. Conclusions and recommendations

All in all, micro-credentials programmes are an excellent addition to the lifelong learning opportunities. They provide possibilities to deepen or enhance knowledge in different fields while still being part of the labour market. Transferability of credit points ensures options to pursue a degree in the field in case there is interest in it. Overall, micro-credentials contribute to a more educated society.

Some recommendations for implementing a micro-credential programme:

- A preliminary information seminar could be organised to introduce the entire programme. This will align participants' expectations to the content offered.
- If possible, separate study groups should be created for learners of the micro-credential programme, this way it is possible to better respond to learners' needs and create a better-suited schedule for them.
- Instead of a tight fixed schedule, fewer but more intensive seminar days should be planned. Also, non-differentiated assessment should be used as this is more suitable for independent/mature learners.
- The programme should have a designated contact person who is committed to regular communication with the learners.
- Although online learning significantly adds flexibility, at least some face-to-face meetings should be organised, because these remarkably increase learners' motivation.
- To make a customized approach affordable for the organising institution, making micro-credentials courses available for a wider public could be considered (so that, for

example, instead of taking part in the entire program, it would be possible to take only one course).

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Higher education student work placement and employability

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Abstract

This study aimed to evaluate student work placement experience with reference to employability skills. An email/phone survey was conducted in 2016/2017 with on-site placement supervisors and alumni of the Faculty of Agriculture, University of Mauritius, who had completed 6-month work placements. Placement specifications and evaluation responses were retrieved from records. 25 out of 28 (89.3%) food science and technology students had secured employment less than one year after graduation, with 14.3% being employed by organisations where they undertook the placement. 21 out of 25 (84%) alumni stated that the placement opportunity had enhanced their employability. Placement providers commented positively on students' attitude, progress and output. Student work placements may have contributed to boost graduate employability. The Faculty of Agriculture 6-month work experience programme was extended to other courses. From 2014 to 2023, it has included 221 students who have been trained for jobs in the agricultural and food sectors.

Keywords: *Higher education; student work placement; food science; agriculture; graduate youth unemployment; employability.*

1. Introduction

Unemployment, working poverty, labour market inequalities and poor quality employment, especially among the youth and women in developing countries, are concerns which need to be addressed globally (ILO, 2019). The United Nations Sustainable Development Goal 8 (SDG 8) promotes inclusive and sustainable economic growth, employment and decent work for all (UN, 2023). However, the International Labour Office reports major deficits in decent work and warns that attaining SDG 8 seems unrealistic for many countries. Young people, especially young women, are disproportionately affected (ILO, 2019). According to the United Nations (2020), unemployment among youth is one of the greatest global issues.

OECD (2023) defines youth unemployment rate as the number of unemployed 15-24 year-olds expressed as a percentage of the youth labour force. In 2016, it was estimated that over 40% of the world's active youth was expected to be unemployed or have a job but live in poverty (ILO, 2016). The COVID-19 pandemic exacerbated youth employment challenges with anticipated scarring effects. The proportion of youth not in employment, education and training increased to 23.3 % in 2020, an unprecedented level in at least 15 years (ILO, 2022).

Mauritius, a small island developing State (SIDS), located off the southeast coast of the African continent in the Indian Ocean, has a population of 1.26 million (Statistics Mauritius, 2022a) and an adult unemployment rate estimated at 8.7% for the first quarter of 2022 (Statistics Mauritius, 2022b). Youth experience a higher-than-average unemployment rate which was 25.3% in 2021 (World Bank, 2023a). Two main factors contribute to youth unemployment: some sectors such as agriculture and export-oriented enterprises, no longer attract low skilled youth due to working conditions and social status associated with these jobs; youth competencies do not meet the demand of employers for proficiency in technical skills (World Bank, 2019).

To tackle the youth employment crisis, the United Nations launched the Global Initiative on Decent Jobs for Youth in 2016. The goal is to leverage knowledge, alliances and resources to create action that leads to tangible results for young people (Decent Jobs for Youth Organisation, 2023). The nexus between youth education and employment was recognised by the United Nations declaration in 2015 with the following statement: "all countries stand to benefit from having a healthy and well-educated workforce with the knowledge and skills needed for productive and fulfilling work and full participation in society" (UN, 2018). Thus, youth education plays a vital role in developing knowledge, values and competencies required to secure decent jobs for a dignified life and sustainable growth.

Since independence in 1968, Mauritius has undergone economic transformation from a low-income, agriculturally-based economy to a diversified, upper middle-income economy with growing industrial, financial, and tourist sectors (Moody's Analytics, 2023). Government strategies have contributed to increase access to higher education and build the knowledge-

based economy towards the creation of an education hub (Knight and Motala-Timol, 2022). The gross tertiary enrollment rate increased from 3 % in 1970 to 44 % in 2020 (World Bank, 2023b). However, graduate youth unemployment has emerged as a socioeconomic concern. The proportion of unemployed youth who had attained tertiary education increased from 7.9% (2010) to 17.4% (2014) and 20.9% (2021) (Ministry of Labour, Industrial Relations, Employment and Training, 2015; Statistics Mauritius, 2021). Skills mismatch has been reported as a key determinant of jobless university graduates (Ministry of Labour, Industrial Relations, Employment and Training, 2015; Ndyali, 2016). According to Hardin-Ramanan, Ballasoupramanien, Gopee, Rowtho and Charoux (2017), corporates and educational institutions in Mauritius identified lack of experience/expertise and no prior preparation/training as important graduate work-readiness challenges.

To address youth unemployment and the graduate skills gap, the Government of Mauritius has invested in initiatives such as the Youth Employment Programme and the Graduate Training for Employment Scheme which engages employers in the skill formation process (Ministry of Foreign Affairs, Regional Integration and International Trade, 2019). The University of Mauritius has been supportive of the government's vision to promote graduate employability and initiated the Otto Essien Programme (United Nations Development Programme/University of Mauritius) student placements project in 1994 and 1996-1998. The Student Work Experience Programme (SWEP), was introduced in 1999 and was designed to expose students to short work placements, real life tasks and activities. It was integrated with the Work-based Learning (WBL) programme for a more structured, modular and progressive approach, and offered to students as an optional experiential learning opportunity (UoM, 2023).

The Faculty of Agriculture of the University of Mauritius plays a leading role in national capacity building for the agricultural, food and biotechnology sectors (UoM, 2023). Interaction with stakeholders, alumni and students signalled the need to integrate student work experience within the programmes of study. In 2002, the Faculty responded proactively by including compulsory 6 to 8 weeks student placements in some undergraduate courses. Student work placements in the field of study were organised by the Faculty of Agriculture and undertaken in external organisations to create opportunities for application of acquired theoretical knowledge. The Faculty experiential learning provision was embedded in other undergraduate and postgraduate courses to benefit a larger number of students. In 2012, the short placement was extended to 6-month sandwich work placement in one undergraduate food science and technology course in light of students' and employers' feedback. The first cohort of graduates who had completed a 6-month work placement entered the job market in 2016. In this context, the study intended to evaluate student work placement experience with reference to employability skills to inform future practice and research.

2. Methodology

2.1. Placement students, organisations and academics

77 students undertook 6-month work placements in 2014 and 2016. Undergraduate students belonged to the 18-24 age-group, with a high proportion of young women (81.2%). They were from Mauritius and Rodrigues, a dependency of Mauritius and the smallest of the Mascarene islands. Postgraduate students on the MSc Agribusiness Management, EU funded intra ACP mobility programme, were from 4 African countries and Rodrigues. 31 public and private organisations in the agricultural, food and hospitality sectors provided 6-month placement opportunities. Each placement provider hosted 1 to 4 students who were mentored by on-site supervisors. Placement providers designated one or more on-site supervisors depending on the number of students being placed at the organisation. 21 academics of the Faculty of Agriculture, University of Mauritius, were appointed as academic supervisors to guide, monitor and assess students' performance during the 6-month work placement, as per guidelines of a Faculty work placement handbook.

2.2. Data collection participants, instruments, methods and analysis

On-site supervisors' and students' placement evaluation reports were maintained as records by academic supervisors at the Faculty of Agriculture, University of Mauritius. Student work placement reports were reviewed to retrieve objective evidence relating to learning outcomes. The "supervisor's final evaluation form" was completed by on-site supervisors. It consisted of a quantitative assessment of student competencies and 1 open-ended question on student performance. The "student work placement evaluation form" was filled in by students and contained open as well as closed-ended questions on quality of experience at the organisation concerned. An email survey was administered (December 2016-January 2017) with 18 on-site supervisors from 14 host organisations (45% of placement providers in 2014 and 2016), as well as 25 alumni of the Faculty of Agriculture, representing 32% of the student population who had completed the 6-month work placement. Feedback questionnaires included open-ended and closed-ended questions. The alumni feedback questionnaire defined the term "employability" as "the ability to secure a relevant job and having the required knowledge, skills and attitude to fulfil job responsibilities effectively". A phone survey was conducted to establish the employment status of 28 Faculty alumni who graduated with a degree in food science and technology with 6-month work placement in April 2016. 5 academics and 1 administrative staff shared their reflections on the organisation, implementation and assessment of student work placements. Their thoughts were critically analysed in light of the internal context as well as the educational, economic and social landscape in Mauritius. Quantitative data was processed by making use of descriptive statistics. Qualitative data was categorised and themes were identified based on the frequency of reported issues to provide insights into the outcomes of experiential learning.

3. Results & Discussion

Table 1. Alumni and placement providers' feedback.

Alumni	On-site supervisors
<ul style="list-style-type: none"> ▪ 25 out of 28 (89.3%) had secured employment ▪ 22 out of 28 (78.6%) had obtained a job in the food sector ▪ 4 out of 28 (14.3%) were employed by organisations where they undertook the placement ▪ 6 out of 28 (21.4%) were recruited by a major group of food companies in Mauritius ▪ 21 out of 25 (84%) stated that the 6-month placement had enhanced their employability ▪ Suggestions for improvement: exposure to various departments of the organisation; on-site visit of academic supervisor; more interaction between on-site and academic supervisors; payment of stipend; sandwich placement shifted to the end of the course to enhance chances of securing a job in the organisation 	<ul style="list-style-type: none"> ▪ Positive comments on students' attitude and output: skills enhancement; progress in learning and developing professional behaviour; contribution to organisation's activities ▪ All on-site supervisors expressed their organisation's willingness to participate in the student work placement programme in the future ▪ Suggestions for improvement: enhanced communication with academic supervisor; more clarity in articulation of programme expectations; less paperwork; extension of placement activities to research undertakings

Table 2. Learners' reported placement benefits and Faculty's staff reflections.

Alumni & students' reported benefits	Academic & administrative staff reflections
<ul style="list-style-type: none"> ▪ 33 out of 40 (82.5%) rated placement experience as good or excellent ▪ 30 out of 38 (78.9%) considered that there were job opportunities in placement organisations ▪ 27 out of 38 (71.1%) were paid a stipend ▪ Best part of work placement and aspects relevant to the programme of study: development of knowledge, hard and soft skills 	<ul style="list-style-type: none"> ▪ Academic supervisors: eye-opening experience and connectivity with the food system ▪ Administrative staff : constructive learning experience ▪ Challenges: securing high number of placements; ensuring student work placement readiness; equivalence of work placement opportunities; workplace language barrier for regional students

89.3% of food science and technology students with 6-month work placement experience secured employment in less than one year after graduation, with 78.6% obtaining a job in the food sector and 14.3% being employed in host organisations. 84% of alumni surveyed stated that the placement had enhanced their employability (Table 1). Furthermore, alumni and students stated that they developed knowledge as well as hard and soft skills during the 6-month work placement (Table 2). 82.5% rated their placement experience as good or excellent and on-site supervisors commented positively on students' attitude and output (Table 1 & Table 2). According to a literature review on higher education work placement/experience research in the United Kingdom, work placement benefits realised by students include general skills development and greater ability to secure a job (Atfield, Hunt and Luchinskaya, 2021). Other authors have also reported the positive effect of work placement on employability skills in Italian and Malaysian contexts (Volpe, 2017; Abdul Wahab, 2022). Teng, Ma, Pahlevansharif and Turner (2019) provided empirical evidence of a significant relationship between soft skills development and job readiness from students' perspectives in Malaysian and Chinese university settings. Two competing theoretical mechanisms have been proposed to explain placement's positive labour market outcomes: the human capital effect which involves skills development; the signalling effect which relates to the assumption that high-ability students opt for voluntary placements to get spotted and not necessarily acquire skills (Atfield et al., 2021). Inceoglu, Selenko, McDowall and Schlachter (2019) have postulated a theoretical model which depicts that intertwined learning and re-structuring of identity processes in novel social environments influence career-related outcomes of placement experiences. Thus, student's receptiveness and ability might have contributed to integrate learning cycles and identity change into meaningful competencies.

On-site supervisors valued students' contribution and expressed willingness to maintain their organisation's participation as placement providers in the future (Table 1). Atfield et al. (2021) reported that employers mentioned the following student work placement benefits: inflow of novel ideas and cheaper human resource. Interestingly, in the present study, alumni suggested payment of a stipend to students (Table 1) which could be important for financial autonomy and self-esteem. Arguments for paid internships include motivation to deliver quality work, job performance and efficiency (Belleenfant, 2022; Legal Service India, 2023). Other suggestions for improvement related to communication/interaction between on-site and academic supervisors (Table 1). Faculty's staff reflected on their constructive experience in arranging and supervising work placements. However, key challenges involved securing a high number of equivalent placement opportunities and ensuring students were well prepared for transition into real-world situations (Table 2). Divine, Linrud, Miller and Wilson (2007) elaborated on HEI time and resource challenges in getting enough internships offers in the US context. Moreover, previous studies reported that joint learning materials developed between universities and employers, effective student support and integration of reflexive activities were crucial for work placement success (Atfield et al., 2021).

4. Conclusions

From the findings of this study, it can be concluded that students who completed 6-month work placements as a requirement of courses at the Faculty of Agriculture, University of Mauritius, experienced positive outcomes in terms of skills development and employability. Placement providers and Faculty's staff demonstrated positive attitudes to the student work placement programme. Since 2017, more students have benefited from 6-month work experience. Some identified areas of improvement have been addressed to ensure quality of experiential learning. For example, a professional development module was introduced to enhance student preparedness for transition to employment. Language skills and intercultural awareness is an emerging challenge in the context of higher education internationalisation. Sustainability of workplace learning opportunities depends on continued engagement of Faculty's staff, students, alumni and stakeholders. It is important to strengthen external organisation, alumni and student participation in design, planning and communication of experiential learning activities for sustained career-related outcomes. More research is needed on work placement/internship learning processes as well as benefits and costs to students, HEIs and employers.

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When intercultural education is problematic: the case of Russian as a foreign language

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Abstract

This paper proposes a reflection on the issues posed by the intercultural teaching of Russian as a foreign language (RFL) in the university context.

In particular, after defining the concepts of “interculturalism”/“intercultural education” and outlining an updated picture of research on intercultural education in RFL, two of the greatest problems of RFL intercultural education are presented: on the one hand, the ambiguity of the theoretical treatment of intercultural education (and, thus, of its practical applications) by RFL scholars, and, on the other hand, the often essentialized, if not stereotypical, portrayal of Russian culture in RFL textbooks, which in some cases distort reality.

Finally, a possible solution is proposed to resolve these issues and make RFL teaching more intercultural.

Keywords: *Russian as a foreign language; intercultural education; intercultural teaching; interculturalism; Russian culture; textbooks.*

1. Introduction

When talking about the concept of “interculturalism” (Abdallah-Preteuille, 2006; Besley & Peters, 2012; Cattle, 2012; Costa & Lacerda, 2007; Dervin, 2016; Kastoryano, 2018; Meer *et al.*, 2016; Penas Ibáñez & López Sáenz, 2006; Sarmiento, 2014; Verkuyten *et al.*, 2019; Zapata-Barrero & Mansouri, 2022), we generally refer to a philosophy or viewpoint that involves support for dialogue between cultures and challenges self-segregation of cultures, ultimately leading to an “intercultural education” (IE), the foundations of which have been laid by the policies of the European Union and UNESCO since the 1990s according to these same assumptions (see, among others: Beacco, 2013; Byram, 2003, 2006, 2009; Byram & Zarate, 1995; Byram *et al.*, 1997; Byram *et al.*, 2002, 2009; Coste *et al.*, 2009; Deardorff, 2020; UNESCO, 2006, 2010, 2013).

In the research field of Russian as a foreign language (RFL), IE is commonly grounded in two basic components: “intercultural communication” (*mezhhkul’turnaya kommunikatsiya*) and “intercultural communicative competence” (*mezhhkul’turnaya kommunikativnaya kompetentsiya*).

Scholars tend to qualify intercultural communication as “an adequate mutual understanding of two participants of a communicative act who belong to different national cultures” (Vereshchagin & Kostomarov, 1973, p. 43; hereafter, the translations are mine). The precondition for and, at the same time, the guarantee of intercultural communication taking place is intercultural communicative competence, which has been defined as “the individual’s ability to exist in a multicultural society, to be successfully understood by representatives of other cultures and by representatives of one’s own culture” (Azimov & Shchukin, 2009, p. 134).

The topic of IE, which has become an object of study in the Russian context since the early 2000s with the publication of Gudkov’s (2000) and Ter-Minasova’s (2000) works devoted to intercultural communication, has been extensively investigated in RFL from various perspectives, with a focus on both theoretical and didactic-methodological aspects (see, among others: Amelina, 2022; Antonova & Arsenyeva, 2019; Berdichevskiy, 2021; Berdichevskiy *et al.*, 2011, 2020; Chumak, 2009, pp. 195–199; Nemtchinova, 2020; Petrikova *et al.*, 2015; Tarchimaeva, 2017).

However, with a few exceptions (e.g., Torresin, 2022a), in RFL research, there is still a lack of critical reflection on the concept of IE that may challenge certain established scientific ideas or orientations and at the same time help to improve the intercultural teaching of RFL in practice.

If IE in general, understood as above, alongside its undoubtedly positive sides, has over time shown dark areas or critical aspects that are difficult to resolve to the point of being criticized

in its very nature and even being related to colonialism (see, e.g., the studies of Aman, 2015, 2017, 2019), IE in the RFL area, as we will see, does not escape this picture either.

This contribution aims to outline two of the greatest problems of RFL intercultural teaching with a focus on the university context: on the one hand, the ambiguity of the theoretical treatment of IE (and, thus, of its practical applications) by RFL scholars (§2.1), and, on the other hand, the often essentialized, if not stereotypical, portrayal of Russian culture in RFL textbooks, which in some cases distort reality (§2.2). Finally, a possible solution is offered to solve the critical issues of IE in RFL and make RFL teaching more intercultural (§3).

2. Problems of RFL intercultural education

This paper discusses the following as the two main problems of RFL IE in the university context: a) how RFL research approaches the concept of IE (§2.1) and b) how RFL textbooks approach the concept of culture (§2.2).

2.1. Intercultural education and ambiguity in RFL studies

It is a well-established fact that scholars still do not agree on what should be meant by “interculturalism” and the correlated concepts “intercultural communication,” “intercultural communicative competence,” “intercultural dialogue,” and others, and that intercultural processes may be looked at through different lenses, perspectives, and approaches (see., e.g., Delanoy, 2020; ten Thije 2020).

However, in the RFL area, the situation is even more complicated. In RFL research on IE, on the one hand, a definition of IE—of its principles and characteristics referable to interculturalism—is seldom provided (see Torresin, 2022a, 2022b), thus giving rise to a wide variety of interpretations. On the other hand, the intercultural dimension, when defined and/or interpreted, is represented in a way that often does not coincide with interculturalism (as we outlined it) but is rather closer to “multiculturalism” (see Torresin, 2022b)—that is, a simple juxtaposition of cultures with the aim of merely “decreasing inter-ethnic tensions,” in which, rather than intercultural dialogue, cultures are invited to a more passive “education for tolerance” (Azimov & Shchukin, 2009, p. 149).

Adding to the ambiguity of uses of the conception of IE in the RFL field is the essentialist treatment of the concept of culture itself (which we will also return to in the next section when discussing RFL textbooks).

Culture is generally conceived by RFL scholars in an exclusively national tone, that is, as merely Russian (see Torresin, 2022a, 2022b), which testifies to a simplified and monolithic view of Russian culture deviating greatly from the foundations and principles of IE. This view completely excludes the transnational “Russophone” world (Caffee, 2013), which

includes Russian-speaking people who are not ethnic Russians, such as many contemporary, internationally renowned Russian-language writers (see Torresin, 2023a).

To sum up, even the most recent RFL studies treat IE in an ambiguous way that does not serve the development of IE itself, as the definitions of intercultural processes and related concepts either lack or are vitiated by multiculturalism (i.e., the pursuit of tolerance rather than dialogue between cultures) on the one hand and, on the other hand, by a simplified and essentialized view of culture itself (understood as purely national, i.e., Russian, or, in other words, in such a way as to exclude the equally important Russophone component).

2.2. RFL textbooks and the distortion of reality

If RFL research approaches the concept of IE in an ambiguous, simplistic, and essentialized way that extends to the same characterization of the target culture, when considering concrete teaching tools at the university level, such as RFL textbooks, the perception and representation of Russian culture here is also rather questionable.

In fact, generally speaking, authors of RFL textbooks seem to rely on (or, if they are academics, to belong to) the RFL didactic-methodological research illustrated above, with which they share a simplified and essentialized view of Russian reality. This influence is evident from the frequently biased, distorted, if not benevolent or even stereotyped portrayal of the Russian world offered by many RFL textbooks (see Torresin, 2022c, 2023b).

In more detail, such a portrayal of the Russian world is conveyed through the omission of some aspects (deemed secondary) over others for subjective and debatable reasons (see Torresin, 2023b). For example, in the well-known RFL textbook *Russkij yazyk: 5 elementov* (Esmantova, 2008–2011), which offers very few cultural topics, more space is reserved for geography, whereas modern and contemporary Russian culture are completely ignored.

Among the deliberately omitted elements is also the Russophone aspect. In other words, the only dimension represented in textbooks is generally that of national Russian culture. For example, in *Poyekhali* (Chernyshov & Chernyshova, 2019–2022), the few cultural elements given refer to the national dimension (Russian holidays, Russian recipes, etc.), especially the classical (among the Russian writers mentioned, we may find Pushkin, Chekhov, Tolstoy, and Dostoevskiy), while the transnational one (e.g., Russian-speaking world, contemporary Russian-language writers, etc.) is not present. This reinforces the idea—already present in RFL research, as we have seen—of Russian culture as purely national, monolithic, and static, which is precisely the idea that passes, through the textbooks, to RFL learners.

Moreover, there are quite a few RFL textbooks that propose the myth of the “Russian soul” (*russkaya dusha*) as a learning component (regarding the Italian educational context, see Torresin, 2022c), thereby fostering the reinforcement of this monolithic and essentialized idea of Russian culture. This occurs also in the very recent textbook *Voyazh po-russki*

(Moskalëva *et al.*, 2020), where the Russian identity is depicted as unique and based on certain constants (tension towards the vast spaces, tendency to sadness or anxiety, strong sense of hospitality, etc.) attributable to the “Russian soul” (pp. 73, 250).

In summary, in many RFL textbooks, a distortion of reality takes place, resulting in the partial, essentialized, and even stereotyped representation of Russian culture, interpreted as national and endowed with fixed, unique, and unrepeatable traits (“Russian soul”).

3. Conclusions

As we have seen, the implementation of IE in the RFL context at the university level is problematic for two reasons: on the one hand, because of the ambiguity of the theoretical treatment of IE by RFL scholars, and, on the other hand, because of the biased and essentialized—if not outright stereotypical—portrayal of Russian culture in RFL textbooks.

In my view, a solution to both problems would be improving the critical reflection on the concept of IE. This could be done if RFL scholars and textbook authors were to dialogue both with intercultural studies, particularly intercultural pedagogy, where “culture” is treated as a complex and multifaceted object of study in an anthropological and sociological sense, and with international intercultural studies, which recognize the complexity of culture.

Clearly, this requires a change that involves both RFL research and teaching practice and that also goes through textbooks.

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Digital pedagogy for the present: an artificial intelligence methodology for curriculum development

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Abstract

In an age of information, course creation at the university-level poses new challenges in that the constant influx of new data makes it difficult for instructors to update courses with the latest research. Using Artificial Intelligence (AI), we created a curriculum that matches the contemporary experiences of students. This approach was used to help design a course on Aging and Adulthood using the life course model. We were able to create a topological map of topics and subtopics that provided the instructor with the ability to quickly understand the shape of the data, thematic connections, and data voids. Choosing from a myriad of research articles from a derived skeleton of topics, the instructor was then able to design a unique course with the most relevant research and supplement the syllabus with seminal works in the field.

Keywords: *Artificial intelligence; topological data analysis; digital pedagogy; curriculum development; life course; epigenetics.*

1. Introduction

The first time I traveled to Spain I was 20 years old and when I left I cried all the way to the airport. My señora was my best Spanish teacher. We would pantomime and dance to make our meanings known. We needed no words when we parted, on her face was the sadness that can only follow the great joy of being forever changed by someone significant—linked lives.

Linked lives is one of the five characteristics of the life course model. A framework that articulates the cumulative effects of our life experiences over time (Elder Jr., 1998, p. 4). A tool that can help us identify vulnerable periods within the context of historical events and create opportunities for informed interventions (Elder Jr., 1998, p. 5). Inspired by my own life experiences, I endeavored to teach a course entitled *Coming of Age: Adulthood* grounded in the life course model. However, the life course model is a novel approach that has only become part of public health curricula as of the last decade (Begg et al., 2015, p. 1). Therefore, a meaningful course would not only need to cite seminal works in the field, and discuss the key innovations in epigenetics, but also be relevant to students. I have now successfully taught *Coming of Age: Adulthood* twice due to the application of artificial intelligence in outlining aging.

Using Artificial Intelligence (AI), the curriculum was up-to-date even given the COVID-19 pandemic and the recent explosion of research in the fields of the life course model, epigenetics, and exposome. Almost half (60,000+) of the articles (130,000+) containing the search term “epigenetics” were published in PubMed during the last five years. The preparation for this course was cut down to a few hours, only requiring a quick 15-minute update from semester to semester.

2. Methodology

Using PubMed, a biomedical literature database accessed at <https://pubmed.ncbi.nlm.nih.gov/>, the researchers extracted articles over 365 days ending on December 8th, 2021, using search terms from a life course glossary curated by the researchers. They used their domain expertise to determine the set of terms and boolean operators (and/or). Data were extracted using the Biopython API (Cock et al., 2009) and transformed data was loaded into a custom-built interactive Python Dash web app (Hossain, 2019) that leveraged topological data analysis. This included generating a topological network (Singh et al., 2007), computing a persistence diagram (Zomorodian & Carlsson, 2004), and identifying the representative cycle (Tralie et al., 2018). Additionally, a knowledge graph was constructed to supplement topological understanding by seeing the conceptual relationships involved in different areas of the topological network.

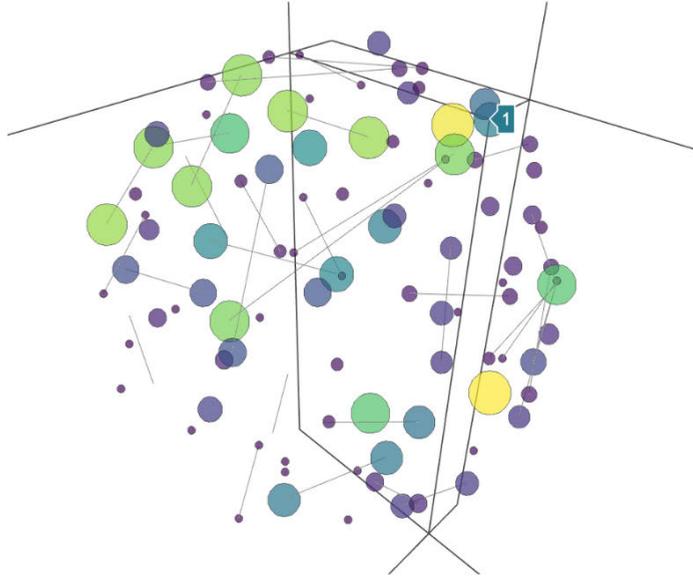


Figure 1. Topological network of Pubmed articles on the life course model

The procedure used to extract topics and sub-topics was a multi-step process. First, the knowledge graph was used to identify the key concepts and their relationships. Those concepts were mapped to the topological network's clusters, which provided a rough segmentation of articles into topic or sub-topic groups (Figure 1). In the topological network, lines between nodes represent connectivity and similarity, and each node represents a set of articles. The node color represents its similarity index, which is any function that summarizes its relative distances from other data points into a single relative distance value. To determine whether a cluster is a strong signal, the persistence diagram visualizes the overall distribution of hierarchical clustering, so that we can determine how many topics are likely and when a topic becomes saturated upon initial or repeated identification (Figure 2). In computing the persistence diagram, we also extracted the representative cycle to determine any persistent topological signal, as it highlights the most salient relationships between concepts across articles. Upon discussion and review of an exported comma separated file (.csv) or Excel file (.xlsx) containing article metadata and their cluster assignments, we determined topics and selected works to include in the curriculum. Topics were labeled, created, modified and/or collapsed to simplify the organization. Altogether, our AI tool extracts the shape of the research topics without having to manually sort through article titles and abstracts. Thus, this framework readily provides a skeleton of topics, subtopics, and their relationships.

Persistent Homology

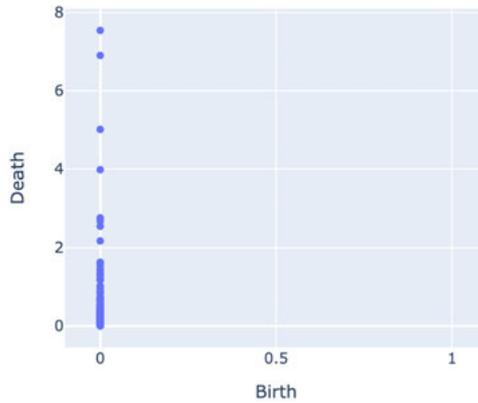


Figure 2. Persistent Diagram of PubMed articles

3. Findings

In the first semester teaching the course, there were 11 topics and some selected subtopics (Figure 3). As a semester is around 14 weeks at Fordham University, roughly one topic can be used for each week and larger or more complex topics are split over two weeks (e.g. Mental Health).

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Disaster <ul style="list-style-type: none"> ○ History of pandemics ○ Syndemic ○ Sociology and aging: Adulthood ○ COVID-19 crisis effects 2. Epigenetics <ul style="list-style-type: none"> ○ DNA methylation ○ Exposome 3. Adverse experiences <ul style="list-style-type: none"> ○ Childhood ○ Adulthood 4. Mental Health <ul style="list-style-type: none"> ○ Digital mental health interventions ○ Suicide mortality ○ Opioid <ul style="list-style-type: none"> ■ Adverse childhood experiences, use behavior ■ Burden of substance use 5. Work <ul style="list-style-type: none"> ○ Among women ○ Work shape ○ School-to-work transition ○ Complex etiology ○ Employment transitions & weight gain | <ol style="list-style-type: none"> 6. Lifestyle <ul style="list-style-type: none"> ○ Unpaid work Norwegian seniors 7. Women <ul style="list-style-type: none"> ○ Intimate partner violence ○ Sustained viremia ○ Maternal <ul style="list-style-type: none"> ■ Preterm births 8. Discrimination <ul style="list-style-type: none"> ○ Coping mechanisms ○ Racial <ul style="list-style-type: none"> ■ Stroke, mortality ■ Cardiovascular ■ Incivility, everyday life ■ Racial configuration, parental couples ■ Sexual minority adults across diverse racial 9. Life expectancy <ul style="list-style-type: none"> ○ Dementia status 10. Linked lives <ul style="list-style-type: none"> ○ Estrangement 11. Old age, Elderly, Frailty, Dementia, Alzheimer's, Sarcopenia |
|--|--|

Figure 3. List of Topics and Subtopics

With the topic list set based on the topology of the life course, the instructor was then able to select readings from each topic, resulting in a comprehensive, up-to-date syllabus. The instructor supplemented a few seminal works to help guide the discussion of the significance of this research from a social context. Overall, the total time for the course creation was roughly two days.

The topological tools also allow researchers to recognize topic connectivity and circularity (identified as loops) as well as research voids. The instructor can use these patterns to discuss the relationships and limitations of data sources with students. The topological network of aging and the life course model clearly demonstrated that understudied groups such as women, racial and ethnic minorities, people who are differently abled or sexual minorities, etc. are often left out of the dominant discourse of research—a significant research void.

4. Discussion

The utilization of AI expedited the process of course development with the most updated research/ readings and positively impacted students. The individual articles covered a myriad of topics relevant to the contemporary experience of students. So much so that discussion easily flowed from week to week as we contended with studies on climate change, early onset ADHD, longitudinal effects of early life adversities (ELA), epigenetic processes, and maternal health from all over the world (Vergunst & Berry, 2022; Nigg et al., 2020; Suglia et al., 2021; Simons et al., 2021; Vedam et al., 2019).

Students' reactions were overwhelmingly positive, even saving articles to help them discuss the realities of mental health with parents or the longitudinal effects of pre-term births with personal doctors (Brenner & Bhugra 2020; Heikkilä et al., 2021).

Every semester students evaluate their courses and below are two anonymous statements from Fordham University Student Course Evaluations (2022) that specifically spoke to the course content:

I really appreciated the way the course was setup—up— with us reading current studies that then relate to the following lecture. The studies having been applicable to current events made the class extremely engaging and interesting.

I really liked the presentations, they were informative and opened my mind up to topics and issues I hadn't really learned about before.

Here are two direct emails from students after the course (2022):

Thank you for such an incredible semester of thought-provoking discussions and readings. I truly learned so much

Taking your class was one of my most fulfilling experiences at Fordham because the discussions and discourse we were able to have amongst peers was a chance to explore deeper thoughts about what shapes us as human beings and what effects are present amongst us in school communities, relationships, work environments, and the world in general.

As an instructor, I seek to teach the courses that inspire this kind of passion in my students, and while I may be an expert in my respective fields of sociology and public health—I do not know everything. However, with the help of this AI-powered methodology, I can enter every semester confident that the research studied in my courses can better prepare my students for life.

Novel data techniques and tools are no longer required just for data scientists but for higher education instructors seeking to maintain relevance and clarity in a rapidly evolving information landscape. Big data is ubiquitous—its overflow causes information fatigue syndrome, a weakening of our ability to think and discern (Han, 2017, p. 60). IBM defines characteristics of big data as having high levels of volume, velocity, and variety (“Big Data Analytics”, 2023). The course taught required deconstructing text data from article titles and abstracts. Typically it would take months to manually extract topics and relationships with moderate success in identifying complex patterns. Furthermore, findings could become outdated during the months of preparation.

To maintain relevance in the present, the COVID-19 pandemic prompted us to integrate other sources of unstructured data (e.g. social media and government sources). Therefore, the methodology is adaptable to any text data source and can be used in other contexts requiring timely and significant research updates, such as the escalating impact of climate change, addressing evolving social crises in psychotherapy, and identifying misinformation in new media.

The limitation of this methodology is that the results are not repeatable as they require an individual to interpret the topological diagrams and knowledge graph to generate findings. However, the expectation is that the user is knowledgeable in the field and that they bring their expertise and lens to unveil an original research narrative.

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New model to evaluate values, beliefs and assumptions in the recognition of prior learning

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Abstract

This research will present the model created for a study on the Recognition of Prior Learning (RPL) in Ireland. This study aimed to identify the values, beliefs, and assumptions operating in RPL between the Assessor, Mentor and Candidate in higher education (HE).

A critical constructivist grounded theory; this paper is focused on the conceptual framework used for the research which adapted Van Kleef's (2007) model of RPL with Schein's (2004) model of organizational culture. Schwartz (2012) theory of values also helped with analysis of any values in the data.

Findings show that similar value systems operate in RPL, with honesty as the primary value, and fairness, openness, and equity also present. The remaining findings and conclusions show that RPL is a challenging field of practice and that resources and training are essential. The assumptions show RPL requires the standards to be upheld.

Keywords: *Values; beliefs; assumptions; recognition of prior learning.*

1. Introduction

Recognition of Prior Learning (RPL) is an important concept in lifelong learning and it refers to an assessment process where value is given for all forms of prior learning; formal, non formal and informal (CEDEFOP, 2018; Werquin, 2010). RPL provides for access to education and for the award of credit. RPL is part of lifelong learning policy development, but there has been little emphasis on understanding the viewpoints of the actors within RPL or the philosophical basis of its practice (Hamer, 2016, Travers, 2017). This research took a critical constructivist grounded theory approach to examine the values, beliefs, and assumptions operating in RPL, aspects of which will influence interactions.

This paper will describe how Van Kleeef's (2007) model of RPL was adapted to provide the theoretical framework required to examine the values, beliefs and assumptions present.

2. Methodology

Grounded theory was chosen as this research focused on the social processes in RPL and the values, beliefs, and assumptions that might be considered significant. This is a relatively understudied aspect of RPL and grounded theory provided the means to report the emerging themes in the data.

2.1. Data collection

This research followed Charmaz (2006) and employed a critical constructivist grounded theory methodology to examine what values, beliefs, and assumptions were present in RPL in a higher education setting.

Semi-structured interviews provided the initial data and the questions were focused on 'what' values, beliefs, and assumptions were important in RPL, and 'why,' this was so. The initial purposive sampling developed into theoretical sampling, and grounded theory techniques supported the analysis of the 82 interviews.

Three rounds of coding proceeded from initial open codes (573), to focused codes (5), and theoretical codes (3). The second round of coding provided the conceptual categories and the primary findings. The more abstract third round of coding provided framework for discussion.

2.2. Theoretical framework created a new model of RPL

The theoretical framework selected Van Kleeef's (2007) model of RPL as the most suitable for this research, as her model combined aspects of adult learning theory and practice and suitably represented RPL (see Figure 1). Van Kleeef (2007) also included values and beliefs in her model while other RPL models in the literature did not (Harris, 1999; Osman, 2004).

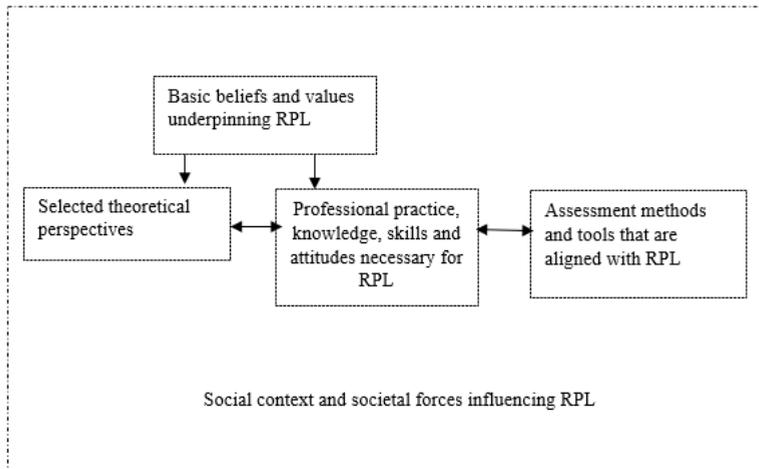


Figure 1. Van Kleeef's model of RPL. Source: Van Kleeef (2007).

To locate values, beliefs, and assumptions within the RPL process, Scheins (2004) theory of organizational culture was employed. Schein's (2004) theory was suitable as the constructs within his model were relevant to the focus of this research (see Figure 2).

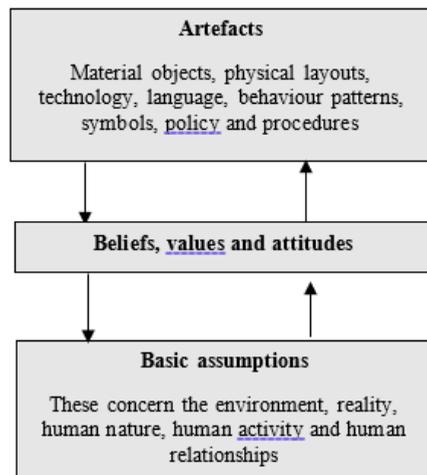


Figure 2. Schein's theory of organizational culture. Source: Schein (2004).

Integrating Van Kleeef (2007) and Schein's (2004) models provided the means to locate the values, beliefs and assumptions operating in RPL in a meaningful way. Figure 3 illustrates this adapted model.

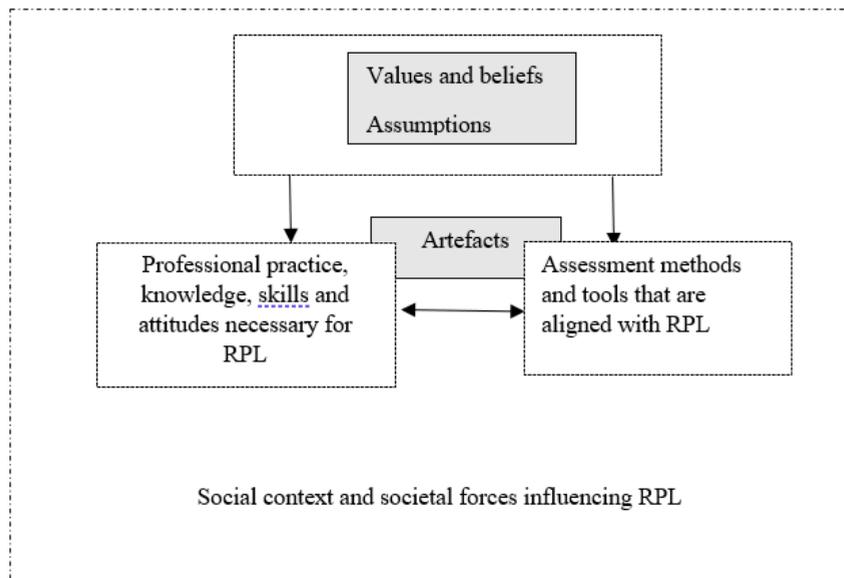


Figure 3. Adapted model of RPL. Source: Schein (2004), Van Kleef (2007).

On the adapted RPL model (Figure 3) each of the elements therein interact to bring about the RPL assessment. And although they are represented here simply, it is a more reciprocal relationship as described by Schein (2004) that occurs in practice. Values, beliefs and assumptions drive the process now and artefacts are represented through the ‘professional practice’ and ‘assessment methods’ of the higher education setting.

In addition to this model (Figure 3), this research employed one more element, Schwartz’s (2012) theory of values which supported the identification of any values arising in the data and the literature. Schwartz’s (2012) model provided a consistent frame of reference and thereby supported the analysis.

3. Primary findings

Due to space limitations this paper only briefly reports the primary findings which were available in the second stage of coding. Here the focused codes were categorized into themes to yield five conceptual categories; the primary findings;

1. The values in RPL; honesty, fairness and openness are to the fore
2. Beliefs supporting lifelong learning and RPL
3. Assumptions; grouped into what RPL provides and upholding the standards
4. Challenges posed by RPL; it is a challenging field of practice
5. Supports for RPL; resources and training are essential

Figure 4 shows how these five conceptual categories were combined into three overarching abstract theoretical codes, providing the most abstract level of reference for the data.

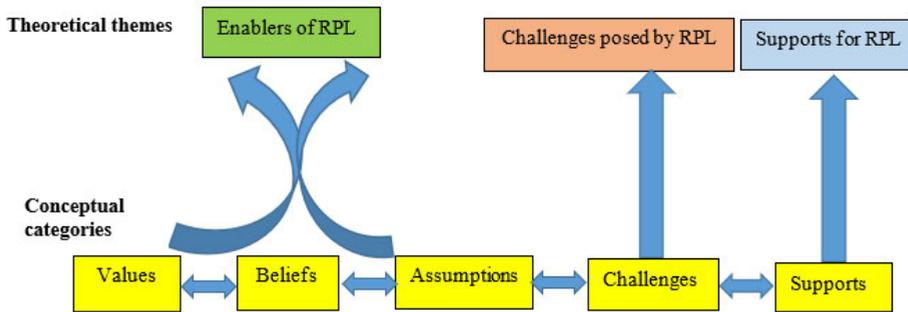


Figure 4. The emergence of the theoretical codes.

Figure 5 locates the primary findings within the adapted model of RPL. A more detailed reporting of the primary findings was not possible within the space constraints of this paper.

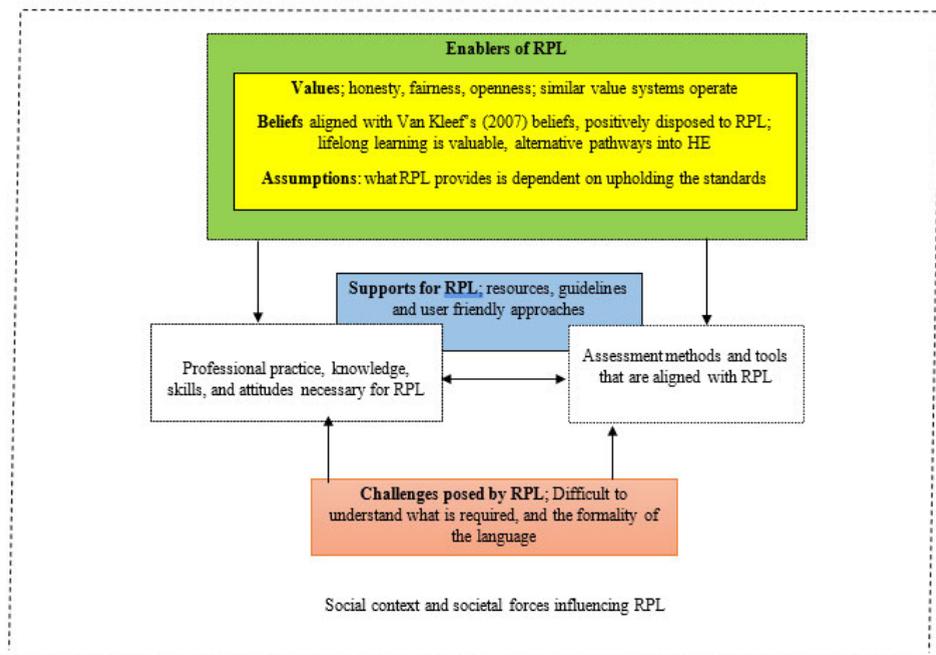


Figure 5. Primary findings in the adapted model.

This paper is focused on Van Kleef's (2007) adapted model which was employed to successfully locate values, beliefs, and assumptions within RPL. The discussion will consider this model.

4. Discussion

The primary findings provided empirical evidence of the values, beliefs, and assumptions present according to the Assessor, Mentor and Candidates in HE in Ireland. While space did not allow for a detailed presentation of these findings, Figure 5 provided a top-level summary. This discussion will focus on the adapted RPL model that provided the conceptual framework for this research.

This research furthered Van Kleeef's (2007) model of RPL by incorporating Schein (2004). Van Kleeef's (2007) original model combined aspects of adult learning theory and RPL practice. She drew from the humanist and critical traditions (Dewey (1938), Friere (1972), Knowles (1970), Mezirow (1978), Kolb (1981), Jarvis (1987), and Schön (1983). Van Kleeef incorporated the knowledge and skills of the RPL practitioner, the assessment, and the social context itself in her model. Significantly, she positioned 'basic beliefs and values underpinning RPL' (p. 13) as key driving forces. She then positioned the remaining elements as interacting with each other.

However, there were limitations with Van Kleeef's (2007) model, the first of which is that she did not position 'assessment methods' as directly influencing 'basic beliefs and values underpinning RPL' (p. 13). It might have been appropriate to do so. The second limitation is that she did not explicitly name the values underpinning RPL, although she did identify her beliefs about RPL in the paper. In this Van Kleeef (2007) stated her belief is that learning does occur outside of HE, and that this learning can be assessed without compromising the standards. A final limitation is that Van Kleeef (2007) did not include the influence of the Mentor or the Candidate in her model specifically, two important additional actors in RPL. Notwithstanding these limitations, this researcher considered Van Kleeef's (2007) model a very good starting point for this study.

In addition to Van Kleeef (2007), this researcher considered Schein's (2004) model of organizational culture useful. It was possible to bring Schein's (2004) insight about the levels of organizational culture into Van Kleeef's (2007) model, thereby locating values, beliefs and assumptions therein.

The grounded theory methodology provided the means to analyse the 82 interviews and Figure 4 illustrates where this analysis culminated. The values, beliefs and assumptions in the data are seen as driving the RPL process. Although space is limited here, this research finds that honesty was the primary value required in RPL according to the participants. There were beliefs in the data in support of RPL and lifelong learning similar to Van Kleeef's (2007). The assumptions show that what RPL can provide in terms of access and credits is dependant on the maintenance of the standards of HE. The challenging nature of RPL provision and the requirements for supports were also foregrounded in the data.

5. Conclusion

Further developing Van Kleef's (2007) model provided the means to locate values, beliefs, and assumptions effectively in an RPL process. The grounded theory methodology identified these values, beliefs, and assumptions in an Irish HE context. The findings have implications for future policy development including the requirement to re-frame the policy discourse to reflect the challenging nature of RPL provision.

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Academic rankings as a source of metrics and benchmark tools for continuous improvement at Técnico Lisboa

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Abstract

Academic rankings not only provide an opportunity to increase visibility and reputation of institutions but also can be used as benchmark tools for quality improvement, despite much criticism of biased coverage and flawed methodologies. As part of the University of Lisbon, Técnico Lisboa – a leading engineering and technology school in Portugal – has monitored and examined rankings through its Rankings Observatory in the context of strategic options, but institutional transformations have been an obstacle to exactly measure Técnico's worth and weight in the context of the University of Lisbon. Those transformations have not contributed to leverage the positioning of the University of Lisbon in major rankings either. This paper discusses the impact of institutional transformations on the University of Lisbon and Técnico in rankings, describes Técnico's attempts to overcome these constraints and gives examples of how it applies rankings as internal benchmark tools towards continuous improvement.

Keywords: *Academic rankings; benchmark tools; quality improvement.*

1. Introduction

The University of Lisbon (ULisboa) acquired its current status in 2013, after the merger of Universidade Técnica de Lisboa (UTL) and Universidade de Lisboa (UL). Among 18 institutions, Técnico Lisboa (Técnico), which was UTL's engineering and technology school, has maintained its name and role in the current ULisboa. This merger has allowed ULisboa to become a 'world-class university', in a trend of recent years in Europe (Docampo et al, 2015). However, it also brought major constraints. Técnico has undergone a decrease in autonomy and diminished visibility and ultimately it has affected its brand identity. It became difficult to exactly measure its performance or establish its 'worth' and reputation, given that the rankings list ULisboa and not Técnico.

In its recently adopted Strategic Plan 2020-2030 (2022), Técnico highlights its ambition 'to become a Europe's leading (top 20) Engineering, Science & Architecture school' by 2030, among other major targets in terms of governance and positioning in the national and European contexts. There has also been a wide internal debate on possibly changing its statutes and adopting a foundational framework, with resulting changes in governance, with more autonomy, more flexibility financially, among other structural transformations.

Despite widespread critique, rankings have been increasingly used by institutions to be part of decision-making strategies or as a benchmarking of quality assurance (Hazelkorn, 2013). This criticism ranges from indicators adopted to the weight some have in scores (Fauzi et al., 2020). Through its Rankings Observatory (Observatory), Técnico has focused on specialised rankings in Engineering and Technology, in its fields and subjects of intervention. It operates as an intelligence unit on these matters, which has sought to overcome existing limitations by using ranking metrics to quantify its contribution to ULisboa, analyse its performance through indicator analysis, and compare Técnico's performance against its peer institutions.

Other limitations still endure. An example of this is the reputational component of rankings, given that some ranking sources have a strong focus on reputation. Reputation surveys (academic, employer) refer to ULisboa and not to Técnico, which makes it impossible to accurately determine Técnico's value and weight, as reputation has a substantial impact on ranking scores, as in QS and THE (Vidal & Filliatreau, 2014).

It is important to note that although the Observatory monitors different rankings, analyses and benchmark exercises focus fundamentally on QS and THE ranking sources.

2. The challenge to overcome the absence of Técnico in rankings

As previously mentioned, one of the major challenges faced by Técnico is the fact that it is not listed in any ranking, and its performance is diluted in the participation of ULisboa. As an added challenge, the merger of UL and UTL led to the situation in which some of the

scientific fields of Técnico are not exclusive. This is particularly noticeable in areas such as chemistry, biology, physics, maths and even in some engineering fields. The attempt to overcome this barrier is to quantify, as precisely as possible, how much Técnico weighs in terms of percentage on ULisboa and consequently to understand how much it contributes to its performance in rankings by subject, in subject areas taught at Técnico.

For this purpose, we chose to look at two dimensions: scientific output (bibliometric data) and volume of students. The former is measured through the volume of publications indexed in SCOPUS whereas the volume of students corresponds to the current number of students enrolled. The subject areas where these dimensions come closest to 100% are those in which Técnico's weight is greater or almost exclusive in the context of ULisboa.

Based on the organization of broad fields in SCOPUS, table 1 provides key outcomes concerning the number of publications of Técnico and ULisboa, i.e. Técnico's percentage of contribution to ULisboa in each subject area.

Table 1. The weight of Técnico Lisboa in the context of ULisboa as per SCOPUS fields.

SCOPUS Broad field	No. of SCOPUS publications (2015-2019) ¹		Weight % (IST/UL)
	Técnico	ULisboa	
Chemical engineering	899	1356	66.3%
Chemistry	1459	2415	60.4%
Computer Science	1180	1650	71.5%
Earth & Planetary Sciences	529	1918	27.6%
Energy	1025	1305	78.5%
Engineering	3502	4106	85.3%
Environmental Sciences	1241	3246	38.2%
Materials Science	1844	2216	83.2%
Mathematics	1035	1180	87.7%
Physics & Astronomy	2735	3871	71.1%

¹ Extractions via Affiliation ID: Técnico (60004956); ULisboa (60106051);

According to the above data, three broad fields taught at Técnico are the greatest contributors to the ULisboa's performance and outcomes: Mathematics (87.7%), Engineering (85.3%) and Materials Science (83.2%). These are followed by Energy (78.5%), Computer Science (71.5%) and Physics and Astronomy (71.1%). The remaining fields account for less than 70%, which suggests that it is reasonable to consider that other ULisboa's institutions, in particular the Faculty of Sciences, significantly contribute to its performance and results.

As regards the volume of students, table 2 provides the volume of students enrolled in Técnico vs ULisboa in the fields taught at Técnico and its weight in the framework of ULisboa, according to the data retrieved from the Portuguese Directorate-General of Statistics of Education and Science (DGEEC).

Table 2. Técnico's weight in the context of ULisboa as per the number of students enrolled in three subject areas, according to the DGEEC classification².

Subject areas	Natural sciences, maths & statistics	Engineering, manufacturing and construction industries	Information and Communication Technologies (ICTs)
Técnico	1130	9624	130
ULisboa	4802	13080	326
% Técnico within ULisboa	23.5%	73.6%	39.9%

The data shows that the number of students enrolled in Engineering, manufacturing and construction industries at Técnico accounts for 73.6% of the ULisboa student population, followed by Information and Communication Technologies (ICTs), with 39.9%.

As for Natural Sciences, Mathematics and Statistics, it is also reasonable to consider that other schools of ULisboa have a relevant contribution and therefore it is more difficult to exactly determine Técnico's weight and standing in ranking sources in these subject areas. This therefore justifies the option for the Observatory to focus on Engineering and Technology sector rankings.

In this regard, it is possible to understand how much Técnico weighs percentage-wise in the context of ULisboa, in subject areas and student population, but these outcomes only reflect an approximate idea of that influence. Finally, it can be said that this is an exercise of trying

² Source: DGEEC database: Students enrolled in 2020/21; Figures relative to 1st and 2nd cycle students

to measure the ‘weight’ of a merged institution in the context of its parent, which could be applied to other examples.

3. Applicability and instrumentalization of rankings

This section discusses and explores some examples of how Técnico’s Observatory applies rankings, namely in the analysis of ranking indicators and scores, and benchmark exercises, which stimulates a quality culture within the institution in its areas of activity, as argued by Berbegal-Mirabent & Ribeiro-Soriano (2015).

3.1. Analysis of indicators and scores

Because the key challenge is to tackle the "non-presence" of Técnico in the rankings, the strategy involves improving the positioning of ULisboa, preferably in collaboration with other schools. In this regard, we would need to be able to accurately understand the impact of Técnico on ULisboa in all indicators, for which access to data (ie. student population, financial data, etc.) from other schools should be needed.

Ranking indicators provide a good comparison tool because they are a common benchmark applied equally to all institutions. Reputation indicators (academic, research and employers) depend on surveys that are conducted among stakeholders. At this level, Técnico’s partners perceive their partnership with Técnico and not with ULisboa. Nevertheless, these surveys are conducted among parent institutions, in this case ULisboa, because Técnico is not eligible for that purpose and its reputation may not contribute significantly to the reputation of ULisboa. A number of indicators should also be defined to exactly measure the weight of Técnico in the positioning of ULisboa and use them as benchmarks for improvement, given that the analysis of indicator scores allows us to identify, for example, underperforming indicators. The examples that follow draw on the latest edition of the THE ranking by subject (2022) in Engineering and Technology. The figure below shows how each indicator evolved in the period 2020-2022.

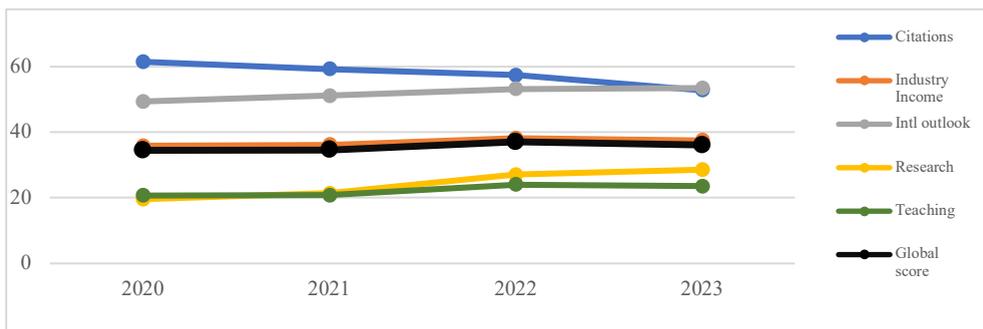


Figure 1. ULisboa performance per indicator and global score. Source: THE (2020-2023).

From the above, it can be said that these observations are critical to identify underperforming indicators or even those which can perform even better. The figure shows that the Citations indicator, which has been constantly decreasing across the 2020-2023 period, should object of concern as it weighs 30% according to the THE WUR by subject methodology.

Table 3 reveals the outcome of an hypothetical exercise of applying a growth percentage to the score of an indicator and, thorough that, calculate a precise rank.

Table 3. An hypothetical approach by applying a growth % to the results of ULisboa.

Name	Global Score	Cits	Ind Income	Intl Outlook	Res	Teach	Inhouse Score	Inhouse Rank
University of Lisbon	36.1	52.8	37.6	53.5	26.3	23.6	36.1	141
A (5% growth)	-	55.4	39.5	56.2	27.6	24.8	37.2	132
B (10% growth)	-	58.1	41.4	58.9	28.9	26.0	38.9	120
C (10% growth in Research & Teaching)	-	52.8	37.6	53.5	28.9	26.0	36.9	134

These results are merely hypothetical and rely on the assumption that the next edition of the ranking would remain unchanged. However, it gives an idea of how the global score and standing would be if we apply a growth percentage in some or all indicators. The inhouse score and rank were calculated by the Observatory, because the THE ranking classifies institutions in bands from the 201st place onwards (201-250...).

3.2. National benchmarking

Benchmark exercises include comparisons with peer universities, either in the national or international contexts. Figure 2 below allows us to observe how the ULisboa globally performed against its peers in Portugal, Universaity of Porto (UPorto) and Universidade da Beira Interior (UBI), in a defined time period: 2020-2023. It reflects the evolution of the global score in the ranking, and it is aimed chiefly at marketing purposes.

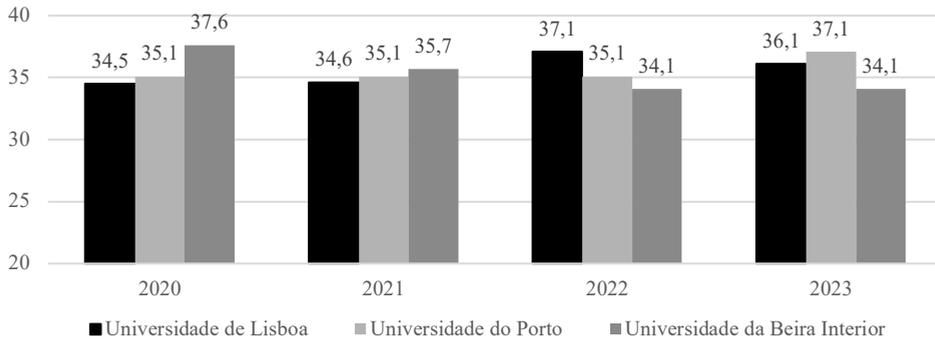


Figure 2. Evolution of global score for the Portuguese TOP 3 HEIs. Sources: THE (2020-2023).

The table below provides the annual mean variation between 2019 and 2023 in each indicator, for ULisboa and Univ. Porto. Based on the percentage rate of growth (or decrease) in that period, we can observe an estimated position for 2024. This can be a useful way of looking at the evolution of the institution during the period in question and take action in advance if a downward trend in the performance of ranking indicators is observed.

Table 4. 2019-2023 variation for ULisboa and UPorto and potential 2024 scenario.

Dimension	Annual Mean Variation 2019 - 2023		Potential scenario 2024*	
	UL	UP	UL	UP
Citations	-3.1%	2.1%	51.2	59.2
Industry Income	2.7%	1.3%	38.6	39.6
International Outlook	3.7%	2.5%	55.5	51.6
Research	8.2%	10.9%	28.5	27.5
Teaching	2.6%	4.5%	24.2	27.8
Global Score	1.7%	4.1%	36.0	38.7

The potential scenario for 2024 allows the governing bodies of the institution to anticipate a likely future estimate if performance keeps the pattern of recent years. It also helps identify priority areas of intervention, according to ranking methodologies.

3.3. International benchmarking

In the pursuit of quality, international benchmarking has also been very important to observe ULisboa's performance in some international networks. Table 4 shows the performance of ULisboa in a network of institutions of Engineering and Technology, CLUSTER, of which ULisboa is part. Among other things, we can track how the object of becoming one of the 20th leading Engineering and Technology institutions in Europe can be achieved or not, and

how these targets may be re-defined. Considering the the scores in each dimension we may clearly underline that reaching the top 20 in 2030 seems to be unrealistic.

Table 4. Performance of CLUSTER institutions.

Rank (Europe)	Rank (world)	Institution	Cits	Industry income	Intl outlook	Res	Teach	Global score
11	50	KULeuven	72.4	96.9	73.7	67	57.7	67.7
12	53	KTH	67.3	64.9	47.2	74.1	72.3	66.2
15	64	KIT	62.6	64.7	81.2	68	65.1	53.7
16	74	Polito	66.7	57.3	55	57.5	59.1	60.3
28	108	Aalto Univ	77.4	53.1	74.9	37.7	45.4	54.5
46	162	TU Darmstadt	48.3	89.7	54.6	47.9	41.8	48.8
70	216	Trinity Col Dublin	74.4	36	86.2	28.4	24.4	44.6
87	261	UCLouvain	54.1	58.6	75.5	28.6	33.7	42.2
90	266	Grenoble Inst. Tech.	46.7	39.9	66	36.3	38	42.1
141	452	ULisboa	52.8	37.6	53.5	28.6	23.6.	36.1
172	541	UPC	40.1	39	52.9	26.3	31	34.1

4. Conclusions

This paper briefly analyses what a subsidiary institution can do to measure its weight within the context of its parent for ranking purposes, as a result of a merger. This need comes from the fact that a potential Técnico position in university rankings cannot be done alone by looking at how the parent university is performing ‘by subject’ because we have to consider the potential input of other schools, specially those who share the same subjects with Técnico, such as as physical sciences, biology, math or chemistry.

Due to these constraints the analysis of rankings undertaken by Técnico, for purposes of its own autonomous strategies and policies, should mainly focus on Engineering and Technology field rankings to determine, as closely as possible, a potential Técnico position on university rankings. The analysis of ranking indicators and scores proves to be relevant to stimulate a quality culture through comparisons with peer institutions, nationally and internationally, in a number of activities, according to ranking methodologies.

As it is a recent activity at Técnico, there is still no visible impact so far in terms of objective results and improvements, however the rankings theme has gained significant awareness among the management board and it has made its way into strategic planning for the next 10 years and has a significant role in quality monitoring by providing key indicators for the

yearly activity plan. Técnico is currently better aware of its performance and position among Portuguese universities.

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Undergraduates as researchers in humanities and social sciences courses: articulating assessment by means of micro and macro cooperative and integrated tasks

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Abstract

The proposal presents an experience of formative-summative and research-based assessment method developed for Humanities and Social Sciences undergraduates. Such assessment experience is organized in micro-tasks that guide the students towards the development of an original and cooperative piece of research, or macro-task. Students are invited to conduct a study with first-hand data and think about the transferability of its results to society and a potential professional future. Here, we describe each assessment procedure and task as well as the tools developed to support the students in the learning process. We also provide examples of the macro-tasks developed by the students, and draw conclusions as regards the effectiveness of such assessment experience. Following a socioconstructivist approach to the teaching-learning process, the method aims at fostering meaningful and contextualized learning and assessment at university, as well as undergraduates' individual autonomy and cooperative skills.

Keywords: *Competences; continuous assessment; cooperative learning; research-based assessment; task-based learning.*

1. Introduction

In the context of today's globalized societies, students are required to acquire multiple competences and skills that allow them to function in the professional world. For that purpose, we designed an assessment experience for Humanities and Social Science students that requires conducting a piece of research with first-hand data and thinking about the transferability of its findings to society. The result has been formative-summative and research-based assessment organized in micro-tasks guiding students towards the development of an original piece of research, i.e. the macro-task. The experience has undergone continuous revision year after year since 2018-2019.

2. A research-based assessment experience

The experience is the result of two teaching innovation projects implemented during academic years 2018-2019 (36 PlaCLIK 2018-2019 2) and 2022-2023 (PlaCLIK, E2022014355) and funded by Universitat Pompeu Fabra. The objective was the design of a research-based assessment method that would foster meaningful learning. Our aim was to give students the opportunity to put into practice what they learn by developing an original research project of their choice and linking its results to a professional area of their interest.

2.1. Pedagogical approach

The proposed evaluation method is based on a socio-constructivist approach to the teaching-learning process (Vygotsky, 1978). As such, the presentation of contents and the demonstration of methods and analyses by the instructor are combined with the leadership and autonomy of the student both inside and outside the classroom. The idea behind our assessment method is that students become self-directed learners, getting involved in the learning process and developing more general skills and competencies than those strictly related to the learning of contents, such as time management, goal setting, self- and peer-assessment, data collection, and resource use, among others (Grow, 1991). A formative-summative type of evaluation and a task-based approach highlight the role of the learner (Skehan 1998; Ellis, 2003; Nunan, 2006). In addition, the eminently practical and collaborative approach to the tasks means that, in this context, the role of the instructor acquires the value of a guide and an adviser in learning. The main aim of such an approach is that students develop those competences that make them autonomous in the analysis of – in our case– intercultural spaces and discourses from a critical, interdisciplinary perspective and, thus, become capable of conducting their own applied research.

2.2. Context and participants

The experience has been implemented in two English-Medium Instruction undergraduate courses – *Discourse Analysis* and *Intercultural Spaces, Languages and Identities* – offered by the Universitat Pompeu Fabra, during several consecutive academic years.

Discourse Analysis is a course shared by third- and fourth-year students from the BA degrees in Humanities, Global Studies, and Political and Administration Sciences. It is conceived as an introduction to concepts and methods for the analysis of oral and written discourses in a variety of disciplines and professional areas such as politics, history, literary criticism, journalism, and advertising, among others. The course aims at the development of students' autonomy in the use of discourse analysis to investigate the relationship between language, author's intention, and social context with a critical perspective.

Intercultural Spaces, Languages and Identities is a course shared by third- and fourth-year students from the BA degrees in Humanities and Global Studies. The objective is to understand socialization spaces that are shared by interlocutors from different cultural and linguistic backgrounds, by exploring such intercultural spaces from a transdisciplinary perspective that includes concepts and methods from critical discourse analysis, educational sociolinguistics, applied linguistics, linguistic anthropology, and social psychology.

Since they are offered in English-Medium Instruction, both courses usually receive a high percentage of international students on either short-term or long-term mobility.

2.3. The structure: Micro- and macro- tasks

As mentioned, course assessment is organized around a macro-task, that is, an applied research project the results of which have to be related to a professional field of students' interest such as public administration, journalism, education, social mediation, advertising, and cultural institutions, among others. To encourage collaborative work, projects have to be carried out in pairs. Students choose their own project partners but choosing a partner from a different cultural and linguistic background is recommended as we wish to promote meaningful intercultural interactions and the integration of international students.

In order to develop this piece of research, students are required to carry out several micro-tasks – both in class and out of class – that will guide them towards the completion of the Final Project Report (i.e. the macro-task). Also, in line with cooperative learning principles, micro-tasks may be done either individually or in small groups, fostering negotiation and co-construction of meanings. Specifically, students are required to do the following micro-tasks:

1. **MODULE ACTIVITIES:** These are tasks done by the students in-class individually, in pairs or in small groups. They include practice tasks related to the theoretical concepts studied in class and linked to each course module, for instance, analyzing interview excerpts in order to detect language ideologies, or thinking about

examples of everyday linguistic profiling. After the activity, results are shared with the group and the instructor, and discussed. When the task cannot be finished in class, students have the possibility to complete it shortly after the session. The Module Activities are compulsory for formative assessment, yet no specific grade is assigned; only the number of completed activities contribute to the final summative grade, accounting for continuous participation. The aim is that students familiarize themselves with terms and concepts specific to the field and learn how to apply them. For instance, two examples of Module Activities are:

- a. Students individually complete a questionnaire taken from the literature and used to collect research data on intercultural sensitivity; then, they critically discuss the clarity and appropriateness of questionnaire items with classmates.
 - b. In small groups, students explore the university's linguistic landscape by taking photos from signs and posters on-site and surrounding areas; then, they share the images in a collaborative online space (i.e. UPF's Aula Global), and conduct a semiotic and discourse analysis that is shared with the whole group.
2. **PROJECT PROPOSAL:** In pairs, students develop a proposal of the research project they wish to carry out. They choose the topic, the research questions and objectives, the kind of data they plan to collect, and the concepts they will use for the analysis. In the proposal they have to include at least one of the course compulsory readings and one of the optional ones as useful theoretical or methodological references for the project. They also have to include, at least, a new reference as a result of an initial documentary research on the topic of choice. The aim is that students develop strategies to plan tasks and to work autonomously with academic rigor. The proposal does not receive a specific grade, but it must be approved by the instructor before the start of the project.
 3. **PEER REVIEWS:** Each student individually has to conduct a critical review of the Project Proposal of another group. Peer Reviews include several related tasks: (a) during a one-hour Seminar session, each student discusses the proposal with its authors and, as a peer reviewer, provides oral feedback; the feedback is reciprocal since this activity is done in groups of two pairs each; (b) peer reviewers prepare individually a one-page-long written peer review of the assigned proposal upon the basis of what has been discussed in class; and (c) reviewers provide oral feedback during the Oral Presentations. The aims of this task are that students become more aware of the elements of a research project, put into practice their critical skills in a typically academic activity, and engage in peer collaboration. Peer Reviews are evaluated by the instructor, but they are made available to the proposal's authors so that they may also be used to improve the project.

4. **ORAL PRESENTATION:** Students in pairs present their project in an advanced state of completion in a conference format and with visual support (i.e. PowerPoint and other materials like audios, videos or images, if necessary). Usually, Oral Presentations are done in-class at the end of the course; however, depending on the number of students enrolled, students may also be asked to record a video of their presentation and share it in the virtual classroom to receive feedback. The aim is that students, in pairs, practice those academic and professional competences linked to public speaking such as, for instance, time management and information synthesis and selection. Students are given suggestions by their classmates, especially by those assigned as peer reviewers. They also receive feedback from the instructor who, afterwards, evaluates them formally.

Consequently, all the assessment activities are interrelated and contribute to the final summative grade that students receive. As such, each micro-task works as a milestone, being functional and essential to reaching the final goal (see Figure 1). Indeed, each assessment milestone, as well as the critical feedback provided by the instructor and the classmates, guide the student towards the development of the final macro-task, that is, the FINAL PROJECT REPORT. For this research-based task, students in pairs have to investigate a real intercultural space of their choice and interest with a focus on language, and collect their own data. The analysis may include such methods and instruments as interviews, focus groups, (participant) observation, questionnaires, discourse analysis of relevant documents, and visual data on linguistic landscape. In doing so, it is compulsory to use theoretical concepts studied in class, as well as those included in the recommended readings for each module.

The research is not to be conducted from an academic point of view but putting oneself in the shoes of a professional such as a journalist, publicist, NGO employee, cultural mediator, or instructor. This professional role is chosen by the students themselves. The project will result in a final written report that, in the future, students may include in a portfolio for potential employers. For this purpose, the report has to include a recommendations section, in which students provide suggestions for those stakeholders that may be interested in their results. Students hand in the Final Project Report after the course is finished in order to have the opportunity to integrate the feedback and suggestions received by the instructor and the peer reviewer(s), as well as all the relevant theoretical concepts tackled during the course.

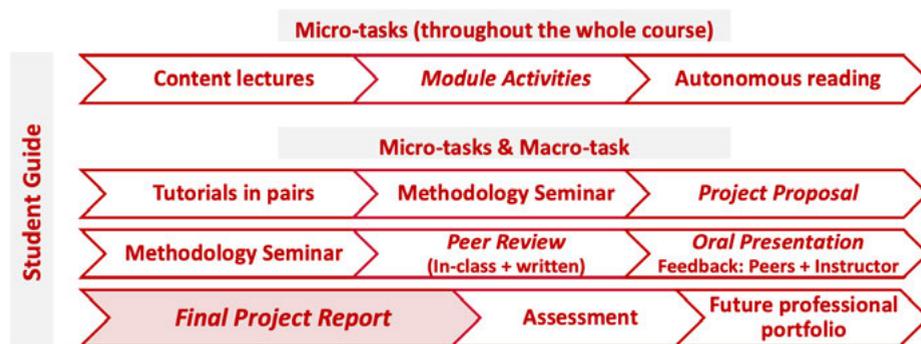


Figure 1. Design of the assessment method. Source: Own elaboration.

2.4. Guiding the students: Student Guide, seminars, and rubrics

In order to guide students towards the successful completion of each assessment task, we developed a comprehensive Student Guide, providing detailed instructions and recommendations on the content and form of each activity. Such Guide may be found in the virtual classroom since day one, along with a detailed calendar of the sessions and deadlines, and examples of studies conducted in intercultural spaces that support the students in becoming acquainted with both useful theoretical concepts and research methods.

Also, two one-hour Seminar sessions are explicitly devoted to the development of the micro-tasks (i.e. Methodology Seminar in Figure 1), providing examples and guidelines for the elaboration of the Project Proposal, Peer Reviews, and Oral Presentation. During these sessions, students have the opportunity to ask questions and clarifications, as well as share their research topic with their classmates. Anyhow, after each task, the instructor provides individualized feedback to the students, either in class or in individual or pair tutorials.

Furthermore, the Final Project Report is evaluated following an assessment rubric that is shared with the students before the submission of the final product, and that may serve as a self-assessment tool. Indeed, in our model, self-assessment functions as a counterpart to formative and summative instructor assessment and an essential activity of the learning process. Similarly, the course includes a rubric for the oral presentation that both the instructor and the peer reviewers use for assessment and peer feedback.

3. Examples of students' research projects

In order to illustrate the variety of projects carried out by the students, we present here a selection of five of the most successful Final Project Reports. For each of them, we report the title, the professional role undertaken by the students, and their chosen stakeholders:

- *The exchange student experience at Universitat Pompeu Fabra*: Students assumed the role of Program Consultants expert in academic mobility and, after their research, provided suggestions for the Office of International Affairs at the university.
- *Attitudes and acceptance towards the South Korean community and 'Hallyu Wave' within Catalan media and multicultural society*: Students assumed the role of journalists and cultural consultants, and the recommendations were directed to South Korean entertainment companies, cultural entities interested in South Koreans' integration in Catalonia, and the Catalan media.
- *Linguistic identities: The use of Spanish in informal intercultural spaces in Barcelona*: Students acted as reporters and cultural mediators, and offered suggestions to universities and their language programs as well as the Barcelona's city council .
- *Students' language attitudes towards ordering at the UPF cafeteria*: Students acted as researchers specializing in interculturality, and recommendations were offered to the Mobility Office at that university, the administration, and the cafeteria staff.
- *Political discourse and linguistic landscape of graffiti in the city of Barcelona*: Students took the professional role of anthropologists at a government institution like the town hall. Stakeholders profiting from the outcome of the study would potentially be local authorities and politicians who can use the information "to apply measures that may improve the quality of life of the citizens or generate a positive social change".

4. Conclusion

The experience presented here is the outcome of four years of teaching to three different cohorts of students of *Discourse Analysis* and four of *Intercultural Spaces, Languages and Identities*. At the each term, the instructor modified their methodology and evaluated its impact, as regards the learning process and the students' workload¹. An in-depth analysis of this constant revision process and the degree of satisfaction of the instructor and the students –who assessed the instructor and the sessions every year– deserves another communication or article. However, although the experience has entailed a high degree of dedication and work by the instructor, we consider the proposal highly satisfactory for several reasons.

First, such research-based assessment method provides students with the opportunity to reflect on how the knowledge acquired in the university context and as a result of academic research can be useful in the real and professional world. Also, it allows them to put into practice theoretical concepts and developing skills and competences related to academic

¹ Though students' evaluations were always extremely positive in all survey items, the survey item "The workload required corresponds to the credits of the subject" always received a lower grade, i.e. 8.7 on a ten-point scale in 2019-20, 7.9 in 2021-22, and 8.9 in 2022-23.

research, such as time management, respecting deadlines, data collection and structuring and carrying out an autonomous research project.

Second, the method puts the students at the center of their autonomous learning process. Also in content lectures and methodological seminar sessions, students have a focal role, since they have to acknowledge the relevance of such content for successfully carrying out each task. As such, the process highly satisfies the students, as shown by the average degree of satisfaction expressed in their teaching evaluations².

Third, it encourages contact, interaction, and collaboration among students from different degrees and diverse academic and professional interests, by promoting co-construction of meaning and knowledge. Also, in the case of the *Intercultural Spaces, Languages and Identities* course, the assessment method allows for the interaction between students from diverse linguistic and cultural backgrounds and, thus, the development of plurilingual and pluricultural competences which, in turn, constitute part of the course contents.

Fourth, since the whole process requires more individualized instructor-student interactions in class and out-of-class tutorials for guidance, it allows for a better understanding of students' interests and needs. As a consequence, the instructor may develop content and activities responding better to those needs, while creating a relationship of mutual trust.

Finally, this assessment experience may be tailored to other teaching contexts, as demonstrated by the rapid adaptation to online teaching during the mandatory lockdown established due to the COVID19 pandemic between March and June 2020, fully coinciding with one of the courses and resulting in extremely positive evaluations by the students.

Lastly, we wish to conclude by quoting Claudia who, when evaluating the *Discourse Analysis* course, wrote: "Overall, I've appreciated the general organization, content and activities of the course. In particular, I found useful and engaging the peer-assessment system. I also found refreshing the clear and ordered presentation of the content seen in class, the assessment deadlines and the evaluation criteria."

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² In 2019-20, the mean grade given by the students was 9.23 for the survey item "In general terms I am satisfied with this subject"; in 2021-22, it was 9 and, when assessing the instructor, 9.62; in 2022-23, the mean grade for overall satisfaction was 9.6.

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Threshold tests as a way to encourage long-term, self-regulated learners in engineering

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Abstract

Traditionally, educators evaluate the effectiveness of a new assessment in a pre-requisite early subject via pass rates, grades and student satisfaction. It may be more appropriate to measure the impact on student results in later stage subjects. In this work we report on the impact of changing assessment, over 10 years, at a metropolitan Australian university for an initial calculus subject (Mathematics 1) on two follow-on subjects: Mathematics 2 and Fundamentals of Mechanical Engineering. Earlier research found that Online Mastery Tests can harm later learning outcomes even though failure rates drop within the pre-requisite subject. Here we show that Paper Threshold Tests, requiring greater engagement, metacognitive strategies result in fewer passes in the pre-requisite subject however, they were also resulting in a major inversion of the grade distribution toward higher grades in the follow on subjects where 60% of students now obtain marks > 75%.

Keywords: *Assessment; mastery learning; progression analysis.*

1. Introduction

A university education serves multiple purposes including providing a strong foundation in the field of choice, transferable practical skills, critical thinking skills, and networking opportunities. The underlying objective is the creation of lifelong learners who have the capability to keep up with advancements in their field and to adapt to changes in their careers (Nilson, 2013).

However, many students commence university only having mastered surface learning techniques, resulting in an erosion of learning and decay of knowledge/ learning loss between semesters (Dills et al., 2016). To combat this, assessments should be designed to encourage students to develop deep learning approaches to maximise knowledge retention for application in the subsequent subjects in the next semesters.

As university subjects often have large enrolments ($n > 500$), it is not feasible to personalise subjects for each student. Instead, assessments should be structured to allow students to develop the learning skills to progress through Bloom's taxonomy (Bloom et al., 2001) moving from recall, to understanding, application, evaluation and creation.

This work examines the impact of the type of assessment used in a pre-requisite mathematics subject at an Australian university on students' long-term retention of concepts and their ability to transfer their learning to subsequent subjects. The focus will be on the comparison of Online Mastery Tests (OMTs) and Paper Threshold Tests (PTTs) in the first-year calculus subject, Mathematics 1 (Math1) and their impact on the grade distribution in the two following subjects, Mathematics 2 (Math2) and Fundamentals of Mechanical Engineering (FME). The investigation covers a ten-year period, with the latter subject (FME) having remained unchanged in delivery or assessment. This work had human ethics clearance (HREC 17-1158).

2. Assessment structures

2.1. Math1 assessment and within subject performance

Math1 is structured to run over 12 weeks where there are 11 weeks of lecture material and 11 weeks of associated tutorials, and in some years, computer labs. Math1 is offered in all three study sessions. Session 1 (S1) has the largest intake and consists primarily of students attempting the subject the first time. Session 2 (S2) includes repeat students and students who had completed Foundation Mathematics (FM) before attempting Math1. Session 3 (S3) was introduced in the summer of 2017 to give students a chance to catch up on Math1 if they had either failed or completed FM in S2.

Between 2008 and 2020, assessment in Math1 was altered in an effort to improve learning outcomes and pass rates. The first three iterations included a 40% Compulsory Final Exam (CFE), one (later two) Class Tests (CT), weekly review questions called Routine and Review Sheets (RRS) and Mathematica Computer Lab Participation marks (CLP) .

The fourth iteration of Math1 assessment was the most significant change, which introduced Online Mastery Tests (OMTs) through the Webassign online platform. These tests were a combination of Mastery learning (Block & Burns, 1976) and Keller Plan/Personalised system of instruction (Rae, 2011). The concept behind Mastery Tests is that if students have a strong grasp of fundamentals, then they can tackle more complex concepts. These tests can be repeated (within reason) to give the student the time to attain proficiency.

It was required that students obtain 80% in each of four OMTs. Students were given three opportunities to attain the 80% requirement in each of the four OMTs. The first OMT was on assumed knowledge and was worth a nominal 5%. The following three tests covered 2 to 3 weeks of content over the first 8 weeks. It was possible to attain a pass in Math1 by attaining the minimum requirement in each of the OMTs and an Optional Final Exam (OFE). OMTs only required a final answer to be submitted whilst OFEs required fully worked solutions.

In S2 2017 the OMTs were replaced with the paper equivalent, Paper Threshold Tests (PTTs). The Math1 assessments and weighting are listed in Table 1.

Table 1. Assessment iteration in Math1, session and years used and assessment breakdown.

Iteration, Session & Year	Assessment Breakdown and percentage weight		
	Quiz/Assess	Mastery test	Final Exam
1. S1 and S2 2008	5% RRS, 25% CT, 10% Assignment	-	60% CFE
2. S1 2009	10% RRS, 25% CT, 5% CLP	-	60% CFE
3. S2 2009 – S1 2014	10% RRS, 25% 2×CT, 5% CLP	-	60% CFE
4. S2 2014 – S2 2016		62.5% OMT	37.5% OFE
5. S1 2017		48% OMT	52% CFE
6. S2 2017 – S3 2020		50% PTT*	50% CFE*

Note: * Note weightings changed to 50/50 Autumn2018).

The grade distribution in Math1 for each assessment iteration is given in figure 1 where F:Fail (<50%), P: Pass(50–64%), C:Credit (65–74%), D:Distinction (75–84%) and H: High Distinction (85–100%).

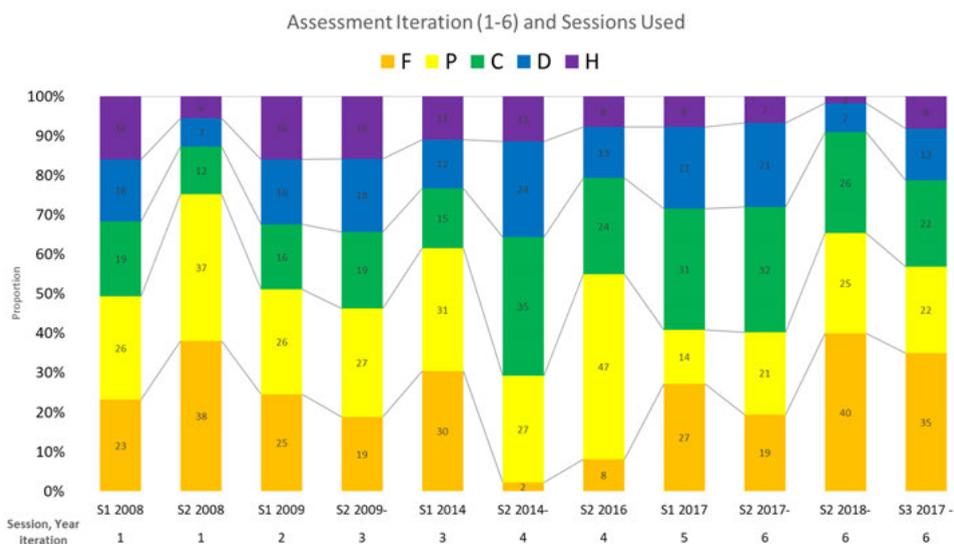


Figure 1. Grade distribution in Math1 with assessment iteration (as outlined in Table 1) and session

The introduction of OMTs in iteration 4 (S2 2014) resulted in a significant drop in fails. Although this decrease seemed positive, tutors began to report that students were just pattern matching instead of fully understanding the material. This minimal approach carried over into Math 2 as well, according to a progression analysis by (Coupland et al., 2017).

Considering these findings, Math 1 assessment underwent a 5th iteration, in which a minimum requirement was introduced for the Compulsory Final Exam (CFE) - now requiring fully worked solutions.

Figure 1 shows the reintroduction of a final exam (iteration 5-S1) resulted in a significant increase in fails. The graphed data is the result after a supplementary exam was given. Pre-supplementary exam the failure rate was 46%. It was concluded that OMTs were not supporting learning of the subject material. Discussions with 80% (n=100) students who attempted the supplementary exam showed that OMTs did not align well with final exam expectations. Students believed they were doing well due to high OMT scores (80%+) but did not invest extra effort on the final exam. Furthermore, OMT only required final answers whilst the final exam required fully worked solutions.

In iteration 6 (S2 2017), OMTs were replaced with PTTs. It should be noted the only other subjects taken in common during their starting semester, Chemistry and Physics, had little change in delivery at the time PTTs were introduced.

As with the first OMT, the first PTT also examined assumed knowledge. The first test was administered in weeks 1 and 3 to give students a chance to either revise or withdraw before

census date in week 4. A score of 80% was required to pass. The questions were structured to reflect the sequence in which the material would be covered in the subject. Throughout the semester, the test was referred to as a reminder of the assumed knowledge.

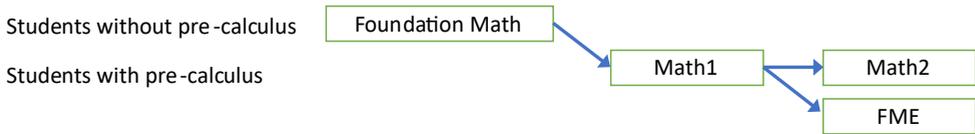
The last three PTTs examined 2 to 3 weeks of content at a time, covering the first 8 weeks. Tests had similar questions to the OMTs, however students were required to show complete working/reasoning where a question was given more than 1 mark.

These tests examined general procedural knowledge and application. Application was included to place the mathematics in context and to break the habit of using only “x, y, z” as variables. These tests had a threshold requirement of 70%. As with the OMTs, students were allowed to sit the tests three times in order to achieve the required mark. Tests were administered in the second hour of a two hour tutorial, with feedback given a week after the first attempt of each test.

From figure 1, it is clear that the introduction of the PTTs resulted in a significant increase in failure rate. However, grade distribution within a subject and low failure rate may not accurately measure the quality of the learning outcomes.

2.2. Progression Analysis

An alternative approach is to examine the impact of Math 1 performance on the subsequent subjects. A typical mechanical engineering student math program is as follows:



Math2 has undergone a number of assessment iterations. For clarity, we have labelled these iterations A, B and C. These are listed in Table 2 and Figure 2.

Table 2. Assessment iteration in Math2, session and years used and assessment breakdown.

Iteration, session, years	Assessment Breakdown and percentage weight	
A. S12008 – S3 2013	30% CTs, 10% Assignments	60% CFE
B. S1 2014 – S1 2017	62.5% OMTs	37.5% OPE
C. S2 2017 – S3 2020	52% (50%*) OMTs	48% (50%*) CFE

Note: *weight change in S2 2017

The grade distribution data in Math1 from 2008 to 2018 is presented in figure 2. The data is grouped based on differences in assessment and iteration. Note that fails in Math2 were high before the inclusion of OMTs (iteration 3B).

The introduction of a compulsory final exam in Math1 (iteration 5C) shows a shift to higher grades (D/H) in Math2. It is unclear however whether this shift occurs because of the introduction of the compulsory final exam in Math 1 (iteration 5C) or the introduction of the compulsory final exam in Math 2 (iteration 5C/6C).

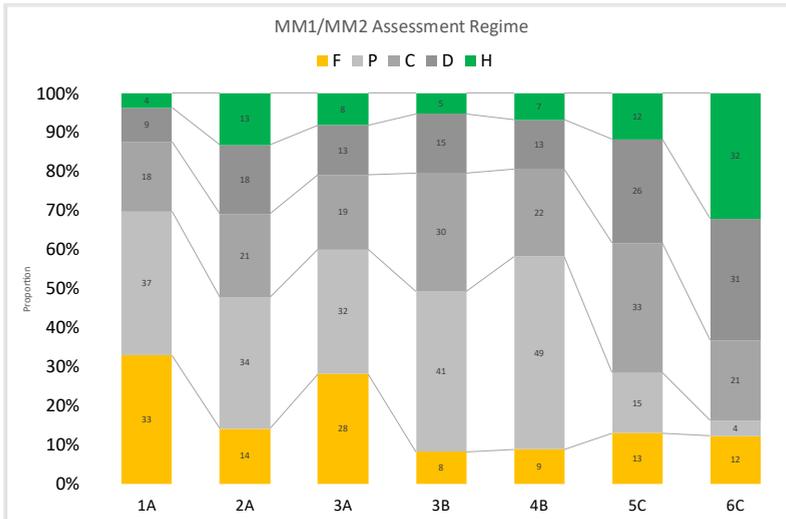


Figure 2. Grade distribution in Math2 with both Math1 assessment (numbers) and Math2 assessment (letters)

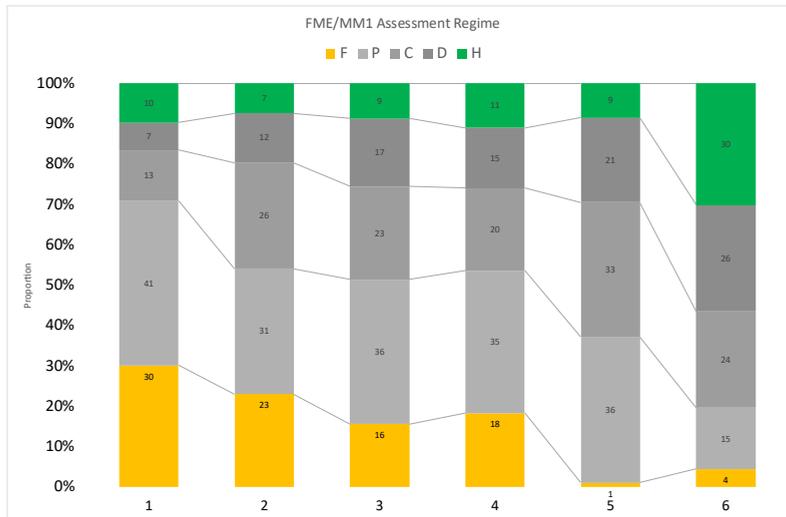


Figure 3. Grade distribution in FME with Math1 assessment iterations

A better indicator is FME, where the subject assessment has not changed appreciably during the time of analysis. The inclusion of the final exam in Math1 (iteration 5) resulted in a dramatic reduction in FME fails and the introduction PTTs in Math 1 (iteration 6) resulted in significant increase in higher grades (D/H) as per Figure 3.

The introduction of PTT's in Math1 lead to a significant improvement in student performance in both Math2 and FME, as shown by the grade distribution in Figures 2 and 3. This resulted in over 60% of students in Math 2 and 55% in FME achieving a Distinction or higher and demonstrates successful transfer of knowledge applied to subsequent subjects.

Furthermore, the delivery of Math 2 was almost identical for 5C and 6C highlighting the impact of the effect of Math1 assessment on Math2. Moreover, the results in FME indicate that students were competently applying the mathematics that they learned in Math1 to a subject in the Engineering Discipline.

This grade inversion was found to be robust for students coming from Math1 from S2 2017 to S12019 into Math2 and FME from S1 2018 to S2 2019 indicating the learning outcomes were not a one-off phenomenon and skills were transferable to follow-on subjects.

The most important aspect of PTTs is that they were only used in a first semester subject, yet the learning outcomes and skills were carried into follow on subjects without PTTs. This suggests that the assessment methods used in the first semester play a crucial role in determining a student's approach to learning in subsequent semesters.

PPTs effectively promote deep learning by encouraging the use of metacognitive strategies instead of surface rote learning (McGuire, 2018). Use of application problems require students to identify important information, use mathematical concepts, and demonstrate their thought process through clear worked solutions and evaluation of the results.

Furthermore, the timing of the three tests follow Nilson's (2013) recommendation for the development of self-regulated learners. The first test provides an initial evaluation of the student's knowledge and effectiveness of their learning approach, with feedback in the following week to encourage an early start. The second test two weeks later allows the student to reflect on the change in their learning approach. The final test at the end of semester offers a chance to refine their learning approach, helping them to build and retain their mathematical skills.

3. Concluding remarks

We demonstrated the effectiveness of PTTs in a first-year calculus subject by analysing progression data to improve learning outcomes and ensuring long-term retention of knowledge. The results showed the importance of implementing PTTs in early semester subjects which can have a positive impact on subsequent subjects.

However, there are drawbacks to using PTTs. Creating 12 distinct PTTs, solution sets, and marking criteria is a time-consuming process, and more versions are required as class size grows to maintain academic integrity. This requires more institutional support for this form of assessment such as appropriate workload allocation and additional resources.

PTTs were difficult to administer during COVID (2020) where S1 had 800+ & S2 300+ students. Due to cost of invigilation for multiple tests, a PDF download/upload approach was taken with reliance on student honesty. Unfortunately, some students cheated, leading to changes in assessment for 2021, and the impact is yet to be analysed.

Learning conditions and quality at many universities have declined due to cost constraints. From this research, investing more resources in first year can have a significant impact on student success in later years by creating independent learners with better long-term outcomes.

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The PASSt project: predictive analytics and simulation of studies aimed at quality management and curriculum planning

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Abstract

Quality management has become a crucial factor for improving student success, with reporting being widely used to scrutinize curricula for possible bottlenecks and resource deficiencies. Predictive capabilities in that context have, however, been often limited to simple regression models acting on historical data, which might not always be available when curricula change often; furthermore, work in curricular planning often demands “what if”-scenarios that are beyond extrapolation, such as determining the influence of changes in procedure on student success, which in itself is based on a multitude of intertwined factors such as social background and individual performance. In the PASSt project, we have been using Machine Learning and Agent-Based Simulation for Predictive Analytics in that sense. As a result, we have been developing an extensive toolset for curriculum planning which we want to outline in this paper, together with some lessons learned in that process. Our work will help practitioners in higher education quality management implement similar methods at their institutions, with all said benefits.

Keywords: *Data modeling; machine learning; agent-based simulation; predictive analytics; quality management; curriculum planning.*

1. Introduction

Reporting is nowadays commonplace in higher education quality assessment: On the one hand, this allows for a guidance of the curricular planning process, on the other hand such assessments are also prescribed by governmental regulation (e.g. the EU “Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG)”, see ENQA 2015). Digitalization has been long lagging behind requirements in that area, with data repositories primarily serving study administration but not analytics; as a consequence policy makers have explicitly made Digital Transformation in that area a priority (e.g. the EU “Digital Education Action Plan” [EC 2018], especially “Priority 3: Improving education through better data analysis and foresight” [ibid.]).

In the course of the PASSt project, we have been extending the scope of study analytics at the partner universities to prediction using Machine Learning and Simulation while at the same time improving the data basis. This paper reports on the toolset we developed in that course for curricular planning and quality assurance, and gives some lessons learned for people seeking to implement similar measures in their institution. In more detail, we:

- Initially define activity dimensions within curricular planning and quality assessment, both acting as our requirements and context (Section 2, “Background”).
- We then review work that is similar in aim or outcome (Section 3, “Related Work”).
- Next, we describe the data basis that is an outcome of a lengthy discussion process between project partners and a wider field of universities (Section 4, “Base Data”).
- The core of our contribution herein lies in the description of our curriculum planning toolset (Section 5, “Developed Toolset”) on the curriculum and aggregate level.
- Before concluding, we also discuss some lessons learned (Section 6, “Discussion”).

2. Background

Our work is aimed at supporting curricular planning in study committees typically headed by the provost/dean of studies, where work typically happens on the following two design levels:

Curriculum: View of a whole study with strong focus on amount of students (input/output, dropout rates), sequences of courses in different phases (e.g. introductory phase, intermediate phase, finishing phase) and semester-wise view of throughput through this system of these lectures implicitly or explicitly connected by their preconditions.

Lecture: View of an individual course in terms of its location within a curriculum (prescribed vs. actually taken semester), capacity (number of examinations per semester), type (lecture, lab, seminar, etc.; mandatory, elective or optional), success rate (as a function of numbers of times already taken; or curriculum if the course is shared between multiple studies), credits granted for successful completion, periodicity (one-time, every semester, every year, every

two years in seldom cases), temporal view of course utilization by students, rules for accreditation, preconditions for inscribing to a course, and so forth.

Even though many of these factors are beyond planning (e.g. number of students starting their studies), many can be influenced implicitly using the following action dimensions which are, quite interestingly, situated only at the lecture level:

Location within the curriculum and preconditions for lectures. An attribution of study phase (beginning, intermediate, finishing phase) ensured by preconditions is selective with regards to students opting in (or out, e.g. by not continuing a study; while this may seem cruel many of the efforts go towards self-awareness over whether a study is suitable for a student or turns out to be the wrong choice). Another aspect is the semester in which students actually take a lecture (vs. the prescribed semester), since this has to do with the perception of students and the success rate (more in due course for the latter).

Capacity. This dimension is occupied with the capacity of lectures in terms of examinations per semester as well as the capacity for students seeking to enroll; many social and effort-wise questions range into that field and are enforced by specific rules (e.g. not being able to take two large lectures that have project character in one term). Where resources are scarce capacity may also be changed by changing periodicity.

Success rate. Students are sometimes impeded by lack of previous knowledge, in which case additional lectures on basics (“introduction to ...”) or shifting lectures from one semester to the other can be used to raise success rates; on the other hand, there might be reasonable doubts on fair assessment by lecturers, which must be further addressed in the process of quality management.

Clearly there is also a *social dimension* in all of this; for example, taking one’s mouth too full will result in a danger of dropping out, and therefore the aim must also be on ensuring that a curriculum is adequate in the light of different target groups which must be empowered to study at their own pace. Even though the project is not focused on individual feedback, we have the option to simulate individual study performance [in credits] based on different (also: *social*) characteristics, which gives a more realistic model of maximal effort invested.

3. Related Work

As said, our work is targeted at curricular planning rather than student self assessment or individual feedback which a lot of approaches seek to facilitate. Some of the examples of the latter include the Ingram (2020) agent-based classroom lessons model, which is an example of Agent-Based Simulation on the individual level, but does not offer general insight for further study analytics. In fact, we are convinced our Agent-Based Simulation is the first of its kind, from having researched the literature to the best of our knowledge. Research

analytics with the intended goal of curriculum planning is also novel; there are a handful of approaches which try to understand curricula in higher education – e.g. De Silva et al. 2021 – however there is lack of a tool approach as novel methods proposed but not implemented.

4. Base Data

Universities are very different in terms of what they assess in their administrative processes on which study analytics builds; therefore it was necessary to negotiate, in view of this project’s goals, what data should be included in a “common data structure” serving as base data for futher analysis among all project partners. The outcome (also compare with Figure 1) is structured as follows:

Base Entities. *Students* (sid) and *Lectures* (lid, title, name, type, credits) with their metadata. Several *Curriculums* (cid, ...) are also present, which are to be outlined in due course.

Linking Relations. *Lectures* are assigned to a *Curriculum* by the presence of a *Curriculum Assignment*; this is, however, a theoretical assignment; the actual realization of that relation is the *Study*, which links a *Student* to a *Curriculum*. In this course a student takes an *Examination* for a *Lecture*. The outcomes and semester of this examination are further taken by us to infer additional data (semester actually taken; distribution of semesters taken; success rate; periodicity and base semester [winter or summer term]; capacity of a lecture).

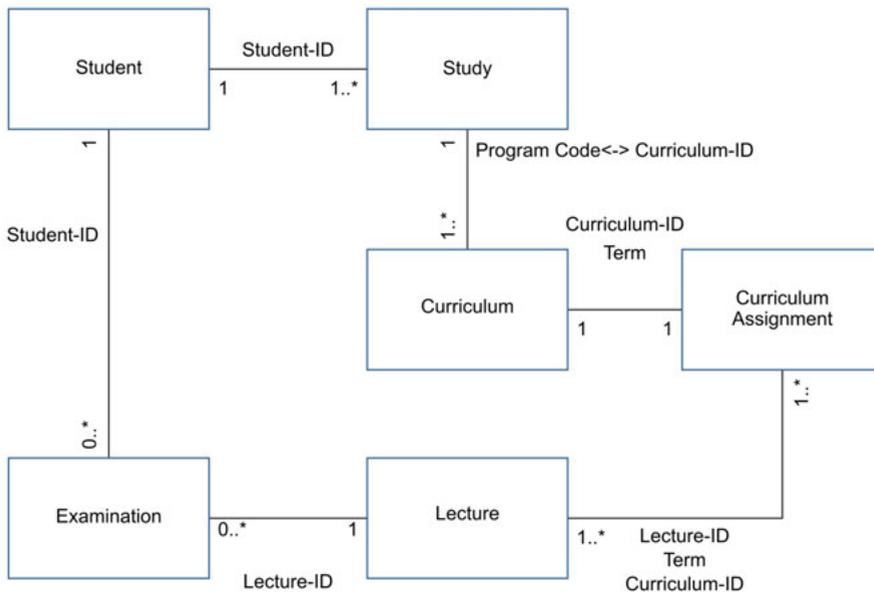


Figure 1. Base data structure for the PASSt project.

5. Developed Toolset

Based on the *Examinations* within the base data, we can infer the actual semester distribution of *Lectures* within a *Curriculum*. The most frequent semester (see red bar in the left part of Figure 2) is then used to build up replica of a curriculum (lectures in semesters, see background table in the left part of Figure 2) that can be simulated by use of Agent-Based Simulation, where each agent represents an individual student. The student numbers are inferred from *Study* within the base data, and can be altered to simulate “what-if” scenarios (see right part of Figure 2). Likewise, capacities of lectures (examinations/semester), type (mandatory, elective or optional), success rates (likelihood of students successfully taking a lecture), periodicity (one-time, every semester, yearly, every two years) and anchor semester (winter or summer) are inferred from *Examination* and *Study*. Student performance (maximal effort in credits/semester) can either be inferred from the mean credits of all students per semester (see again right part of Figure 2), or using a Machine Learning prediction of credits based on individual factors such as (ordered by importance) credits in previous semesters, education background, existence of multiple studies, gender and citizenship (more details cf. Spörk et al. 2021 [in German]).

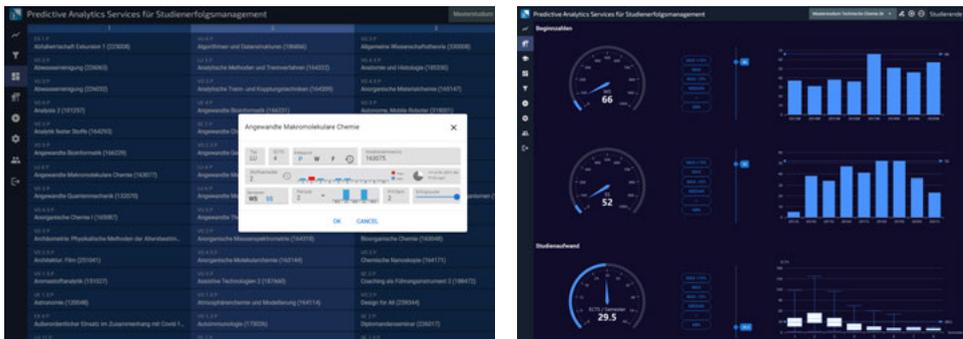


Figure 2. Simulation Input. (left) Curriculum with one lecture being currently edited, (right) number of students in winter and summer cohort, number of credits taken per term

Given their maximal performance, students seek to enroll in lectures and take examinations (subject to maximal capacities = lectures as servers with queues; examinations governed by the aforementioned *success rate*). As outcome, we can observe the semester-wise utilization of a curriculum where most prominent lectures are highlighted in tabular form (left in Figure 3) or visualized as a sim “semester tunnel” (right in Figure 3).

In addition, we have been developing a portal that lists aggregate measures for a whole curriculum (see Figure 4): There we depict student beginner numbers, performance in credits, and status (active, completed and aborted per semester). Furthermore, we have the regulatory measure of “examination-active” students (i.e. more credits than a certain credit threshold).

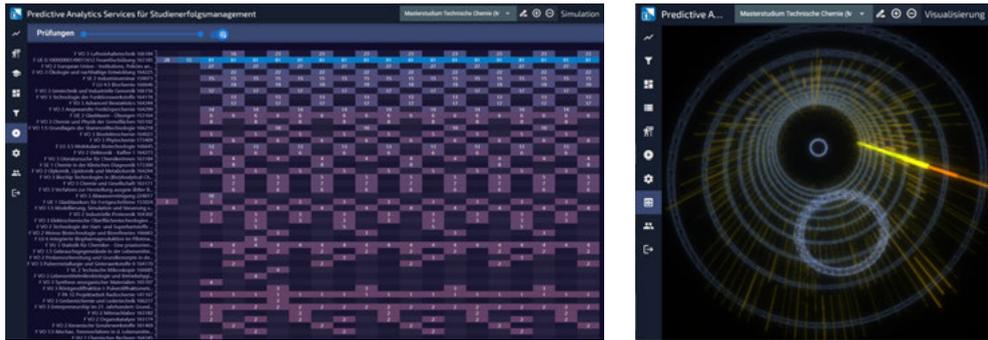


Figure 3. Simulation results. (left) Tabular depiction of utilization, (right) visualization as “semester tunnel”

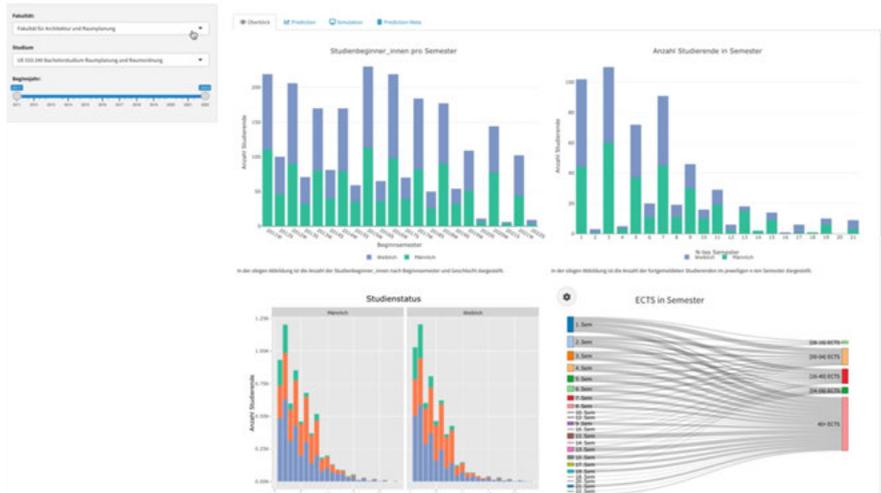


Figure 4. Portal depicting aggregated view per curriculum.

6. Discussion

The developed curriculum simulation is a queuing system with servers = lectures and clients = students with individual amounts of credits (mean credits or determined by Machine Learning). The question is whether that is “realistic” or not. Analysis of actual examinations show that there is a Poisson-curve-like utilization of lectures, where students take less than their maximal amount of credits in the first semester followed by more than the maximum before the performance decreases based on study success and remaining credits to be made. This behavior can be modelled in the simulation, however not as emergent outcome but as a prescribed utilization curve; the cause for this is still an open question, or is this effect because of examinations being taken one semester too late (and thus it would appear that students

have more effort in the second rather than in the first semester). Regardless, one sure take-away is that it would make sense to reward studying uniformly, since no resources are wasted.

It would seem that our approach results in a “recommendation engine” that automatically proposes the best way to increase student success and studyability; however, this is not the case; the most important contribution of our work lies in bringing the numbers to the table; a discussion is always needed since each study commission knows its “problematic” areas, and solutions are based on many factors (but we are contributing some ground truth, of course). In this context, we also wish to emphasize the role of the aggregate views available in the portal (see again Figure 4), which add an overview of the base data per curriculum (filterable also per semester) as well as a prediction component (e.g. predicted ECTS/semester).

In practical terms, our toolset offers an unprecedented data density for *evidence-based curriculum planning*, as we would call it: We have *reporting* based historical data, *prognosis* based on Machine Learning and/or extrapolation of the former (e.g. linear regression); we also support “what-if” type of capacity planning using our *simulation*. The intended audience of such tools ranges from study commissions over provosts/deans to the university management, at which level benchmarking and goal-setting is important not only because one wants to improve studyability but also since may be connected to financing (e.g. via objective agreements set by the state).

“*The ultimate goal is to help HEIs quality management processes and procedures*” summarizes what we aim for best (thank you to reviewer 3 for that perfect one-liner). However, as also noted by the same reviewer, care must be taken as to not employ these methods in order to single out lectures with adverse intents, or (as we would also add) to give a negative prognosis on an individual level. Therefore, an integral part of the PASSt project is to also look at the ethical and legal implications when applying that technology, resulting in a legal guide (e.g. pseudonymization as requirement) as well as a *Code of Practice* document which states what computations may or may not be performed on the base data.

7. Conclusion

We presented a curriculum planning tool based on the individual lecture level that is simulated in an agent-based manner, plus an analysis tool that shows aggregated student data for students of a curriculum; both approaches are supplemented by a machine-learning prediction that can predict student performance based on individual factors. The outcome is that many levels of inquiry are needed (and: possible, with our approaches) in order to increase student performance; however most analysis results demand a post-hoc discussion with the stakeholders.

Acknowledgments

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An innovative, technology-enhanced instructional approach to address the diverse competencies of STEM students in math classes

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Abstract

The transition from secondary to higher education in mathematics raises several challenges for students of STEM (Science, Technology, Engineering, Mathematics) studies. These include amongst others different emphases and requirements and the prohibition of computer algebra systems in basic math education at universities, which leads to a high dropout rate in the first year of study. To address these challenges, a so-called three-level system was introduced at TU Wien (Vienna University of Technology) in first-year mathematics courses to support and encourage students with different levels of high school knowledge. This approach entails several requirements such as a higher correction effort which is countered by the use of an e-learning system called Möbius. It not only provides automatic grading of exercises but also individual and immediate feedback for the students. The analysis of the grade distribution of two years indicates a positive influence of the introduced three-level system on first-year STEM students.

Keywords: *Innovative teaching; evaluation and assessment; e-learning strategies; new teaching models; STEM education; blended learning; technology enhanced teaching.*

1. Introduction

During the transition from secondary to university mathematics education, students experience various difficulties, which makes teaching methods at university an emerging research field, see Voskoglou (2019) and Körner et al. (2014). According to Pinto & Koichu (2022), there are several approaches in order to help students to overcome those challenges. All of which address different origins, including the discontinuity of mathematics education from secondary to university level. This describes the ability to perform algorithms to solve problems taught in secondary mathematics educations in contrast to deeper mathematical understanding required in university math courses of STEM studies.

In line with the results of Rylands & Coady (2009), students' mathematical competences and their ability to pass first-year STEM courses depend strongly on their mathematical background, i.e. the type of school attended and the quality of mathematics teaching. This results in a diverse group of students, some of whom do not have basic knowledge of calculus and cannot follow the constructive material, while others feel underchallenged if the level of mathematics taught is lowered.

Furthermore, the intensive use of computer algebra systems (CAS) in secondary mathematics education has a negative impact on students' understanding of how to manually do math and what it should look like, as pointed out in a Danish study by Jankvist & Misfeldt (2021). As the use of CAS is not allowed in university STEM courses of bachelor level, these deficits in general mathematical skills and understanding are reflected in students' results, not only in pure mathematics courses.

These challenges students are facing lead to a high dropout rate among first-year students in STEM studies, see Geisler, Rolka & Rach (2023), and therefore need to be addressed. The following section presents a general concept of the so-called three-level system that addresses these challenges in mathematics education. In addition, its application in various mathematical subjects at the beginning of the Bachelor's programme is briefly presented, including the use of an e-learning system called Möbius, formerly Maple T.A., which is explained in more detail in Winkler, Körner & Urbonaite (2012).

2. A three-level system to address different mathematical competencies

2.1. Structure of the three-level system

In order to meet the needs in third level mathematics education of a heterogenous group with different backgrounds and skills, a three-level system is designed. The system is established in the context of constructive alignment (objectives, assessment, education and teaching activities), explained further in Biggs (1996) and Wang et al. (2013). The proposed approach states what set of skills is expected from students as a learning outcome of the course

(objectives). The three-level system focuses on providing feedback on students' current knowledge and skills so that they can continuously adapt their learning (assessment), whether they start with a low level of knowledge or already have more developed skills. Figure 1 illustrates the basic idea of the three learning levels of the proposed system (education and teaching activities).

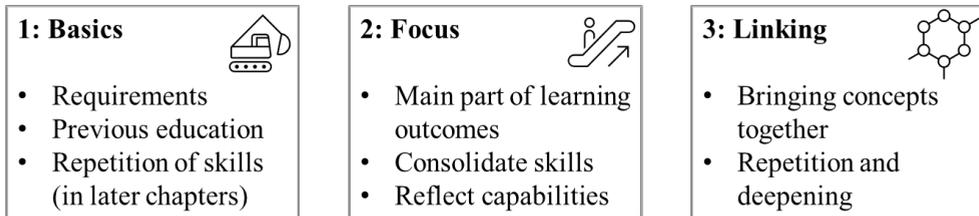


Figure 1. Overview of the key aspects of the three-level system.

The basic level (Level 1), clarifies the basic requirements for each chapter of the course so that students can enter with the necessary mathematical tools, also outlined in Dlouhá, D., Pospíšil & Dlouhá, K. (2022). This level is essentially based on secondary school mathematics and therefore focusses on algorithmic math knowledge, but is adapted to the topics of the respective course as it progresses. In this context, a set of exercises is provided at the beginning of a chapter and has to be solved within a deadline of one to two weeks. The completion is mandatory, but does not influence the final grade. Furthermore, students have an infinite number of attempts to complete this assignment. An example of this level presenting important concepts that the students should be familiar with in order to follow a course on real functions is illustrated in Figure 2.

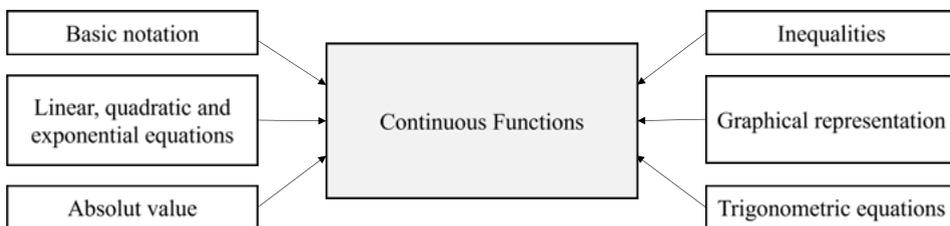


Figure 2. Basic concepts necessary for the topic of real functions.

The focus level (Level 2), addresses the learning outcomes to be achieved in the course. These are mostly the examples that were offered in the traditional form of the course solely. This level focusses on the application of results thought in level 1 to answer further advanced problems. For example, the basic knowledge about an exponential function is used to find range in which such a function must be bijective. The examples to be worked on in the framework of this level are discussed weekly in exercise groups where, depending on the

respective course, the exercises will be either presented by a tutor or the students themselves. A certain percentage, e.g. at least 50%, of exercises has to be solved by the end of the course.

The linking level (Level 3), facilitates the linking of knowledge and skills of the different chapters. This level is oriented towards the final exam of the lecture, where the chapters are not asked piece by piece, but an example on two or more aspects is covered. Students who have not been exposed to this kind of examples usually have difficulties in the final exam, even if they can easily solve tasks on a single topic. In addition, the deepening of knowledge is promoted. To practise combining different topics independently, a typical example would ask students to give a function that satisfies the properties known from level 2, such as bijectivity and continuity. Of course, linking is less present at the beginning than in the later chapters of the course. Generally, exercises of this level are not mandatory, but give bonus points based on the quality of discussion of the student's solution with a tutor.

2.2. Application Scenarios

As of today, the three-level system was applied to two math courses for first-year students at TU Wien. It was first developed for the course Mathematics 1 for Electrical Engineering, Technical Physics, Geodesy and Geoinformation, and later on also applied to Practical Mathematics 1 for Technical Physics.

Mathematics 1 consists of a lecture and an exercise course, which are graded separately. The grade of the exercise course is composed of the percentage of second level examples solved, the quality of presentations, the sum of points of the three exams during the semester and possibly bonus points. The grade for the lecture course is based on the points achieved in the final exam that takes place at the end of the semester.

The three-level system was originally established for the course Mathematics 1, which consists of a lecture and an exercise. Therefore, it is directly applicable to this course in all aspects described and was later adapted to Practical Mathematics 1 while maintaining the basic idea.

3. Implications of the three-level-system

3.1. Emerging challenges

The following are the main challenges selected based on student feedback and lecturer experience. An obvious challenge is the increased workload for students and teachers in a course implementing the three-level system. Compared to traditional educational systems in this type of first-year mathematics course that implemented only the secondary level, those involved face an increased catalogue of demands during the semester. Several teachers and students complain about such systems - students about the increased workload, teachers about

the increased supervision and correction effort. This system is only accepted if it tends to have a positive effect on students during the semester (preparation of midterm tests, weekly homework, short quick tests, etc.) and leads to better results in the final exams.

Furthermore, the three-level system addresses another aspect of individual feedback. First semester students tend to avoid self-assessment tests in the first weeks of the semester to avoid a negative feedback. The first compulsory test of the first semester is usually the first serious feedback students receive, and this feedback is usually rather negative. There are several reasons why the first test is negative, one important reason being the lack of training of the examples in different versions.

3.2. Solution approaches

To address these challenges, several aspects are considered in the three-level system. The use of an e-learning system, which provides a set of examples for students to practice with, allows for individualised, low-threshold feedback for students. This feedback is only available to the students and not to the teacher. Such examples appear partially in weekly homework and midterm tests, so that students see the benefit of practicing these examples during the semester. The first and second stages of the three-level system help to achieve this effect on students. The use of the e-learning system Möbius makes it possible to provide randomised examples and to assess students' results immediately after completion. This means immediate feedback for the students and no correction effort for the lecturer. In addition, the examples provided are randomised by algorithms, i.e. students are given the same question style, but certain parameters (e.g. numbers, functions, vectors, matrices, etc.) are varied. Such a situation forces students to practice their arithmetic skills more than with the traditional, unmodified examples. In the traditional form, students tend to read only the solution of already solved examples and in the exam, the resulting lack of skills to solve the example causes problems. The three-level system avoids such effects from the beginning since students cannot copy solutions in level 2 but need to solve their individual examples. Tomilenko & Lazareva (2020), who use a comparable CAS, have shown that this has a positive effect on students' test scores.

3.3. Additional advantages

Students have constant access to the pool of examples provided via the e-learning system. In addition to the weekly homework, the examples are used to assess the basic knowledge (Level 1) and to prepare for the mid-term tests during the semester. This continuous training of the focused topics provided in the assignment definition of the examples prepares students for the final test of the course at the end of the semester. In the traditional framework, exercises during the semester and final exam were considered as two different parts. In the

three-level system, the skills required for linking learning outcomes (Level 3) contribute greatly to the skills required for the final exam.

In addition to the advantages in the learning process of the students, the lecturers also benefit from this system. They receive constant feedback on the students' current level of knowledge and can react accordingly. If repetitions or question rounds in the lecture or tutorial seem helpful, they can offer such measures in the course.

4. First Analysis of the results of three-level system courses

This section presents and compares the results from exercise courses between 2019 (113 participants) and 2022 (91 participants) to show an initial trend of the impact of the introduced three-level system. These years were chosen since the three-level system was introduced after 2019 and 2022 provides the most up-to-date results after three years of running the three-level system. The data was collected and obtained from the student administration system of TU Wien.

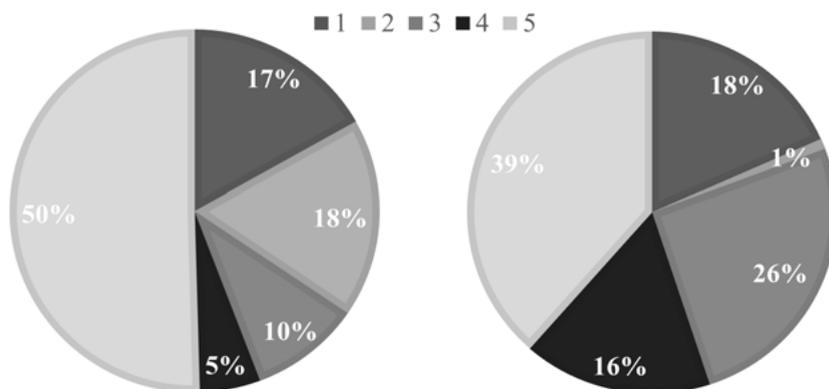


Figure 3. Grade distribution (best “1” to worst “5” grade) of the exercise courses of 2019 (left) and 2022 (right).

Figure 3 shows the grade distribution of the exercises course of Mathematics 1 in the summer term 2019 and 2022 respectively. In both diagrams, “1” corresponds to the best possible grade, while “5” means that the course could not be completed successfully. While in the summer term of 2019 only 50% of the participant of the exercise course were able to pass, this percentage increased to 61% in 2022.

A first analysis of the grade distribution of the final lecture exam also shows a positive trend in the results between the years without and with the introduced three-level system. This tendency with regard to the influence of the three-level system is visible in the overall results, but is not easily verifiable statistically, since students in Austria do not have to take the final lecture exam immediately after attending the exercise course.

5. Discussion

The three-level system is introduced as an approach to address students' challenges due to mathematics education deficits in the first semester of STEM studies, in accordance with the observations of Pinto & Koichu (2022). However, challenges in the transition from secondary to tertiary mathematics are not only related to a lack of skills. They also concern the interaction and communication between higher education teachers and students, as well as the different experiences of students during the transition phase due to different characteristics such as race, gender, sexual orientation or cultural background, see Nasir et al. (2012), Rodd & Bartholomew (2006). Therefore, further development and investigation of the three-level system and continuing teaching methods with respect to these aspects is required.

As mentioned in section 3, automatic grading of randomised exercises with the e-learning system Möbius counteracts the increased workload for the teacher. Nevertheless, the development of examples, including the initial idea, the layout, the algorithm behind the actual exercise, the meaningful randomisation and the grading code is a time-consuming process. Introducing an e-learning tool therefore takes time at first for the initial development, but offers many advantages for teachers and students, e.g. individual, immediate feedback, the constant possibility to access the pool of examples and to observe the learning progress of the students.

To get a first impression of the impact of the three-level system on student results, the grade distribution of the 2019 and 2022 exercise course is presented in section 4. It shows a positive trend in the development of student results based on the increased number of participants who passed the course after the introduction of the three-level system. As the comparison is limited to two years, the positive influence needs to be further substantiated by examining the results of other semesters using more informative statistical methods. Furthermore, the exact analysis of the impact of the three-level system on the final lecture examination needs to be further investigated beyond the positive trend. When merging the results of the exercise and lecture, cohort statistics are required in order to include students who have taken examinations beyond their year group.

It is planned to introduce the presented three-level system in other courses at TU Wien, e.g. in courses of Linear Algebra for Technical Physics. To this end, the approach must be adapted to the corresponding topics, e.g. include basic matrices and vector arithmetic in the basic level. In addition, this subject raises requirements for the automatic evaluation of examples, e.g. ambiguous answers such as the evaluation of an orthonormal basis of a vector space, which can consist of vectors of different order or linear combinations. Therefore, the example pool and the corresponding grading library need to be further developed.

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Development of scientific skills in Higher Education with a flipped classroom-contest approach

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Abstract

In this work, the flipped classroom methodology has been applied to the laboratory sessions in the subject Physical Techniques I of the Degree in Physics at the University of Zaragoza, Spain. The proposed sessions have been distributed in two main parts. The first part consists on flipped laboratory sessions in which during the before-class sessions, the students must understand, design and customize the designs that will have to characterize experimentally in the laboratory sessions. The second part consists of a student contest activity where the students compete against their pairs while improving their learning about the topics presented in the flipped classes. The proposed approach could increase the depth of the acquisition of experimental skills, helping students to acquire a better understanding of the concepts under study in laboratory sessions.

Keywords: *Active learning; collaborative work; flipped classroom; laboratory skills; model-based learning.*

1. Introduction

Model-based learning is the construction of mental models of phenomena by integrating information about their structure, function and causal mechanism, and mapping that information into analogous systems (Gobert and Buckley, 2000). A model can be seen as a representation of a target and serves as a “bridge” connecting a theory and a phenomenon (On and Oh, 2011). If we consider the classical approach of Gilbert (1991), models are built by an induction process based on simplified representations of systems. Teaching of physics (and engineering) has traditionally focused on the development of a conceptual understanding of the relations between the contents, laws and principles of the matter. Physics education research has uncovered serious difficulties in learning (Duit, 2009) because of the lack of models that emphasize the construction of knowledge (Ceberio et al., 2014). Nowadays, model-based learning is becoming an essential part in the evolution of the strategies in science teaching. Despite the difficulty of knowing the nature and content of the mental models of students, instructors can design different strategies to address and evaluate them. In this paper we introduce the flipped classroom as a relevant instructional strategy.

The flipped classroom is a pedagogical method that transfers certain learning processes outside the classroom and uses class time to facilitate and enhance other processes of acquisition and practice of knowledge (Wang et al., 2018; González-Gómez, 2017). It promotes autonomous learning and also frees classroom time to carry out active activities in which participation and the exchange of ideas are promoted. From a model-building point of view, students are encouraged to become more personally involved in their construction, while at the same time the necessary conditions for these models to be contrasted and discussed with their peers are promoted. As a consequence, a flipped classroom has to be a comprehensive approach that combines direct instruction with constructivist methods with the main objective of increasing student engagement and involvement in the course content to improve their conceptual understanding.

In this work, we propose to apply the flipped class methodology to the experimental part of the compulsory subject Physical Techniques I of the Degree in Physics at the University of Zaragoza, Spain. Adding to the advantages of active learning, the flipped classroom allows to dedicate more laboratory time to apply knowledge acquired using active learning strategies, and therefore the learning process can be better followed by the teacher.

2. Proposed Teaching Methodology

The classical interpretation of model-based learning engages students in an iterative process oriented to build a mental model of a given phenomenon. There are many ways to achieve it such as inductive processes, simplifications, comparisons, integration of information, etc. (Casarosa, et al., 2020). Although model-based learning needs to be carried out by the

students, the instructors can adopt strategies to facilitate the acquisition of the models, and to assess that they have been built correctly. It is in this scenario where the flipped classroom methodology is applied, allowing to create an environment of collaborative learning in the classroom, and involving the students from the beginning in their own learning process. By the application of a methodology based on the flipped classroom, the authors expect to contribute to a correct development of mental models by the students.

2.1. Participants and scope

Participants are the students enrolled in the course Physical Techniques I, which aims to provide basic skills in metrology and electronic instrumentation for the measurement of physical magnitudes. In Physical Techniques I, students must be able to analyze basic electronic circuits, determine specifications and tolerances for a measurement, and design the full setup to carry out a measurement, calculating the contribution of every stage to the uncertainty. The theoretical contents of this course have a weight of 4 European Credit Transfer System (ECTS) credits while the experimental part has a weight of 2 ECTS credits. The experimental part of the course is divided in four laboratory sessions: the first session is introductory and intended for students to become familiar with the measuring instruments; the second session teaches students to analyze the stationary and transient behavior of resistor-capacitor (RC) and resistor-inductor-capacitor (RLC) circuits; the third session studies experimentally the behavior of several circuits such as a non-inverting amplifier and a comparator, and the last session deals with filtering and signal conditioning. The basic concepts and lab procedures are previously explained during the theory blocks, which take place before the laboratory sessions.

In this course, students face the basic concepts of Electronics and, in particular, Circuit Theory for the first time. Furthermore, the laboratory sessions require the use of several instruments that students are not used to manipulate. As a consequence, students often need guidance by the instructors, which leaves less space to implement active learning activities.

2.2. Example of application

Traditionally, before the realization of a laboratory session, students receive a theoretical-practical explanation about the goals and the procedures to be followed. Subsequently, during the session, they have access to specific supporting materials (instrumentation user manuals, component data sheets, etc.). Also, the instructors, present during the sessions to help in the realization of the different tasks, have to deal with several groups simultaneously, making it difficult to provide an immediate and comprehensive answer to all questions raised by the students. The proposed flipped laboratory sessions are distributed in 2 main parts.

1. Flipped Laboratory. Before the laboratory sessions, the students are given the designs and their intended application. With the help of electronic simulation software, they must

understand the designs, choose some parameters to make them work as intended and, finally, verify the correct operation of the final designs. During the laboratory sessions, the students have to implement the designs with commercial components and characterize them experimentally, comparing the results with those obtained by simulation. The main idea of this part, which will be more deeply explained afterwards, is to introduce students to the standard design-simulation-characterization process typically used by electronic designers.

2. Student contest. This practice is planned as a very dynamic activity where the students compete against their pairs while improving their learning about the topics presented in the flipped classes. This activity is divided in two sessions: an initial one based on solving a real problem using Toolkit for Interactive Network Analysis (TINA) simulations, and a second one consisting on a quiz. Unlike the flipped laboratory, which is an experience that has already been carried out, the student contest is an activity that we have newly introduced in the current course, where we have applied it to the second laboratory session to obtain preliminary results. If these results are satisfactory as it is expected, the approach will be extended to all laboratory sessions in future courses.

3. Proposed experience

During the before-class activities, the students, divided in groups of 2 or 3 depending on the total number of students enrolled, have access to different materials and references related with the topics of study as well as to an explanation of the main concepts covered. They are encouraged to refer to other subjects such as electromagnetism to ensure a good link with the previously study topics. Also, they have some references to look for the main figures of merit and performance criteria of the system under study. Although some main references are provided by the instructors, the students are encouraged to look for related information and references. The students have to carry out TINA simulations of some performances. For this purpose, they have access to different tutorials, explicative videos and manuals of how to use this software. TINA is a SPICE-based electronic design and simulation software. In the laboratory session, the students will use the free version TINA-TI offered by Texas Instruments. The groups have access to the material two weeks before the laboratory session. But the instructor is going to acquire the role of mentor supervising and assessing in the preparation of the flipped class. Therefore, as a minimum, one week before the laboratory session, a meeting between the teacher and the groups is planned so that students can explain the development of the work they are doing as well as to ask for help with the organization of the flipped class and the bibliographic search. During the laboratory sessions, the students must experimentally characterize the circuits that they have previously studied and simulated.

The circuit that they have to characterize experimentally, the RLC circuit in the session 2, is the one that combines the two concepts: a circuit in which two energy storing elements

exchange energy periodically, and also a circuit in which an energy dissipating element (the resistor) gives out a part of the total energy in every oscillation cycle. Also, the operation of this circuit can be linked to that of mechanical damped oscillations, so that they can relate with all aspects covered in courses on Mechanics about the actual damped oscillating frequency versus the undamped frequency (that of the LC circuit) and the ratio of energy lost per cycle, which is given by the quality factor Q .

To conclude the flipped class activities and also as a way to promote the interest of the students in the presentations of their colleagues, we propose to perform a student contest. This contest consists of two classroom sessions in an interactive classroom where each student can win extra points (half of them in each student contest session) for the total grade of the course. This special classroom contains some television screens with their respective cooperative tables and a main bigger screen with a projector. Making use of the MirrorOp Sender application, the students can connect their devices to the TV screens to benefit the collective work and the share of information and in this way, everyone in the group can easily see what the others want to show. The teacher has access to all the screens of the room so that he/she can show in the main big screen some interesting information of some groups that can be useful for the rest.

For the first session of the student contest, the students have to solve a case study using all the knowledge they obtained in the flipped classes. In particular, it was found convenient that students made use of TINA simulations to solve the case study. They have one hour to read and solve the case with the help of all the tools and information they have available in their computers, the material of the course uploaded in the Moodle Learning Platform and the Internet. As a deliverable, at the end of the session, the students have to send to the teacher a slide with a summary of their solution of the problem. In the last minutes of the class each group has to present and defend their work. The teacher is in charge of deciding which work was the winner to give the group the extra points. In one case study, the students are given a design which consists of a temperature detector connected to an amplifying stage which output will be proportional to the temperature. The student must propose a solution to mitigate the output error by high interferences in the wire connecting the sensor with the amplifier. Several possible signal conditioning circuits are given to the students and they have to choose the appropriate circuit. In other, the students are given a radiation detector contains a Geiger-Muller tube, which produces an instantaneous current pulse when a particle passes through it. This current decays rapidly in the absence of new particles. The students must include an additional circuit that manages to make the presence of the particle visible by prolonging the duration of the voltage peak supplied by the detector. In a similar way as in the previous case of study, the students are given several possible circuits and they must select the appropriate one and integrate everything in a final design (Figure 1).

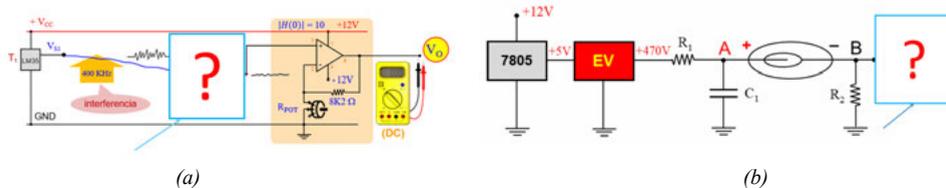


Figure 1. Scheme of systems where the students must include a circuit in (a) temperature (b) radiation detector.

The second session of the student contest consists on a quiz that contained different questions related to the flipped classes. To solve the questions, the students have free access to all the material of the course. To guarantee the collaborative objective of the session, the students only have access to one question of the quiz at a time and they cannot come back in the quiz. At the end of the quiz, the students know their punctuation but not the specific questions that they answered right or wrong. In this way, they have to decide whether or not they want to try to solve the quiz again as the winner is the group with more right questions when the time ends. For this second session the students have one half hour to solve the quiz. The rest of the class is left for the teacher to explain the main solutions to the questions of the quiz and debate with the students their solutions.

4. Assessment

To evaluate how the flipped classroom influences the learning outcomes and the construction of the knowledge model, the assessment of the students is divided in several actions along the course. Among the evaluation actions designed, we can cite specific quizzes, laboratory papers or talks containing information on the studied systems, their operating principles and related relevant information. Working through these resources, student must be able to construct his model and to check and assess his knowledge model.

The assessment of the activity has been focused on two main points. The evaluation of the quality of the resources created by the students and their performance in the flipped class as well as their performance in the student contests. And personal motivation and satisfaction of the students. To investigate how effective the tandem learning outcomes-flipped classroom is, a series of specific evaluation activities have been programmed both in the pre-class activities and in the face-to-face (F2F). A battery of quizzes associated with the use of simulation tools and applets in pre-class activities has been designed, which not only reveals the degree of understanding of the topics covered but also how they have been carried out, one of the bases of the flipped. In addition, both the learning and follow-up resources generated can be downloaded to any device, making it possible to do them anywhere and allowing a flexible learning environment. Another series of issues associated with F2F activities are associated with verifying both the associated specific learning outcomes and the effectiveness of these self-study sessions.

The evaluation of the laboratory sessions is done attending to skills that students are expected to develop along the course. The skills encompass technical aspects such as the implementation of the experimental set-up, the measurement process, and also behavioral aspects such as student autonomy and attitude, time spent, or the elaboration of the final report. The assessment of the skills related to the assembly of the instrumentation is carried out by a questionnaire before the laboratory session, together with viewings of videos of handling the devices. Finally, the assessment of the skills related to the communication of the results is carried out by a report that students have to hand out within the following days after the realization of the lab session (Sánchez-Azqueta et al., 2019). To evaluate the experience and motivation of the students, a specific survey has been created since evidence suggests that there exists a strong correlation between student motivation and satisfaction, and the success of virtual learning activities. To validate the effect that the inclusion of the flipped classroom has on the results of the students enrolled in the course under study, a comparison should be carried out with the grades obtained by students during the academic years when it was not already implanted, but the strategy presented in this work has been performed in a current academic year.

5. Expected results and Conclusions

This work presents the use of flipped classrooms combined with the student contest as a pedagogical tool to implement model-based learning in higher education. In spite not having final results yet, some advantages over the traditional approach are expected using this methodology, such as increased student motivation and autonomy, or a deeper understanding of difficult concepts (Gilboy et al., 2014). In addition, it encourages the use of specific recourses to support the study of the topics and to acquire a deeper understanding of these processes, improving student motivation (Chen et al., 2014). The flipped classroom allows more time for active learning to happen in the classroom, further they develop a collaborative work in a realistic environment, which fosters their learning autonomy and active, participative teaching, promoting the conditions leading to the establishment of peer learning. In summary, the methodology proposed in this work allows students to map the different pieces of information into a general system to develop their own mental model.

In this respect, it can be considered that while non-interactive resources are more convenient to present the topics and main ideas, interactive resources are more powerful to establish links between them to build the models (Sánchez-Azqueta et al., 2016), and to check whether the conclusions drawn from the models are true (O'Flaherty and Phillips, 2015). A process is created so that students engage in the development of the mental models of the topics covered in class with tools aimed for facilitating their construction and also assessing their correctness. The implication of every student is required for this process and therefore fosters their learning autonomy, but also the exchange and social cooperation with their peers to

analyze their own knowledge models, which entails sharing hypotheses, amending their thoughts and working with their cognitive disagreements.

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The essentials of science communication in a course engaging both for students and professionals

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Abstract

On the one hand, science is increasingly entering the governance of modern society. On the other hand, society seems to be lagging behind scientific achievements, increasingly unable even to understand its language. The language gap is based on the well-known intimidating appeal of STEM programs and the unreasonable timidity of scientific degree courses to include communication skills as mandatory. An open course was experimented to provide students with the necessary tools to decode and encode the essential elements of science communication, regardless of disciplinary content. The course, which was designed following the 5W+H "golden rule" of non-academic science communication, has been offered for three consecutive years to nearly one hundred students. The students' perspective is analyzed in terms of their perception of the study effort, the achievement of their own learning expectations and the level of general satisfaction. The main result is that it is possible to involve undergraduates, graduates and professionals in rethinking their approach to communication of scientific content to the general public, with rewarding results for all players, once the focus is on the greatest common divisor instead of the lowest common multiple.

Keywords: Science communication; soft skills; open course.

1. Introduction

On November 27th, 2017, in the Sala Capitolare of the Senate of the Italian Republic, Pietro Greco gave a speech on the correlation between science and democracy, asserting that “scientific knowledge is no longer one of the many elements that nourish culture and reshape the individual and collective life of women and men. But it has been, for some time now, the main engine of the production system and of the social dynamics of the planet itself.”, (Greco, 2018). The guiding idea of this founder of the science communication in Italy is that a society in which science is the *primus movens* becomes a knowledge society and the rights of citizenship must include the right to scientific citizenship.

Shortly afterwards, the SARS-Cov-2 epidemics demonstrated the importance of scientists having the necessary skills to communicate clearly with colleagues outside their discipline, with experts in nonscientific disciplines, as well as with the general public (Sandak, 2022). However, scientists traditionally have not been provided communication training in their education and the effective communication beyond their discipline tends to be a rare attribute (Stevens 2019). Science communication courses in Italy are mostly one- or two-year master's courses, now offered by many universities and scientific institutions; or they are short curricular courses in many degrees in "Communication Sciences"; or are offered as short courses accessible to PhD and graduate students (Trench, 2021). Despite the calls for science communication to be included in STEM education (Baram-Sabari, 2015; Dahm, 2019), and although training activity in various aspects of science communication have been published (Mannino, 2021), a discipline-free approach to developing an essential communication skill toolbox, like those elaborated by the QUEST EU funded project (QUEST, 2021), has not been integrated into most STEM curricula in Italian universities (Davies, 2021). Moving from these considerations, the authors devised a path to provide students with the necessary tools to decode and encode the essential elements of science communication, regardless of the disciplinary contents.

The title of the award-winning novel by Paolo Cognetti, *The eight mountains*, (Cognetti, 2018) originates from an ancient Nepalese myth telling that at the center of the world there is a very high mountain, Mount Sumeru, and around it there are eight seas and eight mountains. The meaning of the legend is in the question: who will have learned more, those who have gone around the eight mountains, or those who have reached the top of Mount Sumeru?

In the world of disciplinary teachings increasingly isolated from each other; in the world of countless sources of "free" (dis)information and global interconnections, a similar question arises when thinking of a valuable modality to introduce students to science communication. Without pretending to answer the question of the Nepalese legend, leveraging on their professional experiences, the authors devised a course in Communication of Science,

informed around few general principles and that also provides the essential toolbox for social media communication. The course has been running online synchronous since 2020 and has been delivered until now to about one hundred students and professionals with very different background knowledge and communication skills. The content and format of the course has been consistently refined based on participant feedback gathered at the end of each of the three editions proposed so far and on the assessment of the communication skills acquired.

In this paper, the content of the course in its latest version is illustrated in detail, also providing the reasons for the didactic choices. The effectiveness of the proposal is analyzed using a few parameters that consider the point of view of the attending students: Perceived Study Effort - PSE, Achievement of Learning Expectations - ALE and Level of General Satisfaction - LGS. The cross-reference of these parameters with the gender, knowledge base and motivation of the participants allowed to draw a synthetic and yet detailed picture of the success of the methodology adopted and of the proposed teaching contents. This 'subjective' students' perspective complements the more 'objective' assessment of the learning outcomes by homework assignments, individual and team presentations and the final production of social media content for the event LumineScienza, yearly registered in the program of the International Day of Light®, promoted by the United Nations Educational, Scientific and Cultural Organization - UNESCO (Lucente, 2023).

2. The Narrative Structure of *Communication of Science Course*

Quite common in the communication realm is the 5W + H rule, and science communication directed at the general public is no different. The course content was designed in modules according to this general rule and the following definitions:

- *How* module: do it and let them know, communication strategies, technical skills of image creation and video making, the unspoken words.
- *What* module: identify the core message, be sure to know it and take your time to study it. Put in evidence, be concise, be responsible, fact checking, sniffing fakes.
- *When* module: it is not that any time is the right time, planning and delivering strategies, one more event?
- *Where* module: different public <-> different media <-> different tools, identify the best medium for delivering your message, basics on social media platforms.
- *Who* module: a different public needs a different language, follow the audience while shaping it, going out while looking in.
- *Why* module: think before say. Another drop in the ocean, is there any reason for your message to be relevant, good reasons and bad results.

The subject of the course is organized in six modules, each consisting of four hours of lectures and four hours of individual or teamwork introduced by a renowned testimonial, as a 'living example' of how to do well. After a few permutations, the modules are now ordered as follow:

Why – Who – What – Where – When – How, as detailed by the course curriculum in Table 1.

The format balances one-to-many lectures and Q&A session with testimonials, individual and team homework, intermixed with presentations and open discussions about the shaping of *LumineScienza*. A detailed discussion about choosing that specific ordering can be found in (Lucente, 2023); to the purpose of this communication is it worth to note that the first three modules set the grounds for the following three and help in building a common language and a shared horizon for the quite heterogenous group of participants, whose distribution in terms of gender, basic knowledge and motivation of the enrolled students in the three editions of the course, is given in Table 2. Enrolment is open to students from the host university as well as to people from other academic institutions and to anyone with a high school qualification. Approximately 42% of participants were not students at the host university and most of them declared professional interest in choosing the course.

On the one hand, the distribution by gender closely matches that of the student population of the hosting university, that represents 58% of the enrolled students to *Communication of Science*. On the other hand, the very same title of the course preferably attracted students from the PE group of disciplines (70%) with respect to the SH group (11.7%), in contrast to student population of the hosting institution, about 60% / 20% in the SH / PE degree courses.

3. The Students' Perspectives

During enrolment, students were asked for the main motivation for choosing the course. Table 2 shows that their response is evenly distributed among the three options, with about one third motivated by practical reasons, for example to complete the number of eligible credits needed in their degree course; personal and professional interest equally share the remaining part.

At the end of the teaching activity, students were asked to fill a feedback form consisting of three sections. The first section is meant to assess their appreciation of the course content. LS students appreciated the *What, Whe*'s modules more than average. SH students found less than average interest in the *How* module while appreciated most the *Why* and *Whe*'s. PE students stay on average for all modules. However, all differences are around one standard deviation, indicating that students from all background knowledge find stimulating activity that help them to decode their "natural communicative inclination" within a methodological framework and to appropriately codify the less mature aspects of their respective communication strategies. The only exception is for those who declared Professional motivation in attending the course, whose

average appreciation of all modules is one standard deviation below average. Professionals may have found too basic some content, especially of the *Why* and *Who*'s modules.

Table 1. Course curriculum of Communication of Science.

Topics	Actions	Outcomes
Get to know 2h	Self-introduction of teachers and students; description of methodology and evaluation criteria; outline of the course content; graphical illustration of the class composition; Q&A.	Respect of the time assigned - Technical issues sorted out – First time on video
Why module 8h	Spoken and unspoken communication; basic principles of communication strategies; visual identity; coordinate image; communication campaign; examples; case history; creativity is not without boundaries; listening of professional communicators.	Elaboration of the personal pay-off – Tips for reading behind the surface – Main mistakes to be avoided
Who module 8h	In the land of lies, truth is a disease (G. Rodari); know the subject, the context, the public, the goal you want to achieve; know yourself; the narrative techniques: objects, slides, posters; verbal, paraverbal and non-verbal language; two RSVP working methods: Respect, Stimulate, Valuate and Present.	Short sensory experience on perceptions – team working – brain storming – focus groups.
What module 8h	What is scientific?; the reliable and unreliable source; read and write a scientific text; the jargon; what is the red thread with society; tell the uncertainties of science; errors, inaccuracies, oversights; the inner balancing of scientific method and also the dark side of science.	Serching the databases – Google trends – cut a long story short – the 5W+H golden rule
Where module 4h	Attention is a rare commodity; content marketing strategies; language experimentations; the publics of social media.	Main features of popular social media – content creations for Insta and fb
When module 4h	Social media manager: basic principles, tips and tricks; the editorial plan; copy it; stay away from; monitoring in real time; post analysis.	Schedule delivering media content – benchmark analysis
How module 8h	Framing; basic principle and social media adaptation; objects, people, background; screenplay; timing; editing.	Personal video: 3' – video editing software
Am I sure? 2h	The only certainty of science is uncertainty; the rigour of the method instead of the method of rigour; one question has many answers; unbias yourself.	Question and Answer game – graphical abstracts – hidden CV
Let's face it 2h	What do we think about the course; what do you think; feedback	Self-evaluation – identify priorities

Table 2. Distribution of the total population of students over three years.

Gender		Basic Knowledge			Motivation		
Male	Female	Life Science	Physical & Engineering	Social & Humanities	Practical	Personal	Professional
36.7%	63.3%	18.3%	70%	11.7%	36.7%	31.6%	31.7%
100%		100%			100%		

Basic Knowledge is classified according to the European Research Council index. Practical motivation refers to those whose attendance was instrumental to completing their eligible ETCS; Personal motivation refers to those who chose to attend because of personal interest; idem for Professional. 100% = 60 compiled feedback forms.

The second section of the feedback module is meant to assess to what extent students achieved their own learning expectations (ALE), their level of general satisfaction (LGS) regarding the whole experience and the perceived study effort (PSE), compared to their initial outlooks. The responses were collected over a five-grade scale and translated in integers from -2 to $+2$: $+$ indicating fulfillment and satisfaction, $-$ indicating disappointment and discontent. The averaged response is reported in Table 3 together with the distribution across the gender, knowledge and motivation categories. Almost all students are aligned in deeming the learning objectives substantially achieved, with the SH group being more satisfied than the average, positively correlated to a PSE significantly higher than the average. The reported LGS is positive for all, with the notable exception of the LS group, probably because all teachers have PE or SH background and are somewhat biased in the examples and analogies proposed. An essential and specific feature of *Communication of Science* is the direct and regular involvement of students in the production of media content (video, poster, text, tweet, slideshow) working in small groups, along with the creation and management of the web event *LumineScienza* at the end of the course (on fb and Insta). The content realized and posted for *LumineScienza* (graphics, videos, texts, ads) is evaluated by the teachers and contributes 50% to the final grade. The groups are formed by teachers to be as much heterogeneous as possible. A great deal of time is devoted to team building: at least two sessions each year are dedicated to introducing the methodologies of brainstorming and focus group. Students are constantly invited to step out the comfort zone and face new challenges.

The third section of the final feedback form is meant to assess how students would qualify their experience in the acquisition of new technical skills, teamwork, work planning and in identifying their own biases and preconceived opinions. Instead of using a numerical index, options were proposed using an "emotional" scale from disappointing to exciting. At first glance, Figure 1 shows an overall "positive" evaluation highlighted by the dominance of the bluish area in all rows, corresponding to a *Surprising* and *Exciting* evaluation of the activity. The categorized analysis is then focused on the other side of the colored spectrum (green, red and orange), considering only values exceeding the corresponding Global averages by more than one standard deviation. Gender category does not show significant difference, except for

Males that found Team Work slightly more *Tiring* than average (25% against 20.7(2.6)%). 20% of the SH group found Team Work *Pointless* and Work Planning *Tiring* or even *Disappointing*, as compared to averages around 3.5(5)%. This is consistent with the below-average level of LGS (see Table 3) expressed by the same group and compares negatively with the above-average values of PSE and ALE. The apparent inconsistency finds a possible explanation in the fact that teamwork and the use of planning tools are widespread practices in the disciplines belonging to the SH group. A similar picture emerges for the Professionally motivated category, that also generally appreciated less than average the content of some modules. Work planning was *Tiring* for 35(8.2)% of all students, distributed in all categories, with peaks of 45% for Practically motivated, a category representing students mainly interested to securing the ECTS in their career. It is worth pointing out that Team Work, which is based on comparison and collaboration among different points of view, allows everyone to "look in the mirror", in front of their own preconceptions (Bias Identification), and this experience was unanimously reported either as *Surprising* or *Exciting*. It is always difficult to recognize and accept your own cognitive biases, so it is encouraging to note that this was the most valued skill across all categories. Professionals, PE and SH students stand out in well above average surprise and excitement, surprise and hype shared by the authors as well.

Table 3. Student perspective of the learning outcome.

Student perception	Gender		Basic Knowledge			Motivation			Average (St.Dev.)
	M	F	LS	PE	SH	PRAC	PERS	PROF	
ALE	0.9	1.0	0.9	1.0	1.4	1.1	0.8	1.0	1.0 (0.2)
LGS	1.2	1.3	0.7	1.5	0.9	1.1	1.3	1.4	1.3 (0.3)
PSE	-0.3	-0.4	0	-0.5	1.5	0	-0.4	-0.5	-0.3 (0.7)

ALE: Achievement of Learning Expectation; LGS: Level of General Satisfaction; PSE: Perceived Study Effort.

LS: Life Science; PE: Physics & Engineering; SH: Social & Humanities. PRAC: Practical; PERS: Personal; PROF: Professional motivations, as defined in the caption of Table 2.

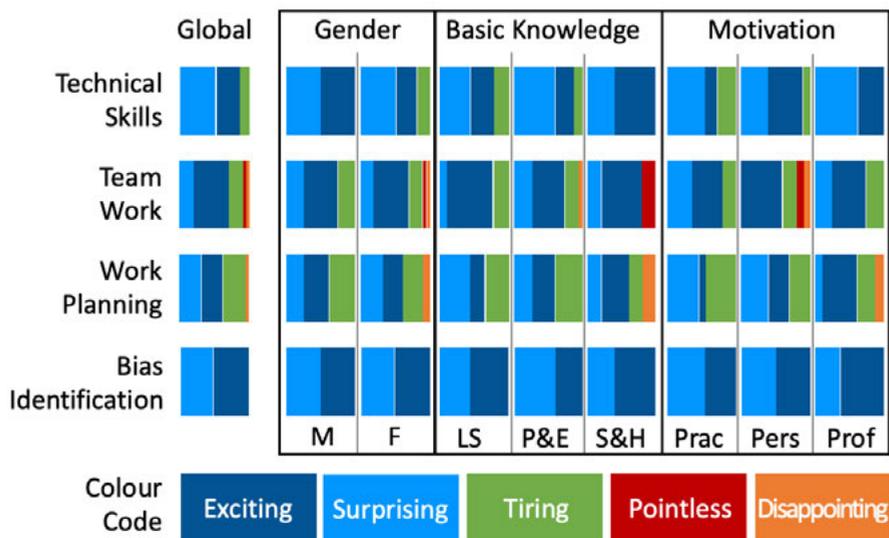


Figure 1. Synthetic graphical representation of the students' appreciation of being engaged in laboratory activity. Options are expressed on the 'emotional' scale illustrated by the color code. Relative percentage is proportional to colored area. The area of each colored square corresponds to 100%.

4. Conclusions

Climbing Mount Sumeru on the straight track, ascending it along gentle spiraling paths or wandering the eight mountains is a matter of personal choice. However, scientific literacy cannot be guaranteed until all scientists have learned the basic skills necessary to communicate with clarity and empathy. *Communication of Science* claims to provide such basic skills in a format compatible with any academic degree program. The syllabus focuses on common principles with respect to specialized languages and communication strategies. The greatest common divisor of the communication of scientific contents of any discipline to a non-specialized public on social media is preferred to the least common multiple of STEM languages and disciplinary communication.

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Teachers of natural sciences: some challenges and perspectives in Brazil

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Abstract

The teaching of Natural Sciences has a fundamental role in contemporary education. However, the traditional emphasis on specific content unrelated to the context of the student has made it difficult to understand and act in an increasingly complex and interconnected world. It is fundamental and urgent to incorporate an interdisciplinary and integrated perspective in teacher education. This work brings to light the challenge of the integration of areas in the natural sciences from a contemporary perspective. In addition, it presents some elements results of the construction of a proposal for teacher education for Brazilian basic education.

Keywords: *Teaching of natural sciences; interdisciplinarity; teacher education.*

1. Introduction

The role and importance played by science and technology in the contemporary world is unquestionable. They are found in practically everything around us and have a strong influence on the way we think, act and live. To deny students basic knowledge such as: telecommunications, astronomical discoveries, energy, genome, transport systems, properties and transformations of materials, climate change, transgenics, among others, is to deprive this group of a sense of belonging to a society that is highly dependent on this knowledge.

However, science has for many years been traditionally taught by emphasising memorisation and the application of formulas that mean little to basic education students. A strong emphasis on long lists of specific content, without links to the student's context, often prevents the necessary depth of understanding and acting in a world that is complex, in which the variables are many and interconnected. The lack of meaning in the learning of these immense lists of contents, whose only goal is the achievement of tests and exams, has been alerted by different teachers, managers and researchers in the area of teaching of natural sciences.

It is essential to give the teaching of Natural Sciences a meaning more in line with the potential that this area has in human development throughout history. To this end, it is essential to incorporate a change of focus: the specific contents are important and essential, but they need to be at the service of something more comprehensive. The contents, therefore, should be seen as means and not as ends of the teaching of Natural Sciences.

Several researchers and educators have been warning for some time about a crisis of meaning in the teaching of natural sciences. If, in the past, the inclusion of scientific themes in basic education had as assumption the learning only of scientific contents distant from the students' reality, today this perspective does not make sense anymore, especially after the invention and dissemination of the internet in which specific knowledge is available at any time (FOUREZ, 2003).

2. Urgent action on Brazil

In Brazil, the debate has been urgent due to a major reform in basic education (BRASIL, 2017) and the implementation of a Common National Curricular Base (BRASIL, 2018) in which the knowledge of the natural sciences is guided by interdisciplinarity and the integration of areas. The primacy of interdisciplinarity and its correlates is already found in the original Parecer CNE-CEB 7, 2010, p.29: *“In the organization and management of the curriculum, the disciplinary, multidisciplinary, interdisciplinary and transdisciplinary approaches require the careful attention of the school institution, because they reveal the*

worldview that guides the pedagogical practices of educators and organize the student's work."

The area of knowledge Nature Sciences lists skills and competences to be developed throughout Basic Education in the thematic axes: Matter and Energy, Life and Evolution and Earth and Universe. Thus, contents that were previously seen in a fragmented way now need a more integrated look, so that the conceptual and methodological tools of the curricular components enable students to investigate, analyse and discuss problem situations that emerge from different socio-cultural contexts, as well as understand and interpret laws, theories and models, applying them to solve various problems of individual, social and environmental nature.

Faced with the challenge of teachers education for a world in deep transformation, the University of São Paulo, especially the Chair of Basic Education, linked to the Institute of Advanced Studies (CEB-IEA/USP) and in partnership with some university teachers, has led the debate and preparation of a project for an Interdisciplinary Science Degree, whose aim is, among others, "*[...] to educate teachers to work in basic school, implying a creative, systematic and responsible inter-transdisciplinary approach to school contents, providing a real transversality in their education*". (PPC, 2022, p.20). The participants are divided into students in the initial education process and teachers working in basic education, concomitantly and shared.

The idea of Inter-Transdisciplinarity can be understood in three different aspects: as an approach or methodology that facilitates the access to complex objects; as an action that overcomes or transits between distinct disciplinary fields; and as a education for or in teaching-learning processes between distinct disciplinary fields (PPC, 2022).

In order to structure the learning spaces, the degree is divided into 4 large education blocks: General Transdisciplinary Education; Transversal Pedagogical Education; Autonomous Project-based Education; Specific Interdisciplinary Education. The first three are common to other qualifications and not exclusive to the area of natural sciences, thus allowing for great integration in the education of teachers from different fields of school knowledge.

3. The sensitive case of natural science

The proposal for integrated teaching of Physics, Chemistry and Biology requires greater mastery of the three areas of knowledge by the teacher, as well as greater in-depth knowledge of astronomy and geosciences. This fact represents a major change in terms of science education in Brazil, leading to innovations also in the teachers' education for basic education.'

The curriculum integration proposed for the Nature Sciences in the BNCC seems to relate to the searches for function and meaning of school knowledge highlighted by Lenoir (2006) when analyzing the differences between visions of interdisciplinarity of different approaches and regions of the planet. The competences indicated in the document for nature sciences present concerns both in epistemological and social plans, as well as focus on the meaning of school knowledge, in the more practical and operational plan, by focusing its propositions in empirical social and environmental issues, and in processes and practices of scientific research, thus presenting concerns both in the function and in the meaning of school knowledge.

The integration of the areas of natural sciences faces a number of challenges ranging from methodological differences and language barriers to conflicts of interest, the resistance of teachers to work collaboratively, the lack of time and resources for integrated projects, the need for new forms of assessment and structural difficulties.

One of the main obstacles to the implementation of proposals that integrate knowledge and the development of interdisciplinary proposals in basic education is the initial teachers' education, usually based on a fragmented view of knowledge and the absence of interdisciplinary teaching materials (SILVA; MAGALHÃES, 2016).

Given so many obstacles involved both in the integration of the areas of natural sciences in basic education, as in the development of integrative proposals, the interest of this research focuses on the impact on the curricular organization of teacher education brought by the changes made in the area of Natural Sciences and their Technologies, by its unprecedented character, requiring a differentiated profile of the teacher of biology, physics, and chemistry, in accordance with an integrative and interdisciplinary discussion.

Undergraduate courses of interdisciplinary teacher education, although necessary, are still experienced in the early stages of construction and implementation in Brazil (GATTI et al, 2022). It is important to highlight that many of the existing degrees in Nature Sciences in the country, due to the tradition of fragmented disciplines, have difficulties in overcoming the content-based and disciplinary model. They end up reinforcing in their curricula the junction, the sum of physical, chemical and biological knowledge and not a real articulation among them.

One of the main criticisms that is made to the teaching of natural sciences is its compartmentalised, watertight and poorly articulated teaching. The lack of articulation in the undergraduate courses makes the challenge for natural sciences teachers almost insurmountable. Although the municipal and state education departments try to overcome the problem by offering some continuing education courses, the degree courses are still far from interdisciplinarity.

3.1. Building an undergraduate course focused on teacher education in an interdisciplinary perspective in Science

In an attempt to promote an expansion of the relations between the scientific knowledge mobilized, the proposal of the new Interdisciplinary Bachelor's Degree in Sciences (USP) carries out some movements: at the same time that it develops a panoramic vision of the scientific culture about our knowledge of the Universe, for example, it delves into its various phases and areas, with the objective of articulating the whole and the part. The introductory curricular component, to be taught by teachers with knowledge in different fields of knowledge (astronomy, physics, chemistry, biology, geoscience, education, philosophy and engineering) has the purpose of providing an overview of this knowledge that will be more and better deepened throughout the course. The idea is to investigate and debate on the knowledge of the Universe produced by the natural sciences over time and the main technologies and tools important to this construction.

Nature Sciences and your knowledge of the Universe

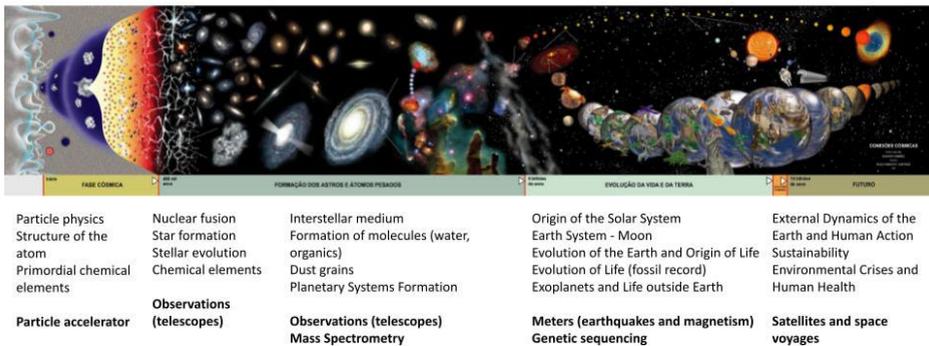


Figure 1. Science, Technology and the construction of knowledge.

The education in natural sciences aims to, while working on the fundamental concepts proposed by the BNCC (BRASIL, 2018): Matter, Energy; Life and Evolution; and Earth and Universe, structure and organize them from major themes that interconnect these topics, as well as by fundamental aspects and themes in science, such as: *Patterns and transformations in nature; Observations, modeling and simulations in the construction of knowledge in Natural Sciences; Energy and the challenges of the 21st century; Matter that forms us and surrounds us and its impacts on modern life; Life, health and environment; Light, radiations, their impacts and applications.*

Furthermore, the purpose of this course is to situate this knowledge in time and space, providing reflections and debates involving the nature of scientific knowledge, its

investigative processes and practices, its relationship with technology, with history and with culture and its relationship with educational spaces, especially the school.

In order to give life to innovative proposals in basic education, it is also part of the objectives of the new Interdisciplinary Bachelor's Degree in Sciences (USP) to structure supervised internships through the development of inter/transdisciplinary projects in partner public schools.

The proposal of the new Interdisciplinary Bachelor's Degree in Sciences (USP) dialogues with the concept of transversality introduced in the Brazilian educational regulatory framework (CNE/CEB, 2010, p. 24): "*transversality guides to the need to institute, in educational practice, an analogy between learning theoretically systematized knowledge (learning about reality) and real life issues (learning in reality and from reality).*" And has as reference the idea that to teach in an interdisciplinary way, the mere juxtaposition of content is insufficient. The necessary change consists of a change in the understanding and attitude of the future teacher (LENOIR, 2006; FAZENDA, 1995), and will only be possible with the overcoming, at least in part, of an exclusively disciplinary curriculum structure.

The work described here fits into the research model called Experiences Report (RE) and tries to seek to "*reach subjects, events and temporalities, the Report imbues other processes and knowledge, linked to modalities of scientific constructions more apt to recognize the importance of the use of narrative skills*" (DALTO and FARIA, 2019).

4. Some considerations

It is essential to highlight that we are immersed in a very dynamic world full of concrete challenges that urge us at all times. Living responsibly and actively requires a certain degree of scientific literacy and, therefore, the mastery of a series of competences and skills in which inter-transdisciplinarity is very present. Real-life problem situations are not, in general, specific to one component. From this perspective, the Natural Sciences proposed for the new Interdisciplinary Bachelor's Degree in Sciences (USP) intends to educate teachers who can meet the current educational demands, starting from real problem situations in which the knowledge of natural sciences is mobilized, in order to build a more just and equitable society.

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Designing co-curriculum experiential learning practice in permaculture for studying science classics

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Abstract

General education (GE) plays a critical role in university education. It embraces a broad intellectual pursuit through the study of and reflection on liberal arts, science knowledge, and real-world situations. The inspiring yet challenging common-core GE foundation course UGFN1000 In Dialogue with Nature, which requires students to study science classics, was launched at CUHK in 2012. To enhance students' learning of the selected science classics, such as Origin of Species and Silent Spring, co-curriculum experiential learning practice in permaculture was designed and employed. This paper illustrates the design of the pre-session preparation, practice sessions, and post-session reflection. It provides a practical and insightful reference to educators interested in developing experiential learning through permaculture in GE and beyond.

Keywords: *Experiential learning; general education; in dialogue with nature; science classics; permaculture.*

1. Introduction

General education (GE) has been a key component of higher education in the 21st Century. It plays a critical role in nurturing students to meet the challenges of the ever-changing world and preparing them to be engaged citizens with global awareness (Office of University General Education, 2013). Taking the opportunity of the educational structure reform in Hong Kong in 2012 (Wang & Gano-Phillips, 2017), a common-core GE Foundation Programme was developed and integrated into the new four-year undergraduate curriculum at The Chinese University of Hong Kong (CUHK). Each year, the science classic-reading course UGFN1000 In Dialogue with Nature in the GE Foundation Programme requires 3,600 junior undergraduates to reflect on the intellectual pursuit of nature and science through the study and discussion of selected excerpts of science classics, such as Charles Darwin's *Origin of Species*, James Watson's *DNA: The Secret of Life*, Rachel Carson's *Silent Spring*, and Joseph Needham's *The Shorter Science and Civilization in China*.

Previous findings suggested that studying science classics as a common-core requirement is very challenging for students (Hoi, Wong & Pang, 2017; Kiang, Ng & Cheung, 2015; Lau, Li & Liao, 2018). Furthermore, without concrete experience of the contexts of the science classics and direct exposure to the related real-life situations, students may find it difficult to fully appreciate the ideas, problems, and dilemmas in the classics and, therefore, their relevance to the students' lives and contemporary situations. To enhance students' learning in this science classics-reading GE course, experiential learning has been employed to bridge the book knowledge and real-life situations and to foster reflection. (Li, 2018) Experiential learning is a transforming process whereby knowledge is created from experience (Kolb, 1984). In Kolb's experiential learning theory, an experiential-learning cycle divides the learning process into four stages, including concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb, Boyatzis, & Mainemelis, 2001). Most students agreed that experiential learning through farming helped them understand the course materials and fostered reflection in the GE course (Li, 2018). The practice can foster a sense of relevance and immediacy, thereby enhancing understanding of dilemmas discussed in the classics and fostering deep reflection on the challenges and ethics of applying science in real-life situations.

While it is largely considered that farming is the foundation of sedentary civilizations, it has brought global concerns regarding food safety, environmental pollution, biotechnology ethics, and sustainability (Food and Agriculture Organization, 2017). The development of sustainable agriculture is of paramount importance to alleviate the pressing of these global challenges. Among various agriculture models, permaculture is a philosophy of living with nature and a practical design to maintain an agriculturally productive ecosystem that preserves biodiversity, stability, flexibility, and sustainability (Holmgren, 2002; Mollison & Holmgren, 1978). It has three tenets (care for the Earth, care for people, and fair share), which

can be achieved by actualizing eleven design principles (Mollison, 2013). Since the philosophy, principles, and practical designs of permaculture echoes with many core issues stressed in the science classics, permaculture is deemed suitable to become a core theme in the development of the co-curriculum experiential learning practice to enhance students' learning this science classic-reading GE course.

For instance, permaculture's tenet "care for the earth" aligns with Carson's viewpoint on the human-nature relationship, in particular, the use of pesticides. Back in the 1960s, Carson had a detailed discussion in *Silent Spring* that the "web of life" is highly complicated. There are times that we inevitably intervene in the relationship, but we should be keenly aware that our acts will bring consequences to other places in the world and in the distant future (Carson, 1962). Today, the global use of insecticides has increased nearly one-fold from 2.3 million tons in 1990 to more than 4.1 million tons in 2019 (Food and Agriculture Organization 2022). The problem of excessive use of insecticides and herbicides weakens the insect biodiversity worldwide and results in an increase of super-pests. Aligning with Carson's desire for biological control, permaculture aims at reducing or eliminating the external input for maintaining or restoring the natural systems. The permaculture principle of "using biological resources" guides farmers to adopt biological insect control instead of pesticide (Mollison, 2013). In our experiential learning practice, we did not apply any pesticides. Instead, we planned tropical milkweed (*Asclepias curassavica*) to attract ladybugs to control the population of aphids in the rooftop garden. Students can therefore have a better understanding of the ideas in *Silent Spring* and foster reflection by practicing this permaculture principle. More examples include the connection between the permaculture principle of "accelerating succession and evolution" and natural selection and man's selection described in Charles Darwin's *Origin of Specie*, as well as the permaculture principle of "relative position" and the natural pattern of yin-yang theory in Joseph Needham's *The Shorter Science and Civilization in China*.

2. Objective

Given that permaculture emphasizes the coherent understanding of the natural systems and values the harmonious coexistence of human society and the land community, which is highly relevant to the broad coverage of the science classics in the GE course, it was deemed an appropriate subject for the experiential learning practices in the science classics-reading GE course. Therefore, co-curriculum practices in permaculture have been designed and employed to enhance the understanding of the selected science classics. This paper aims to illustrate the designs of experiential learning sessions for educators interested in developing similar experiential learning practices.

3. Design of Practice Sessions

The purpose of the practice sessions is to enhance students' learning in the science classic-reading GE course through the experience of permaculture practice in real-life situations. Students could choose this experiential learning practice as an optional assessment component which contributed to a total of 3% of students' course grades. A rooftop garden at the Hui Yeung Shing Building at CUHK had been established as the site of practice. The experiential learning practice was designed with three parts: pre-session preparation, practical sessions, and post-session reflections (Figure 1).

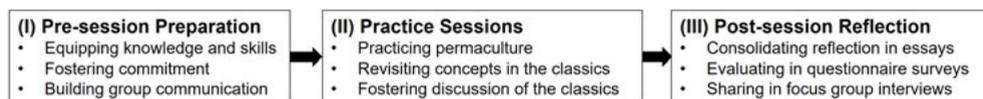


Figure 1 Schematic diagram of the design of the practice sessions.

3.1. Pre-session Preparation

Engaging students before the experiential learning sessions was essential for effective learning. The pre-session preparation aimed at equipping students with pre-requisite knowledge and skills, fostering commitment, and building communication among students in groups before the practical sessions. Blended learning was employed here using two e-learning instruments: (i) the “Experiencing Permaculture” micro-module and (ii) the tailor-designed farming companion mobile App “Growing Edibles 101” (GE101).

3.1.1. Micro-module “Experiencing Permaculture”

The permaculture micro-module was comprised of three short introductory videos about sustainable agriculture, permaculture principles, and designs (Experiencing Classics Website, 2022). The first episode “Agriculture and Sustainable Development” introduced the development of agriculture in Hong Kong and the world, the relationship between agriculture, classic texts, and social issues, and the definition of permaculture. The second episode “Permaculture Principles” and third episode “Permaculture Design” explained the permaculture principles and practice, respectively, which helped students glimpse the philosophy of permaculture. By watching these micro-module videos, students could gain pre-requisite knowledge about sustainable agriculture and permaculture before attending the practice sessions. Students were required to complete a short quiz on the micro-module before registration for the sessions.

3.1.2. Mobile App “Growing Edibles 101” (GE101)

From our experience, students generally did not understand the relationship between nature and farming. Insufficient knowledge of farming techniques also presented an obstacle to their experiential learning. A considerable amount of time had to be spent on explaining basic

knowledge and skills in each practice session. Meanwhile, inadequate attention or mere forgetfulness on the part of the students could lead to poor growth of the crops, resulting in a disappointing learning experience. Therefore, the mobile App GE101 was developed for blended learning (Figure 2). The App contained the following features which helped students learn prior to and during the practice sessions:

- connecting the knowledge, attitude, and value taught in the GE course with farming practices by asking reflective questions and displaying inspiring famous quotes;
- equipping students with essential knowledge and basic skills through tailor-made content, illustrations, and demonstration videos;
- facilitating the selection and planting of seasonal crops;
- issuing reminders and confirmations of daily farming tasks for student groups;
- serving as a platform for communication among students in groups and between teachers and students.



Figure 2 Screen captions of the mobile App GE101. The panels from left to right are the pages on farming techniques, crop information, group work reminder, and the message board for communication.

3.2. Practice Sessions

The practice sessions were a series of two-hour biweekly or triweekly hands-on practice and discussion in groups at the rooftop garden over ten weeks. The sessions aimed to provide hands-on experience in practicing permaculture, revisiting concepts, and fostering discussion of selected science classics. Each session included an introduction, demonstration of farming tasks, hands-on practices, group discussion of classics, and the learning experience (Table 1). Farming practices included soil-mixing, seeding, watering, weeding, pest control, composting, applying fertilizers, pruning, and harvesting. Apart from participating in the four practice sessions, students were responsible for taking care of their own crops between the sessions. It was crucial to carefully select the seasonal crops with appropriate growth periods (70 days in our case) so that students could harvest and enjoy their crops at the end of the sessions. If the growth was unsuccessful, it was also an excellent opportunity to reflect on the farming process and learn from the mistakes.

Table 1 Session plan of each practice session.

Session 1 (Day 0)	
Introduction	<ul style="list-style-type: none"> Introducing the aims of the practice sessions, the rationale behind experiential learning, and the connection between studying science classics and permaculture Introducing the management and safety issues at the rooftop garden
Practice	<ul style="list-style-type: none"> Demonstrating and practicing soil-mixing, seeding, irrigation
Discussion	<ul style="list-style-type: none"> Discussing the hands-on experience and the value of good farming soil Reminding students to bring food leftover for composting in the next session
Session 2 (Day 21)	
Introduction	<ul style="list-style-type: none"> Reading the excerpt from the classics <i>Silent Spring</i> Briefing the relationship of the practice to <i>Silent Spring</i>
Practice	<ul style="list-style-type: none"> Demonstrating and practicing weeding and composting
Discussion	<ul style="list-style-type: none"> Sharing thoughts or questions on the value of weed
Session 3 (Day 49)	
Introduction	<ul style="list-style-type: none"> Reading excerpts of the classics <i>Silent Spring</i> and <i>Origin of Species</i> Briefing the relationship of the practice to <i>Silent Spring</i> and <i>Origin of Species</i>
Practice	<ul style="list-style-type: none"> Demonstrating and practicing weeding, pest controlling, pruning, and fertilizing
Discussion	<ul style="list-style-type: none"> Sharing thoughts or questions on the meaning of pest and their relationships with other plants and animals in the rooftop garden
Session 4 (Day 70)	
Introduction	<ul style="list-style-type: none"> Reading excerpts of the classics <i>DNA: The Secret of Life</i> and <i>The Shorter Science and Civilization in China</i>. Assessing the yield and quality of students' crops
Practice	<ul style="list-style-type: none"> Demonstrating and practicing harvesting and seed saving
Discussion	<ul style="list-style-type: none"> Sharing thoughts or questions on the meaning of seeds and farming cycles according to patterns in nature. Reviewing the whole process of permaculture farming over the ten weeks, such as the lessons learned, the most impressive moments, and their feelings at different stages. Encouraging students to continue rooftop farming after the practice sessions

3.3. Post-session reflection

Students were required to submit a short post-session reflection essay to consolidate their reflection after the practice sessions. Shortlisted students' reflections can be viewed on the Experiencing Classic Website (2022). A year one medical student has agreed to share her experience and reflection in this paper:

“The activity was truly one full of insights, in terms of inducing philosophical reflection on the science classics and our daily lives, especially when the world is in such an abnormal state. To start with, the activity not only granted me the opportunity to have hands-on experience in farming but included some sort of reflecting sessions. This linkage between theory and practice allowed me to have a more in-depth understanding of the view that Carson had: nature had her way of maintaining a balanced ecology, and it is more sophisticated that may be beneficial even for humans. Examples would be weeds, which happen to be ideal indicators for the soil’s condition. Moreover, seeing bees while

watering plants was really something special for me as it shows that humans must rely on nature to yield fruits. Apart from the aforementioned, planting also brought me some insights into my daily life. Participating in the production of fertilizer from food waste, eating a freshly harvested leave, putting my fingers deep in the soil, and hugging bushes are all not part of my daily life, especially the latter ones when the environment is somehow considered contaminated that from childhood I have been taught not to touch things when it is not necessary because they are 'dirty'. It was quite an experience that now I feel like having broken through a bit compared to myself in the first planting session – it feels good to be in direct contact with nature, and things that seem dirty, like soil, may sometimes be even cleaner than ourselves, who are contaminated with artifacts like plastic as so on. Additionally, eating the juicy radish I harvested really gave me satisfaction: the love of freshness felt like something I genetically possessed, and the effort of planting really paid off. My dream to do farming in my old years has been reassured!"

Students were invited to fill in a simple questionnaire and join focus group interviews to give feedback on the practice sessions. From the questionnaire, about 95% of the students agreed at different degrees that the practice sessions were helpful in learning the science classics in various aspects (Table 2).

Table 2 Students' feedback on the practice sessions of experiential learning through permaculture (n=44). The figure represents the percentage of each score.

Score	1	2	3	4	5	6
a) Deepen understanding of the science classics	0.0	2.3	2.3	31.8	43.2	20.5
b) Extend the learning beyond the courses	0.0	2.3	0.0	15.9	61.4	20.5
c) Relate science classics with daily lives	0.0	2.3	2.3	20.5	56.8	18.2
d) Enhance motivation for learning	0.0	0.0	0.0	22.7	54.5	22.7

(Six-point Likert scale: 1 strongly disagreed, 6 strongly agreed).

4. Conclusion

Experiential learning through co-curriculum practice sessions in permaculture was designed and employed to enhance the understanding of science classics in a common-core university GE course. This paper has illustrated the design of the experiential learning practice, which consisted of pre-session preparation, practice sessions, and post-session reflection. The design and practice shared in this paper are helpful for educators interested in developing similar experiential learning practices in GE and beyond.

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Relationship between time management and class attendance in university students: clustering techniques for detection of profiles

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Abstract

Low class attendance by university students is one of the factors that may be related to abandonment ratios, which constitute a serious socio-economic issue. The aim of this work is to confront the influence of the time management capacity of first-year students with their class attendance. With a factorial analysis of a survey carried out, four factors emerged: the students' perception of how they manage their time, the time they spend on less productive tasks, the ability to finish tasks on time and the use of time management tools. Moreover, with classification trees it was seen that students who are able to finish the tasks on time, have a greater capacity for concentration and spend less time on trivial tasks, have higher class attendance. With these profiles identified, it is expected to guide them to improve their time management, increase their class attendance and, as a consequence, decrease dropout rates.

Keywords: *Time management; class attendance; factorial analysis; classification trees.*

1. Introduction

High university dropout rates are a prominent social as well as economic problem. On the one hand, students change their life goals and on the other hand, the investment made, and the opportunity cost have a strong impact on the organizations and governments in charge of university educational management. In Spain, 33% of students do not finish the degree in which they began their higher education stage, of which 21% drop out and the remaining 12% change their degree, which implies an annual loss of €974 million (Pérez & Aldás, 2019). Undoubtedly, figures are high enough to try to reduce the dropout rate of students.

The reasons for school dropout can be approached from three perspectives (González Tirados, 1985): (1) from the perspective of the student's characteristics (aptitudes, abilities, motivation, etc.) (Esteban et al., 2016), (2) from the perspective of the institution (complexity of the studies, student-teacher relationship, educational methodologies, etc.) (Bartual Figueras & Poblet Farrés, 2009), and (3) from the perspective of society (family, cultural, socioeconomic, etc.) (Cervero-Fernández et al., 2017).

Among all these reasons, we pay special attention to those related to the student himself. Concretely, to the way in which these students manage their time. Other authors have studied time management by students. For example, Adams & Blair (2019) found a significant correlation between time management and grades obtained, although there was no difference according to gender, age or entry qualification. In contrast, Oreopoulos et al., (2022) suggest that low-touch programs that offer scheduling assistance, encouragement, and reminders for studying lack the required scope to significantly affect academic outcomes. On the other hand, Murray et al., (2022) provide methods, resources, and strategies to help students better manage their time, offering their combined experience in mentoring and training STEM students and their time management skills, and Khiat (2022) uses an automated adaptive time management enabling system to guide students in managing their time more efficiently, thus impacting in their performance.

There are also studies that analyze the determining factors regarding the degree of attendance to classes by university students, such as the one carried out by Moores et al. (2019), and even Sloan et al. (2020) indicate that there are studies in which poor time management is pointed out, among other factors, as a cause of school absenteeism. Nevertheless, we believe that the relationship between time management and student attendance in face-to-face classes has not been sufficiently analyzed due to its economic and social importance as mentioned above.

So, to deepen this gap, the objective of the work proposes to analyze the relationship between the management that students make of their time and class attendance in university studies. The identification of student profiles will make it possible to offer proposals for improvement in time management and, consequently, we hope that there will be an increase in class

attendance by students. We also hope that this increase in class attendance will have a direct impact on the reduction of university dropout rates.

To achieve this objective, the rest of the work is divided into 3 further sections. In section 2, we show the methodology used to develop the study. Section 3 shows the results obtained and finally, section 4 presents a series of conclusions and possible future lines of research.

2. Methodology

In this section is explained the dataset used, the factorial analysis and classification trees employed in the study.

2.1 Data Collection

To collect the answers from the students, a survey about time management, based on the publication by Neill (1996) has been carried out. The questionnaire consists of 28 questions which answers are represented by a scale that goes from 1 to 8; 1 being the statement “doesn't describe me at all; it isn't like me” and 8: “this statement describes me very well; it is very much like me”.

The sample is made up of 135 first-year students of Business Administration and Management, and Finance and Accounting degrees. This data has been cross-referenced with face-to-face attendance at the classes of the subject Applied Computer for Business, common to both degrees in three levels, low for students who attended less than one third of the classes, medium for the students who attended from one to two thirds, and high for those who attended more than two thirds. Personal data such as gender or age has not been included in the study because of privacy limitations.

2.2 Factorial analysis

A factorial analysis of the survey data has been carried out, with a double objective. Firstly, to identify representative factors of student time management and secondly, to reduce the dimensions of the data set.

2.3. Cluster analysis

With the factors obtained and normalized, the objectives are, on the one hand, to classify the students in different groups according to their attendance and, on the other hand, to see how time management factors influence this classification.

To do so, among the range of existing classification techniques, it has been decided to use recursive partitioning for classification trees Breiman (2017). The reason is to obtain an easily interpretable taxonomy by levels that allows dividing the students according to the rules of the tree based on the values of the factors which allows to see their importance and influence

in the classification. This gives the possibility of identifying in which aspects of time management each student should be guided individually.

3. Results

The results have been obtained using the programming language for statistical computing R, highlighting the nFactors library to calculate the number of factors for the factor analysis, stats library for factor analysis and rpart2 library for classification trees.

3.1 Factorial analysis.

Initially, a correlation matrix of the responses to the survey is calculated. In Figure 1 it can be observed a slight correlation between the survey answers.

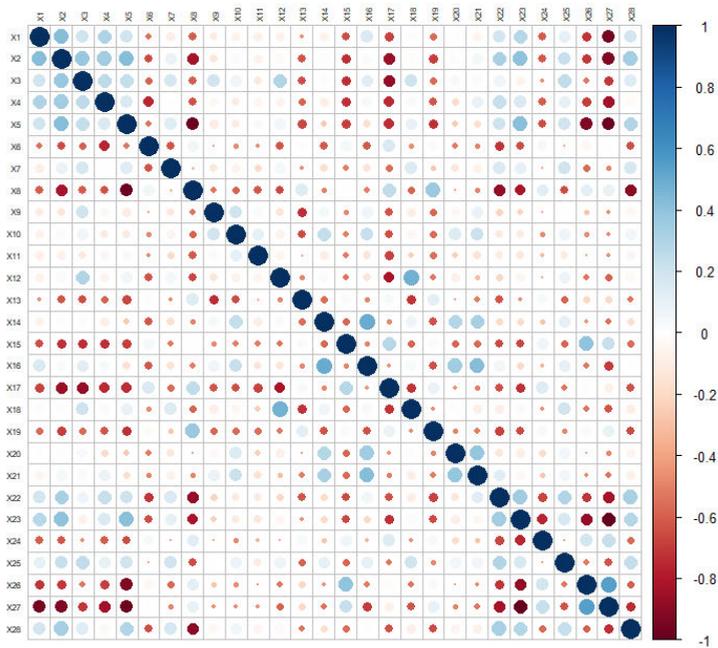


Figure 1 Correlation Matrix.

In order to ensure that the factor analysis can be carried out with guarantees, the KMO values have been calculated with a value of 0.84 greater than 0.5 and Barlett's sphericity test, which offers a K-squared value of 204.72 and a p-value of $< 2.2e-16$. This indicates that the factory analysis can be carried out with guarantees.

Four metrics have been tested to select the number of factors according to Raïche (2013): Eigenvalues: Eigenvalues with a value higher than one. The acceleration factor indicates where the elbow appears. The optimal coordinates (OC) correspond to an extrapolation of

the preceding eigenvalue by a regression line between the eigenvalue coordinates and the last eigenvalue coordinates. The parallel analysis criterion compares the eigenvalues of the sample correlation matrix with the eigenvalues obtained from a random correlation matrix for which no factors are assumed. According to the results obtained, the number of factors to be retained is 4.

Analyzing the results of performing a factorial analysis with varimax rotation shown in Table 1, Factor 1 represents the student's perception of his good time management. Factor 2 explains the waste of time. Factor 3 indicates the student's ability to complete tasks on time, and Factor 4 explains whether the student relies on any tool to keep track of his time. Regarding to Factor 4 it is true to that only question 12 has the highest value, but we decide to keep it because other questions has similar values and influence in Factor 4.

3.2 Cluster analysis.

The survey data has been divided randomly in train (110 students) and validation (25 students). The process to train the classification tree is a cross-fold validation, with a fold of 5 and 10 repetitions. The maximum depths tested are 1, 3, 5, 7 and 9. The metric to choose the best configuration is the accuracy of classification. The results obtained indicate that the maximum depth obtained is 5 and an accuracy of 36.8% which is low. However, with the validation set results shown in Table 2, the accuracy is 40%. Observing that it's difficult distinguishing between students with a high or medium assistance.

The final classification tree can be observed in Figure 2, this taxonomy allows to classify the students according to their answers to the survey.

The values shown in the leaves of the tree correspond to the probability of each class, high (left), low (center) and medium (right) value. Analyzing the taxonomy, it can be concluded that Factor 3 is the most important. That is, whether or not they complete their tasks on time. Those who do not complete their tasks tend to have a low-medium attendance and those who do comply to a medium-high attendance.

Table 1 Components matrix result of the factorial analysis.

Question	Factor 1	Factor 2	Factor 3	Factor 4
01 My life is very well organised.	0.592	-0.171	0.265	
02 I manage the way I use my time really well.	0.710	-0.232	0.201	0.103
03 I make effective plans for getting things done.	0.505	-0.150	0.310	0.365
04 I am good at breaking complex tasks down into achievable chunks.	0.513	-0.221	0.231	
05 I use my time effectively.	0.712	-0.287		
06 I procrastinate over doing difficult tasks.		0.476	-0.109	
07 I accurately predict how long tasks will take.	0.531		0.128	0.185
08 I waste a lot of time.	-0.244	0.589		-0.190
09 I am on top of my important tasks at the moment.	0.185		0.376	0.353
10 I accomplish what needs to be done each day.	0.217		0.509	0.268
11 I do the most important tasks during my most energetic periods of the day.	0.254		0.183	0.237
12 I prepare a daily or weekly "to do" list.	0.346	-0.125	0.174	0.370
13 I spend a lot of time mucking around.		0.433		-0.333
14 I meet deadlines on time			0.753	0.112
15 I easily get distracted from important tasks	-0.117	0.632		
16 I get important tasks done on time.	0.202		0.810	
17 I find myself procrastinating over tasks that need to be done.	-0.163	0.584		-0.423
18 I have a weekly schedule on which I record fixed commitments.	0.378	-0.107	0.269	0.286
19 I spend too much time on trivial matters		0.568	-0.124	
20 I always complete tasks before they are due	0.194		0.642	
21 Despite interruptions, I get important tasks done.	0.234		0.676	
22 I am in control of how my time is spent.	0.617	-0.189	0.178	
23 I am satisfied with the way I use my time.	0.708	-0.241		
24 I find distractions to be very tempting.	-0.112	0.605	0.152	
25 I monitor progress towards my goals.	0.582		0.315	0.171
26 I have a hard time concentrating.	-0.253	0.656		0.351
27 I am hopeless at time management.	-0.382	0.623		0.385
28 I balance work, rest, and play.	0.629	-0.118	0.146	0.136

Table 2 Confusion matrix for validation data.

	High	Low	Medium
High	4	4	3
Low	1	1	2
Medium	4	1	5

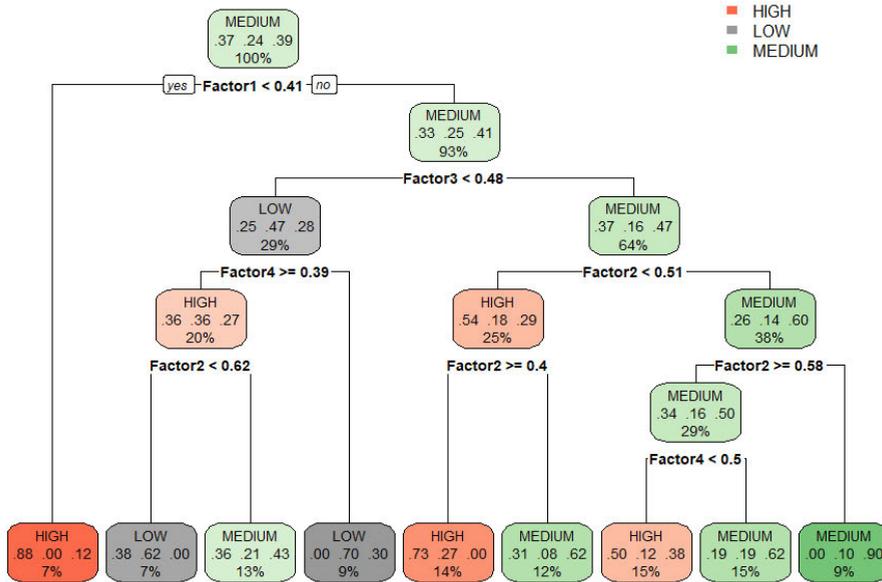


Figure 2 Final classification tree.

4. Conclusions

Poor class attendance is a problem that affects the university community. With the survey, four factors that define the temporary management of students have been identified. The elaboration of the taxonomy yields weak results in terms of precision but has allowed us to see the relationship between time management factors. It can be concluded from these weak results that there are other factors that affect attendance, and this cannot be fully explained by time management. Although, the tree taxonomy allows us to identify student profiles to orienting them in order to improve their time management, increase their class attendance and decrease dropout rates. The study is limited by the protection of personal data of the students.

As future lines of work, it is intended to expand the survey to analyze other causes such as repetition of the course, the family environment, the perception of difficulty of the subject, or if the student does other activities that affect attendance. It is also intended to expand the sample with different subjects and degrees to enrich the results and make them more global.

Establishing a relationship between time management and dropout rates, this presents a challenging problem due to the difficulty involved in contacting students who have dropped out and having their willingness to complete the surveys.

Methodologically, several models will be compared, such as Ordinary Least Squares or Spline Regression.

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The engagement in university students: preliminary psychometric analyses of the Spanish version of the engagement vs. disaffection with learning scale

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Abstract

The level of active participation of students in a learning activity is referred to as student engagement. Research indicates that engagement and disaffection are two complementary factors with two domains: behavioral and emotional. Unfortunately, there are no multidimensional instruments available in Spanish. Therefore, a study was conducted to analyze the psychometric properties of the Spanish version of Engagement vs. Disaffection with Learning (EDL). A sample of 194 participants was analyzed in terms of distribution of item responses, factor structure, internal consistency, and the correlation with other measures of engagement and personality traits. Results confirmed the scale's reliability in terms of internal consistency. However, some problematic items were identified. The Spanish version of the EDL appears to be a promising scale for assessing engagement among Spanish-speaking students, with the need to review some of its previous items. The EDL could be a useful tool for educators and researchers in the field of education.

Keywords: *Disaffection; education; engagement; motivation; university.*

1. Introduction

Initially, *engagement* is a phenomenon linked to the labour world with its construct of *burnout* (Maslach & Leiter, 1997). Although, due to its implications, it quickly spread to the education sector, especially in higher education institutions. The concept definition of student engagement is the degree of active student participation in a learning activity (Skinner et al., 2008).

It is often conceived as a multidimensional phenomenon involving academic and personal factors related to the student, as well as factors related to the context in which the learning process takes place (e.g., campus facilities, social environment, services, etc.) (Sinclair et al., 2003), constituting itself as a subjective construct (Moreira et al., 2020). Likewise, emotional support from teachers (Mazer, 2017) and greater communicative clarity (Titswort et al., 2010) have been linked to higher levels of student *engagement*. Traditionally, there are three identified domains in the *engagement* phenomenon: affective, cognitive and behavioral, which are all highly correlated (Bond & Bedenlier, 2019; Eccles, 2016). However, other authors consider it more appropriate to differentiate the negative aspects (i.e., disaffection) from the positive ones (i.e., *engagement*), arguing that it is more disaffection than a lack of *engagement* (Skinner et al. 2008, 2009).

Research in this area has shown that student *engagement* predicts learning, motivation, performance, and academic progress (Lin et al., 2019; Wang, 2017; Zamarripa et al., 2022). Students who exhibit high levels of engagement are more prone to preparing for classes by engaging in activities such as reading, studying extensively for exams, or completing homework assignments. They could think about the applicability of course content to their lives, how they can implement practical knowledge and skills, and how the subject can benefit their future careers (Mazer, 2017).

To promote *engagement* in our students. Currently, the international scientific literature offers numerous instruments to measure *engagement* or components of it. However, it can be challenging to find instruments that effectively capture cognitive, emotional, and behavioral factors all at once (Moreira et al. 2020). Additionally, many of these instruments have not been validated for use in the Spanish language. Therefore, the objective of this research is: 1) to validate the *Engagement vs. Disaffection with Learning* scale in a sample of Spanish university students and 2) to investigate the factors and characteristics that are related to high levels of *engagement*.

2. Method

2.1. Participants

The inclusion criteria were (1) being a university student at the time of responding the questionnaire, and (2) having a proficient level of Spanish. The study sample comprised 194 students, with 154 women (79.4%) and 38 men (19.6%), and 2 non-binary individuals (1.0%). The ages of the participants ranged from 17 to 48 years, with a mean of 20.6 ($SD = 3.83$). The participants' educational background was diverse, with 95.4% pursuing higher education degrees or certificates, 3.6% enrolled in master's or postgraduate programs, and 1.0% in doctorate programs. Most of the participants (76.1%) reported living with their family of origin, while 9.1% lived alone, and 7.6% cohabited with their own partner or family.

2.2. Measures

The EDL is a 27-item instrument that assesses students' engagement versus disaffection in the classroom by measuring behavioral and emotional participation or rejection in classroom learning activities (Skinner et al., 1990, 1998; Wellborn, 1991). All items are scored on a four-point Likert scale, which ranges from *1 = does not describe me at all* to *4 = describes me totally*. This scale aims to measure four domains of *engagement*: Behavioral *engagement* (5 items), Behavioral *disaffection* (5 items), Emotional *engagement* (5 items) and Emotional *disaffection* (12 items). Nevertheless, the items in the Emotional *disaffection* scale can be consolidated into five, as some items are variations of different negative emotions, such as frustration, boredom, or concern. The scores of these four factors are obtained by adding the scores of each of the items that are part of it. However, other research has found the better functioning of the two-dimensional structure: *commitment vs. discontent* or *emotional vs. behavioral* (Skinner et al. 2009).

The original English-language version of the Agentic Engagement Scale (AES; Reeve, 2013) includes five items measuring students' dialectical and transactional participation in class (e.g., *"I defend my opinions even if they are not in line with those of my classmates"*). Item responses are presented on a 7-point Likert scale, ranging from 1 (*completely disagree*) to 7 (*completely agree*). Items were translated and adapted into Spanish through a parallel translation and reconciliation process.

The Spanish version of the Mini International Personality Item Pool–Five-Factor Model–Positively Worded (Mini-IPIP-PW; Martínez-Molina & Arias, 2018; original version by Donnellan et al., 2006) was administered. This instrument assesses the Big Five personality domains of extraversion, agreeableness, emotional stability, and openness to experience through 20 items. Items are scored on a 5-point Likert scale (*1 = not at all - 5 = completely*) to assess each personality trait. The Spanish Mini-IPIP-PW has demonstrated adequate

validity and reliability ($\alpha \geq .90$), and a positive relationship with engagement (Qureshi et al., 2016).

The Utrecht Work Engagement Scale for Students (UWES-9S; Schaufeli & Bakker, 2004) is a nine-item scale for assessing work engagement, characterized by three domains: vigor, dedication, and absorption (e.g., “*My studies inspire me with new things*”). Items are scored on a 7-point Likert-type scale, ranging from 0 (*never*) to 6 (*always*). The three-factorial structure of the UWES-9S has been confirmed, showing a high internal consistency ($\alpha = .84$).

An ad-hoc questionnaire was also administered to gather sociodemographic data, including participants' gender, age, current field of study, and admission GPA.

2.3. Procedure

The data collection for this study took place between October and November 2022 and utilized a convenience sample method. The invitation to participate was sent to undergraduate university students via their virtual campus. Participants were directed to an online questionnaire hosted on the Qualtrics platform (<https://www.qualtrics.com>), which included the previously mentioned instruments. Participants were encouraged to share the link with their social media contacts (e.g., Twitter, Instagram). Before starting the questionnaire, all participants were informed about voluntary participation, anonymity, and confidentiality in the study, and gave an online informed consent. The study was conducted in accordance with the Declaration of Helsinki (World Medical Association, 2001) and received approval from the University of Barcelona's bioethics commission.

2.4. Statistical analysis

Descriptive statistics of sociodemographic variables and items of the EDL scale were analyzed, as well as data on skewness, kurtosis, and response endorsement to evaluate the floor and ceiling effects. The acceptable value of skewness and kurtosis are those in the range $[-1, +1]$ (Ferrando and Anguiano-Carrasco, 2010). Statistical analyses were performed using the Jamovi program version 2.3.21.

To assess internal consistency, Cronbach's alpha values and item-total correlations were calculated. A minimum alpha value of 0.70, as recommended by Nunnally and Berstein (1994), was used as the threshold for a reliable measure. Pearson's correlation coefficient was used to compute the correlations between the domains of the EDL.

The convergent and discriminant validity were assessed through correlation analysis between the scale domains of the EDL and the AES, UWES-9S, and Mini-IPIP-PW. Pearson's correlation coefficients were computed and interpreted according to Cohen's criteria (1988).

3. Results

3.1. Item-level descriptive analysis

Table 1 includes the distribution of the scores of the items on the EDL scale. The items with the lowest scores were items 24, “*When I’m in class, I feel bad*” ($M = 1.52, SD = .76$) and 25, “*I get cranky when I’m doing activities in class*” ($M = 1.41, SD = .64$) and those with the highest scores are items 1 “*I strive to do well in college*” ($M = 3.29, SD = .68$) and 9 “*I enjoy learning new things in class*” ($M = 3.17, SD = .80$).

The skewness and kurtosis indices show an adjustment to normality in most items, although there is a slight positive asymmetry. In this way, there is an observation that some items concentrate with the largest percentage of answers in the answer option 1 = *does not describe me at all*, showing a floor effect of that item. Also, some items show a ceiling effect by concentrating the highest percentage of responses in option 4 = *describes me totally*.

3.2. Internal consistency

According to Cronbach's alpha, internal consistency levels are satisfactory for the four domains. Table 2 shows the levels of both Cronbach's α and the item-test correlation for items structured in the four domains. Items with critical item-domain correlations ($< .40$) are bold in this table.

3.3. Convergent and discriminant evidence

There was a large positive correlation between the domain of behavioral and emotional engagement ($r = .63$) and a large negative correlation found between this domain and behavioral disaffection ($r = -.73$). Similarly, a large correlation ($r = .70$) was observed between the emotional engagement domain and the UWES-9S engagement scale. The UWES-9S demonstrated moderate correlations with the remaining domains of the the EDL.

Table 1. Descriptive statistics of the EDL items.

Domain/ Item	M	SD	Skewness	Kurtosis	Percentage of Item Endorsement			
					1	2	3	4
Behavioral engagement								
Item 1	3.29	.68	-.55	-.33	.05	11.2	46.5	41.7
Item 2	2.74	.82	-.24	-.44	7.0	29.4	46.5	17.1
Item 3	1.95	.97	.67	-.62	40.6	32.1	18.7	8.6
Item 4	3.02	.76	-.46	-.01	3.2	18.2	52.4	26.2
Item 5	2.96	.80	-.30	-.56	3.2	24.6	45.5	26.7
Emotional engagement								
Item 6	2.67	.85	-.16	-.58	8.6	32.1	42.8	16.6
Item 7	2.96	.79	-.52	.03	4.8	18.7	52.4	24.1
Item 8	2.19	.82	.28	-.42	19.8	47.1	27.3	5.9
Item 9	3.17	.80	-.77	.18	3.7	13.4	44.9	38.0
Item 10	3.06	.79	-.45	-.40	2.7	19.8	46.0	31.6
Behavioral disaffection								
Item 11	1.79	.92	.97	.04	47.6	32.3	12.8	7.0
Item 12	1.57	.75	1.21	.95	56.7	32.1	9.1	2.1
Item 13	1.71	.87	1.00	.07	52.4	28.9	14.4	4.3
Item 14	2.60	.89	.12	-.81	8.6	41.2	31.6	18.7
Item 15	2.62	.92	.06	-.89	9.6	39.0	31.0	20.3
Emotional disaffection								
Item 16	2.01	.78	.54	.08	25.7	52.4	17.6	4.3
Item 17	1.89	.79	.53	-.34	34.8	44.4	18.2	2.7
Item 18	1.79	.83	.76	-.26	44.4	35.8	16.6	3.2
Item 19	2.02	.96	.56	-.69	35.8	34.8	20.9	8.6
Item 20	1.81	.94	.86	-.32	48.1	28.9	16.6	6.4
Item 21	3.09	.87	-.71	-.16	5.9	16.0	41.7	36.4
Item 22	1.83	.82	.84	-.12	43.3	35.8	15.0	5.9
Item 23	2.24	.98	.42	-.80	24.6	41.2	19.8	14.4
Item 24	1.52	.76	1.51	1.86	61.5	28.3	7.0	3.2
Item 25	1.41	.64	1.58	2.27	66.8	26.7	5.3	1.1
Item 26	2.91	1.00	.44	-.96	10.2	24.1	29.9	35.8
Item 27	2.96	.97	-.53	-.75	9.1	21.4	34.2	35.3

Table 2. Cronbach's α and item-test correlations levels for the EDL scale.

Domain/ Item	Cronbach's α	Item- domain correlation	Domain/ Item	Cronbach's α	Item- domain correlation
Behavioral engagement		0.70	Item 4		.69
Item 1		.40	Item 5		.67
Item 2		.61	Emotional disaffection		.77
Item 3		.13	Item 1a		.54
Item 4		.61	Item 1b		.51
Item 5		.65	Item 1c		.42
Emotional engagement		.84	Item 2a		.57
Item 1		.63	Item 2b		.53
Item 2		.71	Item 2c		.42
Item 3		.62	Item 3		.59
Item 4		.63	Item 4		.44
Item 5		.59	Item 5a		.62
Behavioral disaffection		.81	Item 5b		.59
Item 1		.48	Item 5c		.40
Item 2		.54	Item 5d		.34
Item 3		.65			

Note. Items with item-domain correlation < .40 are in bold

Table 3. Pearson correlation between EDL scale with other variables.

Scales	Behavioral engagement	Emotional engagement	Behavioral disaffection	Emotional disaffection
EDL				
Behavioral engagement	-			
Emotional engagement	.63**	-		
Behavioral disaffection	-.73**	-.55**	-	
Emotional disaffection	-.48**	-.64**	.61**	-
Mini-IPIP-PW				
Extraversion	.65	.16*	-.01	-.14
Agreeableness	.17*	.14*	-.09	.01
Conscientiousness	.24**	.16*	-.36**	-.25**
Emotional stability	.07	.20*	-.01	-.18*
Openness to experience	.14	.17*	.04	-.02
AES	.36**	.43**	-.19*	-.32**
UWES-9S	.53**	.70**	-.49**	-.59**
Admission GPA	.19*	.12	-.19*	-.07

Note. * $p < .005$, ** $p < .001$

4. Discussion

The results of this study show that despite finding satisfactory levels of internal consistency according to the four-factor model proposed by Skinner (2008), there are some items (p.e., item 3 "When I'm in class, I participate in discussions") that show a low discriminative capacity to differentiate between high and low values of engagement. This lack of

differentiation between behavioral engagement and disaffection has been previously observed in other studies (Immekus & Ingle, 2019).

Our findings support the correlation between the EDL and other forms of engagement, as work engagement, in line with the study of Skinner (2009). On the other hand, we did not find the expected results according to academic achievement (Wang, 2017). However, we observe relations between behavioral engagement/disaffection and conscientiousness and between emotional disaffection and Emotional stability (Muenks et al., 2017).

Despite the novelty and significance of the research topic, this study is subject to limitations, such as the use of a convenience sampling method for participant selection. Moreover, it is essential to employ a larger sample size to conduct a confirmatory factor analysis of the scale and assess its internal structure.

5. Conclusion

The EDL scale is a promising instrument for studying engagement in the Spanish population, with satisfactory internal consistency levels and evidence of convergent validity with other engagement measures and personality variables. However, it is necessary to remove or review in depth the functioning of some items to ensure the adequate performance of the EDL scale.

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Increasing student engagement with COIL Padlet

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Abstract

Student engagement undoubtedly deserves attention and time of lecturers and researchers. This paper aims to showcase how to increase the engagement of international marketing students with a simple, technology-enhanced course addition based on an online bulletin board (Padlet) collaboration between two universities in different continents.

This conceptual paper provides (a) for other educators a case study, detailing the efficient collaboration of two lecturers in different universities for a joint course design; and (b) for researchers some initial data of increased student engagement.

Keywords: *Student engagement; COIL; international marketing; course design; experiential learning.*

1. Introduction

Engaging students into the learning process is essential for deep learning experiences. In recent decades education thankfully has added new forms to traditional classroom lecturing, where the professors recited theoretical input, explained, and narrated as the central figure in the educational setting. A plethora of interactive methods and technologies, including case-study based teaching, integrating online exercises and games into lectures provide opportunities for student engagement. These innovative forms require certain investments in training and time from the lecturers which can be a limiting factor of a wider deployment. However, due to simple technology-enhanced tools, stimulations of student engagement can be nowadays achieved, even for challenging international education topics.

In this paper we present a course design how to increase the engagement of international marketing students with a simple addition based on an online bulletin board (Padlet) shared between two universities in different continents. A description of the lecturers' collaboration, which was initiated via a Collaborative Online International Learning (COIL) between the two universities and involved 40 students, is included. Their joint development of a learning cycle on the topic of cultural difference in the context of marketing is explained in detail. Several observed indicators of increased student engagement are also summarised.

This paper addresses several themes addressed in the conference, namely (a) Globalisation & International, (b) e-learning strategy, and (c) Innovative teaching and learning experiences.

2. Theoretical background and method

In the research community, there is agreement that “student engagement” is a complex phenomenon, with one consensus being on the core dimensions (cognitive, behavioural, and affective/ emotional). (Kuh, 2003, Kahu, 2013, Bond et al., 2020). Even though the exact definition of student engagement and its measurement remains controversial, researchers observed positive impact on students' learning (Fredrick & McColskey, 2012; Kahu & Nelson, 2018; Bowden et al., 2021), with Bond et al. (2020) providing an overview of most used indicators of student engagement per dimensions based on 243 studies. These indicators range from “learning from peers” and “deep learning” for cognitive student engagement, to “participation/ involvement” and “achievement” for behavioural student engagement and “positive interaction with teachers and peers”, “enjoyment” and “interest” for affective student engagement; however to fully understand and measure student engagement, a quantitative analysis of easily measurable indicators may not be enough, and should be accompanied by observations of the learning environment and a better understanding of students' reflections and perceptions (Bond et al., 2020).

The experiential learning theory as introduced by Kolb (1984) stipulates learning as a cycle which creates knowledge through the transformation of students' experience with reflective practice. In a simplified way, the students' learning cycle can be described by the phases of concrete experience, reflective observation, abstract conceptualisation and active implementation, and deep learning is defined as moving from isolated to integrated knowledge. Providing the opportunity to students of strong experiences and stimulation of reflections with links to theoretical related material should achieve the highest level of learning (Kolb & Kolb, 2011). This approach also allows the lecturers to better understand students' learning by observing the students and by reviewing their reflections. The obvious relationship between experiential learning activities and student engagement has been reported by several studies (Winsett, 2016, Li et al., 2019).

International marketing education has a long tradition of using technology to enrich students' learning (Bell et al., 2001), with tools having drastically improved over the years. Hence, sophisticated technology-enhanced international teaching approaches such as COIL have been possible since over a decade, with the aim to bring lecturers and students from remote distances together (Jie & Pearlman, 2018). The integration of experiential learning theory with COIL has successfully been applied to internationalise an entire business school's curriculum and to develop intercultural skills among students (Nava-Aguirre et al., 2019).

This conceptual paper proposes that combining experiential learning theory with the opportunities provided by technology-enhanced online collaboration can efficiently contribute to a positive and interactive environment for students and increased student engagement. Next, the paper provides a detailed course design for International Marketing, enriched by a simple added course activity, namely COIL Padlet.

3. International Marketing course design

The eight public Swiss Universities of Applied Sciences and Arts are closely linked to the economy, culture and society, with their educational concept focusing on providing highly practice-relevant degrees. At the University of Applied Sciences Northwestern Switzerland (FHNW), lecturers experiment on providing students in addition to theoretical knowledge with applicable skills for future jobs. The course design of International Marketing in the BA programme of International Management was up to 2021 based on interactive and theoretical study units. Additionally, due to the COVID travel restrictions students' mobility such as international study abroad was limited. Hence the lecturer in the spring of 2021 explored opportunities to enrich this 12-weeks autumn semester syllabus for students with international experience; the overall aim was to allow students to learn about cultural difference in international advertisements in line with the course objective. The International Office at FHNW provided the contact to a professor at a partner university in the US. The

two lecturers agreed on a lean collaboration for an international exchange for the students, with the additional aim of improving student engagement. The learning experience took place on a shared online space on Padlet which as a website application is an online bulletin board where students wrote their posts and provided comments and reactions to posts of students abroad (called COIL Padlet for this project). The discussions were structured along four tasks and called COIL #1 to #4 (named COIL(s) subsequently). Students were able to receive bonus points (5% of total grade) on providing a reflection on their learning.

Table 1. Summary of adapted International Marketing course design.

	Original course design	Course addition (COIL Padlet)
Lecturer's preparation	Prepare students' reading list, prepare lecture content, case studies and exercises	Collaboration between two universities; plan 12-week semester syllabus with every 3 weeks a COIL, specify task descriptions and two-week time windows for activity; create and deploy Padlet before semester start
Students' preparation	Prepare reading on international marketing	Prepare for COIL # 3 (selection of a still or video advertisement with a cultural aspect)
Study units	Discussion of students' reading; theoretical input from lecturer; case-study group work	Topics on COIL Padlet: COIL #1: Students' interests; COIL #2: Food; COIL #3: "Cultural" advertisement; COIL #4: Religious holidays Reminder to comment on Padlet during two-week time window; time in classroom to allow discussion on COIL Padlet; educational dialogue on students' observations (retrospect); task descriptions on Padlet; reminder for COIL #3 (finding a "cultural "advertisement)
Assessment	Exam	Exam; reflection paper (bonus points)

The asynchronous discussions on the COIL Padlet were planned across the semester (Table 1), involving topics that built on each other. The COIL Padlet website was made available from the beginning of the semester and two-week time windows for working on each active COIL were defined. The time windows were helpful as students did not share the teaching day nor was the curriculum at the two universities fully aligned. Students were able to work in the classroom on the Padlet during the four "COIL" study units (for 20 minutes). Simple tasks, except for COIL #3, were intentionally designed to easily engage students (excerpts from COIL Padlet: "What are your interests?"; "What is a typical food in your culture?").

In line with the experiential learning theory, the lecturer asked the students to reflect after COIL #1 in groups whether they observed more differences or commonalities across the two sets of students (see Table 2). The lecturer synthesised their findings in an educational dialogue with them. For the more involved COIL #3 students had to select a still or video

advertisement with a cultural aspect which they also had to describe with a marketing theory. Two steps (in italics in Table 2), preparation of learning cycle and explicit abstract conceptualisation, were added to the experiential learning cycle by Kolb (1984) to better describe the learning experience of the students and the efforts involved.

Table 2. Mapping of COIL Padlet on experiential learning cycle including effort.

Experiential learning cycle	COIL Padlet Implementation	Effort for students	Effort for lecturer
<i>Preparation of learning cycle</i>	Set up joint Padlet across two universities, design four common COILs for students	None	Moderate, one day for collaboration (email, calls) of two lecturers
Concrete experience	In-class COIL #1, #2 and #4 were built on simple topics on cultural difference	Little, as time was allocated to post/comment	Little, encouraging and reminding students to post and comment
Reflective observation	Time allocated in class to reflect in groups on commonalities/ differences across COIL #1 discussions	Little, additionally implicitly	Little, facilitating an educational dialogue to synthesise students' observations
Abstract conceptualisation (implicitly)	Students select a suitable "cultural" advertisement in preparation for COIL #3	Moderate, students to match their learning to COIL #3	Little, reminding students to find advertisement
Active experimentation	COIL #3 on a "cultural" advertisement with a marketing theory	Little, as time was allocated to post/comment	None
<i>Abstract conceptualisation (explicitly)</i>	Written reflection (one page) a few weeks after COIL #3	Moderate, 1-2h to summarise their reflection	Moderate, half-day grading/ providing feedback to students

To encourage students' abstract conceptualisation, the lecturer created a reflection for students. The prompts (Table 3) were crafted with the aim of encouraging critical reflection, while at the same time allowing students to make connections to marketing theory.

Prompts were structured to help gain insight into the cognitive (Q1, Q4) and affective student engagement (Q2, Q3) dimension, and were based on research related to assessment rubrics from Brock University (Brock University, n.d.), University of Edinburgh (The University of Edinburgh, n.d.) and ongoing work of one of the authors (Miller & Staley, 2023).

Note that the reflection reports are discussed here as a mean for both students (to explicitly conceptualise) and lecturers (to learn about students' development implicitly) and the results are not the central focus of this conceptual paper.

Table 3. Prompts provided to students for their written reflection on COIL #3

Reflection on existing marketing knowledge and emotions.	Your experience with the COIL #3:
	Q1. What did you know about cultural aspects in promotion before COIL #3?
	Q2. How did you feel during the task, and what about the interaction with other students?
Connection to academic marketing concept & evidence of development	Your take-aways, learnings from COIL #3
	Q3. Have you learnt anything which you will use for future international marketing tasks?
	Q4. Did your understanding of culture change? Does a marketing theory from your reading/ class discussion make more sense now?

4. Observations and learnings

At the end of the semester, the collaborating lecturers reviewed their individual class observations, including the reflections provided from the students. Overall, they considered the COIL Padlet implementation, following an adapted experiential learning cycle, a success in terms of effort-benefit considerations. As summarised in Table 2, the perceived effort for the added tasks was little, however the benefits were significant. The lecturers were pleased by the positive learning environment created in class due to the COIL Padlet and the level of keenness of students to contribute. They also observed that students actively engaged with each other outside the allocated time in class. Students mentioned that they are interested in more interaction with partner students via synchronous lectures which the lecturers are investigating for future collaborations. They have already shared at their respective universities the observed positive behaviour of the students and the overall course design.

Whereas the behavioural dimension of an increased student engagement was captured directly by the lecturers' observations, they used the reflection reports to gain insight into the cognitive and affective dimensions. Selected quotes from these reports (as shown in Table 4) further support the claim that students were engaged in the COIL Padlet (structure and possible indicators, in brackets, as suggested by Bond et al. (2020)).

Table 4. Selected quotes from students' reflection reports.

<p>Cognitive student engagement (Learning from peers, deep learning)</p>	<ul style="list-style-type: none"> ● “Personally, it always helps me a lot when I get practical examples of theoretic content. Through the intercultural exchange, I now have examples in mind that help me to <i>internalize the theoretical knowledge</i>.” ● “From the lectures we learnt about high- & low context cultures but from COIL #3 I got to see practical examples of that and how different the communication is <i>which made it easier to understand</i>.” ● “Personally, I perceived the interactions with students of other nationalities during COIL #3 as very insightful. What especially <i>developed during this COIL</i>, was my perspective on the cultural iceberg model, as ...” ● So, thanks to this exchange, <i>I will stop assuming</i> that even if the cultures are similar, there are tools that cannot be used in all countries and that is why I must inform myself first.” ● Also, in terms of academic knowledge COIL has also helped me to <i>deeply understand different ads</i> and how stereotypes and subliminal messages are used. ● “... During the last three years of studies, we had a look at Hofstede’s dimensions... But it was the first time that I have really adapted my thinking and tried to <i>implement the theoretical knowledge</i> when talking to US students.”
<p>Affective student engagement (Positive interaction, enjoyment, interest)</p>	<ul style="list-style-type: none"> ● “The <i>interaction</i> with the international students is <i>very fascinating</i> and informative. Many students are <i>highly involved</i> into the discussion and give their own experience or expertise through their own cultural lens.” ● “Overall, these COIL tasks have been <i>very fun and insightful</i> to a completely different culture than ours. In combination with our marketing classes, it opens many views on how to reach the target audience ...” ● “... Secondly, this task was <i>fun</i>. The students posted so <i>many amusing ads</i>. Studying interactively like this and keeping in touch with each other helped to ease the difficulty of the pandemic.” ● Overall, I am <i>grateful</i> for having been able to be part of this experience.”

5. Conclusions

We believe the presented case study should allow international educators to explore similar course designs without much effort and contribute to a wider deployment of modern and technology-enhanced forms of teaching. Further research on measuring student engagement can use the reported lecturers' observations and students' quotes as starting points. Limitations of this paper are the small number of students involved and the explorative approach of this new course design and could be addressed systematically in future projects.

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Positive effects of mindfulness practices on academic performance and well-being

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Abstract

This qualitative study explored potential positive effects of mindfulness practices among university students. The mindfulness practices were provided at an experiential space, the Brain Booth at the university library, meant to learn about the mind-body connection, reduce stress, and optimize learning. The Brain Booth activities were available to students at any time during the library working hours. The findings showed that the Brain Booth was experienced as helping students to 1) Relax and Destress; 2) Calm down; 3) Foster focus and clarity; 4) Actively engage and reenergize. A strong preference was outlined for mindfulness activities without a digital component or screen time. The study showed that the Brain Booth is helping students, at their point of need, with some of the major factors that affect their academic performance the most, as well as with their overall well-being.

Keywords: *Mindfulness; well-being; university library; academic performance; students; Brain Booth.*

1. Introduction

One of the major trends in higher education lately has been that student needs are increasingly front and center with a focus on supporting students holistically. Nowadays, most of university students are Generation Z, the most ethnically diverse generation yet walking on university campuses. Also, students have to navigate in a very fast-paced societal environment, which very often leads to a lack of concentration known as mind wandering. Studies show that Generation Z multitasks daily at least across five screens and that two of the factors affecting their academic performance the most are stress and anxiety (Seemiller & Grace, 2016). The Brain Booth is an initiative in a higher education setting addressing these student challenges through mindfulness and contemplative pedagogy.

The Brain Booth at the university library is an experiential space to learn about the mind-body connection, reduce stress, and optimize learning. Mindfulness, as defined by Kabat-Zinn (1994), “means paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally.” Zajonc (2013) outlines that “contemplative pedagogy offers educational methods that support the development of student attention, emotional balance, empathetic connection, compassion, and altruistic behavior, while also providing new pedagogical techniques that support creativity and the learning of course content.” The Brain Booth initiative introduces mindfulness and contemplative pedagogy to the campus community and offers mindfulness practices through intentional brain breaks and activities that support emotional self-regulation and foster singular thoughtful focus. The Brain Booth activities include: biofeedback, coloring, curated game station, gratitude-express, light and sound therapy, massage chair, meditation, origami, virtual reality-immersion, and more. Students showed great interest in the initiative. It is known that different activities do not work the same way for everyone, hence the Brain Booth has been offering a variety of such to accommodate and be able to provide support at the point of need. These activities are available to students at any time during the university library work hours.

The following major trends emerged from the scholarly publications in the last five years (2017-2022), after a systematic literature review on positive effects of mindfulness practices and contemplative pedagogy in academic settings (We are unable to include here the complete list of identified and reviewed publications. A full bibliography is available upon request.):

- Use of physical spaces devoted to mindfulness practice. There is evidence for an increasing use of physical spaces devoted to mindfulness practices on campus premises, especially in academic libraries (e.g., Chun et al., 2021; Duffy et al., 2021; Gibson & Regan; Hartel et al., 2017; Karadjova, 2018, 2019; Karadjova-Kozuharova & Baker, 2022; Ruhlmann, 2017).

- Incorporating mindfulness practices in university/college curricula. Some scholars and practitioners have designed and conducted ongoing mindfulness training in the classroom across curricula to support an attentive, present centered, and non-reactive mental mode (e.g., Bartel et al., 2018; Colaianne et al., 2020; Fung et al., 2019, Hartel et al., 2017; Ramasubramanian, 2017; Reeve et al., 2021; Schwind et al., 2017; Warren & Deckert, 2019) or in specific curricula such as music (Bartos et al., 2022) and chemistry (Vitha, 2022), as well as focused on the role of the Instructor (Placito de Rango, 2018; Schwind et al., 2017).
- Most of the studies have focused on using breathing techniques, meditation and journaling as mindfulness practice activities in their studies (e.g., Azevedo & Menezes, 2020; Egan et al., 2022; Ramasubramanian, 2017; Schwind et al., 2017). Most of the studies concluded with a recurring call for more research and rigorous testing of the effectiveness of mindfulness practices on academic performance (e.g., Bamber & Scheider, 2022; Duffy et al., 2021; Finkelstein-Fox, et al., 2018; Schwind et al., 2017). It was also noted that brief mindfulness activities might have positive behavioral outcomes without the need for full mindfulness courses.

Considering all of the above, conducting a study on the potential positive effects of the mindfulness practices in the Brain Booth, which offers a variety of mindfulness activities, was a natural next step for the researchers involved with the initiative.

2. Methodology

The researchers employed a qualitative inquiry to explore potential positive effects of mindfulness practices among university students. The research question was: How do university students experience the mindfulness activities with the Brain Booth? A questionnaire with two open-ended questions through an anonymous Google form was made available to the Brain Booth visitors for the duration of the Fall 2022 semester. The consent form preceding the questionnaire required the acknowledgement of a student status to be able to complete it. The two questions were: 1) Which activities did you find helpful and why? and 2) How would you describe your overall experience with the Brain Booth activities? The collected narratives from 95 respondents were analyzed using the In Vivo Coding method to formulate initial codes from the texts. Afterwards these were grouped in emerging themes and patterns to outline the findings of the study. In general, relying on individuals' self-reported effects might be acknowledged as a limitation of a study, but due to the nature of this study, it should not be considered a disadvantage. For example, if a student reports that a mindfulness activity has helped them to relax or to destress, they are actually the reliable source of such a report.

3. Findings

The overall results of the study were very positive. 100% of the respondents found their experience with the Brain Booth helpful and pointed out at least one mindfulness activity as having a positive effect on their academic performance or well-being. The major findings on how university students experience the Brain Booth activities were that they help them to: 1) Relax and destress; 2) Calm down; 3) Foster focus and clarity; 4) Actively engage and reenergize. Specific activities mentioned the most were coloring, origami, and the puzzle station, followed closely by the massage chair, light & sound therapy, the tabletop gaming station, and the pedal study desks.

3.1. Relax and Destress

The majority of the respondents, 72%, experienced the activities as helping them to relax and destress. Here are some specific examples from the narratives:

“A convenient unwind from the heavy load that college can press on a person.”

“It helped me destress.”

“I had a great experience. I love how there’s different stimuli for relaxation.”

“It gives me a way to distract myself and relief myself of stress.”

“It really relaxed my body and mind.”

3.2. Calm down

Many of the students, 27%, described that the activities were helpful with calming them down and helping with anxiety. Below are some specific examples from the narratives:

“...very helpful because it helped calm me down much faster...”

“They were very fun and helped calm me down.”

“...were relaxing and help calm any nerves that I had for my exam.”

“I loved it and it helped bring my anxiety down.”

3.3. Foster Focus and Clarity

A significant number of students, 25%, found the activities to be helpful with fostering focus and clarity, which is extremely important in addressing the challenge of the well-known ‘mind wandering,’ namely, the lack of concentration issue. Here are specific examples from the narratives:

“It made my mind feel clear.”

“...helpful before my calculus exam.”

“It really helped my brain kick-start and focus easier on my studies.”

“...it gets my brain going so I can do my homework or concentrate better.”

3.4. Actively Engage and Reenergize

Last but not least, a significant number of students, 23%, experienced the activities as also helping them to actively engage and reenergize. A few examples from the narratives:

“...it helps my overall work flow...”

“...helping to keep be active and engaged.”

“...using (the activities) to get reenergized.”

4. Discussion

The findings of this study support the notion that mindfulness practices have positive effects on students' academic performance and overall well-being. The finding that the majority of the respondents have experienced the Brain Booth helping them to relax and destress is consistent with the scholarly literature outlining this outcome after mindfulness practices (e.g., Azevedo & Menezes, 2020; Bartos et al., 2022; Ramasubramanian, 2017; Schwind et al., 2017).

This study showed that the mindfulness activities at the Brain Booth were helping students calm down and diminish anxiety in addition to relaxing and destressing, which means that the offered activities are addressing both factors affecting academic performance the most, namely, stress and anxiety. The study showed that the Brain Booth was helpful with fostering singular thoughtful focus, which addresses the lack of concentration exhibited through 'mind wondering.' The Brain Booth's offerings of many different activities available to students at any time distinguishes this from other studies on focus improvement (e.g., Ramasubramanian, 2017; Bartos et al., 2022). Such a setting makes it more convenient for students to participate in such activities, hence provides an opportunity for self-help without a need for a constant formal class or session meetings at regulated times. In addition, the Brain Booth was experienced as reenergizing and supporting active engagement. In the future, the researchers plan to design and conduct a study on exploring if any of the specific offered activities are correlated with any of the specific findings of this study.

An interesting outcome of the study was the fact that the activities mentioned as helpful by name the most were the activities not including any digital components or screen time. Also, some specific statements in the narratives were very explicit in support of that notion, for example, “they” (the activities) “are a fun distraction that doesn't require my eyes to be glued

to a screen.” Considering these, the researchers plan to increase the stations with such activities in the Brain Booth to be able to accommodate more students at the same time interested in those activities. At the same time, the Brain Booth will continue to provide the full plethora of offered activities, because this is an important point that makes the initiative unique and innovative. It is also well regarded by the Brain Booth visitors, as stated directly for example: “I really like using the brain booth and I think it’s a great idea. There are many options for people to choose what they like best, so it’s an inclusive space.” The study showed that the Brain Booth is helping students, at their point of need, with some of the major factors that affect their academic performance the most, as well as with their overall well-being. To sum it all, as one of the participants stated, “Always feel much better after spending time there.” As a future step, the researchers will submit a grant proposal to conduct a feasibility study and develop a replicable model of embedding the Brain Booth initiative in high school settings as well.

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Peer coaching in a leadership development program: the role of developmental relationships

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Abstract

Notwithstanding the increasing widespread of the peer coaching technique for leadership development in the business settings, there is a remarkable scarcity of theoretical and empirical research on the adoption of this technique and on the measurement of its effects, especially in the higher education. This study describes the implementation of peer coaching in a leadership course delivered in a public Italian University to Master's degree students and presents two scales to measure the effectiveness of and the satisfaction with this technique. The results from the adoption of these scales and the students' reflections on their learning experience provide suggestions on how to encompass developmental relationships within the design of a leadership learning journey in the higher education context.

Keywords: leadership development; peer coaching; experiential learning.

1. Introduction

Higher education institutions and, in particular, business schools recently have devoted attention to the design of educational programs aiming at developing students' leadership skills vital for contemporary organisations (Allen et al., 2022). However, to date, most of leadership programmes in higher education still strongly rely on cognitive training, limiting the transferability of the learning into the participants' real-life context (Day et al., 2014). Social cognitive and constructivist learning orientations (Allen et al., 2022) maintain that behavioural change in a learning programme can be effectively attained providing participants opportunities to interact with the environment and derive meaning from their experience. In this regards, developmental relationships are identified as a key component of effective leadership development (Leskiw & Singh, 2007). Specifically, experiential learning advocates the value of consulting with knowledgeable peers (Schön, 1983), as it allows individuals to assist each other in learning and drawing insights into personal behaviour (Parker et al., 2008). In this regards, peer-coaching has been increasingly employed in leadership development programs (Eriksen et al., 2020). In a peer coaching session, the peers alternate between being the coach and being the coachee and reciprocally listen to each other and ask open-ended or probing questions to trigger partner's reflections and increase his/her self-understanding (Parker et al., 2008). Notwithstanding the increasing widespread of the peer coaching technique in the business settings, there is a remarkable scarcity of theoretical and empirical research on the adoption of peer coaching and the measurement of its effects, especially in the higher education (Eriksen et al., 2020).

The next sections will review the literature on peer coaching and will describe in detail the implementation of the peer coaching technique in a leadership course delivered in a public Italian University to master's degree students. The presentation of the methodology adopted, the related peer-coaching measurement scale developed and the analysis of the students' reflections on their learning experience will provide suggestions on how to encompass developmental relationships within the design of a leadership learning journey in the higher education context.

2. Theoretical background

The foundation of peer coaching as a way for managers and staff to advance their careers draws on the breakthrough work in clinical supervision by Goldhammer (1969) (Britton & Anderson, 2010). Peer coaching is a sustained, structured interaction that is typically dyadic in nature (D'Abate et al., 2003). The coach-coachee relationship is lateral and mutual and it is centered on the development of a particular set of skills or on performance enhancements, as it entails the coach supporting the coachee's improvement by providing feedback (Hagen et al., 2017).

Peer coaching is considered an effective learning technique, as it allows individuals to develop their skills and knowledge in a particular area (Hagen et al., 2017). This process allows two or more colleagues to reflect on current practices, expand and refine skills, share ideas, teach one another, and solve problems in the workplace. Peer coaching has become increasingly popular amongst teachers to enhance their teaching skills but also among students to enhance their personal skills (Slatter & Simons, 2001; Lu, 2008). Furthermore, those who participate in peer coaching experiences are better able to find their own answers to problems whether they occur at work or even in their personal life (Murry, 2009).

Consistent evidence displays three key components of peer coaching which are trust, reflection, and solid communication skills. The literature explicitly states how crucial it is to build a peer coaching relationship based on trust (Jackson, 2004; Robertson, 2005). According to Wenger et al. (2002), trust in peer coaching grows over time, similarly to a community of practice where members get to know one another better (Wenger et al., 2002). Reflection is another essential component of peer coaching. According to Jackson (2004), peer coaching is fundamentally a reflective activity, hence participants must be adept at reflection (Loughran, 2002; O'Connor & Diggins, 2002). According to Jan Robertson's (2005) coaching leadership model, coaches can better enable partners' ability to critically reflect on their issues and topics by developing their reflective interviewing abilities. The capacity to actively listen is fundamental to have fruitful reflective conversations (Robertson, 2005). Finally, solid communication skills include the ability to give non-evaluative criticism. Rice (2012), conducting research on a group of faculty members in higher education, discovered that people who engaged in "formative discourses", while receiving peer coaching, appeared to have a positive opinion of the process. Thus, through peer coaching, leaders can gain deeper insights, develop valuable skills, and create meaningful connections with their peers.

3. Method

3.1. Structure of the Leadership development programme

The Leadership course analyzed in this study is delivered, as elective, in a public University in Italy to Master's degree students. The course lasts six weeks during which students participate in 15 in-person classes for 30 hours overall. After the sixth week students take the exam and subsequently, on a voluntary basis, they can continue their leadership learning path for other 16 weeks. The methodological approach implemented in the course draws on the experiential learning cycle (Kolb, 1984), the intentional change process (Boyatzis, 2006) and the whole person learning pedagogy (Hoover et al., 2010). During the in-class lectures, students familiarise with the theoretical framework of emotionally intelligent and resonant leadership (Goleman et al., 2013), understanding in-depth the characteristics of each leadership style (Visionary; Coaching; Affiliative; Democratic) and the techniques to put

each style into practice in real-life contexts. At the end of the course (week 6), students are asked to submit a personal leadership learning plan reporting: i) the developmental objectives, namely the specific leadership styles they want to develop; ii) the concrete actions they wish to undertake to practice their leadership in real-life settings; iii) the contexts and the persons with whom to experiment the new behaviours; and iv) a timeframe for action. In the subsequent 16 weeks students are continuously stimulated to put into practice their personal leadership learning plan in a variety of environments and with different people. During their learning journey they are engaged in at least three peer coaching sessions that consist of a conversation with a classmate to share their experimentation of the leadership behaviours. When in pair, students have the opportunity to learn alternative ways to improve a specific behaviour and progressively become aware of the learning outcomes attained. During the course, the instructor introduces the peer-coaching technique to the students and provides a template to conduct the sessions. After each session students are invited to report, on a digital platform, their reflections on: i) the main topics discussed; ii) the perceived benefits of the session; iii) the coach's questions that helped them to construct meaning from the learning experiences. At the end of the 16th week, a survey is administered to the students to collect their opinions on the peer coaching experience.

3.2. Sample

A group of 112 Master's degree students who completed all the activities of the leadership course serves as a sample of this study. The sample has an average age of 23.93 (SD 1.19), and 66.1% were female. Most of the sample had previous working experiences (59.8%).

3.3. Measures

To measure the effectiveness and the level of satisfaction of the peer coaching activity, we developed two scales.

Peer coaching reflection. Based on the work of Parker et al. (2008), we developed four items measuring the extent to which students make sense of their learning process and the progress attained through the peer coaching experience. Sample items are "The conversation with my coach helped me to become aware of the learning progress I was making over time during the course" and "The conversation with my coach helped me to identify the behaviors that led to positive results in my leadership learning experience". Items were measured on a 5-point scale in which 1=totally disagree and 5=totally agree. We performed an Exploratory Factor Analysis (EFA) using Maximum Likelihood and Promax rotation, which shows adequate loading magnitude (from .63 to .77), and inter-item correlation (from .42 to .57, $p < .01$). The four items account for 49% of the variance, Cronbach's alpha is .79.

Peer coaching satisfaction. Drawing on Baron and Morin (2009), five items capturing students' level of satisfaction with the peer coaching activity were developed and measured

on a 5-point scale in which 1=totally disagree and 5=totally agree. Sample items are “I felt comfortable sharing my experience with my peer coach” and “I enjoyed the sessions with my peer coach”. EFA showed the items account for 48.2% of the variance, with adequate factor loadings (ranging from .62 to .75) and inter-item correlations (from .33 to .63). Cronbach’s alpha is .81.

4. Results

When asked about the extent to which peer coaching helped them make sense of their learning experience and develop a stronger awareness of their learning achievement, students tend to agree on the positive influence of this technique (M=4.11, SD=0.61). Verbal comments provided by the student reported that: *“It helped me to compare myself with a totally foreign person. The comparison made me think about many aspects that I did not consider before.”*; *“I was able to express myself freely without feeling intimidated, I always felt listened to, understood. My partner helped me figure out how to change some of my behaviors. She has allowed me to discover further perspectives and ways of acting.”*; *“When I had to tell a situation in which I had been able to put into practice one of the styles seen in the classroom, it was useful to me because I thought about the results obtained and I was able to make a comparison with the past ones and make sure to make the good decision next time.”*; *“At the end of each session, thinking back on what was said, I was always amazed by all the things that I managed to highlight and on which I reflected”*.

This empirical evidence shows that peer coaching has several benefits in terms of development, self-reflection and awareness. Students particularly appreciated looking back at their experience and making sense of it analysing their progresses and results, and discussing with peers about possible alternative behavioural strategies.

Concerning the level of satisfaction with the peer coaching sessions, students agreed they perceived a high level of interpersonal comfort and commitment in their relationship with their peers (M=4.43, SD=0.51). In their verbal comments they report: *“Peer coaching was undoubtedly helpful, particularly since you have to communicate with individuals you do not know”*; *“I was compelled by this to be as specific as I could be about my goals and personality traits. I was encouraged by peer coaching to communicate more precisely and avoid using unclear words.”*; *“The peer coaching exercise was very beneficial. Speaking with strangers really allows me to be honest”*.

These results show a high level of satisfaction with the peer coaching experience, highlighting the positive environment built by the process, and underlining the impact perceived by the participants on themselves.

5. Discussion

There are several contributions offered by this study to the research on leadership development and to the design of educational initiatives.

First, this study highlights the relevance of a learning technique based on an interpersonal relationship which supports the leadership development process. The peer coaching sessions help participants to give meaning to their learning experiences and at the same time represent an appointment which requires them to have put into practice the leadership behaviors they identified as critical in their learning plan. Since experimenting the leadership behaviors in real and different contexts represented one of the most relevant difficulties for those who attended the course, the mutual discussions with the peer-coach allowed the participants to take inspiration from their peer's experiences and helped them to: identify more situations in their real life to use as learning environments; identify alternative behaviors to practice in specific situations; see their behaviors and their impact from a different perspective; reflect on future behaviors to adopt in similar situations; appreciate their growth over time; share difficulties and understand that these difficulties are often common. This is consistent with previous studies highlighting the role of peer coaching in providing support and encouragement during the development path, and in allowing learning from one another (Anderson et al., 2005; Donegan et al., 2000).

Second, this study offers two scales to measure the peer coaching process from the perspective of those who experienced it. Measuring the perceived effectiveness and satisfaction of the peer coaching experience helps to design learning initiatives that keep the different dimensions of this process under control, and allows to avoid the risk of unfruitful relationships. In addition, these measures help the participants to become aware of the results of their peer coaching experience and to reflect on the characteristics of the relation undertaken, in order to improve it if needed.

Third, this study provides evidence of an educational course characterized by an integration of different learning tools to support personal development. Indeed, this course combines theoretical, experiential and interpersonal dimensions, and consequently encompasses three different learning paradigms to make leadership development more successful. This combination of dimensions and related tools can enhance the learning of effective leadership behaviors by creating a process where the participants understand the characteristics of the leadership behaviors, define a personal learning plan to put them into practice, experiment them in real life contexts and interact with others on this experience obtaining feedback aimed to improve the subsequent experimentation.

One limitation of this study is related to the use of self-reported measures by the participants and their consequent potential bias. Although the satisfaction coming from the peer coaching experience requires a personal evaluation, the measurement of the level of reflection on the

learning experience induced by peer coaching might benefit from a third-party assessment. Moreover, future research may consider implementing quasi-experimental design to investigate the impact of the peer coaching activity on the change participants experienced in their leadership behaviours.

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The current HE classroom: promoting new types of learning, executive function processes and strategies to foster students' motivation and academic success

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Abstract

Students' academic success in this digital, globalized era requires their mastery of processes such as goal setting, planning, prioritization, organization, flexibility to change, storage/manipulation of information in working memory, and self-monitoring. These processes are called executive function (EF) processes. It is important to integrate strategies that systematically address these processes in the classroom to help students understand how they think and how they learn. This paper provides a paradigm for understanding/helping students integrate strategies involving EF processes; it describes how strategic, systematic instruction and adaptations to classroom-work and tasks may benefit all students, while effectively addressing the needs of students who exhibit significant weaknesses in these processes. Furthermore, individuals and organizations involved in HE express the need for other important types of learning that do not readily emerge from Bloom's taxonomy: e.g., learning to learn, leadership, interpersonal skills, ethics. This paper introduces D. Fink's proposal for a broader taxonomy of significant learning.

Keywords: *Pedagogical engineering approach; executive function processes; Dee Fink's Taxonomy of Significant Learning; new learning/teaching strategies.*

1. Introduction

Research (e.g., Bandura, 2000; Brunstein, Schultheiss, & Grassman, 1998; Helliwell, 2003; Kasser & Ryan, 1996; Meltzer, Reddy, Sales Pollica, & Roditi, 2004b; Pajares & Schunk, 2001) shows that academic success for all students, is inextricably linked to their motivation, effort, persistence, academic self-concept, and self-efficacy. Their academic success in this digital and globalized era requires their mastery of processes such as goal setting, planning, prioritization, organization, flexibility to change, storing and manipulating information in the working memory, and self-monitoring. Such processes are referred to as executive function (EF) processes.

As educators, we need to realize that it is increasingly important not only to integrate strategies to systematically address these processes in the classroom to help students understand how they think and how they learn, but also that teaching, like all professions, should allow research to inform its practice. In this paper we provide a paradigm for understanding and teaching students strategies that integrate executive function processes. It describes how strategic and systematic instruction and adaptations to classroom work and assignments can benefit all students, while effectively addressing the needs of a large number of students who exhibit significant weaknesses in these processes.

As is currently known, individuals and organizations involved in HE are expressing the need for other important types of learning that do not readily emerge from Bloom's taxonomy, e.g., learning to learn, leadership and interpersonal skills, ethics, communication skills, character, tolerance, and the ability to adapt to change. This state of affairs requires a pedagogical engineering approach and new types of learning that go far beyond the cognitive domain of Bloom's taxonomy and even, beyond cognitive learning itself. It is also in response to this need that we present here Fink's proposal for a new and broader taxonomy of significant learning.

2. Executive Function

Executive Function (EF) refers to a family of control functions that are essential to concentrate, pay attention and think, when going on automatic, acting on intuition or the initial impulse may be ill-advised (Burgess & Simons 2005; Diamond, 2012). These functions depend on a neural circuit in which the prefrontal cortex plays a prominent role (Anderson, Jacobs, & Anderson, 2008; Craik, Bialystok, Gillingham & Stuss, 2018). There is general agreement (e.g., Miyake et al., 2000) that there are fundamental EFs: Attention; Inhibition or inhibitory control; working memory; and cognitive flexibility. These form the basis for higher-order EFs such as reasoning, problem solving, and planning (Christoff, Ream, Geddes, & Gabrieli, 2003; Collins & Koechlin, 2012; Lunt et al., 2012). Executive

function processes provide us with the “big picture” of a situation, a theme or a task at hand, and allow us to switch flexibly between this big picture and its relevant details.

There exist six processes that researchers (e.g., Christoff, et al. 2003; Collins et.al., 2012; Diamond, 2012; Diamond, 2012; Lunt et al., 2012; Meltzer, et al., 2004b; Meltzer & Krishnan, 2007) have found to be key to executive function: goal setting; planning and prioritizing; organizing; retaining and manipulating information in working memory; flexible switching; and self-monitoring and self-control. These processes are referred to as executive function processes, and are of vital importance to all aspects of academic performance because, since as we all know, students' academic success in this digital and globalized age requires not only their technological expertise but, more importantly, their mastery of the above-mentioned processes.

As educators, we may have occasionally noticed that “although some students demonstrate strong conceptual reasoning skills, these same students are inefficient with their work and have difficulty demonstrating what they know in the classroom; their study skills and test performance are compromised; and their academic grades do not reflect their actual intellectual capacity. What we are usually unaware of is that for these students having executive function weaknesses, their conceptual reasoning skills may be stronger than their production and productivity” (Meltzer, 2010, p.28). Meltzer et al., (2007) studies found that students with executive function challenges, have particular problems with academic tasks that involve the coordination and integration of different subskills, such as beginning writing tasks summarizing information; taking notes; studying; planning, executing, and completing projects on time; maintaining attention during long, detailed assignments; and remembering to submit their work on time. Furthermore, their problems with attention, working memory, and inhibition create additional challenges, and their productivity with classwork and homework is affected.

2.1. Why Are Executive Function Processes So Important?

Research (e.g., Bandura, 2000; Helliwell, 2003; Kasser & Ryan, 1996; Sheldon & Elliot, 1999), as already mentioned, has largely supported that academic success for all students, is inextricably linked to their motivation, effort, persistence, academic self-concept, and self-efficacy. These cognitive and motivational processes are connected with students' use of executive function strategies, as well as with their academic performance (Meltzer & Krishnan, 2007). As such, strategies that address executive function processes provide an entry point for improving academic performance. Along with Meltzer (2010) we argue that when students learn and apply these strategies effectively, they become more efficient and thus begin to succeed academically. Academic success in turn boosts self-confidence and academic self-concept, which results in more focused effort so that students' hard work is

targeted strategically toward specific goals. The learning environment and the instructional methods and materials all play an important role in mediating this cyclical relationship.

For all students, but particularly for students with learning and/or attention difficulties, effective strategies and focused effort will help them to bridge gaps between their skills and the academic demands they face (Meltzer et al.,2004b). In other words, their academic performance is often dependent on their knowledge of and willingness to use strategies. Students, therefore, need to understand their own learning styles. This will help them discover which strategies work well for them, as well as why, where, when, and how to apply each specific strategy. This understanding is referred to as metacognition, or the ability to think about one's own thinking and learning. Metacognition underlies students' use of executive function processes.

Executive function challenges may take different forms:

- Problems with Task Initiation involve procrastination or failing to do what we know we are supposed to do and, trouble transitioning from one task to another.
- Organizing, Planning and Prioritizing Weaknesses show up when the student has trouble committing to plans; waits until the last minute to start a project; underestimates time to complete a task; gets caught up in details and misses the "big picture".
- Poor Impulse Inhibition is made evident when the student talks before thinking; does not consider long-term impact of an action; and interrupts or blurs out socially inappropriate comments.
- Trouble Shifting Tasks implies having difficulty stopping an activity and moving to the next; having trouble tolerating unpredictable events or schedule changes; and becoming "stuck" on a particular line of thinking.
- Trouble with Emotional Control is associated with being over-reactive to small problems; easily upset and having trouble calming down; and unclear about what triggers an emotional reaction.
- Poor working Memory encompasses trouble with multi-step routines; problems following complicated group conversations and trouble multi-tasking at work.
- Trouble Keeping Material Organized show up when students have trouble keeping track of belongings, files; and their home and work environment is messy or disorganized.
- Poor Self-Monitoring Skills imply difficulty noticing careless errors; trouble reflecting on what works and what does not work; and poor awareness of others.

3. Importance of Teaching Explicit Strategies

3.1. For Goal Setting

Currently, to achieve an optimal balance between a curriculum-centered approach of education and a student-centered approach, teachers need to share the goal-setting process with their students, to help them become independent learners. Research findings (e.g., Pintrich & Schunk, 1996; Schunk, 1995, Meltzer, 2010) support the importance of teaching goal-setting strategies and also show (1) a strong cyclical relationship between the ability to set personal goals and sustain higher levels of motivation as well as the development of positive self-efficacy (which promotes success); (2) that students may be more motivated and interested when they engage in tasks of their choosing, and that they may work harder on self-made goals than they do when they work toward the plans and expectations of others; (3) that when teachers share the goal-setting process with students and give them appropriate guidance, students can learn how to set reasonable goals, which increases their motivation and willingness to persist.

Researchers (De la Paz, 2007; Graham, 2006 in Meltzer, 2010) suggested that when students learn to set effective personal goals, and when their learning is supported by meaningful feedback (self-assessment and teacher feedback) as well as by appropriate learning experiences and strategies, they show improvements in their academic performance. According to De la Paz, and Graham, given a complex process such as writing, students are more easily able to manage the multiple demands of the task when they learn how to self-regulate their efforts through goal setting and planning. Research evidence also shows that this is true both for typically developing students and for students with learning challenges (Carlson, Booth, Shin, & Canu, 2002, in Meltzer, 2010). Indeed, while all students benefit from learning how to set goals, students who struggle with academic tasks benefit even more.

3.2. Some Strategies to Help Students Setting Goals

Meltzer (2010) argues that “given the pace of the curriculum, the diversity of learning styles represented in the classroom, and the large volume of content, many educators find it difficult to make the time to teach goal setting, as it is not a component of the content-centered curriculum” (p.81). Nevertheless, setting goals should be taught through classroom accommodations and direct, systematic instruction.

The following common instructional accommodations provide students with scaffolds that help them with goal setting. These accommodations constitute “best practices”.

- *Rubrics*: Allow students to have a clear idea of what the teacher is looking for and how performance may be assessed.

- *Visual representations of projects* completed by previous students (pictures or actual examples), can lead current students through a sample prior to giving them a similar assignment.
- *The use of calendars and phased timelines*- Calendars provide visual reminders of due dates, as well as schemas for setting and achieving short-term goals that contribute to the successful attainment of the larger, final goal (Newport,2006; Villa, 2018, 2021).
- *Direct, systematic instruction* allows students benefit from explicitly learning how to set goals. It entails three key components considered the most effective in goal setting:
- *Self-understanding/Self-knowledge* is an important component of a resilient learning style, which in turns ensures that students set reasonable and appropriate goals;
- *Grasp of the “big picture,” or schema*, with respect to broad goals for the year or the term, along with more specific content-or lesson-related goals, and
- *Valuing the task* –research (e.g., Villa, 2018, 2021) shows that it is essential to understand that individuals are motivated to achieve goals that are in line with their own strong desires and values; and that individuals have a deep-rooted desire to have an effect on their environment and to obtain results that they value within their own contexts.

Furthermore, self-determination theory suggests that people are motivated to act in a manner that is consistent with their values (Deci & Ryan, 2000). These are powerful drives that exist in all learners.

3.3. Strategies for Planning and Prioritizing

Planning and prioritizing are essential for success in today's classrooms. Current emphasis on long-term projects and expectations for independent work have increased the requirement for all students to plan and prioritize independently. Thus, students' ability to arrange tasks in order of importance and use strategies to complete them on time is directly related to their success and their ability to achieve their goals in all academic areas. Effective planning and prioritizing leads to efficient time management, which in turn increases productivity, relieves stress, and has a positive effect on student learning and performance (Misra & McKean, 2000 as cited in Meltzer 2010).

Time management involves interactions among several different executive function processes, including goal setting, prioritizing goals, planning goal achievement, and prioritizing tasks to accomplish objectives (Britton & Tesser, 1991). These processes are fairly complex for most students; therefore, it is important to begin by focusing on the foundational processes involved in time management: (1) Knowledge of time; (2) knowledge of task; (3) Prioritizing tasks; and (4) Monitoring progress. (Villa, 2021; Newport, 2006; Wolters, 2003).

Students who implement time management strategies are often considered to be more self-regulated, more aware of their thinking processes, and more able to manage their learning across contexts than those who procrastinate (Wolters, 2003). Efficient time management is a combination of innate abilities and learned strategies. However, the challenges of time management have become increasingly complex. Daily packed schedules and “timeless” distractions like video games and social networking sites (e.g., Facebook and MySpace), can easily reduce a student’s task efficiency and productivity.

3.4. Strategies for Accurate Time Estimation

Students often make independent choices about the order in which they will approach their tasks and how they will schedule their time. Although they typically have established routines, students often do not reflect on the efficiency of their habits. (Villa, 2021).

Educators can support the ongoing development of accurate estimation skills by providing structured opportunities for reflection after tasks (Teaching assistants may guide this exercise). For students to allot adequate time to complex projects, studying for tests, or even accomplishing everyday tasks (e.g., eating lunch, includes preparing food, or waiting in line to pay for it) they need to learn strategies for doing so. Perfecting the ability to estimate the time required for a task is a gradual process that improves with practice and age.

Educators can help students become accurate time estimators with estimation strategies such as:

- Dividing a large-scale project into its smaller components, and then estimate the time it will take to complete each part.
- How long will it take breaking the task down into multiple steps/estimate the time to allocate to each step.

By helping students get a clear understanding of the different types of activities (obligation, aspiration, and negotiation) in their daily lives, teachers can provide them with a method of prioritization that results in the creation of a productive and efficient schedule.

4. Concern Regarding University Teaching

Research (e.g., Fink, 2003, 2013; Saroyan, & Amundsen, 2004) reports concerns regarding learning goals not going beyond a understand-and-remember type of learning; professors having difficulty integrating additional activities to the lectures and discussions; and programs not considering the challenge and complexity of good teaching. Furthermore, the “get busy with research and publishing” pressure is considerable, even beyond tenure, to maintain strong research (and teaching) records.

5. Call for New Kinds of Learning

Research and leaders in business, industry and government have identified the so-called “critical competencies”, for the current societal needs, which include: (1) Conscientiousness, personal responsibility, and dependability; (2) Ability to act in a principled, ethical fashion; (3) Skill in oral and written communication; (4) Interpersonal and team skills; (5) Skill in critical thinking and in solving complex problems; (6) Respect for people different from oneself; (7) Ability to adapt to change; (7) Ability and desire for lifelong learning (e.g., Gardiner, 1994; Martin-OCDE, 2018; Luna Scott-UNESCO, 2015).

Individuals and organizations involved in higher education stress out that our current dynamic new world requires new kinds of learning. In this digital and globalized era students need to learn how to learn; to acquire and develop leadership and interpersonal skills, ethics, communication skills, character, tolerance, and the ability to adapt to change. Therefore, there is a pressing need for new kinds of learning that go well beyond the cognitive domain of Bloom’s taxonomy (1956, 2001), and even beyond cognitive learning itself. We need a new and broader taxonomy.

5.1. Defining Learning as Change

For learning to occur, there has to be some kind of change in the learner. No change, no learning. Learning is seen as a central underlying mechanism to acquire knowledge and skills, as well as long-term behavior change, which should positively impact performance (Campbell 1990; Hesketh & Neal 1999; Fink, 2003, 2023; London & Mone 1999 as cited in Attri, 2018). Significant learning requires lasting change that is important in terms of the learner’s life.

Fink (2003, 2013), presents a new vision of teaching in which students are engaged in their learning, resulting in a high-energy classroom and students experiencing meaningful and lasting change. In addition, it is presented as a value in life, since learning enhances students' lives and prepares them to participate actively and effectively as valued members of society.

This new vision involves: (1) Significant learning; (2) Integral course design; and (3) Better organizational support. A particular perspective on learning, defined in terms of change, guided D. Fink (2003) in the construction of this new taxonomy. Thus, for learning to occur, there has to be some kind of change in the learner. No change, no learning. With this perspective in mind Fink created a taxonomy with six kinds of significant learning (see Fig.3).

5.2. Major Categories of the Taxonomy of Significant Learning (L. Dee Fink, 2003, 2013)

Each category of significant learning contains several more specific kinds of learning that are related in some way and have a distinct value for the learner.

- **Foundational Knowledge:** Ability to understand & remember specific information and ideas. Value: Provides basic understanding necessary for other kinds of learning. (e.g., Pre-requisites).
- **Application:** Engage in some new kind of action: intellectual, physical, and/or social. Engage in various kinds of thinking critical, creative, and practical. Value: Allows other kinds of learning to become useful.
- **Integration:** Able to see and understand the connections between different things. Sometimes they make connections between specific ideas, between various learning experiences (e.g., between courses or entire disciplines), or between different areas of life (e.g., between school and work or between school and leisure life). Value: Gives students a new form of power: Intellectual power.
- **Human Dimension:** Learning about themselves and others; how and why others act the way they do; enables students to function, and interact with others more effectively. Discover the personal and social implications of what they have learned. New understanding of themselves (self-image) or new vision of what they want to become (self-ideal). Value: informs students the human significance of what they learn.
- **Caring:** A learning experience changes the degree to which students care. It is reflected in the form of new feelings, interests, or values. Value: Fosters in students the energy they need for learning more about something and making it a part of their lives.
- **Learning how to Learn:** Learn something about the process of learning itself. Learning how to be a better student; engage in a particular kind of inquiry; become a self-directing learner. Value: enables students to continue learning in the future and to do so with greater effectiveness

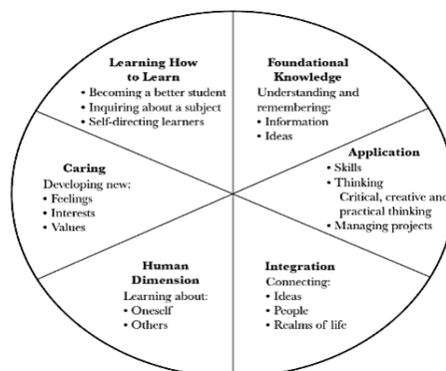


Figure 3. Taxonomy of Significant Learning. (Fink, 2013)

Regarding the course outcomes, it is quite reasonable to expect that educators who decide to adopt Fink's Taxonomy and set their general course objectives in terms of significant learning would greatly facilitate that at the end of the course in question, students will: *Understand and remember* key concepts, terms, relationships, and so on; know how to use the content; be able to *relate* this subject to other subjects; understand the personal and *social implications* of knowing about this subject; *care* about the subject (and about learning more about it); and *know how to keep on learning* about this subject after the course is over.

6. Conclusion

Faculty members are increasingly aware that something is missing in their teaching practice. Although they want their students to achieve higher levels of learning, they continue to use teaching practices that are not always effective in promoting such learning. Traditionally, they have relied heavily on lectures as the main form of teaching. There is a need to change the nature of the role of professors from being primarily lecturers to being professors primarily designers of significant learning and environments. It is undeniable that teaching, like all professions, should allow research to inform its practice. This requires facilitating that faculty acknowledge and accept research-based evidence showing that: (1) academic success for all students, is inextricably linked to their motivation, effort, persistence, academic self-concept, and self-efficacy; (2) academic success is closely connected to the strategies that support executive function processes to help students understand how they think and how they learn, while effectively addressing the needs of those students who show significant weaknesses in these processes; 3) academic success is also closely related to the effectiveness of strategic and systematic teaching and adaptation of work and tasks in the classroom; (4) there is a need for new and multiple kinds of specific learning by students, that is, something more than understanding and remembering subject-related information.

By integrating the Taxonomy of Significant Learning into their teaching practice, professors may realize that they can actually foster the acquisition and development of skills that do not readily emerge from the Bloom's taxonomy. Accordingly, pre- and in-service teacher education and updating programs should integrate these topics in their curricula, since as Hargreaves (2003) argues, and as educators all have noticed at some point, teachers tend to teach in the same ways they were taught.

"We won't meet the needs for more and better higher education until professors become designers of learning experiences and not teachers." —Larry Spence (2001).

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The value of the teaching quality innovation projects in the universities. The case of Quid Sapienza

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Abstract

The research presents the results of a survey conducted in Sapienza, University of Rome, aimed at studying the use of Innovative Didactics methods among teachers trained in the context of a teaching quality innovation project (QUID). The goal is to understand the usefulness of teacher training to disseminate innovative practices and the effectiveness of the most advanced student-centered teaching and learning methods centered on the use of technology, also by comparing the results with other similar studies reported in the literature. The study highlights the value of the QUID project as a tool for raising awareness and disseminating innovative practices. In fact, the training of teachers is more effective to promote their awareness of adopting ID methods to promote involvement and better performance of the students. Conversely, the pandemic period has not positively influenced the progress process in the use of innovative teaching practices, but only in the use of technologies.

Keywords: *didactic innovation projects, innovative didactics, quality of educational innovation, university teaching practices,*

1. Introduction

In the last decades, the attention toward Innovative Didactics (ID) by the Italian Universities has grown, as well as abroad. As a recent survey shows (Mazza & Valentini, 2021), between 2016 and 2019, numerous teaching innovation projects were launched. Half of those analyzed in the mentioned study is concentrated between 2017 and 2018, in response to the indications of the European Commission regarding the desire to establish the European education area by 2025. Sapienza, University of Rome was among the first Italian universities to promote a working group and a project on the Quality of Educational Innovation (QUID). In the theoretical framework, we have adopted an extended concept of ID, which implies processes that stimulate the active, creative, and collaborative dimensions. Although Innovative Didactics (ID) and distance learning do not necessarily coincide, digital technologies can support these dimensions. For this reason, we have also focused on research that have studied the use of digital technologies to develop cooperative and collaborative learning processes e the teaching strategies adopted by academics. The second part presents the results of a survey conducted in Sapienza, University of Rome, aimed at understanding the use of ID methods among teachers trained in the context of the QUID project.

2. Theoretical framework

There are a variety of definitions of ID in the literature. A synthetic framework, within the studies conducted by the Joint Research Center Institute for Prospective Technological Studies of the European Commission, is offered in Kampylis, Bocconi & Punie, 2012. We have adopted an extended concept of ID: as a process of overcoming the traditional practice of teaching based on a frontal and transmissive approach in favor of student-centered learning processes that stimulate the active, creative and collaborative dimension (Sancassani et al., 2019). In previous studies (Mazza & Valentini, 2021; Mazza & Valentini, 2023) we have critically examined the Italian and non-Italian literature on models of didactic innovation, and the main theoretical frameworks concerning innovative didactics (among others, Mezirow, 2001; Meyers & Jones, 1993; Watkins & Mazur, 2013). Furthermore, starting from the classification proposed by Fedeli & Frison (2018), we have focused attention on participatory and interactive strategies and methods to facilitate learner-centered learning. This review shows that ID can be promoted regardless of technology. At the same time, digital technologies can facilitate student learning and action. This could happen both in more learner-centered approaches, but also in more transmissive teaching.

Among others, Calvani (2005) and Ranieri (2004) have focused on the use of digital technologies to develop cooperative and collaborative learning processes. Trentin (2017), Rivoltella (2012), and other scholars have studied innovative teaching methods in hybrid learning modalities, based on the integration of physical and online teaching spaces.

Moreover we have analysed some recent studies that have investigated the teaching strategies used in the pandemic emergency by the Italian academics because during this period the diffusion of the use of digital technologies has obviously increased, but has not necessarily increased the use of innovative teaching strategies (Mazza & Valentini, 2023; Bruschi, 2020; Consiglio et al., 2020; Ramella & Rostan, 2021; Tamborra, 2021). According to Tamborra (2021), digital technologies have been used to reproduce frontal and transmissive teaching without innovation, risking keeping the typical practices of face-to-face teaching unchanged. Conversely, other research has shown greater innovation, especially when ID practices or training were already established (Mazza & Valentini, 2023).

Considering the theme of this paper, it is useful to deepen some results of the research presented in Ramella & Rostan (2020), based on a survey conducted on a sample of 3.398 academics from various Italian universities. Their study shows that innovative didactics is adopted and prevalent with respect to the “frontal lesson” strategy since before the pandemic, but during the emergency an impoverishment and simplification of innovative teaching methods has emerged. They identifies three innovative approaches. Firstly, the use of the transmission-dialogical strategy (based on traditional lectures, but enriched by discussions between academics and students) has doubled. Secondly, the strategy of interactive transmission (based on the active involvement of students through exercises, laboratories, and group work) has remained constant. Thirdly, the diffusion of the collaborative-innovative strategy (based on group work, peer-to-peer discussion, and evaluation methods, activities aimed at transversal skills, and projects aimed at stimulating students’ creativity and problem-solving skills) has halved.

Given the theoretical framework on ID and what emerged from the review of research on teaching strategies used in the pandemic emergency, we focused our attention on the University of Rome, which has decided to invest, since the academic year 2016-2017, in the QUID project. It aims to disseminate ID models, methods, and techniques among its professors to ensure the growing adoption of ID in the university. The project has reached its seventh edition and there are now over 500 professors who have acquired ID knowledge and skills. In particular, the study presented in this work aims to: 1) verify the usefulness of the QUID as a tool for knowledge and dissemination of innovative practices; 2) understand which innovative teaching strategies the professors who took part in the QUID use in the classroom and with what degree of effectiveness; 3) detect the strengths and weaknesses in the use of the ID that the professors have found.

3. Methodology

In this study, the interviewees who participated in the project up to the fifth edition (the academic year 2021/22) were interviewed - therefore at the end of the pandemic. The decision

to focus attention on this type of professor stems from the awareness that they are the most expert in ID and that, for some reason, they are the ones who make more active use of it, as well as possessing the greatest and most adequate knowledge and skills to be assessed. Out of 350 teachers and researchers, 54% participated in the research (189), of which 37.4% worked in the Health area (HeS), 32.3% in Hard Sciences (HaS), 18.2% in socio-political sciences (SPS), and 12.1% in the humanities (HS). The interviewees were asked, through an interview with a semi-structured questionnaire distributed through a web survey, to evaluate both the effectiveness of the experience in the QUID project and the adoption of Innovation Didactics (ID) and to report the limitations and benefits highlighted in classroom teaching. A mono and bivariate analysis of the collected data was then performed and the utility (UR), ID use (IDR) and effectiveness (ER) rates were constructed to measure respectively how much the QUID experience was useful to teachers, how much the application of the identity document in the classroom and the effectiveness they consider to use the identity document in their teaching activity. These indicators were developed by comparing, respectively, the average value of the perceived usefulness of innovative didactics with respect to the organization of teaching and the relationships with colleagues; the frequency of use of ID didactic tools and teaching methods; and the effectiveness of ID methods to promote the learning of content. Finally, a linear regression analysis was performed using the Pearson regression coefficient (r), between -1 and 1 to verify the degree of significance of the application of the ID by the teachers with respect to the different scientific areas in which they operate. This made it possible to understand whether some scientific areas use ID more and more effectively and how much QUID's experience in using innovative teaching methodologies has influenced them.

4. Outcomes

Research has shown that the QUID Project has been very useful for university professors to deepen their knowledge of ID methods and techniques and to better understand how to apply them in the design and implementation of their teachings (see Table 1). The recorded utility rate is 85.7% with the highest peaks in the Healthcare area (93.3%) and in the political and social sciences (91.4%).

It is no coincidence that the Pearson regression coefficient is also very high in all scientific areas and above all in those in which teachers have considered QUID more useful (U) ($r_{U \times SPS} = 0.997$, $r_{U \times HeS} = 0.993$, $r_{U \times HS} = 0.990$, $r_{U \times HaS} = 0.983$).

This result of the QUID is confirmed by the use that the interviewees declare to make of the ID in the classroom. The average utilization rate (IDR) is 56%. Although it is lower than the awareness gained in teaching innovation, it still demonstrates a commitment to its application. In detail, among the professors who use ID, 18.2% do it continuously and as a

priority, 59.4% in a limited way and limited to some activities, and only 22.4% sporadic and occasionally. But how is the ID used (see Table 2)?

Table 1. The value of the QUID experience as an incentive to use the ID.

	MR⁹
improve the planning and organization of their teaching activities	32.5 %
useful for exploring new methods and getting up to speed on new ID techniques	24.6 %
meet colleagues and exchange ideas and teaching experiences	10.1 %
train new hires in ID methods	10.1 %
strengthen relationships with colleagues to think about forms of collaboration in the classroom	9.1%
align with international standards of use of ID	7.3%
improve the coordination of teaching contents between the teachings of the course of study	6.3%
TOT. Responses	370

Source: Sapienza (a.a 2021-2022).

Above all to verify and evaluate the learning results in the classroom, but the share of respondents who use innovative methods to involve students, encourage them to participate, and stimulate interactive and participatory learning, placing them at the center of training, is also very significant. In this sense, they apply ID most effectively and adequately to pursue its objectives, especially in the Hard Sciences. Training objectives that they also claim to achieve, given that the effectiveness rate stands at 99.3% with the highest peaks in political-social sciences (99.9%) and in Healthcare (99.8%), followed by Humanities (99.6%) and the Hard Sciences (99.3%). Respondents see significant improvements in the learning outcomes obtained in classrooms where they use ID and better development of their skills thanks to the improvement of participation, involvement, and peer comparison (see Table 3).

Table 2. How do they use the ID in the classroom?

	MR%
methods of verification and/or ongoing evaluation	38.0%
quiz at the beginning, during, or at the end of the lesson	35.6%
realization of group work and project work	24.3%
intermediate tests	23.0%
written exercises	11.8%
short presentations in the classroom	5.3%
<i>r (use ID for macroarea): rIDxHeS=0.981; rIDxHas=0.996; rIDxSPS=0.968; rIDxHS=0.942.</i>	
student-centered and peer activism methods	37.8%
collaborative learning and community discussion	22.5%
group work	19.2%
ongoing self-assessments	17.9%
peer-to-peer assessments among students	17.2%
flipped classroom	17.2%
role-playing and simulations	6.0%
<i>r (use ID for macroarea): rIDxHeS=0.994; rIDxHas=0.996; rIDxSPS=0.984; rIDxHS=0.967.</i>	
stimulation/incentive methods	24.2%
discussion of case studies and problem-solving	49.5%
joint lessons between colleagues or with expert testimony in the classroom	13.4%
document reading	10.3%
ex-classroom lesson (visits to museums, organizations, institutions, companies, etc.)	8.2%
help of videos	7.2%
participation in conferences and seminars	6.2%
research and study activities in the classroom	5.2%
<i>r (use ID for macroarea): rIDxHeS=0.978; rIDxHas=0.991; rIDxSPS=0.986; rIDxHS=0.930.</i>	
TOT. Responses = 468	

Source: Sapienza (a.a. 2021-2022).

Table 3. Teachers' considerations on the effectiveness of the application of ID in teaching.

effective for:	MR%
improve student performance and learning outcomes	17.8%
encourage more interactivity in the classroom and encourage participation	16.4%
generate engagement and implement students' emotional involvement beyond the classroom	13.5%
enhance critical thinking and the development of abstract reasoning	11.7%
enhance transversal and vocational skills	11.4%
foster more collegiality between teachers in setting up the content and more interdisciplinary connections between the knowledge acquired	9.3%
get more feedback and better understand student needs	7.6%
make teaching activities more engaging through the use of technologies	7.0%
improve the quality and effectiveness of assessment tools	3.1%
implement interactions with stakeholders and teachers and students of other universities and create contacts with the labor market	2.2%
<i>r (use ID for macroarea): rIDxHeS=0.964; rIDxHas=0.985; rIDxSPS=0.970; rIDxHS=0.819.</i>	
TOT. Responses 951	

Source: Sapienza (a.a 2021-2022).

5. Discussion and Conclusion

The study highlights the value of the QUID project as a tool for raising awareness and disseminating innovative practices. Recent studies conducted during the pandemic had, for example, reported low values in the use of student-centered methods and peer activism (for example, the use of these more advanced teaching methods had increased on average from 2.9% to 7.7% in the previous two years (2019-21) (Mazza & Valentini, 2021). Similarly, the progressive improvement confirms what has emerged in the literature, i.e. that the pandemic period has in no way positively influenced the progress process in the use of innovative teaching practices (but only in the use of technologies), while on the contrary, the training of teachers was more effective. Finally, this research highlights how, although in absolute values, the more advanced methods, i.e. the student-centred and peer activism methods are significant in percentage terms, they are not dominant with respect to the other two types (“methods of verification and/ or ongoing evaluation” and “stimulation/incentive methods”) which however express lower levels of innovation. This limit is confirmed by the considerations of the students. University-wide structural surveys have been initiated to assess student satisfaction with ID. These surveys mostly refer to the use of technology in distance or blended learning. The growth in student participation in opinion surveys indicates an increasing attention to teaching and a corresponding demand for quality that must be taken into account in order to implement improvement actions (Sapienza, 2022). In 2020-21, the positive evaluations expressed by attending students on overall satisfaction with courses

amounted to around 87%, an increase over the previous year. It should be noted that students on Master's courses express more variability in their judgments, perhaps due to a greater experience of university life. These opinions could be taken into consideration precisely in order to identify specific aspects for improving teaching quality. The satisfaction ratio expressed on various aspects of the educational offerings reveals a high level of satisfaction with the use of technology in teaching. At the University level, on average, the ratio of highly satisfied students to dissatisfied students is 3.8%, an increase over the previous year. This ratio, when calculated with regard to the evaluation of online teaching activities (multimedia films, hypertext units, etc.), reaches levels well above this value: 8.5% for Bachelors courses and 12.2% for Master's courses. This means that teaching supported by technology manages to meet students' learning expectations to a greater extent. These tools will have to be further developed in order to build the basis on which cooperative and collaborative learning experiences can grow. It is therefore clear that, although teachers are aware of the importance of adopting ID methods that favor more student involvement and better performance, it is necessary for them to further enhance the methods of use of innovative teaching methods, also (but not only) using digital technologies so appreciated by the students.

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The search for values as a didactic tool - an interdisciplinary perspective

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Abstract

The present article explores the didactic potentialities of an interdisciplinary approach intended for university, master or doctorate courses where the development of professional strategies and the acquisition of English for Specific Purposes (ESP) are the main target. By exploiting a heuristic method provided by semiotics, namely Floch's Axiological Square, students can acquire the toolkit that permits them to analyse the process of value creation as well as the discursive procedures and lexical peculiarities typical of corporate communication. Although the focus is on pharmaceutical discourse, we are convinced that the methodological apparatus illustrated here is potentially applicable to other ESP domains and that it highlights the importance of dialogue between apparently distant disciplines for better educational outcomes.

Keywords: *Floch's Semiotic square; learning by doing; ESP; interdisciplinarity.*

1. Introduction

The present contribution¹ is part of a vaster project aimed at exploring the heuristic and didactic potentialities of an interdisciplinary approach (Swales, 1990; Perrenoud, 1998; Bhatia, 2008). This is a proposal intended for university, master, or doctorate courses where the acquisition of English for Specific Purposes (ESP) is aimed at developing skills that permit the production of effective communicative strategies capable of creating and presenting a credible and convincing corporate image. The focus here is on pharmaceutical discourse but we are convinced that the methodological apparatus proposed can be exported into other ESP domains.

Within the realm of specialist-language education, recourse to the analytical and practical tools made available by disciplines apparently remote from each other may impact, positively, upon processes of student learning and motivation (Holmbukt & Larsen, 2016). We wish to highlight the contribution Floch's semiotics of marketing might well make to corporate communication. The dissection of the semiotic mechanisms underpinning the production of meaning may foster and enhance the motivation of ESP learners.

The objective is, therefore, twofold: on the one hand, to provide learners with some of the tools they need to understand value-endowing discursive procedures; on the other, to allow them to “learn by doing” (Ellis, 2003; Steffens et al., 2015; Niemeier, 2017), that is, to acquire some of the rhetorical strategies and lexical peculiarities typical of corporate communication indirectly. The learning outcomes expected upon completion of the didactic activities illustrated below (in section 3) are:

- Acquisition of a theoretical tool for text analysis (semiotic square) and its application to various domains beyond its original scope;
- Ability to identify the value sets encoded in texts and to replicate them for effective communication;
- Ability to recognise the dynamics of meaning-making processes;
- Acquisition of the ESP and discursive strategies typical of pharmaceutical communication.

¹ The authors conceived and discussed the paper together. In particular, Andrea Fenice is responsible for Sections 3 and 4; Renzo Mocini for Sections 1 and 2.

2. Methodology

In order to show how our approach may be implemented, two pharmaceutical websites were selected: *astrazeneca.com* and *pfizer.com*². This choice was dictated by criteria of opportunity as the companies chosen seemed particularly suitable for illustrating the educational potential of an interdisciplinary approach that brings marketing semiotics and ESP in a dialogue. Eco (1988) claims that semiotics aims to describe the workings of communication and signification. According to Greimas (1966), the elementary structure of signification is produced according to a semiotic square (see Figure 1), which allows us to represent semantic categories by implementing three opposite logical sets: presupposition or contrariety, complementarity or implication, and negation or contradiction. Floch (1990) applies this tool to marketing, describing how companies invest their products with a set of values. Starting from the opposition between “existential values” and “utilitarian values”, he posits that promotional strategies fall into one or more of the four categories associated with the vertices of a square: Practical, Ludic-Aesthetic, Utopian and/or Critical.

- The Practical set of values is associated with utilitarian values and highlights the functional features of a product.
- On the contrary, the Utopian set corresponds to existential values and aims at exalting general principles such as life, identity, adventure, freedom and so on.
- The Ludic set, also called aesthetic, focuses on the qualities a product possesses, which are capable of enhancing leisure and/or generating aesthetic appeal. This set of values refers to pleasure, enjoyment as well as luxury, beauty, and other non-utilitarian characteristics.
- Finally, the Critical set of values emphasises an object as such. This mode presents the product in purely concrete, pragmatic terms by focusing on elements such as the cost-benefits ratio or value for money.

Crucially, Floch’s square, like the semiotic square in general, is not arranged statically, but is a dynamic configuration of concepts. This means that the semantic space between them is as important as the vertices themselves. In practical terms, a textual configuration not only can, but is likely to use more than one value set and mixed value strategies as well. This is also why we strongly believe in the semiotic square as a teaching tool capable of stimulating reasoning rather than mnemonics. Students do not learn a series of “labels”, static categories to which to assign textual strategies, but they are encouraged to develop critical thinking and question all the assumptions they make, avoiding simplistic often inaccurate binary solutions.

² The analysis that follows is based on the version of the two websites mentioned (last accessed on the 29th of January 2023).

Within the domain of corporate communication, this semiotic tool can be didactically exploited to investigate the language and discourse strategies used by pharmaceutical companies to showcase their research products and frame information disclosure. After all, the square describes only the deeper (more abstract) levels of signification, while “at a more superficial level, the positions are converted into values that ultimately will be desired and pursued by the subjects” (Floch, 2001, p. 113). Therefore, the same values can be discursively realised in different ways, also depending on the semiotic mode selected: verbal, non-verbal or both. This way, the square allows for “the recognition of pertinent expressive features in the production of a specific meaning effect” (Floch, 2001, p. 137). Against this background, students will be guided to use the axiological square to analyse the various value-endowing devices employed by pharmaceutical companies on their websites. Figure 1 below displays the four Flochian strategies and their corresponding value sets.

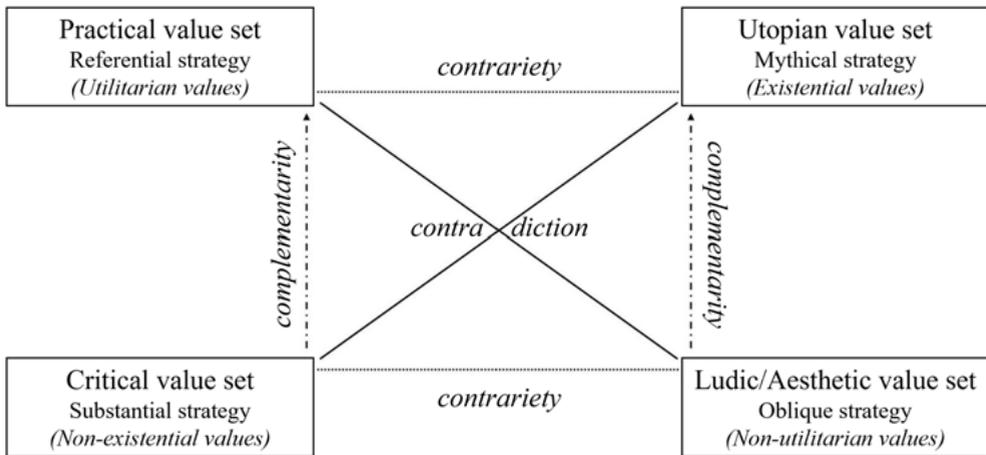


Figure 1. Floch's axiological square.

The practical value set is based on utilitarian values and corresponds to what Floch calls a “referential strategy”: a “set of procedures aimed at presenting the discourse in question as true” (Floch, 1990, p. 274, our translation and emphasis). Clearly, not only marketing, but any other form of communication including pharmaceutical discourse can adopt this strategy of factual *presentation* of reality, by foregrounding objectivity, providing data, tables, graphs, and referencing scientific sources.

Conversely, a utopian value set corresponds to a mythical strategy based on fundamental, existential values. It can be found almost without variation in the discourse of pharmaceutical companies. Life, health, the power of science and social well-being are some of the most common utopian values called upon to enhance their communiqués.

Floch associates the ludic or aesthetic set of values with an oblique form of advertising, which relies on less immediate communication that required active interpretation, a “cognitive effort” to understand indirect messages. The label “aesthetic” refers to non-utilitarian values that stress the aesthetic/ludic pleasure experienced by the subject. Just as the practical set of values was an *ostentation of reality*, its contradictory opposite – the aesthetic set – is a strategy of *concealment*. Therefore, the enunciator can “strike the ludic chord” of the enunciatee implicitly – or as Floch puts it, obliquely – through aesthetically pleasing images, or enticing calls for action.

Finally, the critical value set denotes a substantial strategy. Looking at Floch’s examples for marketing (quality/price, cost/benefits ratios) this set does not seem to apply to pharmaceutical discourse. However, one should make distinctions between the meanings of “substantial”, going beyond the common meaning (ample, sizeable), and focusing on its etymological meaning: “pertaining to the substance or essence”, “involving an essential part or point” (Etymonline). Marrone (2007) proposes a revised square in which the substantial strategy consists in a sort of “close-up” of the object *per se* and its perceptible characteristics. Thus, the emphasis is on the object itself, a “hyper-realistic” *presentation* where some identifying characteristics are selected and magnified in their perceptual nature, often in isolation from their context.

3. Didactic activities

The didactic activities outlined here are not meant to act as a thorough and exhaustive examination. Rather, they simply provide a sample analysis to illustrate the teaching application of the Flochian axiologies. Once the basic concepts of Floch’s square have been explained by the teacher, the students are asked to analyse selected portions of pharmaceutical websites to look for the specific value strategies adopted by the enunciator.

As expected, these websites regularly adopt the practical value set. Given the abundance and easy identification of this kind of strategy, the students should start their analysis by identifying verbal and visual elements leading to a referential strategy. Significantly, the expression “what science can do”, which we find on the homepage of AstraZeneca, is an eloquent example of this communicative solution. In general, most webpages of pharmaceutical companies feature articles with more or less technical or general-purpose health information. On *pfizer.com*, for example, a menu provides links to various informative sections, such as “how drugs are made”, “product list”, “coronavirus resources”. Similarly, AstraZeneca’s website displays charts and visual data summaries all intended to pinpoint relevant medical facts. Since it is frequent and easy to detect, this kind of pragmatic strategy is a good starting point for students to accustom themselves to the characteristics of Flochian analysis. While analysing communicative strategies, students can – osmotically as it were –

identify instances of ESP and recurring syntactical structures. However, the teacher should point out that, although the provision of information is the overt aim of these websites, the practical value set is not necessarily the only strategy involved.

Once the students have familiarised with the referential strategy, we suggest that the teacher guide them to make comparisons with its complementary communicative solution, the substantial strategy. Both are easily found together in visual discourse. We argue that very similar images can implement one or the other strategy depending on the (mainly verbal) context in which they are placed. The article “Harnessing the power of cell therapy” on the AstraZeneca website, for example, is accompanied by the silhouette of a woman’s body full of animated pictures of magnified cells, proteins and other microscopic elements. This picture possesses almost no informative content. Despite using actual images obtained using a microscope, it is a mere collage whose only purpose is to attract the reader’s attention. In this case, the magnification is simply a “hyper-realistic zoom”, a focus on the object *per se*, which indicates a substantial strategy. However, when the article describes the CAR-T cell therapy, the pictures of magnified cells refer directly to the scientific information that is being given. Here we can identify a vertical movement on the square towards a practical set of values since the picture is a visual aid to the verbal explanation of the research data provided.

An eloquent illustration of the ludic set can be found in the lexical choice concerning the link buttons. Normally, these are variously labelled as “read more”, “find out more”, etc. On *astrazeneca.com*, however, we also find buttons such as “explore our latest film” or “explore all our science centres”. The same call for action is present on the Pfizer homepage where the first button reads “Explore our science”. These labels frame the search for information as a quest, in a sort of mild gamification where the user is rewarded with various kinds of data. Interestingly, on the Pfizer website, the button “Explore our science” leads to a section called “science will win”, which refers to the “war against diseases” but also subtly reinforces the semantic domain of “game”. It is clearly a different kind of ludic value set compared to that used by Floch to analyse the promotion of a product for its aesthetic or enjoyable features. However, in both cases, the enunciatee is presented with an indirect message which requires active participation to be decoded. Here, the metaphor of exploration is used to tell a story, adding an aesthetic component to an informative text, using a mixed strategy that exploits contrasting value sets on the diagonal of the square.

During the final phase of the learning unit, the teacher can guide the students through more complex analyses, focusing on less obvious cases where multiple strategies can be detected. When entering the AstraZeneca homepage, for instance, the user is welcomed by a conspicuous teal banner. On the left, there is the aforementioned white caption reading “What science can do”; in the right-central area, we find a mid-ground close-up shot of a man’s silhouette full of colourful lights. A closer examination shows that the blue light in his head is the schematization of a digital network with floating 0s and 1s, while the yellow and pink

lights in his chest are folded proteins and a double DNA helix. In the bottom-right-hand corner, there is a white “i” information icon. A click of the mouse reveals a short paragraph:

Disease understanding: Connecting broader omic-technologies can identify the more complex and transient molecular changes that underpin the course of disease. AstraZeneca is turning this data into knowledge, to help identify novel drug targets.

Here, the focus of the textual segment is clearly the image, which reveals a clear substantial strategy: it is aesthetically appealing, but the students should be warned that this does not necessarily imply the choice of an aesthetic strategy. In actual fact, the values are not ludic/aesthetic (non-utilitarian); rather, the caption stresses the usefulness of science, indicating a practical and/or critical position on the square. Which of the two is dominant? We suggest the latter. Although the paragraph quoted provides hard scientific facts, evoking objectivity and research practices through the use of a highly specialised lexicon (e.g., *omic-technologies*, *transient molecular changes*), two communicative aspects need to be underlined. Firstly, this excerpt exhibits factual information, but it does so without entering into detail. It is the written equivalent of the aforementioned “zoom effect” focusing on a very specific aspect of medical research without any precise context. We might argue that this excessive close-up actually diminishes the strength of the informative content. The phrase “turning this data into knowledge” does not explain much of the actual process, and it is not even clear what “this data” or “knowledge” refer to. Secondly, the excerpt appears only if the user passes the mouse over the information icon. This means that the written message is backgrounded in favour of visual communication. Referring back to the image, the same strategy can be identified: although the visual elements shown are the result of advanced technology and scientific research (actual pictures of DNA and folded proteins), they yield no actual scientific information. Again, we can find the “hyperrealism” which Marrone considers an aspect of the substantial strategy, rather than the factual presentation of reality indicating a practical set of values. Therefore, the analysis performed using the square reveals a vertical semantic movement from a practical to a critical value set.

As a final example, the students might consider that, with the exception of titles and menu items, AstraZeneca’s homepage opens with a claim followed by a call to action:

We are transforming the future of healthcare by unlocking the power of what science can do, for people, society and planet.

Discover more about our company [Link button]

The initial claim enacts a mythical strategy, presenting a utopian value set. Students should be invited to focus on the language used: on the one hand, the presence of words referring to existential values: *future*, *people*, *society*, *planet*; on the other, the use of the continuous present “we are transforming” that suggests both a constant effort and a future plan. The

enunciator is implicitly creating a narrative where the company plays a proactive role in shaping the world. The verb *unlock* adds to this strategy: “unlocking the power of science” creates a mythical, almost heroic configuration with the company as the protagonist of a story. Further evidence of this strategy can be found in the short videoclip accompanying the claim. This is no place for a multimodal analysis, which would go far beyond the scope and aims of this paper. Suffice it to mention that the voiceover introduces the video telling us that “This is the *adventure* of what science can do”, and claims that science has taken them “to places [they] never thought possible” making them “pioneers”. Using this perspective, one can explain the peculiar verb used in the link button, *discover*, which reinforces the narrative of the explorer the term *adventure* connotes. This is also an instance of the different though associated ludic strategy created by the “explore” link buttons mentioned above.

4. Conclusion

Contemplating Floch’s square and the generative potential of the values presented at the four vertices as they interact vertically and transversally with each other to produce semantically nuanced texts, it should appear clear that the discourse found on pharmaceutical websites rarely pursues a single strategy. Therefore, Floch’s square should be presented to ESP students not as a simple list of strategies but as a tool capable of facilitating the interpretation and replication of the values encoded in texts. In other words, the square is a dynamic tool and should be used to highlight logical relations rather than to assign mere labels to segments of discourse. When used heuristically, the semiotic apparatus proposed here can favour the acquisition by learners of discursive and linguistic skills crucial to effective corporate communication in English. The illustrative analysis carried out has striven to corroborate the fact that the Flochian method appears to be applicable beyond its original scope, confirming the pedagogical potential and value of “any form of dialogue or interaction between two or more disciplines” (Moran, 2002, p. 16) and calling for further research in this direction.

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Design and manufacturing of a LIGHTBOARD - Combining the peer-to-peer idea with project based teaching

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Abstract

Lecturers in higher education find it challenging to involve students into critical thinking, carefully pondering solutions to mechanical engineering problems. Project based teaching gives the opportunity to gain both, higher learning outcome and self-reliant study skills. During fourth semester mechanical engineering a guided one semester project (180 hours workload, 6 ECTS) related to a complex real engineering problem focusing on customer demands and possible solutions. It comprised of the design and manufacturing of a lightboard – a “learning glass panel” consisting of a high quality optiglass panel which is surrounded by LED lights. As on regular whiteboards a lecture may be given and filmed directly writing on the 16:9 screen glass panel with fluorescent pens – the lecturer always facing the audience. This lightboard project directly involves students in the production of a teaching device (peer-to-peer approach) and the teaching method is regarded beneficial in terms of students` learning outcome and self-reliance as well as engineering skills. However, the work load is very high and grading is insufficient. Therefore, the method and the role of a lecturer as facilitator is discussed.

Keywords: *Lightboard, project-based learning, peer-to-peer teaching.*

1. Introduction

Globalization and ready accessibility of information nowadays encourages HTW Berlin to move to a competency-based teaching model helping graduates to acquire autonomy and to appropriate the learning process: Huguet et al. (2017), Pfennig (2020), Pfennig (2022). Practicing problem-based learning in education enables students to gain skills above and beyond sheer theoretical and factual knowledge: Balvea and Albert (2015) and reinforces their natural desire to learn: Gomez-Pablos et al. (2016). In general, project based learning methods: Efstratia (2014), Balve and Albert (2015) improve

- interpersonal and interaction skills,
- the capacity of dealing with conflicts and uncertainty,
- communication and presentation skills,
- the ability to work autonomously and assume responsibility,
- the capacity of reasoned decisions,
- and the ability to dive quickly into new areas of knowledge and apply this knowledge in practical situations

The peer-to-peer approach applies well in project based teaching where advanced students generate teaching material for first and second year students: Pfennig (2020), Pfennig (2019). Class results indicate that involving students directly into teaching activities (preparation of lecture videos) can be very effective in getting students to engage in critical thinking: Lord, (2012) entailing deeper learning outcomes: Goto and Schneider (2010). Lecture videos produced via the peer-to-peer approach during student projects: Pfennig (2019) are successfully implemented in inverted classroom teaching scenarios in a first year materials science course at HTW Berlin: Pfennig (2020). Inverted classroom teaching covers the scientific input via defined self-studying phases enabling communicative teaching approaches (group work, discussions, hands-on problems, etc.) during face-to-face time: Pfennig (2020), Pfennig (2022), Setren et al. (2019).

Most self-study phases of the inverted classroom lectures are accompanied by lecture capture videos because lecture videos provide both, an audio and visual stimulus: Gulley and Jackson (2016). But, -with exception of screen casts- the lecturer generally turns her or his back towards the students which is rated disruptive by students. Therefore, lightboard video recording offers a promising low threshold solution to teach short sequences online and simultaneously face students. A lightboard is a “transparent blackboard” consisting of a high quality optiglass panel surrounded by LED lights: Pershkin (2020). The lecturer may directly write on the lightboard with fluorescent pens, being filmed in front. During post processing the video is mirrored and the video lecture topics may be directly used e.g for self-studying (Figure 1). As the production of lightboard videos is easy and post productions not time consuming at set of lecture films were produced partly on student demand. These can directly

be implemented in the self-study phase of inverted classroom teaching scenarios correspondent to video captures, online lectures, written information and other teaching resources: Pfennig (2018), Pfennig (2019-3), Pfennig (2020), Pfennig (2022). However, since there was no device readily available, a completely new lightboard was designed and manufactured as a one semester student project and implemented in teaching at HTW Berlin starting 2019.

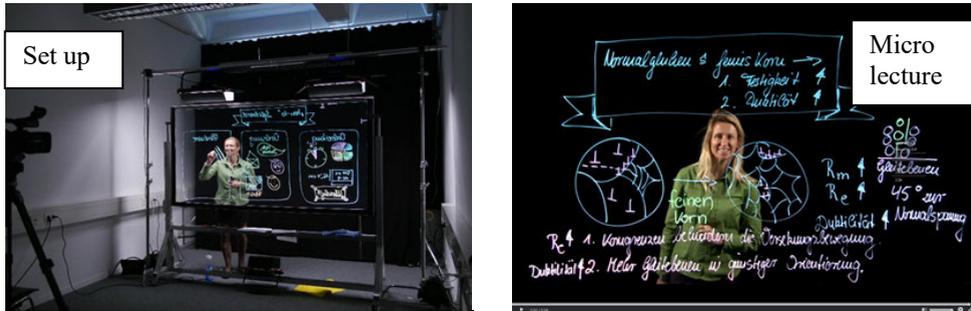


Figure 1. Examples of lightboard videos at HTW Berlin: left: production, right: lightboard video ready to use.

2. Project Lightboard – design

The fourth semester of mechanical engineering comprises of a 6 ECTS course “interdisciplinary engineering project” to be conducted in 6 months. Students chose among 20 to 40 projects facilitated by different lecturers, that is: all students voluntarily chose the “lightboard-project. The entire scenario accounts for 180 hours in total (contact time in meetings is approximately 20 hours), 70 for self-studying and design, 8 hours for presentation and 82 hours of lab work on the lightboard. The lightboard project was selected by 9 students (generally too many, but all of the students were very eager to work on and contribute to the project). The project was sub-classified into 3 phases: kick-off: directly at the beginning of the semester, design: 8 weeks (+4 weeks time to adjust) and manufacturing: 12 weeks.

To keep all students in the lightboard project, they agreed on 3 teams of 3 students each working on different designs in a competitive manner with the best design to be transferred into the product. Teams were formed easily according to students’ preferences, because these students knew each other for more than 2 years. Work packages were agreed on 1. layout of the design, 2. order and setting of the room for the lightboard, 3. manufacturing and redesign and 4. documentation. The first milestone, the layout of the designs was set for a period of 6 weeks, finish after 12 weeks. This implied intensive work, but offered time for the finding of the design, feasibility study and evaluate order and/or shipping time of components. The role of the lecturer was to facilitate, answer questions whenever these aroused, manage conflicts once students asked for advice or help and keep track of mile stones and dead-lines.

3. Project Lightboard – manufacturing

3 different designs were presented differing in complexity of the design. After presentations and approximately 4 hours of discussion the students agreed on a design comprising of electrical adjustment of height (Figure 2). The group defined new competencies and responsibilities with 1 student in charge of welding, 2 for orders, 2 for room installation, 2 for construction and 2 for documentation.



Figure 2. Images of lightboard production and glass micro flaws/precipitations.

During manufacturing of the lightboard e.g. welding, construction, electrical installation it was soon clear that the motor of the chosen design was not deliverable. The group agreed on another design with the same student competencies. Another drawback was the low quality of the glass panel consisting of unacceptable micro flaws and precipitations (Figure 1, right). All the time the students were facilitated by the lecturer and project leader via skype, slack and email contact. However, the rebuying of the second glass panel was done by the project leader/lecturer. Due to the redesign the time scheme was extended 4 weeks.

The manufacturing report was delivered on time and applied for instruction manual for other projects (HTW Berlin delivered the design in 2020 to a university in southern Germany). The film documentation lacked of professionalism.

4. Discussion: lessons learnt, evaluation and self-reflection

Project based teaching allows students to learn science and learn how to be independent thinkers. Students should be capable to take responsibility of their own learning process and find their own study pathway. The project based method implements a structural teaching change with grades not being the main focus: Balvea and Albert (2015) emphasizing in non-technical skill development although the capability of planning actions to solve situations might stay ominous: García (2016). However, as traditional courses do not always prepare

individuals to be competitive, and consequently may have little value or relevance to students after they graduate: Sarta (2014) project based learning prepares engineering students for market needs in a globalized world.

The lightboard project directly involves students in the production of a teaching device implementing their skills received in former classes. Therefore, these students were not only engaged in the design and manufacturing itself but also in the process of project work. The sustainability of the product, the implementation of the lightboard as teaching device further encouraged students. Students had to arrange with different engineering related tasks such as the design, manufacturing, welding, ordering components, handling equipment and reporting properly on their project progress. But also social skills were accomplished, such as: communication with sales person, team building, reporting properly written and orally, discussions of project related problems, discussing social related problems during workflow, to deal with unforeseen problems during the project postponing of orders and finding experts to support (e.g. welding, calculation, etc.). For them it was the first time to actually be involved in a real product related work giving them the feeling of importance of themselves as engineer, person and project college.

When implementing the project based teaching method, the attitude of lecturers is of great importance to the success of the method: Lasauskiene et al. (2015). It is strongly suggested to assign a sufficient substructure for both the teacher and the student. Every student should relate to a duty according to his or her own ability: Ergül et al. (2015), where their characteristics and qualities, environmental conditions along with fundamental principles should be taken into account: Kaya et al. (2014). Transparent steady course demands and sufficient high quality learning material need to be provided to make the method successful – even in terms of better grades: Kaya et al. (2014). Tasks were clear, grading was transparent all the time (Figure 3), contact hours set, the project leader available online all the time offering valuable advice and helping with viable tasks or decisions. Still, grading of the course (comprising of: engineering skills, creativity, feasibility, communication, management, documentation, reporting regularly was mixed (Figure 3): 1 student scored: A+, 1 student: A, 1 student: A-, 2 students B and 4 students: B- (note, students were members of different groups). The B- was mainly related to lack of participation and communication as well as missing of deadlines and quality of the reports.

These deficits could have been detected earlier if fellow students had reported the difficulties. Students often lack of help and support among each other when carrying out the tasks: Gomez-Pablos (2016) and may not know how to interact effectively so that lecturers and administration should discuss and reinforce social skills along with providing guiding templates to help staying focused.

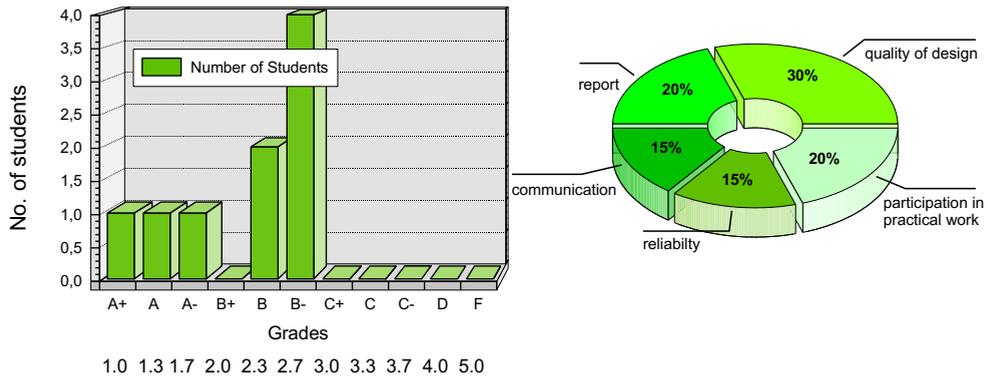


Figure 3. Distribution and constitution of student grades: project lightboard.

Four draw backs during the project were vital to its ongoing: First, the insufficient quality of the glass panel which was costly in terms of time. Second, the framing was calculated according to a feasibility study and highest load and strain. However, aluminum profiles distort during welding leaving the frame of the glass panel bent (it does not impair the functionality of the lightboard). Third, the electrical motor for the electrical height adjustment was not deliverable so that the group hat to change to a different design. Forth, was related to the project leader because here the lack of tight guidance during the project and the renunciation of close reporting intervals was disadvantageous in terms of project planning.

Therefore, one of the most important lessons learnt is to not accept more students that were intended initially. And during this project, closer guidance and facilitation by the lecturer is highly advised to keep students working on the main tasks fulfilling the work packages. Decisions have to made earlier to direct students and it is also necessary to set non-negotiable deadlines. These were not given ahead of the project start because a lightboard has never been designed before (now there are custom-ordered designs available) and no one new about the project outcome. However, the creativity of the engineering design is not suppressed with strict framing, moreover it may help students to focus on the project outcome. The most important lessons learnt are:

- Closer facilitation towards fulfilling milestones
- Clear advice on task (deliverables of the work packages)
- Feasibility study and component availability right from the beginning
- Mid-term reports and/or weekly reports to keep close the project proces
- 6 students are a good working group size to handle well for lecturers

5. Conclusion

The peer-to-peer approach was combined with project based teaching to design and manufacture a lightboard that may be used by every lecturer at HTW Berlin to generate low threshold lecture videos. Advantage of lightboard videos over lecture capturing is that students are faced directly during online teaching and are therefore secured in their teaching process. A guided one semester project (180 hours workload, 6 ECTS) related to a complex real engineering problem focused on customer demands and possible solutions. The lightboard project directly involves students in the production of a teaching device and therefore these students were not only engaged in the design and manufacturing itself but also in the process of project work and sustainability of their project outcome. 4 work packages were defined. Results were compiled and presented at milestones. Students had to arrange with different tasks: design, manufacturing, welding, ordering components, communication with sales person, team building, reporting properly, discussions of project related problems, discussing social related problems during workflow, handling equipment, dealing with the postponing of orders, finding experts to support (e.g. welding, calculation, etc.). Lectures learnt to facilitate properly are: offer closer guidance, make decisions earlier to direct students and to set non-negotiable deadlines. Quintessence is that the creativity of an engineering design is not suppressed but supported by close guidance allowing for students to focus on the project outcome. During the project based work students took over the responsibility for their own learning process. Although grades were not sufficiently high, the teaching method is still assessed as beneficial in terms of lightboard design and construction, learning output of students and lecturer, understanding of project work, concentration and attentiveness as well as both joy of studying and working as a future engineer.

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The impact of technology adoption in teaching and learning within ODeL

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Abstract

The emergence of the fourth industrial revolution (4IR) instigated various institutions of the world to move towards technology integration in teaching and learning. The purpose of the current study was to assess how impactful was Wolfram System Modeler (WSM) software to students in their studies by utilising the technology acceptance model. MS forms online survey was utilised to collect data from participating students of the Solid Mechanics (SME3701) module. SME3701 module was targeted whereby 95 students participated. Data analysis was done through IBM SPSS Statistics. The findings of the study indicated that students found the software WSM interesting as evidence of the module performance as compared to before the introduction of the technology. The module performance improved drastically as evidence of the students 'acceptability of the technology.

Keywords: *Teaching and learning; Wolfram System Modeler.*

1. Introduction

The emergence of technology during the current digital age has transformed the distance education space into what is currently. Technology is playing a fundamental role to deliver modern engineering education to the next generation (Abbad, 2011). Apparently, appropriate, and yet effective utilization of technology is tremendously important for distance education (Amanullah, Chandran, and Stojcevski, 2014). In the view of Arinto (2013), the transition of distance education emerged as far as correspondence to open distance learning (ODL) and eventually to open distance e-learning (ODeL). ODeL platform allows teaching and learning to take place due to technology enablement without the confinement of the physical building (Arinto, 2016). The teaching and learning in an ODeL platform permit learning to take in both synchronous and asynchronous (Alfonso, 2012). The University of South Africa (UNISA) is one of the distance education universities that experienced the mentioned evolution of distance education to now Ode since 1950 (Arinto, 2016; Arinto, 2013). Numerous universities all over the world are gradually shifting from a predominantly print-based mode of delivery to an online mode characterized by using virtual learning environments and various web technologies (Arinto, 2016).

Notably, the evolution of the Fourth industrial revolution is exponentially growing more than ever before while disrupting industries all over the world. 4IR is characterized by 3D printing, the Internet of Things (IoT), and the fusion of technologies (Xu, Min, Jeanne M. David, and Suk Hi Kim, 2018) influencing the education sector to follow suit. Educational technology can be defined as the study and ethical practice of facilitating learning and improving performance by creating, using, and managing suitable technological processes and resources. To recognize the value of such technology, it is essential to familiarize ourselves with the technology adoption process and the factors affecting it (Kannan, Punithavathi, and Sambandam, 2018). Hence, the current study utilizes TAM to assess technology adoption in the institution of higher learning as is preferred in various sectors.

2. Methodology

This Tavallaei and Talib, (2010) mention that research methodology refers to the researcher's general approach in carrying out the research project. As of the current study, researchers earmarked research problems to be solved within the institution of learning utilizing TAM in view of collecting quantitative data by means of an online survey (Microsoft forms) from the Advanced Diploma students at an institution of higher learning in South Africa. The quantitative research approach (Creswell, 2014) was found to be suitable for collecting quantitative information from the students utilizing the TAM survey. The collected data was focused on the Solid Mechanics IV module in the Advanced Diploma course in Mechanical Engineering for the first semester, of the 2022 academic year. The module's main content is

vibration analysis. For the year 2022, seven assessments were given to students, four of the assessments were based on Wolfram System Modeller (WSM). During the assessments, students were required to analyze a physical model problem, and solve it using mathematical equations. They would then construct the physical model onto WSM, insert boundary conditions for the model operation, and then simulate to obtain and interpret the mathematical analysis on a graph.

Research samples are participants from whom data is collected (McMillan & Schumacher, 2014). In view of the current study, the module has 158 registered students, however only 138 fully participate in the assessments given by the lecturer. For this survey, 95 students voluntarily participated, as was aligned with convenience sampling which deals with the availability of selected participants (Creswell, 2014; McMillan & Schumacher, 2014). The online survey form was structured into 3 categories, sections A, B, and C. Where section A, comprised demographic information, section B concentrated on quantitative data regarding Perceived ease of use (PE), Perceived usefulness (PU), Attitude (AT), and Intention to Use (ITU). While section C collected the student's personal views and comments about WSM. A 5-point Likert scale was utilized to collect the quantitative data in section B. McMillan and Schumacher (2014) viewed Likert scale questionnaire as the supreme and most extensively used form of a scaled questionnaire. While SPSS (Statistical Package for Social Sciences) was used to analyze the quantitative data.

The validity and reliability of the research instrument provide lead to meaningful interpretations of data (Creswell, 2014) and for decision making. Statistical analysis was done to determine the internal consistency between the questions in the questionnaire. The Cronbach Alpha reliability test tabulated in Table 1 resulted in a correlation coefficient of more than 0.70 which is viewed as a high internal consistency. If the items are strongly correlated with each other, their internal consistency is high, and the alpha coefficient will be close to one as is of the current study (0.918) (Fontanilla, 2016).

Table 1. Cronbach's Alpha Reliability Test.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.918	0.923	17

3. Results & Discussion

The results of the current study are comprised of demographic (section A), quantitative survey (section B), and qualitative analysis (section C) as explained in the above section.

3.1. Demographic results

Demographic data were gathered for all the 95 participants considered for analysis with (26%) female and (74%) male participants in the survey. With 0% in the 15-19 age group, 50.5% in the 20-29 age group, 42.1% in the 30-39 age group, 6.3% in the 40-49, and only 2.1% in the 50+ age group. The number of e-learning courses taken by the student during the semester, with 3.2% having taken 1 module, 7.4% with 2 courses, 27.4% with 3 courses, 21.1% with 4 courses, and 42.1% with above 5 courses. Only 54.7% had e-learning courses that incorporated computer simulations, these 52 students were registered for Solid Mechanics. 33.7% had 2 courses with computer simulations, 9.5% had 3 courses, 1% had 4 courses, and 1% had 5 of these courses. Out of the total number of participants, 89.5% were exposed to computer simulation software, while 9.5% have not been. 83.2% had personal computers that meet the minimum requirements for the software to run, while 8.4% had not and 7.3% of students answered may be.

3.2. Student ease of use of WSM

Figure 1 shows the perceived ease of use of WSM. The response of the students was rated on a scale from 1 to 5, with 1 being strongly agreed and 5 being strongly disagreed. Finding WSM easy to use, 47.8% of students strongly agreed. The average percentage of students learning to use WSM was 48.8% strongly agreeing. The interaction with WSM being clear to the students was on an average percentage of 48.2% strongly agreeing. The average for students being able to solve complex engineering problems related to Solid Mechanics using WSM was an average percentage of 53.6% strongly agreeing.

Perceived usefulness plotted in Figure 2 for using the WSM to enhance the student's effectiveness in learning, an average percentage of 48% of strongly agree was recorded. Using WSM to improve the student's course performance was averaged to a percentage of 47.4% strongly agreeing. For using WSM to increase the student's productivity in their course work, the average percentage was 50.4% strongly agreeing, and finding WSM useful in their studies, was averaging 45.2% strongly agreeing.

Attitudes from Figure 3, the student's results for disliking the idea of using WSM in their studies 73.8% strongly disagree. students found a generally favorable attitude toward using WSM was 45.6% strongly agreeing. For students believing that it's a good idea to use WSM for their course work 41.4% strongly agreed and among those finding WSM, a foolish idea 81.4% strongly disagreed.

Intention to Use results is shown in Figure 4. The student's response to WSM making teaching and learning interesting was 41.4% strongly agreed. Of students who intend to continue using WSM during the semester were 43.2% strongly agreeing. Students who in intend to continue checking announcements from WSM frequently averaged 46.4%. Students

who intended to recommend WSM to their peers in the industry averaged 46.4%. And students who intend to be heavy users of WSM averaged 51.4%.

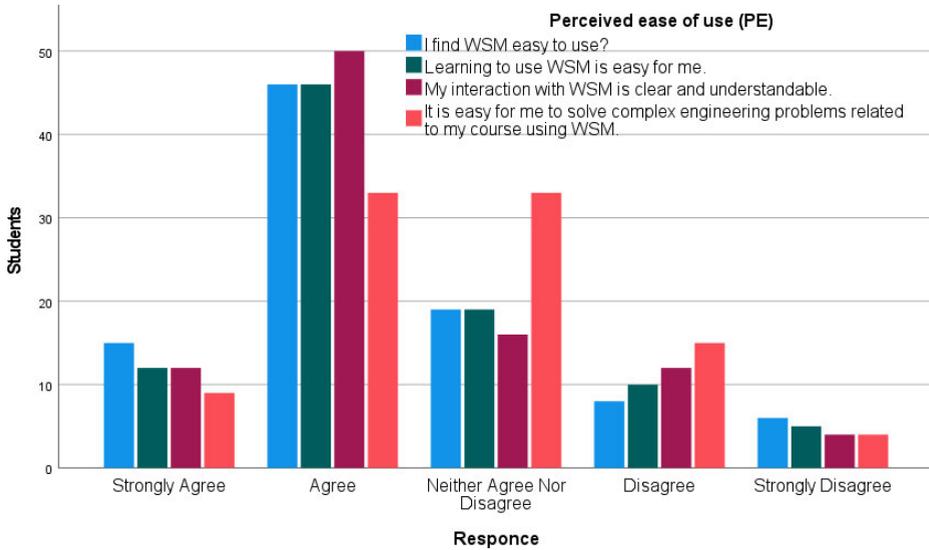


Figure 1. Perceived ease of use (PE).

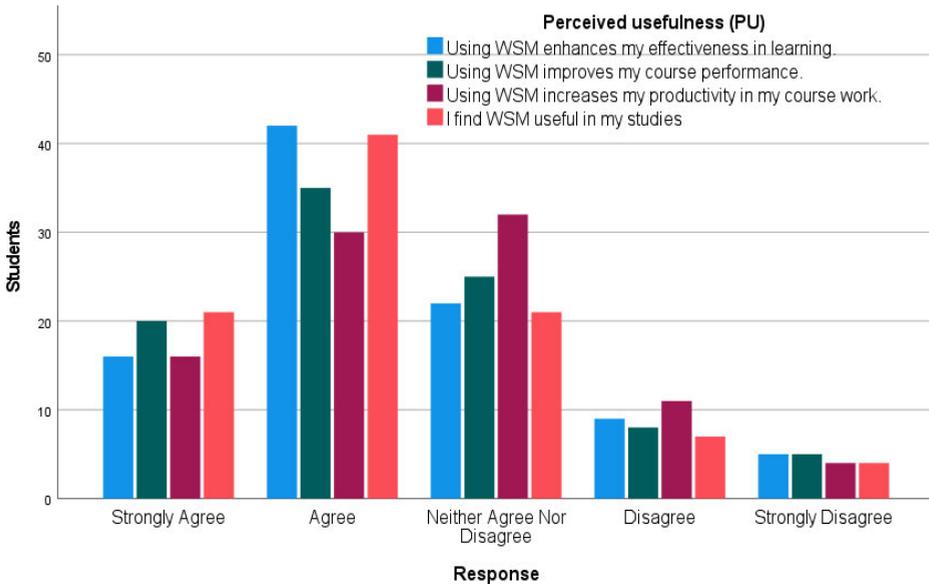


Figure 2. Perceived usefulness (PU).

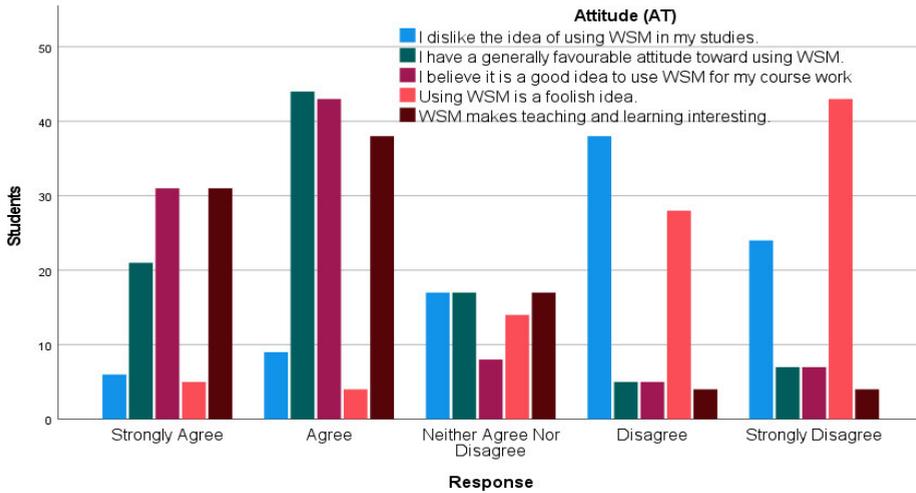


Figure 3. Attitude (AT).

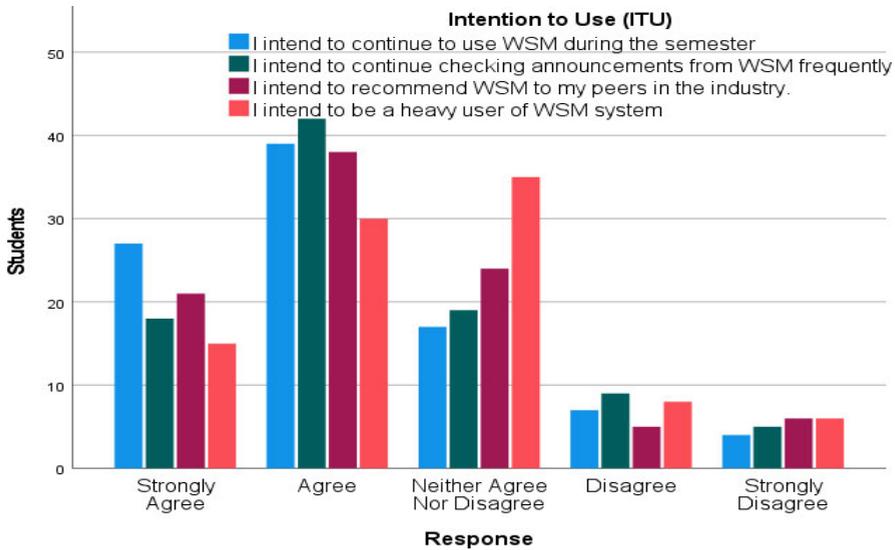


Figure 4. Intention to Use (ITU).

3.3. Student's personal views and comments about WSM

With the integration of WSM into the module, the gap between experiments and theoretical studies was bridged. With the complexity of the vibrations system, WSM was able to improve the student's understanding of the module by displaying these vibration systems, simulating the model according to various boundary conditions, and plotting various graphs to interpret the model.

Challenges were encountered by students when their computers were not able to meet the minimum requirement for the software to operate. Third-party software had to be installed to assist the software in running, this then resulted in extra resources being used for this. Cloud-based operations are recommended as they are much easier for students to access. Due to the complexity of the software, resources were provided by the lecturer, however, this does not suffice, as students must learn to navigate the software before attempting to construct the model. This is evident that a support structure must be put in place to assist students more. According to the lecturer's experience with the integration of WSM into the module, students who frequently consulted were able to troubleshoot the challenges incurred.

Despite all the challenges, students' attitude towards the software was good. The student's reaction toward WSM taking the place of the theoretical approach to solving engineering problems, was that they acknowledged that the theoretical approach had to be done, and it was complemented by the software's ability to interpret the theoretical condition they inserted.

It was noted by the lecturer that since incorporating WSM in the module, the student's performance has increased. Students found that WSM contributed to their performance by giving more knowledge, however, some did mention that due to the pressure and the short duration of the semester, they were not able to use the software effectively. They also emphasize that WSM should have its separate module so that when it's integrated into the different modules, they are able to use it effectively.

When the students were asked, "Will you recommend WSM to other students?" 65% said yes. The remaining number includes those who did not know and those who felt that they had not used the software effectively to be able to recommend it to other students.

4. Conclusion

The current study utilised the technology adoption model to access how students viewed the integration of WSM into the SME3701 module at the diploma level in the department of Mechanical Engineering. As alluded to earlier, TAM focussed more on Perceived ease of use (PE), Perceived usefulness (PU), Attitude (AT), and Intention to Use (ITU). The research findings clearly indicate that the introduction of WSM software into the module brought some hope to the students as they received the initiative with open hands. It was also good that almost all students registered for the module has access to the computer and could easily interact with the software. The students were now able to simulate, plot graphs, and interpret the data without any challenges. The lecturer was able to provide background information regarding the purpose of the software and how it would assist them to understand the module better. As result, the students perceived the software and the intervention positively. They also find it userfriendly and developed a positive attitude towards it. The increase in the pass

rate of the module was a good indication that students found WSM very useful. When they were asked a question if they would refer other students to this software almost 65 % agreed to indicate their intention to further utilize the system.

The findings also indicated that the age group of these students is aligned to the current technological dispensation as consistent with Porter and Donthu (2006) in their study. Young students find technology interesting, and it enhances their learning experiences.

TAM, in this regard, managed to assist in determining how students found the adoption students WSM in their SME3701 module as supported by Park (2009). Both quantitative and qualitative results concur with each other that student welcomed the integration of the WSM in their module as their positive performance speaks a volume.

The adoption of technology in teaching and learning can assist academics in better presenting their content to students since most institutions are now embracing online learning. It is therefore recommended that a similar study can be adapted to other modules in the faculty to encourage other academics still reluctant to utilize technology for teaching and learning to follow suit. The adoption of technology in teaching and learning is slowly becoming the reality in this dispensation of 4IR technologies.

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Moodle-based e-learning courses for introduction to critical thinking in a multidisciplinary perspective

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Abstract

A course design to introduce to critical thinking was built in the context of the need of developing these skills, with aiming at proposing this course beyond disciplinary knowledges. Critical thinking may be considered a process that transcends disciplines, committing students to be actors of their learning. Due to constraints related to the high number, the diversity of students (<500 students/session), this course was proposed as an online learning environment on Moodle. The course contains learning modules including resources and interactive components. We discuss here the strengths and limits of this course design. Optimization and opportunity to adapt the framework of online learning environments for students to exercise critical thinking are considered.

Keywords: *Critical thinking; e-learning; Moodle; learning environment.*

1. Introduction

1.1 Context

The need for the development of critical thinking relies upon the confrontation with economic, social, human and environmental issues, in a state of political and technical reconfiguration. Critical thinking might be considered as a set of requested tools for students' own development but also for caring for others and our environment. Being a set of attitudes and habits related to discernment, thinking and vigilance over one's judgments and those of others, it shall be included in all academic program. Indeed, critical thinking is a central component for personal and professional autonomy, for social integration and significant contribution at scientific level. One shall note also that critical thinking dynamics is never a definite asset and should be constantly nurtured. Therefore, the development of critical thinking has been promoted both at the French national level - being an institutional injunction (Kammerer, 2021) - and at the international level, being promoted by the United Nations Educational, Scientific and Cultural Organization (UNESCO) or the Organization for Economic Cooperation and Development (OECD) guidelines.

Critical thinking is widely acknowledged as a state of mind and a set of practices that nurture and reinforce each other's. Its place in education is crucial as underlined by the analysis of Sellars et al. (2018) or Southworth (2022). These skills are called to play a major role i.e., for sustainable development or promotion of peace.

Our institution offers a wide range of educational programs in the disciplinary fields of Law, Economics, Management, Life and Health Sciences, Sciences and Technologies, Humanities and Social Sciences. More than 79,000 students are spread across 6 campuses located on different sites. Our course was developed facing two challenges: (1) to provide a course conceived as an introduction and an awareness-raising to critical thinking, while (2) offering this teaching in a multidisciplinary manner, so that it is de-compartmentalized and accessible to all undergraduate students (second and third year), regardless of their discipline or campus.

1.2 Critical thinking nature and training

While the nature of critical thinking itself might be debated (Sellars, 2018), one can point out that substantial contributions have been elaborated to provide a common language around the concept and the specific capacities, attitudes and cognitive strategies intrinsically linked to the exercise of critical thinking (Ennis, 1987; Paul et al., 1989).

Critical thinking is often referred as a reflective process in which the propensity for self-correction is essential (Ennis, 1987; Lipman, 2003) and being best practiced when students have an in-depth knowledge in the considered field (McPeck, 1981).

In order to offer an educational program in a multidisciplinary manner, we focused on the non-disciplinary dimensions of critical thinking since it can be referred to a global set of minds and a wide set of skills that are applied to any subject and/or action, as highlighted by Dekker (2020). Indeed, key factors in critical thinking development may rely upon a multidisciplinary curriculum, a student-centered pedagogy, and the diversity within the academic community engaged in the teaching (Dekker, 2020). We also based our approach by integrating a critical thinking definition encompassing those from primary schools to universities (Eduscol 2016). The latter stresses out (1) attitude such as curiosity, autonomy, lucidity, modesty and listening, which are often omitted when considering critical thinking (Thonney and Montgomery, 2019), as well as (2) the necessity to discriminate between facts and interpretation, knowledge and emotions, inquiries and exchanges.

1.3 Moodle-based e-learning courses for critical teaching

We faced pedagogical, practical and administrative challenges: how to provide an awareness-raising courses to critical thinking, while offering it to a very large audience and taking in account (1) the heterogeneity of the students' profiles (i.e., disciplinary fields, campus localizations) and (2) a sustainable offer regarding the dimension of the administrative staff in support? In a context of the massification of higher education, we aimed at conceiving these courses to be open to every second- and third-year undergraduate student, while being accessible at any time, in order to increase opportunities for students to enroll and conveniently follow these courses.

E-learning appears as a counterintuitive solution for introducing to critical thinking since it relies in part on social interactions and skills. However, critical thinking e-learning environments have been experienced and their efficiency analyzed (Haghparast et al., 2014, Chou et al., 2019, Puig et al., 2020). Thus, we chose to develop an autonomous and asynchronous courses without individual following, with a fully automated examination process. Moodle was chosen being an open-source learning management system that allows users to develop e-learning, providing amenability and integration of various types of learning sources (Hirschel 2012).

Here we discuss several aspects like the amenability of e-learning, student autonomy, success rates, interest generated among colleagues, and the fact that this teaching can serve as a basis for the construction of other teaching units where critical thinking plays a predominant role.

2. Courses design

This optional courses were proposed to second- and third-year undergraduate students. The multidisciplinary academic team, which conceived the courses are mainly in the disciplinary fields of Sciences and Technologies, and Humanities and Social Sciences. We also articulate

our constraints with the three pillars of pedagogical alignment in the construction of this teaching: objectives, teaching activities and assessment (Biggs, 2003). The courses aims, its organization, functioning, timeline and the evaluation process were clearly outline in an introductory section. A forum was open to answer the different questions and requests of the students.

Several aims were defined (1) to reinforce the overall reflexive capacity to increase the freedom of thought and the ability to make choices, (2) to perceive the limits of one's natural abilities to evaluate information in certain circumstances and to demonstrate both modesty, lucidity, caution and listening, according to the information and circumstances; (3) to acquire new tools and criteria to evaluate the qualities of information and to distinguish facts, knowledge, opinions and beliefs; (4) to raise the awareness of taking into account the diversity of perspectives to help develop constructive and respectful communication strategies with others. Activities were built according to these objectives.

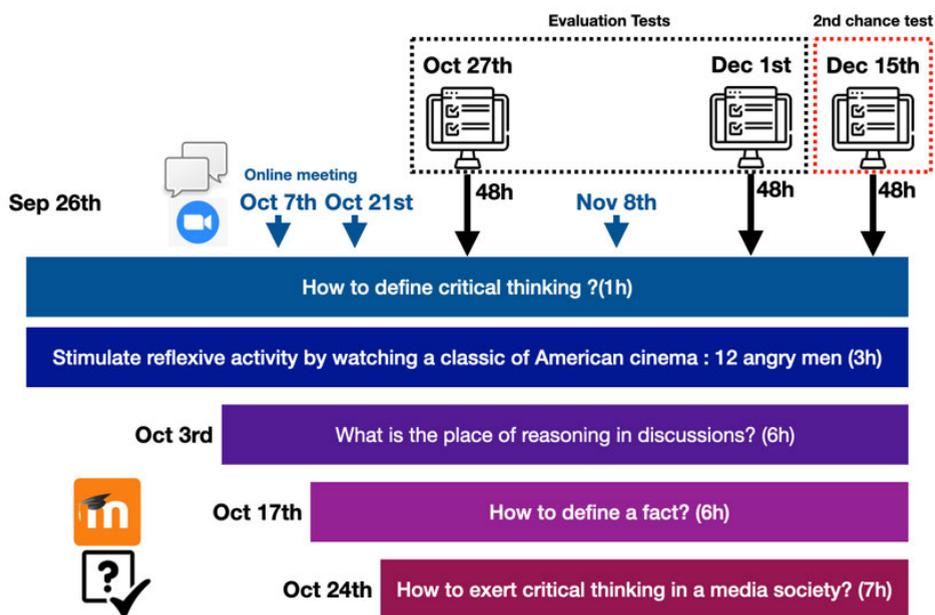


Figure 1. Overall scheme of teachings (academic year 2022-2023). Courses were provided online using Moodle platform. Five sections were proposed and self-assessment of the understanding of the courses to the students.

The courses were made up with five main sections: (1) how to define critical thinking, (2) stimulation of reflexive activity by watching a classic of American cinema: “12 angry men” (the latter movie can be referred to as an example to illustrate the manifestations of critical

thinking (Boisvert, 2015)), (3) to address the place of reasoning in discussions, (4) the definition of a fact and finally (5) how to exert critical thinking in a media society. Overview of the architecture, calendar and assessment schedules is provided in figure 1. Each part of the courses were built upon various activities posted on a Moodle page: guided analyses of films, texts, images, online tests (online multiple-choice quiz, with immediate feedback), etc. Students were asked to complete all of these activities while carefully following instructions. Three times during the semester were organized on-line meeting with students using zoom software.

Learning outcomes were assessed as follows: two continuous assessment evaluations (CC1 and CC2): CC1 was related to part 1, part 2, and part 3 of the courses while CC2 was related to parts 4 and 5 of the courses. A "second chance" exam was proposed before the end of the semester to students who did not have the overall average on the first two exams as following the rules of the University. During the duration of the evaluations (48 hours), the on-line pedagogical resources were hidden. The tests allowed the teachers to verify that the students had consulted the available resources, that they had understood and assimilated the key concepts explained in these resources, and which students were then able to implement simple skills in simple case analyses. During the academic year 2022-23, 466 students enrolled and participated to the learning outcomes evaluation. Furthermore, 40 students were enrolled but did not participate in the exams.

3. Evaluation

We performed courses evaluation in order to improve the teaching and to enable teachers to undertake a reflective approach to the courses. This evaluation combined quality assessment and analysis of students' academic results at the end of the courses. To avoid and minimize the risks of complacency bias or any Hawthorne-type effect, the evaluations were carried out by an independent service of the university, devoted to pedagogy and Innovation support. The latter are discussed in the following section. The courses quality assessment was based upon an anonymous questionnaire addressed to the students using the LimeSurvey software. It was made up of 28 closed questions (regarding general appreciation, contents, animation, interactions and activities) and 4 open questions (Why do you choose to follow these courses? What are the strengths of these courses? What proposal would you make to improve the courses? Do you have any further remark?)

4. Results and discussion

Our institution is acknowledged for both the excellence and diversity of its research and its educational programs, as well as for its territorial anchoring. It aims to engage students to be actors, as citizens, and to position themselves through skills such as those of critical thinking,

that implement both careers and personal lives. Several teaching formats that mobilize critical thinking are proposed in the disciplinary fields but few courses are offered to respond both (1) to the heterogeneity and diversity of our students and (2) to the need to develop critical thinking skills. Therefore, we specifically developed a course entitled “introduction to critical thinking”, built in the specific scheme of courses designed for transversality and enrollment of large groups (up to 600 students). The latter courses, which were optional and proposed to second- and third-year undergraduate students immediately found its audience: 420 students in 2021 and 506 students in 2022. The profiles of these students exhibited diversity, since these students engaged in degrees in different disciplinary fields such as law, political sciences, economics and social administration, education and training sciences, sociology, economics and management, information sciences or linguistic studies.

Regardless of the courses attractiveness, we observed attendance to the tests and examinations that were above the average (personal observations). More than 90% students finished the courses in 21-22 and 87% in 22-23. In 22-23: 466 students participated in the evaluation tests. Out of the 466, 71 students did not get the average at the end of the evaluation test and therefore performed the so-called 2nd chance test. At the end of this test, only 25 students did not validate the courses.

By relying on the results and observations from questionnaires, interviews and analysis of student productions, several teaching strengths emerged: (1) asynchronous Moodle based-teaching unit (mentioned by 88 students out of 190 responses; “distance”, “no time constraint”, “freedom of organization”, autonomy were appreciated, and could be correlated to the reason why the students chose this courses (53 students out of 196 responses), (2) contents (18 students out of 190 highlighted the nature of the activities and their diversities (videos, online tests,...)).

This diversity of different didactic sensitivities and approaches of the teachers appeared in the feedback from the evaluation, as well as a strength and as a source of complexity. While proposing rich and original activities, it appeared that the latter could be adapted and be more concise or request a smaller workload. Some activities could be more efficient if shorter, according to the students, in order to allow them to develop synergy between the time management and the dynamics of the courses. We undertook an adaptation of the distribution of the workload.

More video resources and more interactive resources could accentuate the originality of the offered supports and to promote dynamism. More sensitive themes and more current events are a stimulating development track, thus illustrating the need to resolve the cognitive gap inherent in critical thinking between emotion and reasoning.

We also noted that “12 Angry Men”, the cinematographic work that introduced the courses, was well perceived, as well as its input. It drove the viewer to widen their scope and to put

in perspective their own opinions. Beyond prejudices and motivations, it is here the mechanism of critical thinking that is highlighted (Boisvert, 2015).

Several areas for improvement have emerged and remarks that rose during the quality assessment of the courses mirrored considerations that had been at the core of the creation of these courses. The areas for improvement raised by the students mainly concern the evaluation methods (46 students/181 responses, complexity of the questions, other methods, clarity of the questions) and the workload represented by the activities (22/181).

We also identified several limits. The first limit is related to the importance of regulated discussions (an essential didactic tools for the confrontation of facts, ideas and opinions). This dimension is hindered by the intrinsic potentials and limitations of Moodle. Several verbatim from students expressed their desire to participate in these intellectual exercises in the context of the courses, but the pedagogical team was not able to overcome the constraints that a large audience generates on Moodle. In contrast, the meeting organized online had very mitigated success (attendance was very scarce, never reaching more than 30 students) and revealed mostly administrative questions, the need for collective reassurance and little exchange about critical thinking. One might also interpretate the low number of students in the online sessions as a sign that the students have taken the courses in complete autonomy.

The availability of teachers and administrative staff has not been questioned, indicating that the interactions setup and the information made available are adequate. Together with mail exchanges, this online meeting appeared to be sufficient for students' assistance and guidance throughout the courses. Both online meetings and evaluation emphasized that the themes and methods used during the courses were discussed in larger settings (friends, family, other courses).

The second limit was related to the difficulty to evaluate skills related to critical thinking online. The Gordian knot of the pedagogical relationship remains the act of evaluation, so the creation of the different controls generated questions and dissatisfaction, which found an echo among the students both for the length and level of difficulty. A few questions were considered based more on memorization skills than critical thinking and "disconnected from the content of the courses". These questions were revised and modified. Evaluating open-mindedness, curiosity, and modesty remain the challenge to be taken up.

Another point of consideration was the architecture of the courses on Moodle, since it is a crucial point for the operability of these courses. We aimed for clarity and efficiency. The inherent limits of Moodle can make one fear a lack of fluidity and logistical heaviness. The courses quality assessment resonates these concerns, but the quality of the courses structure and the clarity of the instructions was also highlighted. This contrast might be related to the heterogeneity of students' relation towards Moodle and e-learning.

The conclusions of the courses evaluations lead us to several observations, including that the students appreciated developing their critical thinking and became aware of the abilities that are requested to maintain a critical thinking. These courses has raised an interest in other departments in our university, which asked for their students a free access to evaluate the interest of these students in such program. Therefore, teaching supports and assessment tests could be used, adapted and might be proposed in another format, to increase and maintain students' enthusiasm in practicing critical thinking, and ensuring that they can deepen the concepts presented and apply them in cases of increasing complexity according to their discipline, which could optimize their learning. Two constraints potentially limit its expansion within our institution, linked to the human resource that is requested both at the pedagogical and the administrative levels for maintenance of online teaching and satisfying levels of interactions with students.

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Tailoring professional development to postgraduate students: it's not the chicken, it's the egg

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Abstract

Graduate employability and professional development are more commonly discussed in an undergraduate context. Yet many postgraduate students seek professional development as part of their programme of study. There are challenges in providing an in-programme tailored, person-centered professional development offer at post graduate level when student cohorts are often large and international. This case study explores a professional development provision embedded into a master's programme, centred on developing self-reflection through experiential learning approaches. The students tailor their path through taught workshops and lived experiences, to recognise gaps and take actions to fulfil their development needs; during their studies, and as reflective practitioners of the future. The paper concludes there is a need for self-reflection to be practised and assessed as part of a professional development provision at master's level, but that measuring the impact of developing this skill in an individual cannot be accurately captured immediately post-graduation.

Keywords: *Postgraduate; professional development; employability; self-reflection; tailored.*

1. Introduction

Graduate employment outcomes, captured in the Graduate Outcomes Survey (GOS) and other employability measures are of significance to the ‘triple helix’ of higher education institutions (HEIs), industry and government (Eztowitz, 2003). These outcomes have societal and economic impacts and are cited as one of the top reasons students chose to go to university by Universities UK (2022). Employment outcomes are used in the Financial Times business school rankings as a measure of return on investment. Such crude calculations overlook additional gains for individuals, some of which may not be recognised until later in their working lives. Capturing postgraduate outcomes in this way is less common.

‘Employability’ on the part of the individual depends on the knowledge, skills and attitudes and the way those assets are used and presented to employers (Hillage & Pollard, 1998). McQuaid and Lindsay (2005, p. 205) argued such a “hollowed out” definition of employability focuses on the supply side only, ignoring labour market demand that enables those with the requisite competencies to become employed. Winterton and Turner (2019, p. 538) show inconsistencies in the attributes employers claim to want from graduates. Notwithstanding these concerns, most HEIs develop employability practices that focus on enabling students to achieve GOS measures of ‘success’ by developing skills and work readiness techniques. Graduate skills and attitudes most desired by employers are prominent in HEI curricula, but overwhelmingly focused on undergraduate provision.

Graduates are not “oven ready chickens” perfectly prepared for the graduate jobs market (Atkins, 1999) and two graduates from the same programme do not necessarily have the same professional aspirations. Rather than seeking to deliver the chicken, HEIs might better focus attention on the egg: the egg as the individual; the nucleus, with all the potential to develop into a functional individual who can contribute to, and gain satisfaction from, the world of work. The outcomes for the egg are in many ways yet to be determined, depending on nurture, nourishment and support. A successful HEI employability offer should be centred on developing self-reflection and personal action and in turn, providing the egg with what is needed. This kind of employability input should start much sooner than a student’s arrival in a master’s programme, as early as primary education according to Kashefpakdel, Rehill & Hughes (2018). The role of HEIs is to enable students to identify and explore their professional development needs and provide a menu of opportunities to meet these.

Considering ‘sought after’ skills can be useful in framing professional development provision for post graduates. However, re-focusing such provision to a person-centred approach, with the student owning their professional development and tailoring their learning through effective self-reflection and action, offers a more flexible and aspirational approach to employability. In this way students can determine what ‘success’ means to them as individuals rather than trying to conform to a ‘one size fits all’ measure.

2. Professional development provision

For the postgraduate taught programme in human resource management at a Russell Group business school with a large and international student cohort, the professional development provision evolved over a decade into an offer tailored to individual needs. The provision is embedded and recognised as a key component of the programme and while not credit bearing in itself, it is part of the formal timetable and is assessed through the core HRM academic module of the programme. Professional development provision runs parallel to the core module, providing professional development opportunities and experiences in the context of the academic programme as part of co-curricular activities. Students attend professional skill workshops where they are introduced to a development area and provided with context (made aware of why each is being included in their learning offer). The workshops are often active learning experiences in themselves (team challenges, Lego activities, business simulation, action maze, group discussions, for example). They attempt to develop personal and professional skills in the student such as teamworking, presentation, cross cultural communication, commercial awareness, resilience and reflection, alongside digital and technical skills such as video presentation, project management and performance management. Collectively, these workshops provide a buffet of opportunity for students to experience and practise each skill.

Simultaneously, students are part of ‘activity teams’ that provide vehicles for self-directed experiential learning in team working and collaboration, cross cultural awareness, communication and presentation skills, all set in a framework of self-reflection. Students are ultimately assessed in the core academic modules through team presentations on an academic issue, an individual video presentation and, most significantly, through an individual reflective essay. In this way students experience ‘authentic assessment’ (Gulikers, Bastiaens & Kirschner, 2004, Pg. 69) that is meaningful and contextualised. Motivation for this approach is captured well by Fonteijn and Decker (2021, para. 6): “this is all necessary because we don’t want our students to feel that their education is separate from their personal growth and that they are merely jumping through academic hoops until graduation, when their lives start.”

The provision also involves a range of optional peripheral opportunities (also contained within the programme rather than centrally positioned) such as e-mentoring, industry projects, networking/alumni events and professional accreditation by MOS (Microsoft Office Specialist) the CIPD (Chartered Institute of Personnel & Development). The central university careers service and the HRM programme intersect to bring value in terms of supporting students with the techniques and etiquettes necessary to enter the graduate labour market, such as job searches, application tuition and mock interviews. The focus here is on the process of gaining entry to the graduate labour market, while the content for the applications and interviews is primarily gained in the above provision.

3. Intentional design principles

The design of the postgraduate professional development deliberately involved the following principles:

- Experiential, active and uncomfortable
- Engagement, feedback and belonging
- Integrative learning and assessment

3.1. Experiential, active and uncomfortable

Kolb's learning theory (Kolb, 1984) informs the experiential and active approach that underpins the professional development provision in this instance. Experiential teaching and learning practices of this nature are encouraged by business school accrediting bodies like AACSB (LeClair, 2018), but come with warnings of 'explicit moral duty' on the part of the HEI to protect all stakeholders from what can create uncomfortable and new learning experiences (Lund Dean, Wright & Forray, 2020). However, in general terms, and depending on a student's preferred learning style, being challenged to learn in an uncomfortable space has the potential to create excellent learning outcomes.

This approach also requires effort and a potentially a different skill set on the part of the teaching team too, in order to effectively scaffold and protect students as they learn in this experiential way as part of their activity teams. Here the personal tutor as activity team mentor shows their value. The cautions are worth adhering and mitigating where possible as the potential gains to the student are significant. Activity teams promote 'real play, not role play' (Forster & Robson, 2019, Pg. 358) as students explore their team working and collaboration abilities; taking ownership of their learning. Significantly, active learning is noted as one of the 'Top 15 skills for 2025' by the World Economic Forum (Future of Jobs Report, 2020, Pg. 36.).

3.2. Engagement, feedback and belonging

The reflective essay as an assessment, guarantees an element of student engagement with this format, but the potential value is much greater than this one grade on a student's transcript. The process of understanding and practicing in small episodes (through the workshops) then experiencing 'for real' in activity teams when preparing team presentations, informs the reflective essay that follows, where reflections and future actions are captured by the student.

Students are encouraged to seek feedback from their peers to inform these reflections, allowing reflection in action and on action (Schon, 1983). Formative feedback is also gained from the professional skills workshops, personal tutors who mentor the activity teams, 1:1 meetings with the professional skills tutor and peers on the programme, allowing students to explore different team roles/contributions and build resilience and empathy in their

understanding of team contributions and effective team working. Here students are co-creators of their own learning.

There are also gains in terms of 'belonging'; both from a sense on the part of the student in the team and on the programme, but also 'belonging' in terms of the programme's ownership of the teaching and learning process.

3.3. Integrative learning and assessment

Importantly, our model seeks to comfort criticisms from traditional educationalists that competence-based approaches to education are crowding out knowledge in the curriculum and that the true purpose of HEIs is to develop a students' ability to critique rather than simply serve the employers' agenda (Young, 2007). Our model for professional development allows both agendas to co-exist and not one at the expense of the other. Research-led academic content remains untouched, but the compulsory co-curricular tailored offer that runs parallel, develops the student's professional skills and both intersect to provide experiences and opportunities for students to develop. There are signposts, links and references to the academic content in the professional skills offer, encouraging students to think, learn and reflect on the whole programme, including the experiences of critically engaging with the academic content of the core programme. This integrative learning approach is assessed by the reflective essay that requires students to synthesise and make connections in their experiences, knowledge and skill development across the entire programme through articulation of personal critical reflective comment. This may also be an example of 'synoptic assessment' more commonly adopted in 16-18 year educational programme design but may feature more in HEI educational design going forward if student learning is indeed enhanced by this approach. (Constantinou, 2020).

4. Challenges

The international make-up of the HRM master's programme student cohort is similar to many postgraduate business school cohorts across the UK. This presents additional gains, but also different challenges and some questions yet to be answered. Working collaboratively in cross-cultural teams and the wider programme cohort, presents the opportunity for students develop a 'global mindset' (part of most leading business school education strategies), through exposure to other students from different nationalities, cultural backgrounds and other diversifying factors. However, these gains are limited by a student's language ability, pre-conceived ideas of how to learn in an educational environment and a range of (conscious or unconscious) bias. Perceptions (cultural or otherwise) of the value of co-curricular workshops and activities can also impact on attendance. Arguably, these factors are also areas of our responsibility to include and address in programme as part of the student's development. Further, the skills we look to develop in the postgraduate professional

development provision – to question, to be curious, to work effectively as part of a team, scaffolded by self-reflection – neglects the geography of where students will ultimately be seeking employment. Country context matters here in terms of economic, political and cultural influences and expectations. Are the skills we look to evoke desirable for graduates in all country labour markets?

Evaluating the success of this professional development approach is hampered by the same challenges referred to in the opening paragraph of the paper; the desired outcome is to develop the student into a self-aware, reflective and lifelong learner and this is not easily captured or measured at the immediate end point of graduation. However, to inform our way forward, baseline data of student's perceptions of their professional skills have been collected at the entry point to the programme and future work will capture perceptions upon completion of the programme, allowing initial evaluation.

5. Conclusions

There is a strong case for an element, or elements, of self-reflection to feature in all HEI post graduate professional development provision, whether or not it is assessed, to ensure students authentically recognise the value of their experiences and take away genuine learning that can influence their future actions. Without this, students risk becoming robots, chasing only graded activity as a homogeneous mass. Indeed, if every graduate emerged with the same repertoire of employability skills any market advantage would disappear (Akins, 1999, p. 272). Self-reflection and trained articulation will allow them to stand out as unique and demonstrate their potential to employers.

However, the success of the professional development offer discussed above (the value to the individual), is only recognised if the skills of reflection are sufficiently developed, and this may be an area for further consideration. Here, the narrative needs particular attention because students need to understand the pedagogical approach sufficiently to appreciate why and how we are meeting their professional development needs in the programme. The aim is for them to understand the value of the professional skill workshops, the activity teams, the assessments and their intended outcomes. Being more explicit in this respect is intended to surface skill requirements allowing students more effectively to recognise and to articulate the skills/assets they have gained and their transferable nature (Daubney, 2021). Moreover, the contribution of a HEI to a postgraduate's professional development officially lasts 12 months but should continue to deliver beyond this to develop students' self-reflective abilities and effectively enthuse them to become reflective practitioners (Schon, 1983). That aspiration is clear, but the challenge is in capturing and measuring this as an output.

Given the pace of change apparent in the current labour market, the skills, competencies and knowledge required of our postgraduates will continue to change. Employability is “a

continually re-constructed concept” (Williams, et al., 2019), and perhaps the only constant is the need for our postgraduates to be self-aware and reflective, in order to move ahead with purpose and advantage. Professional development is a continuous process, potentially without end. Being reflective and acting continuously to develop professionally, coupled with the ability to articulate how experiences have prompted actions to overcome gaps and the subsequent strengths now beheld, will make the graduate unique and when the time is right for them, ready to hatch. As a lifelong reflective practitioner, they will however, need continuously to “self-baste” (Atkins, 1999).

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Academic dishonesty, essay mills, and Artificial Intelligence: rethinking assessment strategies

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Abstract

This paper considers how universities should respond to the threat from academic dishonesty, including essay mills, and Artificial Intelligence undermining assessment processes, and institutional credibility. The article describes steps taken to combat the use of essay mills, but also tools like ChatGPT, apparently able to generate essays that appear credible, and sufficient to offer a solution to an imminent deadline. The paper argues for reconsideration of the traditional essay, which may already be of questionable value. We should look to alternatives. The paper discusses whether universities should ban ChatGPT and similar tools, or accept them and design assessment processes that are more difficult to fake. The paper proposes a modified version of the essay, namely a reflective report, and explains why this is a more creative and idiosyncratic approach, better suited to today's learners, and better aligned with employers' expectations regarding employability and the skills graduates need.

Keywords: *Academic dishonesty; essay mills; artificial intelligence (AI); assessment; reflective statement, employability.*

1. Introduction

This paper is based on experience of teaching a postgraduate module, International Political Economy and Business (IPEB), a long-established, popular, and successful module within a suite of international business (IB)-related degree programmes. It has relied on a 2,500-word essay as its standard form of assessment. Results used to be consistently excellent but growth in cohort size, following expansion of the university's postgraduate intake, coincided with higher failure rates and some evidence of increasing academic dishonesty (AD) among successive cohorts.

Academic dishonesty (AD) is a 'deceitful or unfair act intended to produce a more desirable outcome on an exam, paper, homework assignment, or other assessment of learning' (Miller, et al., 2017:121). AD takes many forms, but in recent months alarm has focused on the threat from Artificial Intelligence (AI) and the risk that students would resort to chatbots to help with essay writing (Moser, et al., 2022, Sparrow, 2022). This paper discusses different forms of AD and measures to reduce its incidence. AI is a new challenge and has prompted a change in the assessment – perhaps not before time given the limitations of the standard essay as a form of assessment, and its questionable contribution to graduate employability.

The paper is intended as a contribution to a live debate in higher education (HE), one of vital importance given the challenge that AD and now AI presents to the integrity of universities' assessment strategies and awards standards.

2. Essay mills and how to reduce their use

The problem of essay mills was first raised in our School in 2016 by student representatives in a postgraduate staff-student liaison committee meeting. The reps told us that use of essay mills was a growing problem, especially among students whose first language was not English. My university, like many others, offers master's courses overwhelmingly comprised of high fee paying international students, some with rather poor English language competence.

It is not only overseas students who resort to buying essays online, an apparently more 'secure' form of cheating than old-fashioned plagiarism via copy and paste. The latter will usually be caught by plagiarism detection software like Turnitin, but a one-off essay commissioned from an essay mill is harder to spot (Ross, 2021).

Our response to the essay mill threat was first to take down the posters in the students' first language that were on Department notice boards advertising 'help with your essays' and 'academic tutoring services'. We also stepped up publicity regarding in-house study skills and writing support, and ensured the university provided more resources. In addition, we worked harder to alert students to the risks from essay milling, which at the very least could

mean failing a course, but also students being blackmailed to re-use a service they had fallen prey to (Draper, et al., 2021; Yorke, et al., 2022). In the most unscrupulous cases, once a student provides their contact details, they are exposed to threats, and extortion.

Local providers targeting our students were evident, but essay mill services are widely advertised online, even alongside universities' official promotion of their courses. Essay mills are beyond national jurisdiction, so even where they are banned by law, this has no effect (HM Government, 2021).

My unsophisticated detection system for spotting milled essays relies on judgement and experience, but this is not foolproof. Nevertheless one strategy did reduce the incidence of milling. The assignment brief was amended to say that all references cited must be to authors on the module reading list or in the course book, an edited collection written by various experts (Baylis, et al., 2020). International organisations (UN, IMF, WTO, WHO, EU, etc) are also legitimate sources. This proved an effective deterrent. It is presumably harder for essay mill writers to use the named sources, and if they tried, clear anomalies were easily identified, such as random placement of references with no relation to what the original author actually wrote. We also reinforced the formative assessment process, emphasizing the need to focus on presenting argument supported by sources from module readings.

With large cohorts, and to be frank, too many students with poor English and a basic lack of competence, many students are tempted to engage in AD. The closed reading list reduced the incidence of essay milling, saving students money, but the weakest students still failed to write a passable essay. Some would engage in the random referencing trick, which is especially unwise when the marking team knows the reading list well.

So, the essay mill may be the cheating instrument of choice after copy and paste, but it has limitations, and carries severe risk. Our task is to become more adept at identifying AD, and appropriate action is needed to protect the assessment process and the integrity of awards.

3. Assessment – rethinking what we ask students to do

There are many ways to assess students' learning, from the traditional combination of closed examination and essays, to group work, literature review, project report, multiple choice questions, long answers, short answers, open questions, twenty-four hour open book examination, presentation, videos and podcasts, group work, role-playing, reflective statements, and more besides (Pugh, et al., n.d.). Viva voce is a long-established form of assessment and standard for doctoral candidates. If conducted properly, it can be very effective but it is quite unsuited to large cohorts, and out of favour where students operate in an increasingly litigious and customer-focused marketized system, such as now applies in the United Kingdom (Nixon, et al., 2016; Molesworth, et al., 2009).

Examinations and essays are still the commonest forms of assessment in many institutions. In Britain, reliance on examinations and essays stems from the grammar and private school educational models of the 1950s and 1960s, consolidated at the university level, especially in arts, humanities, and social science disciplines. Assumptions regarding formal academic writing became established in elite institutions, Oxford, Cambridge, the Ivy League in the United States, Les Grandes Écoles in France, and the crème de la crème elsewhere.

We should escape from formulaic essays shaped by a formative assessment based on ‘an essay outline’. This consists of planning an essay structure and adding some indicative references. But students are often not very good at this, so we end up doing it for them. The submissions that follow are often underwhelming, although some are excellent. The weakest suggest that today’s students are not ideally equipped to write traditional academic essays, especially overseas postgraduates adjusting to very different expectations from their experience at home, both in school and university. Writing in a foreign language compounds the challenge.

The traditional essay may suit training for future academics, and perhaps journalists, but it far less helpful for careers in business, or in specific sectors such as games development, an actuary office in an insurance company, banking, or research in a pharmaceutical company. Essays are not much use in sport, food production and processing, nor in tourism and hospitality. We should find better ways to demonstrate employability, namely the skills that employers say graduates need (Swain, 2022; NACE, 2023).

Employers look for graduates with core competences around communication, various software, IT, and data handling, and teamworking, even project management. They also want evidence of creativity, and critical and analytical thinking.

Instead of the formal academic essay, students need something more open-ended and better attuned to individual idiosyncrasy. Assessment should provide more scope for analysis and critical thinking than essays typically reveal. Moreover, assessment needs to accommodate changing learning styles shaped by technological innovation and social media.

A student, perhaps stressed and tired after working shifts in a part-time job to support their studies, and approaching a submission deadline, might try to complete an assignment dishonestly, perhaps through traditional plagiarism via copy and paste, or submitting an entire essay found on the Internet with a changed title and some course sources added as references. Or they might contact an essay mill offering ‘help with your assignment’, masquerading as honest tutoring (Stokel-Walker, 2022). Or, they might seek help from AI, the latest threat to academic integrity.

4. Artificial Intelligence tools

The supposed threat to HE from AI has been headline news in recent months. According to some, chatbots like ChatGPT or GPT-3 can answer a wide range of challenges that risk undermining much of the teaching and learning process (Sparrow, 2022). ChatGPT, or its Google rival Bard, can provide seemingly plausible answers to almost any problem (Kleinman, 2023). But they turn up misinformation, and invent quotes from sources, adding apparent veracity (Delouya, 2022). So while chatbots utilize algorithms that synthesise data from a huge number of sources to produce answers to problems, they are unable to distinguish truth from fiction. They are not concerned with truth. Chatbots may generate grammatically well-formed answers to questions, which with the addition of a few plausible-looking references may be enough to avoid detection even by an experienced marking team.

A student website reports that ChatGPT cannot yet deliver an entire essay of 2,000 words, but it can provide answers to targeted questions, text that can be assembled into a reasonable looking essay once intext references are added, so might get a pass (Snepvangers, 2023). Alarmingly, the article constitutes advice on how to use ChatGPT to gain a modest pass.

AI is developing and is likely to get better at solving complex problems, and it is already an integral part of the graduate workplace (Tomlinson, 2022). AI is used in finance, banking and insurance, leisure and tourism, retail, and research and development of new products and services, including in manufacturing and in the IT sector. It has been used to influence political campaigns and to predict the future. It is therefore unlikely, and unrealistic, that universities should ban its use. We cannot bar students from using the Internet, and equally we cannot prevent them using AI. Australian universities have led the way in warning students about using AI-generated text, and have opted for a return to examinations and pen and paper (Cassidy, 2023). But another strategy is to accept AI as something we have to live with. This has important implications for assessment.

Of course, we use a range of assessments in a degree programme. Some modules are better suited to assessment by essay than others. But I have progressively lost confidence in the formal essay, and am adapting it to focus on the learning process, and on ways of thinking. Perhaps this will help combat the essay mill and chatbots too, by encouraging freedom of expression in assessment. If we step away from demanding conformity to imposed frameworks this may reduce anxiety and lessen the temptation to engage in AD.

AI instruments are readily accessible. They may become as integral to the student experience as any favoured search engine. Universities cannot shut out something already present and available. They will have to accommodate this reality, this rapidly developing and adaptable technology (Gold Penguin, 2023).

5. The reflective report – a variation on the traditional essay

My proposal is to retain the module focus on key readings that assist understanding of current challenges around international relations, climate change, finding a balance between economic imperatives and environmental sustainability, and discussing alternative forms of governance. This reflects the importance of geopolitics as a focal area for management and business studies education (Mollan and Sweeney, 2022). But assessment must take account of how students study, different learning styles and previous educational experience, the multiplicity of sources they may use, and the limitless nature of the internet including Artificial Intelligence. So the assessment will become a reflective essay, as follows:

Assignment: International political economy and business: a reflection on what I have learned from the module (2,000 words).

Consider what you have learned from the module. Identify ideas that have changed your thinking, or provided new insights about the international political economy and business.

Refer to *at least five key readings*, explaining how they have shaped your learning.

Provide a critical and reflective assessment of your learning. What has been the most rewarding aspect of the module? What has changed or reinforced your thinking? Is there anything you will think about more deeply, and for more time, in the future?

Use Harvard referencing for all sources mentioned in your report.

You must demonstrate learning from the module, and from module sources, including the course book.

You may write in an informal style, using first person pronouns (I/we).

You may use Internet sources but *you must reference these, and provide a critical commentary* on any material you use.

While reflective essays have become a fairly commonplace form of assessment in recent years, the origins of the approach are centuries old and credited to the French thinker Michel de Montaigne (1533-92) (Halpin, 2014). We anticipate that reflection along the lines suggested above will give students an open opportunity to draw on any aspect of the module, to demonstrate learning, and importantly, to give personal responses to the module and issues raised. This allows for creative and thoughtful reflection, and will ensure individual, unimitable, idiosyncratic responses. The reflective statement recasts the essay by focusing on process, how insight is gained, and how thinking develops (Tomlinson, 2022).

We also anticipate less or even no recourse to essay mills. The assignment brief is designed to make the assessment almost unrealizable though recourse to AI. But if students do use

internet-enabled assistance, the assignment brief indicates that this must be referenced, commented upon and critically appraised.

While the assignment insists on evidence of engagement with module reading, it does not preclude Internet searches. Students are instructed to comment critically on what they find.

6. Conclusion

This paper has described a response to the threat from essay mills and other forms of academic dishonesty (AD). The article recognizes the risk that students may resort to artificial intelligence (AI) to compose essays and other written submissions. The paper recognizes that most universities use a wide range of assessment methods, but examination and formal essays are still favoured methods of assessment in many institutions especially in humanities and social science disciplines.

Weaknesses in the traditional essay approach are highlighted, including the view that essays are not the best way to develop the skills and competences identified as contributing to graduate employability. A different kind of written assignment, involving personal response to module content and reflection on the learning process can allow a more creative, idiosyncratic and relevant task, better matched to contemporary learning styles and new technologies. A reflective statement can better identify core take-aways from a module. It constitutes an easier, more relevant and more creative form of assessment.

Finally the paper maintains that it is more fruitful and realistic for universities to embrace emergent technologies such as AI, rather than prohibit their use. The essence is to ensure students' critical engagement with material encountered during their studies, and making this central to the assessment process. This will better prepare graduates for entry into fulltime employment.

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Thinking outside the box – virtual labs in engineering education

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Abstract

An important part of engineering education is training in laboratories. If done correctly, such a hands-on approach is much more effective than pure lectures, where knowledge is only passively absorbed. The traditional lab is usually on-site, requires students to be on campus, and learning content is limited to the particular focus of that institution. For this reason, five European universities have formed a partnership and developed a joint platform that offers experiments that can be experienced in virtual labs and accessed repeatedly. This way students profit from the expertise of different institutions, while gaining intercultural work experience. Additionally, virtual labs reduce the immense expense of student mobility, are more inclusive towards minority groups and lower costs for universities in the long term.

Keywords: *virtual labs; engineering education; structural engineering, virtual access to experiments.*

1. Introduction

The COVID-19 pandemic had a huge impact on teaching and teaching methods: from one day to the next physical attendance on campus and in the classroom was no longer an option. This posed various challenges to the different disciplines as new, digital teaching formats had to be created in a rather short amount of time. While the humanities and social sciences were able to hold synchronous classes online relatively easily via conference tools, or convert teaching materials into asynchronous e-learning modules, the engineering disciplines were faced with the challenge that a vital part of their curricula consists of laboratory experiments. These are often devised for a better understanding of theoretical knowledge taught in lectures and vital in the education of future engineers. Laboratories can lead to a substantial learning success among students that is difficult to achieve in other traditional learning environments or didactic situations. Therefore, implementation of digital learning is only successful if laboratory experiments are included in digitalization efforts.

Another setback for a comprehensive education was that suddenly exchange programs could no longer take place. Giving students the chance to extend their education to fields not offered at their home university has been part of the teaching program of several European universities. This led to a partnership with a strong exchange between participating departments. Such partnerships among European universities had always required students to travel to different locations to have the chance to participate in experiments offered by different universities. However, the overall expense of student mobility is immense (Johri & Jesiek, 2014) and may exclude students from lower income backgrounds (Ackers, 2010; Rodríguez et al., 2011) or countries with with a lower income level (e.g. eastern European countries) unless fully sponsored. Students with a disability are also at a disadvantage.

The pandemic offered the chance to rethink teaching options and make excellent education more easily available to all students. The PARFORCE project has executed this by bundling the expertise of different partners across Europe and providing students with access to different facilities from their home computers or by using facilities at the university in their home country. Creating virtual labs made it possible for students to expand their knowledge beyond the area of expertise of their home university and beyond individual personal restrictions.

2. Project PARFORCE

2.1. Strategy and objectives

Five European universities across different countries have formed a strategic partnership within the framework of Erasmus+. Two universities are situated in Germany (Bauhaus-Universität Weimar and Ruhr-Universität Bochum), one in Croatia (University of Osijek),

one in North Macedonia (Institute of Earthquake Engineering and Seismology at the Ss. Cyril and Methodius University in Skopje), and one in Portugal (Universidade de Aveiro). Each partner university has a different focus. This is often based on their respective geographic situation or the different demands that are placed on local structures (e.g., earthquake-prone, growing, i.e. climate-related exposure to fire effects, wind as an impact and as a resource). Together, they developed a common platform for digital/virtual laboratory experiments to support higher education in European civil engineering and contribute to the students' understanding of course content.

The availability of various laboratory experiments that are not part of the standard education at each university is the main objective of the project. The experiments planned in this project are: boundary layer wind tunnel experiments, non-destructive and destructive experiments on a shaking table, and fire resistancy tests. The project applies the concept of immersive 3D representations for detailed and realistic visualization in virtual reality to the performance of laboratory experiments in the context of higher education in civil engineering.

2.2. Local labs vs. Virtual labs

A laboratory is understood as a scientific or technological environment in which scientific or technological research, development experiments, tests or analyses are conducted (Terkowsky et al., 2020). Technical laboratories are used to build, develop, and test technical solutions, processes, and products. Laboratories in engineering education can be used for empirical research to observe, measure, test, analyze, and especially to develop understanding. Unfortunately, the use of local labs in engineering education is limited due to severe time constraints and their highly specialized nature. In addition, these laboratories require students to be physically present on site. Zutin et al. (2010) point out that the inefficient use of expensive and highly sophisticated and specialized equipment that is common in traditional laboratories can be overcome by providing online labs to learners as technology-enhanced learning environments. Virtual labs offer several advantages over traditional labs, including almost unlimited time availability, interoperability, reusability, and location-independent access. Online labs do not require the learner to be present on site, but can provide an experimental experience that is accessible from the learner's location, regardless of the distance to the institution.

2.3. Shortcomings of labs

Laboratories can offer educators the opportunity to provide students with a learning environment where they can creatively solve engineering challenges designed to facilitate competencies required of engineers in the digital age. Degree programs as mechanical engineering aim to prepare students for the highly practical nature of their future careers, in addition to providing them with a scientific background.

Planning and conducting experiments in the laboratory are among the typical tasks of graduates. For this reason, it is important for them to gain experience working with full-scale equipment while still studying. This includes e.g. printers for additive manufacturing, prefabrication lines, or equipment used for long-term testing, such as a wind turbine with a Structural Health Monitoring system installed.

Engineering laboratories have great potential to activate and develop competencies that go beyond the conventional knowledge and skills that can be acquired in traditional classroom settings. However, they often fail to provide additional learning objectives (Terkowsky et al., 2020). Many laboratories present students with tasks and topic descriptions that clearly describe of a problem and a well-defined solution strategy. Of course, this is in stark contrast to many challenges in an engineer's professional life, where neither the problem nor the solution is explicitly known in advance. Thus, this approach of strongly guiding students contrasts with the aim to produce competent, self-organized and self-controlled engineers.

3. Virtual labs

Appropriate learning objectives are the starting point when planning an engineering education environment. Providing engineering labs requires appropriate facilities, equipment, and staff. As a result, they are often more costly than traditional classroom environments. Making such labs available as virtual labs involves monetary costs for technical equipment and infrastructure. In addition, time is required for didactic planning. However, these costs are quickly offset by the virtual lab's unlimited scalability and permanent availability.

The use of physical and virtual laboratories in engineering education curricula requires a rationale for how student work in laboratories and how this can complement the learning objectives of traditional classroom settings. Therefore, the formulation of learning objectives should emphasize the importance and potential of laboratories for engineering education.

Virtual labs, such as a virtual wind tunnel or chemistry labs developed at the Ruhr-University Bochum, are a better choice than local labs. These are web-based applications that simulate real engineering test facilities in civil, environmental, and process engineering. Essential parameters such as wind speeds, wind directions or turbulence intensities can be varied in a boundary layer wind tunnel experiment according to realistic configurations or processes. Therefore, the test results, such as the modeled structural response etc., can be experienced virtually (see fig. 1) with the same result as in an on-site lab. The students perform experiments independently from their home PC and evaluate them according to scientific methods and requirements.



Figure 1. 3D virtual representation of the Boundary Layer Wind Tunnel at the Ruhr-Universität Bochum - remote access points are marked "i" and show explanations about steering and sensing of experiments as well as videos of specific experiments; experimental parameters can be varied within a certain range, corresponding data from previous experimental campaigns can be downloaded for further processing.

The idea of the virtual labs was motivated by the fact that specialized laboratories are highly valued by teachers and students. Students in particular appreciate that these labs offer an intensive learning experience. Virtual labs can thus be understood as a complement to specialized laboratories with virtual, but realistic experiments in order to make the students' learning experiences more comprehensive.

Students are expected to plan and conduct experiments on their own. This usually includes planning the measurement series: e.g. preliminary considerations as to which gas flows and which liquid flows need to be measured in order to fulfill the task of the specialized laboratory. After the experiments, the students apply the knowledge gained in lectures. By studying the experimental script to evaluate the measurement results, they formulate statements about the quality of the results. This is necessary because measurement errors and fluctuations can also be incorporated into the model response monitoring within a virtual experiment in order to reproduce the system realistically. Teachers can tailor the application to students' prior knowledge.

Using a provided script, students prepare to conduct the experiment in the virtual test facility, developing the ability to plan a systematic experiment independently. The experiments are designed so that exploratory learning can be used to observe the phenomena described in the experimental script, such as the systematic variation of the main operating parameters of the experimental plant (pressure, temperature, mass flows, etc.). Students should be able to identify measurement errors and outliers and correct them by adjusting the accuracy and reliability or taking additional measurements to increase the statistical stability of the results, if necessary. While the students prepare independently without teacher supervision, the process of the virtual experiment and the evaluation of the results must be supervised by competent teachers.

Following scientific procedures, appropriate documentation and presentation of both the experimental procedure and the results are presented by the students in a report, e.g. in the form of a protocol, possibly with an oral presentation.

The learning objectives are to prepare, plan, execute and evaluate experiments independently, and assess the results in a knowledge-based manner. Exploratory learning enables students to subjectively discover new aspects. At the same time, they become familiar with scientific working processes and acquire sustainable knowledge and skills that go beyond technical and methodological knowledge – above all, independence in decision-making. This enables them to apply what they have learned to new situations and scenarios. These skills are necessary to be able to solve problems in a competent and systematic way later in their careers, and are far more valuable than inert knowledge passively acquired in lectures.

3.1. Virtual labs and virtual exchange

Virtual labs can be made available to students across different countries and expand the scope of learning by involving institutions with different expertise. Besides the greater advantage in knowledge, two other aspects stand out: on the one hand, more students can gain intercultural experience and on the other hand, more equal opportunities are created, especially for students who are often excluded from physical exchanges due to the aforementioned reasons.

When the labs and the assignments are set up so that students from different countries work together in a study group, they learn to interact and collaborate with people from different backgrounds. This is a valuable experience given the increasing importance of international collaborations today. Different perspectives and new insights can be shared through established interaction. In addition, an intercultural learning environment can help those learners who are not from the majority group (Gay, 2018) and may otherwise be excluded.

4. Conclusion

Integrating virtual labs into engineering education has several advantages, if done right. Students can access virtual labs from home; they do not need to be on campus or even in a particular country. As such, virtual labs are much more inclusive, allowing everyone to participate regardless of disability, social background, or the need to work in order to support themselves financially.

In terms of the skills that graduates should have, it has been shown that the learning outcome is much higher when engineering students have the opportunity to test and apply the knowledge they have acquired in lectures in a laboratory; especially in a lab that focuses on a hands-on approach. Availability, didactic variability and cost efficiency are best when the

lab is virtual. Exploratory learning can have a better impact on the comprehension of learning material. This will lead to more independent, self-directed and self-organized future engineers who have more than just passive, scientific knowledge. Students learn the process of researching and applying their skills to real-world tasks. It promotes the ability to identify problems and generate ideas, enabling the learner to understand what needs to be done to find solutions.

A third advantage of virtual labs is their intercultural nature: not only do they offer students the opportunity to acquire knowledge not taught at their home university, but they also give students the chance to gain experience working with people from different cultural and linguistic backgrounds. They learn to overcome and appreciate culturally determined differences in approaching tasks and finding solutions.

Thus, it can be said that including virtual labs has brought significant benefits and lasting improvements to engineering education, broadening the the expertise taught and providing a lower threshold for participation.

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Students experience of blended teaching formats in pre-calculus courses

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Abstract

This work aims to investigate the difference (if any) between two blended teaching formats in a pre-calculus course for undergraduate engineering students. In 2022 students could choose among two settings for the preparatory course: a face-to-face and an online blended format, both based on a Pre-Calculus MOOC. At the very end of the course, we collected data from a survey to which 129 students answered. The analysis of the responses shows that the main differences between face-to-face and online blended formats concern intrinsic characteristics of the two settings. On the other hand, the data show that an accurate planning of the online format allows students' engagement even more than in face-to-face blended setting. Moreover, the findings shed a light on the potentiality of online learning in making the transition from high school to university smoother.

Keywords: *Innovative teaching; MOOC; STEM; preparatory course; transition; mathematics.*

1. Introduction

One of the main obstacles for students enrolled in first year STEM programs is the Calculus course. Different researchers in Mathematics Education (Tall, 2004) suggest that the main difficulties are created by a different approach to mathematics with respect to the one seen in high school, since there is a shift of the focus from procedural aspects to conceptual understanding (Clark and Lovric, 2008). Moreover, learning resources are perceived in a different way (Kock, Brunetto & Pepin, 2019) and students are supposed to study and work with more independence with respect to high school. In order to smoothen the transition between secondary and tertiary education, universities usually offer preparatory courses to first-year students. As Gamer and Gamer (2001) pointed out, student-directed learning promotes conceptual learning more effectively if compared to teacher-directed approaches. One possibility to encourage student directed learning is given by blended learning formats. In this context, Massive Open Online Course (MOOC) is a significant resource that can be exploited in a blended course: students have to watch videos making sense of their content without the teachers' guidance; they have the possibility to self-evaluate themselves with exercises and to resort online forums and other sources clarifying their doubts. All this engages students in different mathematical activities that generate a personal production of meanings and mathematical knowledge.

Blended learning formats recently became even more preminent and relevant, since universities are trying to adapt to the “new normal” after the COVID-19 pandemic forced them to do remote teaching (Bakker *et al.*, 2021). It is well documented that emergency remote teaching and online learning are quite different (Hodges *et al.*, 2020), but the exceptional situation of 2020 created room for new teaching experimentations with online learning, since both students and teachers gained familiarity with new technological tools as services for web conferences (as Zoom, Webex, Microsoft Teams), software for sharing boards and contents (as Jamboard, padlet, Google Drive) and so on.

In this work we want to investigate how students experience online and face-to-face teaching in terms of quality and usefulness. We will focus on a pre-calculus preparatory course, delivered in 2022 for first year students at Politecnico di Milano, in which students were given the possibility to attend face-to-face (f2f) classes or online classes.

2. Methodology

The preparatory math course is delivered every year at the Politecnico di Milano before the beginning of the first semester. Usually, the course is structured in two parts: a MOOC that students are invited to attend during the summer and eight classes delivered in the two weeks before the beginning of the academic year. The pre-calculus MOOC is delivered on the POK platform (www.pok.polimi.it), where students can watch videos about theory explanations

and resolutions of exercises, test their basic knowledge in mathematics through quizzes and interact with other students and tutors through a forum. The MOOC course is structured in six chapters: arithmetic, algebra, geometry, logics, functions, probability. The eight classes of four hours each, follow the syllabus of the MOOC course.

In the 2022-23 academic year the attendance part of the preparatory course was organized in two different formats, that we will call face-to-face (f2f) and online blended classroom. In the face-to-face format the eight classes were delivered in a traditional classroom setting, that is tutors and students met in a physical learning space. Each class started with a “warm-up” activity that was carried out in small groups, followed by the correction of the tasks and the discussion of other examples and exercises by the tutor. At the end of the class, a formative assessment test was left to students in order to solidify their knowledge and skills. In the online format there was not a physical room: the tutor and the students were interacting using an online platform (Webex). The online class started with asynchronous activities, in the sense that students were not connected live with the tutor. Students received instructions about which part of the pre-calculus MOOC had to be studied (videos and quizzes) and, afterwards, they were prompted to solve the task of the “warm-up” activity, posting the solutions and questions on the MOOC forum. Later, there was a synchronous part of the class, delivered through the online platform, in which the tutor discussed the solution of the warm-up activity, addressed the questions, and deepened the topic. At the end of this part students were given some time to answer the formative-assessment test (the same the face-to-face students were doing). We underline that the two formats are equivalent in the sense that they refer to the same topics and use the same educational resources, but they differ in terms of educational environment and timing. The MOOC was available for both groups, students received instructions by email when they enrolled to the preparatory course and they were reminded about all educational resources daily by verbal communication by the tutor.

The preparatory course, which was not mandatory, was attended by 380 students, on average. Among them, almost the 15% of students attended the online format, held by one single tutor, while the huge majority attended the f2f format held by 7 tutors in 7 physical classrooms. More precisely, two classes had about 20 students while the other 5 had about 60-70 students. At the end of the course, namely at the end of day 8, students were asked to respond to a satisfaction survey voluntarily. We collected 129 responses (about the 40% of the students who attended the last lesson). The survey is composed of 4 parts, we focus on the questions about the course, and open comments and suggestions. The former is formulated as three (0-2) likert-scale questions. Table 1 reports the 16 items (i1, i2, i3, ...) to which students answered using 0- “disagree”/“not at all”, 1- “agree”/“enough”, 2- “strongly agree”/“fully”. We classified the 16 items a-posteriori according to the two dimensions we wanted to investigate: D1) the quality of the course in terms of *tutor practice* (i12-i16), *topics* (i5), and students’ *interaction* with each other and with the tutor (i10, i11), and D2) the usefulness, in

terms of overcoming the transition issues, such as fostering conceptual-mathematics (i6-i9), prompt autonomy (i1-i4).

Table 1. List of the items divided into the dimensions under analysis.

Quality	Usefulness
i5 - During the classes we revised the most important topics we studied in high school.	i1 - Before the beginning of the refresher course I attended the pre-calculus MOOC.
i10 - During the classes, we worked on our own.	i2 - During the refresher course I attended the pre-calculus MOOC.
i11 - During the classes, we discussed and cooperated.	i3 - During the refresher course I was involved in the Discussion forum on the pre-calculus MOOC.
i12 - During the classes, the tutor fostered students' collaboration.	i4 - During the refresher course, I did the formative-assessment quiz.
i13 - During the classes, the tutor involved students.	i6 - During the classes, I found a new language to do mathematics.
i14 - During the classes, the tutor's explanations were clear.	i7 - During the classes, I found new mathematics topics.
i15 - During the classes, the tutor precisely answered our questions.	i8 - During the classes, we focused a lot on formulas and algorithms to solve exercises.
i16 - During the classes, the tutor positively influenced the independent study.	i9 - During the classes, we analyzed definitions, theorems, and general properties.

Source: by authors (2022).

In this work we aim at addressing the following research question: “How do students experience online and face-to-face teaching in terms of quality and usefulness?”. To that end, the students’ responses were analyzed both quantitatively and qualitatively. For each item, we resort to descriptive statistics (mean, standard deviation, and histograms) distinguishing between two groups of students, namely the f2f students’ responses (102) and online students’ responses (27). Moreover, we employ the one-way analysis of variance (ANOVA) to determine if data from the two groups have a common mean. We recall that the ANOVA helps determine if the mean of the two (or more) groups are all the same. The null hypothesis H_0 is that, for each item, the means are the same (Wu & Hamada, 2000). Once the test is performed, the H_0 is rejected if the returned p-value is less than a specific threshold (0.05 by default). Indeed, the p-value consists of the probability of making a mistake rejecting the H_0 . Finally, we analyzed the students’ comments looking for the indicators of quality and usefulness, to deepen our analysis and to better interpret the previous results. It is worth

noticing that among 127 students, only 90 provided a comment. More precisely, almost all the online students (23 out of 27) left a comment, whilst only 67 (out of 102) of the f2f students did.

3. Data analysis and discussion

In this section we report data analysis of the 16 items related to the quality and usefulness, enriched by some of the students' comments. Table 2 summarizes the results of the statistical analysis. We observe that there are only two questions (i2, i14) whose responses are statistically different (p-value < 0.05, marked with * in Table 2). Nevertheless, some questions (i5, i10, i11) have slightly different results with respect to the two groups (0.05 < p-value < 0.15, marked ** in Table 2).

Table 2. In this table for each question, we report the p-value obtained by the comparison between the two groups and the means (standard deviation) of the two groups.

<i>Usefulness</i>	i1	i2	i4	i6	i7	i8	i9	i10
p-value	0.48	0.00*	0.17	0.84	0.49	0.49	0.45	0.07**
mean (std) online	0.81 (0.87)	1.56 (0.64)	1.59 (0.50)	1.15 (0.60)	0.89 (0.70)	1.18 (0.55)	1.66 (0.55)	1.33 (0.48)
mean (std) f2f	0.94 (0.81)	0.67 (0.66)	1.73 (0.46)	1.12 (0.68)	0.99 (0.67)	1.10 (0.57)	1.57 (0.57)	1.12 (0.55)

<i>Quality</i>	i3	i5	i11	i12	i13	i14	i15	i16
p-value	0.54	0.15**	0.11**	0.49	0.22	0.01*	0.547	0.57
mean (std) online	0.63 (0.74)	1.56 (0.50)	1.81 (0.39)	1.74 (0.44)	1.78 (0.42)	1.56 (0.50)	1.78 (0.42)	1.56 (0.50)
mean (std) f2f	0.53 (0.71)	1.70 (0.46)	1.62 (0.58)	1.66 (0.53)	1.64 (0.52)	1.80 (0.42)	1.83 (0.40)	1.62 (0.56)

Source: by authors (2023).

We observe that the most relevant difference between online and f2f students concerns the use of online resources, i.e., the Pre-Calculus MOOC, during the two weeks of the preparatory course (see i2 in Table 2). More precisely, the percentage of f2f students who

declared not to use the MOOC is greater than four-times the percentage of online students; on the other hand, more than 60% of the online students declared to study the MOOC resources during the course (see Figure 1). We stress that such a difference depends on the structure of the online course, in which students were recalled to study the videos and to do activities on MOOC on a daily basis. It is important to underline that the MOOC was available to all the students and both formats were designed according to the MOOC structure. This allows us to claim that students resort to online resources only if they are directly instructed about it. Furthermore, a student of the online course commented: “*I really appreciated the forum. It really helped me to see different strategies to solve some of the exercises [warm-up tasks]*”. This is an indicator that the guided use of the online resources also allows students to exploit the potentiality of new tools, such as the forum.

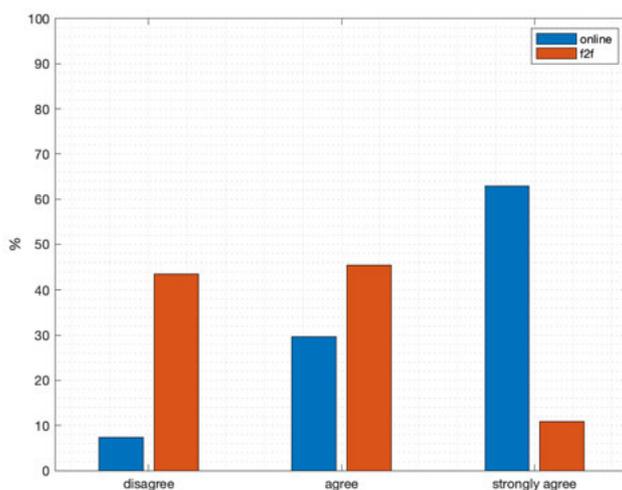


Figure 1. The percentage of answers to i2. Source: by authors (2023).

The item i10 regards the self-regulation of the students, namely if they perceived they worked on their own during the classes. The two groups are slightly different (1.33 for online and 1.12 for f2f) because online students reported more work on their own than f2f students. This could be explained by the fact that half of the online class was explicitly devoted to asynchronous and autonomous activities (such as the warm-up exercises). To that end, we report the following comment by an online student: “*[I appreciated] the possibility of managing on my own the study moments and reviewing the scheduled topics*”. The comment underlines two aspects: the autonomy dimension and the scheduled topics. The student was able to self-organize their study thanks to the shared planning of the classes. Therefore, we argue that the majority of first-year students may lack autonomy when they are not guided as they were used to in high school.

The item i14, whose answers are statistically different, concerns the clarity of tutor explanations. However, from an educational point of view the difference of the two means (1.57 for online and 1.80 for f2f) are not relevant, because the values are high. We infer that the different results depend more on the tutor-factor than on the format-factor. Indeed, looking at the f2f format, the 7 tutors were perceived (by students) positively in different ways, namely the means associated to each tutor ranges from 1.5 to 2. Moreover, students of both groups commented with positive feedback about tutors, for instance a f2f student reported “*I do appreciate the clarity of the tutor explanation*” and an online student wrote: “*the tutor is very competent, clear and precise*”.

We underline that i14 is one of the 5 questions related to the tutor's influence on the course, so that any possible differences between the two groups' answers may be affected by the tutor-factor. However, the means of those questions are not so different. In particular, we focus on i12 and i13 which aimed at investigating tutor's influence in fostering students' collaboration and involving them during classes, respectively. The means of the online classes (1.74 for i12 and 1.78 for i13) are slightly higher than the f2f classes (1.66 for i12 and 1.64 for i13). Despite the common idea that online classes are not a good setting for engaging students, this result shows that students may have an active role even in online classes. Another result that supports such a claim comes from the answers to item i11, in which students were asked if in classes they discussed and cooperated. The two groups' means are 1.81 (for online) and 1.62 (for f2f) with a slightly statistical difference (p -value=0.11). Moreover, the analysis of the students' comments shows that only one of the f2f students provided a comment about the students' collaboration: “*I liked to work with my course mates to solve the tasks*”, while online students gave more comments in such direction, for instance: “*I really appreciated the possibility of learning not only from the tutor but from my course mates' ideas and advices*” and “*I liked the continuous discussion and interaction among mates*”. Somehow, students felt they discussed and interacted more online than students did in the classroom.

4. Conclusion

The spreading of innovative learning and teaching experiences raises questions about their efficacy and impact with respect to “traditional” experiences. In this work, we do not dwell on the definitions of such terms, but we are interested in investigating how students perceive differences between two formats of the same course. To that end, we focus on a preparatory course for first-year students in a STEM program, addressing the following research question: how students perceive online and f2f teaching in terms of usefulness and quality. The usefulness and quality dimensions are meant in the frame of transition between high school and university mathematics.

Overall, the data analysis shows that no perceived differences were reported by the students for the two formats, which were perceived both as good courses. This was also supported by a final question in the survey: “do you recommend this course to future first-year students?”, to which none of the students answered “no”. Nevertheless, we underline that the few differences can be explained according to the unavoidable characteristics of the course, such as the tutors who taught the course, and the different instructions the students received. Concerning the latter aspect, we stress that students need to be guided step by step in the use of educational resources. Despite having the same topics and tasks of the f2f format, the online format was not just a migration to a remote teaching method, but it was carefully planned according to the potentiality and constraints of the online environment. In this way also online students were able to interact, discuss and cooperate gaining autonomy and being guided during the transition to higher education.

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Should we be afraid of open book exams? Our experience

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Abstract

This study reports our first experience introducing open-book exams in the Anatomy subject at a medical school. Students were authorized to bring study material to the exam and consult books, atlases and their own notes. Our objective was to check whether the test scores were significantly higher or lower compared to the rote tests taken before it. After statistical analysis, there are no differences in the mean, median, range, minimum score, or maximum score. These results are consistent with the consulted bibliography. We can conclude that there is no need to be afraid of implementing this type of exam in the future.

Keywords: *Open-book; exam; test; rote; memorization; grades.*

1. Introduction

At the beginning of this 2022-2023 academic year, a guideline was announced at our Cardinal Herrera University that many of us did not expect: the midterm continuous assessment exams could not be rote. This instruction did not affect final exams, but it did put professors in a position to replace the traditional midterm exams with other types of evaluable activities, or allow the midterm exam but with the presence of notes: what in the literature has come to be called open-book exams.

The controversy between open-book and rote exams is not new. The latest recommendations point to a mixed method of examination since each type of examination assesses different skill sets in students.(Johanns, Dinkens, and Moore 2017). Other authors recommend using it as a complement to closed-book questions and believe that the post-covid world could be a good time to rethink opening up to these possibilities.(Zagury-Orly and Durning 2020). The grades tend to be generally higher and prepare the student for a proactive knowledge of the exam content and the application of the subject to solve problems. (Dave et al. 2020). Some experiences in health students have shown how the use of tools, including Internet searches, are not very useful in questions about problem solving or those in which evidence has to be analyzed to issue a clinical attitude, so it is necessary that the student has studied the subject from memory (Mathieson, Sutthakorn, and Thomas 2020)

After reading some examples in the literature, in the Anatomy III and Anatomy IV subjects of the Medicine degree, we planned this course to carry out an open-book midterm exam and analyze the results to see if there were differences in results with respect to traditional exams. Therefore, we allowed students to do the midterm exam using the analog material they wanted: books, notes, notebooks, sheets, atlases, cards, etc. The only material we did not authorize was digital material that could be used to directly search the questions on the Internet. The exam proceeded normally. Finally, in the final exam in January 2023, the exam was performed from memory in the traditional style, without any materials, thus complying with the guidelines implemented this year.

2. Objectives

Our goal is to verify whether open-book testing has had an impact on student grades. Although general research wishes to find differences between groups (alternative hypothesis), in this specific case the good news would be that the implementation of open-book exams has not influenced student grades and, therefore, the implementation of these tests have not affected the performance of our students.

3. Material and methods

The first step is to carry out a search of the grades of the students in the subjects of Anatomy III and Anatomy IV that are taken by the Medicine students of the Cardenal Herrera CEU University in Alfara del Patriarca (Spain). Anatomy III is taught in the first semester (September to December, with an exam in January) and Anatomy IV in the second semester (February to May, with an exam in June). In each subject there is a midterm exam and a final exam that are evaluated on a total of 10 points, so that for each calendar year we will find four exams in total. An advantage of this research is that both subjects are taught by the same professor, which guarantees homogeneity in both teaching and evaluation. The exams were of the same style over the years: multiple choice questions without open questions, with incorrect answers subtracting a third of the correct ones, with 50 questions for the final exam and 40 for the partmidterm exams. These common characteristics made it very easy to compare the different exams since the methodology has remained constant. To avoid biases in our results, we eliminated the exams that due to the Covid-19 pandemic could not be done in the classroom and had to be done virtually or through proctoring. Therefore we discard the exams "Midterm Anatomy IV 2020 (which in fact was not held), Final Anatomy IV 2020, Midterm Anatomy III 2020, Final Anatomy III 2021 and Midterm Anatomy IV 2021". Beginning again with Final Anatomy IV 2021, exams were already carried out under normal conditions in the classroom and therefore the confounding factors disappear. We will use Student's t test to compare the means between both groups of exams to check if there have been differences between both groups.

4. Results

The main search results are shown in Table 1 from the most recent to the oldest. In it we find the parameters of the 17 exams, the second one being the exam of interest because it is the one that was carried out as an open-book. At first glance, it may be striking that there are small variations in the number of students who take the partial exam and the corresponding final exam. These variations can be explained for several reasons: students who follow the normal course but finally drop the subject for the extraordinary session in July, or because they enroll when the course is halfway through, or who do not take the partial exam for some justified reason, etc.

Regarding the average of the exam, it can be seen that it has been oscillating in values close to 6 and 7, with excellent years like 2018, and years with very low average grades like in 2022. If we compare the average of the same group of students who took the open-book exam (6.09) and later the final exam (5.84) we see a slight decrease, although not as pronounced as the one suffered by the Anatomy III 2021-22 group (which average dropped almost 2 points) or the group from Anatomy III 2019-20 (which lowered the average 0.64 points). It

is not possible to establish a clear trend as to whether the final exam has a better mean than the midterm, since we find different cases every year. Regarding the range, practically every year there have been students with grades of less than 1 and brilliant students with a 10 or almost a 10. In the open-book exam there are no differences in this regard

Table 1. Measures of central tendency that describe the different exams. The Open-Book exam is highlighted with an asterisk and bold characters. Last row shows the average of the †-marked five midterm exams made before the Open-Book exam for comparison.

	Delivered exams	Average	Median	Standard deviation	Range	Minimum	Maximum
Final Anatomy III 2023	60	5.84	5.85	1.90	9.0	0.5	9.5
*Midterm Anatomy III 2022	59	6.09	6.40	2.04	9.0	0.8	9.8
Final Anatomy IV 2022	56	6.44	6.45	2.18	9.7	0.3	10.0
†Midterm Anatomy IV 2022	61	5.62	5.70	2.43	9.9	0.1	10.0
Final Anatomy III 2022	64	5.56	5.30	2.16	8.1	1.5	9.6
†Midterm Anatomy III 2021	60	7.54	8.25	2.28	9.1	0.9	10.0
Final Anatomy IV 2021	48	7.77	8.25	1.85	9.0	0.9	9.9
Final Anatomy III 2020	59	5.93	5.67	2.12	9.5	0.5	10.0
†Midterm Anatomy III 2019	59	6.16	6.30	1.99	8.1	1.9	10.0
Final Anatomy IV 2019	47	7.14	7.47	2.03	7.1	2.9	10.0
†Midterm Anatomy IV 2019	49	7.71	8.20	1.85	7.2	2.8	10.0
Final Anatomy III 2019	51	7.14	7.50	1.81	7.6	2.4	10.0
†Midterm Anatomy III 2018	50	6.60	7.30	2.18	9.7	0.3	10.0
Final Anatomy IV 2018	61	7.03	7.30	1.89	8.1	1.6	9.73
Midterm Anatomy IV 2018	60	7.89	8.29	1.99	9.2	0.8	10.0
Final Anatomy III 2018	63	7.17	7.27	1.64	6.8	2.7	9.5
Midterm Anatomy III 2017	61	6.85	7.10	2.01	8.2	1.8	10.0
†Midterms previous 5 years	279	6.69	6.62	2.30	9.9	0.1	10.0

Source: self-made

Figure 1 represents the distribution of student grades in the different exams in a box plot for quick and easy visualization. The exam marked in dark color is the open-book exam. In addition, we have marked with a thick line the period in which, due to Covid-19, proctoring examinations were carried out to avoid confounding variables. At first glance, there is not much variability between the open-book exam and other exams taken previously.

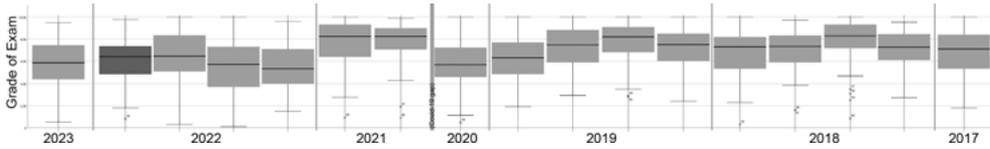


Figure 1. Boxplot of each one of the exams, showing retrospectively the range and median. The second dark on the left is the open-book exam. Source: Self-made.

It might be thought that the partial exams and the final exams are not comparable, since the number of questions in the final exams is greater, the amount of knowledge is considerably larger, and that this could affect the results of the exams. For this reason, the results of the five previous partial exams have been grouped in Table 1, obtaining an average of 6.69, somewhat higher than the 6.09 average points reached in the open-book exam. There are hardly any changes in the 50th percentile, which reaches 6.40 in the open-book exam and 6.62 in the average of the five previous midterms. There are no changes in the minimum marks (0.1 in the five previous midterms and 0.8 in the open-book exam) or maximum marks (10 and 9.8 respectively). This comparison can be visualized graphically in a more comfortable way in Figure 2:

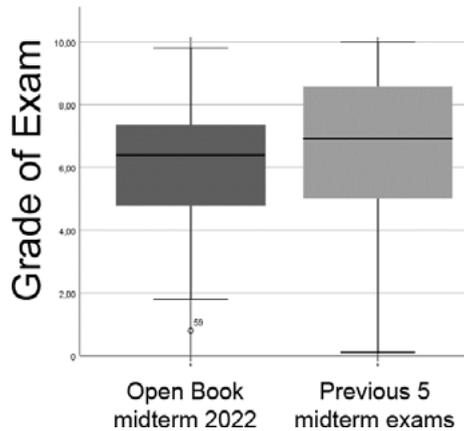


Figure 2. Boxplot comparing the open-book exam scores with the overall scores of the previous five midterm exams, marked in table 1 with an †obelisk. Source: Self-made.

The mean score for the rote exams was 6.77, while the mean score for the open-book exam was 6.09. To check if this difference is statistically significant, we have performed the Student's t-test to compare the different parameters using the categorical classification variable "open-book exam" or "rote exam". In all applied parameters, Levene's test indicated that equal variances were assumed and that the two-sided p values for each of the parameters were not significant. That is, for 15 degrees of freedom, the mean ($t = -0.853$, $p = 0.407$), the median ($t = 0.587$, $p = 0.566$), the range ($t = -0.465$, $p = 0.648$), the minimum ($t = 0.572$, $p = 0.576$) and maximum ($t = 0.480$, $p = 0.638$) do not represent a statistically significant

difference between the two groups. With these data we can conclude the main objective of the study: the fact of taking an open-book exam did not significantly alter the parameters of the exam with respect to the exams performed rote.

5. Discussion

Our findings are consistent with other studies that have analyzed the impact on open-book exam scores. Spiegel found no significant differences in the two cohorts (open and closed exams), both in academic performance and knowledge retention. (Spiegel and Nivette 2021). The acceptance among the students is also high, a study in London in which students were asked for feedback found 65% of students wanting more open-book exams. (Chadha, Maraj, and Kogelbauer 2020). Another study reports that 85% of the students preferred an open-book exam, due to less stress and pressure, valuing positively that the effort was focused on comprehension rather than on memorization (Quille et al. 2021). However, these exams must be carefully prepared to ensure the validity, reliability and fairness of the examinations (Er et al. 2020). There are also many risks and limitations, for example the evaluation of the information retrieval instead of the knowledge acquired (Dave et al. 2020).

Before concluding, we want to highlight a limitation of our study and that is that it is based on only one open-book exam (the first of them). However, we wanted to analyze these results early so that we could consider whether to continue using it or not next year. Another limitation of this study is that we have focused solely on the exam grade, without taking into account other results of the learning process or the distribution of other quantitative parameters such as the number of retaking students, or the relationship with other course assessments such as the dissection practical exam. For future editions we will analyze this data and implement some Feedback questions to find out the preferences of the students and the perceived difficulty.

6. Conclusion

The analysis of the results of this first open-book exam allows us to conclude that there have been no significant differences between performing the exam in this way and the traditional rote way, and therefore there should be no fear of continuing to use them in the future. However, we have only carried out one of these exams, so we will have to continue analyzing the results in the following courses

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Experiencing third spaces in between university and society: transdisciplinary learning experiences in a shopping center

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Abstract

What happens when a university leaves its campus and enter spaces that seem reserved for completely different functions and areas of life – such as shopping? What opportunities and potentials arise from such a shift for the dialog between science and society? Is it an innovative way for science communication to reach groups other than the education-oriented middle class? What skills do academics need to succeed in such a setting? These and similar questions formed the starting point of the Berlin project “Mall Anders - Open Learning Lab for Science and Society”. For seven months in 2021/22, TU Berlin used a retail space in a shopping mall to test new ways of communicating science and co-producing knowledge in a dialogue between the university, business, civil society, politics, and culture. The relocation of university life to a public shopping center enabled broad public involvement in teaching and learning, high activating potential in overcoming the rifts between university and society and new impulses for science communication, participatory research, and student-organized teaching.

Keywords: *Transdisciplinary learning; knowledge transfer; didactics; transformative science; participatory research; science communication.*

1. Introduction

A central question in the debate about participatory ways of knowledge production concerns the forums and infrastructures of collaborative research and learning alliances on major societal problems (Bergmann et al. 2012; Fam et al. 2019; Gibbons et al. 1994; Thompson Klein/Philipp 2023). How can inter- and transdisciplinary spaces be created that mediate between academia and society – and how should they look like in practice? What are the requirements of experimental learning facilities that follow a transdisciplinary objective, and which kind of learning dynamics do they enable?

To plausibilize these problems and related questions on hybrid areas, transfer practices, and *thirdspace* (Soja 2007), which increasingly accompany the debate on academic research and teaching, this article makes the case for a specific pioneer project in Berlin: *Mall Anders - Offenes Lernlabor für Universität und Gesellschaft* (Mall Anders - Open Learning Lab for University and Society). *Mall Anders* (ambiguously translatable as “The Other Mall” or “This Time Differently”) was a transdisciplinary teaching and learning space in the core of a shopping center that operated over seven months in 2021/22. This article presents (1) idea, genesis, and shape of the project, (2) theoretical foundations and didactic methods applied within it, and (3) central learning experiences for different participants at the interface between university and society.

2. “Mall Anders” - Origin and Design of a Public Learning Lab

Mall Anders was established in fall 2021 in the middle of *WILMA Shoppen*, a retail shopping center in Berlin-Charlottenburg. Its genesis was the result of TU Berlin’s transfer policy and continuous efforts to strengthen the cooperation between the university and representatives from business, politics, civil society, culture, and media. With the mediation of the municipal administration of Charlottenburg-Wilmersdorf, the university obtained a 380-square-meter retail space whose previous user, a retailer specializing in gift items, had gone bankrupt during the first phase of the pandemic and left the entire interior (shelves, lighting, cash register systems, etc.) along with plenty of merchandise in the shop.

A service-learning course at the TU Berlin had the task to redesign the retail space with the given materials. The *Natural Building Lab* (2021) of the Faculty of Architecture, which specializes in practices of circular building, offered students an interdisciplinary design seminar with the creative task of exploring the space, its context, its intended purpose, and the range of materials left behind with the task to prepare it for a transdisciplinary learning site. After eight weeks of analysis and reflection, the students decided on a flexible, easily changeable interior design that consisted almost entirely of upcycling the given materials: shelf combinations became room dividers and projection surfaces for video installations, drawers were transformed into seatings, stuffed animals served as seat upholstery –

civilization trash became interior architecture (Mall Anders 2022). Mall Anders inspired the discourse of sustainable development both materially and didactically (cf. Philipp 2023) and thereby aimed at contributing practical knowledge to the ongoing transdisciplinary debate

3. Theoretical Foundations and Expectations

Transdisciplinarity has been negotiated and elaborated since the 1990s (Vilsmaier et al. 2023). As academia is increasingly expected to be impactful for society, new responsibilities arise that force researchers to consider their role in the research process. In the face of systemic uncertainties and normative plurality, scholars alone can neither represent the various perspectives and interests nor make reliable predictions about future developments. In addition to ‘applied science’ and ‘professional consultancy’, Funtowicz & Ravetz (1993) recommend a *post-normal science*. This calls for constructive stakeholder involvement and thus aims at the establishment of democratic research structures which consider the concerns of those people ‘affected’ by the research results. It is therefore a prerequisite of transdisciplinary learning to recognize the plurality of knowledge resources (Philipp & Schmohl 2023) and the necessity of horizontal and dialogical processes.

Mall Anders aimed precisely at this goal, to provide space for the interplay of plural knowledge resources, to allow heterogeneous forms of knowledge to meet and to enable interaction. The claim to test different ways of knowledge communication and production, however, presupposed a reflexive opening of academic knowledge culture in order to unfold effectiveness (Marej 2020). *Mall Anders* therefore rejected traditional transfer logics of unidirectional knowledge transmission and aimed at the multidirectional flow of knowledge between diverse members of society. By confronting academic knowledge with local everyday and practical knowledge, the experimental space triggered processes of reflection and learning about tacit forms of knowledge (Polanyi 1966) as well as power differences of situated knowledge (Haraway 1988). Against this background, the question arose where and how such a place could be created and which challenges would emerge. On the one hand, non-participation or fake participation (cf. Arnstein 1969), which would only serve academic self-assurance, should be avoided. On the other hand, the widespread problem was that only members of the educated middle classes participate and that other population groups are not included. Therefore, first, a place in the city was sought that was accessible to everyone and had no educational barriers: a shopping mall. Moreover, the content of the project was conceptualized in a democratic way with a plurality of themes, methods and techniques.

Mall Anders opened its doors in December 2021. Its program was conceived through an open call for projects: students, teachers, and other staff members of Berlin’s universities, and public actors from the arts and civil society were invited to use the space temporarily by proposing an interactive educational aim and concept. The applicants had to explain the

communicative methods and potentials they were aiming for with their project. There were no thematic requirements. The use of the site was free of charge for all groups and was organized, supervised, and supported by a team of student assistants and early career researchers.

During its seven-month duration, *Mall Anders* hosted over 250 events. The content spectrum was broad and comprised sustainability (e.g. circular economy or mobility), urban development, digitalization, pop music research, and linguistics up to ancient cultures and numerous other topics and disciplines. The methodological approaches included workshops, (interactive) exhibitions, science slams, short lectures, quizzes, infomovies, creative workshops for children, artistic performances, and individual counseling (see: Berlin University Alliance 2023).

The primary user groups were: (1) *students*, who used the space in the context of project workshops or student research, e.g. to present their own research or to collect data in conversation with visitors, etc. (2) *Senior researchers*, who presented their research on current issues such as the future of liberal democracies or the latest developments in catalysis research. Their favorite communicative methods were exhibitions, panels, storytelling events, and science slams. (3) *Representatives of civil society*, who addressed either locally relevant topics such as urban transition, mobility, land use etc. or overarching societal challenges such as conflict resolution techniques. Furthermore, Mall Anders was also an arena of (4) *artistic intervention*: the co-production of knowledge at the intersection of art, technology, and science (Chemi/Du 2017) created knowledge exchange through artistic products, artistic practices, and interpersonal exchanges. Finally, the (5) *curators* of the site used it as a display and experimental space of current science theory debates. The whole project was an open invitation to reflect on the cognitive, communicative, and organisational tasks of science and academic learning through the confrontation with new audiences. This enterprise included theoretical preparations and structured reflection workshops, but also daily tasks such as creating an inviting atmosphere for everyone involved and explaining the learning space and its program to the visitors.

Different forms of learning and interaction defined *Mall Anders*: in (1) *everyday mode* during the few time slots when there was no program announced, a team member welcomed visitors at the entrance area to answer questions. The space was open to the public on a daily basis, and Mall Anders' visual identity of color coding, palm trees, lounge chairs, and modular-mobile furnishings attracted people to enter, linger, and interact. Another free form of interaction was what we called (2) *Open House or Project Display*. Mall Anders became a publicly accessible co-working space for students, scholars or artists who transferred their work to the mall and thereby provided insights into their work processes and research practices. In addition, *Mall Anders* served as a (3) forum for exchange and reflection for *workshops and conferences* with experts on transdisciplinarity and science communication.

This interaction largely took place between actors of the academic and other professional communities. Visitors participated by joining the conference, sharing thoughts and topics. The most frequented formats were the ones explicitly oriented towards interaction: *events curated by cooperation partners* (4), which significantly determined the program. The cooperation partners announced their respective event via the website and through their networks, they planned and designed their learning arrangements, and prepared how to address passers-by and visitors. The events ranged from one-hour to multi-day exhibition, dialog, experiment, and workshop formats.

4. Learning Experiences

Both after each event and at several larger workshops, we reviewed critically the procedure the results and processed them for later events. In two debriefing reflection-workshops after seven unusual months of university life in a shopping mall, we identified four dimensions of learning experiences.

(1) *Visitors and passers-by* often reported that *Mall Anders* was in many ways an irritation in the flow of consumption, a disruption of spatial expectations, a surprising learning experience in a place where this was not to be expected. First-time visits were often stimulated by interest in individual topics, by curiosity about the unusual store and its aesthetics, or by *personal* contact. In the conversation with academic representatives, some visitors recognized *Mall Anders* as a space of information, an opportunity to reflect their own knowledge resources and their own educational biography. Thereby, *Mall Anders* was a means of educational reflection.

(2) *Students, professors, and university members* revealed to us that the communication framework of the mall exposed the limits of their communicative ability when it came to opening up research questions to a new, unknown audience. How do I talk about my research if I am not confronted with scientists? How do I address my audience if I do not know anything about their personal and professional backgrounds? How do I arouse their interest? For many university members, the unusual formats entailed significant challenges. In this respect, *Mall Anders* was also a reflection on the limits and challenges of science communication in a time, in which audience formations are constantly changing and the legitimacy of science is increasingly put in doubt (Bucchi/Trench 2021).

There were also learning experiences on the side of the (3) *shopping center management*. The non-commercial use of store by a university helped to overcome the embarrassment of unused areas. It was capable to attract a new audience and media attention, at least temporarily. On the other hand, the work of students in the shopping center and the unconventional nature of some interventions inevitably led to conflicts with other store operators. *Mall Anders* rather unintentionally initiated the discussion about to what extent

shopping centers are willing to leave behind the outdated doctrine of an “architecture of seduction” (Venturi/Brown/Izenour 1979: 20) and instead embrace the social interaction with their visitors as a process of ‘collective creativity’. However, for the latter, visitors need to be recognized as co-creators rather than as consumers.

A continuous learning experience happened also within our own (4) team of *initiators and curators*: the colleagues who daily managed *Mall Anders*, opened and closed its glass doors, curated the program, advised the scientists and students, answered the visitors’ questions, endeavored to connect with the other stores, and much more. One central learning experience was dealing with the spatial and social threshold between inside and outside. Many passers-by were aware of the challenge of exposing themselves to the risky, unknown space – but how to react? The team learned to shape the threshold permeable: constant attention and unobtrusive personal contact were the keys to signal accessibility and arouse curiosity. Balancing between ‘welcome culture’ and restraint was a challenge. Children, meanwhile, were the ones least shy about entering our space, and furthermore technical and scientific installations and experiments and other playful interaction offers in the entrance area gained attention immediately.

With all these communicative dynamics, *Mall Anders* turned out to be an example of *boundary work* (Gieryn 1983), as it operated on the demarcation of science from non-science and the interrelatedness of various forms of knowledge resources such as professional knowledge, scientific knowledge, embodied knowledge (Gustafson 1999; Freiler 2008), etc. The specific combination of learning lab, upcycling practice, and maker education in a shopping mall turned *Mall Anders* into an experience of public irritation. The building type shopping mall was originally entirely oriented towards consumerism and capitalist exploitation logic (Kroes 1996: XIV; Coleman 2006: 145-167). However, it has long since ceased to be exclusively dedicated to shopping and has become a place for leisure and urban life. The fact that it could also serve as a place of university life and science-society interaction therefore appears to be a reasonable extension.

As an in-between learning space (Vilsmaier 2015), as a transdisciplinary forum of debate, *Mall Anders* enabled the work on rhizomatic intersections (Deleuze/Guattari 1980) of problem contexts and thereby dispensed hierarchical structures. Originally intended as a means of science communication, as a service of university representatives for society, *Mall Anders* turned out to be a learning experience for the universities themselves. At the crossroads of science and society, it was not only a space of risk and rehearsal, but also a marketplace of competence acquisition for scholars of all disciplines and qualification levels. In this respect, *Mall Anders* was also a ‘boundary work’ on the university’s societal role and its communicative potentials.

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Adaptation of the interprofessional collaborative competency attainment scale for usage across professions

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Abstract

Health and nursing professionals, not only in clinical environments but also in nursing homes or in the home environment, are increasingly influenced by digital technology, specifically in the smart home. Technology professionals in IT are affected as well: clients, but also the professionals acting on their behalf, depend on technological support and consultation, because they themselves need to make responsible decisions concerning issues such as data security. More broadly, it is necessary to enhance multidisciplinary perspectives to collaborate across technological and non-technological professions. Meeting this challenge requires educational interventions to promote multi-professional collaboration competencies. Research on enhancing these competencies requires measurement instruments. For this purpose, this paper describes the adaptation of a measurement instrument originating from interprofessional collaboration in health care, the ICCAS, and its translation for application in a German language context via the TRAPD method. The results of a pretest evaluating the comprehensibility of the items are reported.

Keywords: *nursing education; technology education; digital transformation; multi-professional collaboration.*

1. Introduction

Florence Nightingale is reputed to be the founder of professional nursing education (Attewell, 1998, Egenes, 2009). Since then, nursing education and training underwent changes, developed (Scheckel, 2009) and the current and ongoing change in medicine and health through digital technologies will inevitably affect nursing as well (Barbosa et al., 2021). While the replacement of professional services in these social fields of action is unlikely (WHO, 2019, Dengler & Matthes, 2019), networked digital technology and infrastructures are increasingly being implemented in these fields, including in private homes (Brynjolfsson & McAfee, 2014).

Unsurprisingly, these changes not only require technological skills and competencies, but also competencies in areas like collaboration (van Laar et al. 2018). But while the debate in this regard has mostly focussed on industrial requirements, our interest is at the intersection of healthcare/nursing and IT/technological professions, including the most private space, the home. Two professional fields merge in people's homes, or in nursing homes, with the implementation of smart home technology (Bartsch & Stilz, 2021; Nettelstroth et al. 2022): Professionals providing care, healthcare and autonomy support,¹ and technological professionals providing the IT infrastructure, but also technological support and consultation, for example with regard to data security, data protection and privacy in these sensitive personal spheres (General Data Protection Regulation 2018).

With the purpose of creating a multi-professional training within higher education to support multi-professional collaboration at the intersection of healthcare and nursing professionals and technological professionals (specifically, IT), our goal is to be able to measure whether this training has the intended effect and, therefore, to provide for valid measurement. Because of the longstanding work on interprofessional collaboration in healthcare and nursing, instruments are already available in this field, but may not be valid for the intersection with technological professionals. For example, they often refer to 'teams', whereas work at the intersection we intend to describe may not be perceived as team work by the professionals. We chose the ICCAS instrument, which is currently only available in French and English (MacDonald, et al., 2010). Thus, we aim to adapt it to collaboration across professions while also translating it into German language following the TRAPD method (European Social Survey, 2020; Harkness, 2003).

¹ For example in Ambient Assistant Living.

2. Multi-professional collaboration between healthcare and nursing professionals and technological/IT professionals in the context of the digital transformation

Historically, professional work in nursing and related fields has rather been seen in opposition to technological professional work, due to two conditions: First, it has been rather unaffected by digitalisation beyond its use for personal communication. Consequently, health care professionals have long been rather unfamiliar with work-related technologies such as electronic health records (Pohley & Wittmann, 2021). This is the case, despite the fact that an electronic health record can serve as a means of providing personalized care in terms of care and case management through data extraction and data analysis (Snoddon, 2010; Wittmann & Weyland, 2020; Striković & Wittmann, 2022). Additionally, when it comes to nursing people in their own homes, professionals, not only nurses, are increasingly confronted with smart home technology implemented to maintain the resident's independent lifestyle. But secondly, professional work in the field has historically been a predominantly female profession, originating in religious orders with charity as a common ground (Gauci et al., 2022; Friese, 2018; 2021). In contrast, professional work in technological areas, especially IT, has historically been predominantly male, associated more with math and anti-social imagery and less associated with service in social fields (Ensmenger, 2015).

Multi-professional collaboration, we contend, therefore requires substantial changes in perspective from both professional viewpoints, including active listening from the part of the technological professionals, and the readiness and ability to articulate one's concerns in relation to technological professions from the part of the healthcare and nursing professionals. To support multi-professional collaboration competencies by students from both professional areas, we developed a training based on role-play located in an innovative academic smart home simulation lab, using perspective taking on multiple instances, added by an introduction into the varying professional perspectives on the smart home, as well as reflection and discussion (Striković & Wittmann, 2022). Following the curriculum-instruction-assessment triad (Achtenhagen, 2012; Pellegrino, 2012), in order to assess the outcome of the training we require an instrument that can validly capture multi-professional collaboration across the healthcare and nursing as well as the technological professional fields – we are not aware of any such instrument.

3. Adaptation of the Interprofessional Collaborative Competency Attainment Scale

Because of the longstanding work on interprofessional collaboration in healthcare and nursing, instruments for assessing interprofessional collaboration competency are already available in this field, but may not be valid for the intersection with technological

professionals. One instrument identified through a systematic literature review conducted by Striković and Wittmann (2020) is the Interprofessional Collaborative Competency Attainment Scale (ICCAS). The ICCAS seems to be suitable for adapting it to collaboration across professions since MacDonald and colleagues (2010) propose that it “can be applied to a variety of interdisciplinary tasks and settings, such as social work and human services education” (p. 304) as well. Moreover, the ICCAS is also a validated questionnaire (Archibald et al., 2014) and has been replicated and revised (Schmitz et al., 2017). Unfortunately, the questionnaire is only available in English and French (MacDonald et al., 2010), which means that it not only has to be adapted but also translated into German before being used for assessment of multi-professional competency in a German context. For this, we chose the TRAPD method consisting of five steps: The first step is to translate the items independently. This also includes the deliberate modification of the ICCAS items’ content with regard to multi-professional contexts. Second, the two different translations are discussed under the supervision of a reviewer. If there are remaining points of discussion after the review phase, the third step is to settle them with an adjudicator. The fourth step is to conduct the pretest whereas the fifth step is to document the whole process thoroughly (European Social Survey, 2020; Harkness, 2003).

The authors speaking German as their first language consider themselves as suitable translators, reviewer and adjudicator, due to their individual backgrounds:

1. *Translation:* MP and SiS have a professional qualification in health care and computer science, respectively.
2. *Review:* AS’ research focuses on modelling and measuring multi-professional competencies – specifically in nursing education. Furthermore, he has a background in electrical engineering and IT.
3. *Adjudication:* EW has advanced experience in developing questionnaires.

Regarding the adaptation of the ICCAS, there were some challenging phrases and terms. For instance, the original questionnaire often refers to an interprofessional team or team members whereas work at the intersection we intend to describe may not be perceived as team work by the professionals. For example, on the one hand, technological professionals provide the IT infrastructure, but also technological support and consultation; on the other hand, nurses act on the behalf of the patients in order to support their autonomy. Hence, in such a multi-professional context, when fulfilling customers’ needs technological professionals have to consider clients’ autonomy, too. Thus, the goals of these two professional groups overlap whereas they do not coincide as it would be in a team situation. As a consequence, we determined ‘representative of another profession’ to be more appropriate than ‘interprofessional team (members)’. Moreover, some items included health specific terms expressing the patient-centered care. In order to adapt the instrument to the broader context

of collaboration across professions, we used the term ‚problems‘ instead (see Striković & Wittmann, 2022).

4. Conclusion

As we have argued, the digitalisation necessitates multi-professional collaboration. With the purpose of evaluating a multi-professional training within higher education, we chose the ICCAS in order to adapt it to collaboration across professions while also translating it into German language following the TRAPD method. The results of a pretest evaluating the comprehensibility of the items are reported.

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Story/No Story: narrative design exercise for shared ways of seeing

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Abstract

A case example is presented of an innovative teaching and learning experience, devised somewhat emergently for a mixed class of 30 undergraduate design students in Beijing, China. It shares the benefits of a mash-up approach drawing on fundamentals of design practice translated into an intensive five-day observation-to-animation exercise, with unexpected learning value to students of three different design-related disciplines.

This paper outlines the instructions given, the process followed, the resulting designed outcomes, and student feedback gathered some three and a half years later. These testimonies evidence the lasting impact of this activity on the students despite its short duration, and specifically the value of observation, creative experiment, facilitating peer relationships, collaboration, and peer learning across the three disciplines. All of these elements were explicitly absent from other learning modules in their curriculum. The scenario provides a framework to inspire and guide similar collaborative activities across design disciplines.

Keywords: *narrative design; observation; animation, interaction design; drawing, sensemaking; action learning.*

1. Introduction

As this is a qualitative personal account, this paper is written in the first person, giving the author's subjective perspective on a particular teaching situation, accompanied by samples of the visual output of the students and of their recollections of the project.

While visiting Beijing from the UK I was invited to lead a short course for a mixed class of 30 Animation, Information & Art Design (Infodesign), and Photography undergraduate students. I had complete freedom to cover any areas I chose, with no learning outcomes specified by the hosting faculty. However, as I had come expecting to run a product innovation course, this left me with a short time to plan. Having no experience of animation I consulted a friend and former colleague, Dr Hugo Glover, who gave me very helpful suggestions for accessible and stimulating approaches to animation. It was a new challenge to me to devise a learning exercise that would be equally engaging, relevant and stimulating to students of all three loosely connected disciplines. Looking for common ground between them, I devised an activity that would emphasise practises common to all – namely observing, visualising, and storytelling – but not overly familiar or unchallenging. I was confident that I could draw on my own expertise in innovation design, of products, services and digital experiences, to conceive such an activity, but was uncertain how successful it would be.

The main activity outlined here required the students to work together in mixed teams of three or four people, to examine a simple (to them), everyday task in detail, by describing in text, then enacting it, recording on video, translating to a storyboard then into a stylised animation. By moving from the detailed recording of the actions to a free, abstracted visualisation, the exercise balanced the contrasting elements of technical exactitude and creative fluidity.

2. Educational context

Animation as a practice demonstrates and builds skills of visual narrative and observation (Williams, 2009; Dobson *et al.* 2018; Glover, 2020). Constructivist theories of learning suggest students acquire knowledge by active engagement, connecting existing knowledge with new stimuli (Bada & Olusegun, 2015). In design pedagogy the studio learning environment is considered fundamentally important for enabling active engagement for tacit knowledge acquisition, not only 'hard' technical skills, such as drawing and modelmaking, but the softer skills of observation and creative association, as well as informing development of a personal perspective or ethos (Wilson & Zamberlan, 2017).

In design pedagogy, drawing objects is a well established studio activity to observe and interrogate, principally for a better understanding of their material and formal qualities but also to practise and build this skill of noticing, that is, to develop attentiveness to details of

form and materiality. The principle can be extended from object to experience; if through drawing we learn to “see things more clearly” (Edwards, 1997), it follows that in enacting and studying a short temporal experience and focussing on the minutiae of the actions involved, students would learn about the specific chosen experience but more importantly, would develop technique for observation, relevant to all three specialisms. While such detailed scrutiny is important in design knowledge, a less formal, less deliberate form of noticing is also important in creative practice for making serendipitous connections. The term encounter (Adamson et al, 2011) is helpful to convey such a subtler kind of openness to connections and insights that may yield creative progress:

“Knowledge is always fragmentary, partial and provisional, and only comes into its own through the unexpected challenges, confirmations, elaborations and unsettlings that result from encounter.” (Adamson et al 2011)

Similar claims are found in theories of sensemaking – the process of giving meaning to experience – (see eg Weick 1995), of which the activity of design is an example (Stevens 2013). Sensemaking is triggered when a person becomes aware of a disruption, a deviation from the expected (Weick, 1995, p. 5). This enables one to “comprehend, understand, explain, attribute, extrapolate, and predict” (Starbuck & Milliken, 1988, p. 51); to understand connections among, for example, people, places, and events (Klein et al., 2006); or to explain surprises or discrepancies.

The exercise was planned therefore to promote shared ways of seeing and acting – to encompass in a very short time these complementary practices of observing and noticing, analysis and creative synthesis, and (by fostering their collective and individual agency) action-based learning (van Lier 2007). In so doing, the students collectively produced an abstracted narrative film of striking quality.

3. Exercise Instructions and Sample Outcome

- Class divided into 8 teams of 3-4, at least one from each discipline.
- “Imagine someone carrying out a simple task over a few minutes in the home, at work, or a public place, (eg boil an egg, fasten a tie, hang a picture on a wall). It should be something you can do yourself, and include physical objects.”
- “Make written notes in as much detail as possible: What steps are required? Any emotions like frustration, delight? Parts that are easy, difficult, unthinking, require other objects, special skill or knowledge etc..?”
- Each team member then enacts the task, recorded in simple video using phones.
- Storyboard sketches of key steps: draw up a storyboard using stills from the videos.
- Edit the video footage into an abstract 16 second movie. “It does not have to be instructive. Be as expressive and stylised as you like.”

- Divide the 16” video equally across the team
- Working solo, trace the video frame by frame (rotoscoping) on tracing paper or digitally, and embellish with any visual style (fig 1) then animate the frames.
- Each team re-assemble their 3 or 4 segments back into one 16” movie (fig 2).

The finale of the course was to show all eight animations to the class as a single film, titled *Story/No Story* (Stevens 2019) to which I added text titles and an upbeat soundtrack. In the end, the students, myself and the hosting faculty were very pleased and impressed with the results, both in terms of learning outcome and in the resulting output of the students.

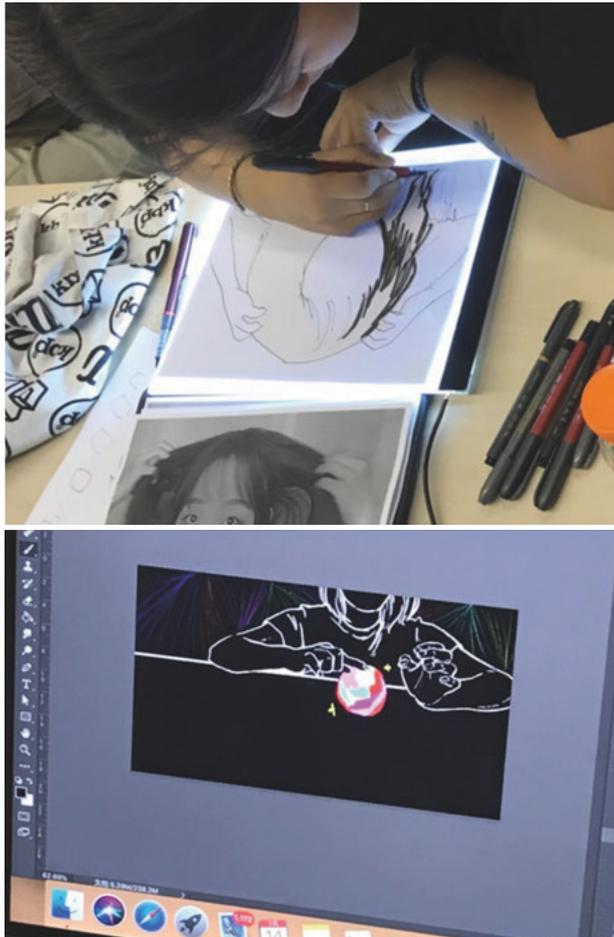


Figure 1. Frame-by-frame tracing of live action (rotoscoping) using paper over a tablet (top) and directly on screen (bottom). Photo credit: author.



Figure 2. Sample frames from the final compiled animation show the variety of styles and media. Credit: student participants, see Acknowledgements.

4. Student Feedback

The following are extracts from reflections of six student participants, now graduates, who kindly responded in English text to my emailed request for feedback.

4.1. What do you remember most from the class?

“What impressed me most was the group animation cooperation, in which everyone built different visual styles through the way of real shooting and turning to tracing. When these styles were played together, they brought me a novel experience ... The whole class was full of lively atmosphere and innovative and open teaching contents.” **Yuxin (Animation).**

“The most impressive thing for me was that the teacher encouraged group members to create an animation together. At first, we doubted ourselves about this, worried that our styles would have conflicts if combined... Finally, to our surprise, we did fantastic work, brightening our eyes. ... After I graduated, looking back, this class was the most impressive to me because it was a brand-new attempt for me to learn how to make animation like that. I hope more classes like this can be added to students' schedules in the future.” **Yuelin (information & art design).**

“It was the first time for me to make animation informally, so the part where the team did different styles of animation impressed me the most. The teacher asked us to pick a small routine in the daily behaviour and record it as detailed as possible. As first it may seem tedious and superfluous, but soon we realized that it is a delicate observation method to every detail, which can help us to create animation more vividly.” **Zhonghe (animation).**

“In the last class, when everyone's animations were connected and played together, it was very touching. Another point is that I have always been very timid to brainstorm and express ideas quickly. But in the first class, I could imagine an interaction product... with students from different majors and exhibited our ideas in class, which impressed me a lot... Thank you, you brought us a wonderful course that I still remember many details even [after] four years passed.” **Hanjie (information & art design).**

“I attended this course a long time ago, but the experience is still memorable because it was the first time I had worked in a group for a project. Plus, the diversified academic background among the members and experiencing the complete design process was truly inspirational. At the time... sketching, sculpture, and Chinese painting were my daily routine. However, it was the first time I took the hybrid class that consisted of three different classes. It was unfamiliar but exciting. I got to meet new classmates and established friendships with them over time. This was a very exciting process.” **Lingjun (Photography).**

“I remember clearly... our group made a short animation video and a poster about beauty and makeup, trying to break and re-think about this daily routine though this whole creative process. The process of research and design inspired me a lot in my later practices. I found that the design methodologies I learned from the class are actually widely used by people doing interaction or industrial designs. I majored in animation, so that these methodologies do not usually work straightforwardly in my own creative practice. However, the way the class taught me to observe life, find pain points and dig into it — the way of thinking really helped a lot in my own studies.” **Rui (animation).**

4.2. How did you feel being in a mixed class of photography, animation and digital designers?

“In a hybrid classroom, the integration of different majors can provide suggestions from different perspectives for the implementation of project cooperation, and these suggestions can create new sparks.” **Yuxin.**

“I think it's cool! Because we are from different majors so that we have different perspectives and different methods of solving a problem. We learned from each other and leveraged our respective strengths to complete our final work. For example, I learned how to make a frame-by-frame animation under the guidance of my team member who majored in animation.” **Yuelin.**

“It was an amazing experience to have classes with students from different majors. Different people grasp different knowledge and have different understanding on one topic. Therefore, when facing the same design, they choose different angles. They were all very enlightening.”

Zhonghe.

“Being in a mixed class is, at first, painful, but I definitely learned a lot from this diversity. At the time ... most of us did not have a very clear idea of what our majors were really about and what we were learning... I think that being able to have a mixed class in freshman year really expanded my vision not just in an interdisciplinary perspective, but gave some more depth to my understanding of my own major — animation, which became crucial to my later trans-disciplinary studies and career path.” **Rui.**

“When cooperating with other members, I have sensed the charm within a cross-major environment. We come from different fields of studies, but gathered as a whole, displaying our own unique strengths. We help and encourage each other during the process, as well as reminding each other of the designing procedures and details. As time progresses, the fascinating aspects of cooperating with people that come from different academic backgrounds have taught me the basics, and the importance of personnel speciality during the designing process.” **Lingjun.**

5. Conclusion

The structure of the unit was highly successful in achieving a range of learning outcomes, and is easily repeatable via simple instruction, with hardware and software commonly already used by many students. The same structure could, I suggest, also be valuable for younger learners or non-design students, as the rotoscoping technique is highly accessible to less expert or able students, and produces very satisfying results.

The teams achieved a high quality output, demonstrating the complementary practices of observation, analysis and creative synthesis, and an intense combination of group and solo work, and of intra- and interdisciplinarity. From these written reflections, and in the class atmosphere at the end of the module, it is clear the intensity and intimacy of the challenge had a highly emotive resonance. Participants found collaboration daunting at first, then enjoyed the lively and energetic atmosphere in the class, and ultimately made valuable learnings and lasting friendships, and produced an artwork they were immensely proud of.

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Collaborative knowledge construction during computational lab activities in Financial Mathematics

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Abstract

Nowadays, there is a growing interest in including some aspects of computation and computational thinking within science subjects, in particular Mathematics. Moreover, the COVID pandemic has increased the opportunities for remote-based work across economies, including education. This implies that workers and students should be able to collaborate remotely using collaborative technologies. In this paper, we show how tailored student-led computational practices designed for a Computational Finance module provide opportunities for the co-creation of knowledge in Financial Mathematics in a Computer-Supported Collaborative Learning environment. We analyzed students' answers to a weekly survey using Gunawardena et al. (1997) Interaction Analysis Model for collaborative knowledge construction. The results show that, in a large number of discussions, the highest levels of the collaborative learning process were achieved.

Keywords: *Collaborative knowledge construction; computational thinking; computer supported collaborative learning; inclusive computational practices; interaction analysis model; financial mathematics.*

1. Introduction

Nowadays, there has been growing interest in including some aspects of computation and computational thinking within science subjects, in particular in Maths pathways. The use of computation can deepen the learning and experience of Mathematics; at the same time, Mathematics also provides a meaningful context which computational thinking can be applied to (Lockwood et. al., 2019). In this setting, Computational Finance is a new and highly interdisciplinary Math subject, relevant to master Financial Mathematics and computational thinking and fundamental for high-level quantitative finance jobs. Despite the incredible growth of Financial Mathematics programs in the last few years, it is worthy to notice that the Computational Finance curriculum is under-researched. Moreover, the COVID pandemic has caused a rapid increase in the demand from employers for remote-based work across economies (World Economic Forum, 2020). The same happened in the education sector. This implies that workers and students should be able to collaborate remotely, using digital tools for communication and shared workspace.

In this paper, we show how tailored student-led computational practices designed for a Computational Finance module delivered at University College Dublin provide opportunities for the co-creation of knowledge in Financial Mathematics in a Computer-Supported Collaborative Learning environment (CSCL). We analyzed the students' responses to weekly surveys to address the following research question: do the activities designed for the Computational Finance module allow students to create shared knowledge in financial Mathematics?

2. Theoretical framework

CSCL is a field of research, emerging in the '90s, focused on how technology can facilitate the sharing and creation of knowledge and expertise through peer interaction and group learning processes (Resta & Laferrière, 2007). CSCL grounds on socio-constructivist theories, where learning is seen as a construction process performed by communities of practice, social units participating in a common situation with a shared goal. Communities of practice are built through the coordinated use of collaborative technologies, tools that enable individuals to jointly participate in the construction of a shared knowledge (Roschelle & Teasley, 1995). The design of CSCL environments is crucial to promote the process of collaborative knowledge construction. Donnely et al. (2014) identified four features that should be considered when creating CSCL activities: (1) tasks should be meaningful to engage students in exploration and relevant problem solving activities; (2) simulations and dynamic visualizations can create emerging conditions for collaborative learning; (3) students need to be encouraged to collaborate in their work; (4) it is important to cultivate the use of metacognitive strategies over time, to enhance students' capacity to self and co-

regulate themselves in socio-cultural environments. An example of similar CSCL for Mathematics can be found in (Barana & Marchisio, 2016).

The “inclusive computational practices” definition (Caballero & Hjorth-Jensen, 2018) is perfectly aligned with the above description. In fact, this definition includes a wide range of high-level coding activities like having students work in groups with simulations to understand the main characteristics of a mathematical model; giving students pieces of code to complete or modify in order to adapt them to a different problem; critically inspecting and judging computational inputs and outputs; advising students on open-ended group projects where they write code from scratch. Inclusive computational practices have been heavily used to design physics undergraduates’ modules in Michigan State University and Georgia Tech (Caballero et al., 2012; Caballero & Hjorth-Jensen, 2018). Here computation and computational thinking are a central element and not a tool in the design process.

The process and outcomes of collaboration can be analyzed using different frameworks. This study adopts the Interaction Analysis Model (IAM) for collaborative knowledge construction designed by Gunawardena et al. (1997). According to Lucas et al. (2014), interaction is “the process through which negotiation of meaning and co-creation of knowledge occurs and should be viewed as the totality of interconnected and mutually responsive messages, an entire gestalt formed by the online communications among participants”. Thus, the co-creation of knowledge is conveyed by interaction. Based on this definition, Gunawardena et al. (1997) developed a IAM oriented at capturing the knowledge construction process when a community of practice learns using collaborative technologies. It is composed of 5 phases: (1) sharing and comparing of information; (2) discovering and exploring dissonance or inconsistency among ideas or statements; (3) negotiation of meaning/co-construction of knowledge; (4) testing and modification of proposed synthesis or co-construction; (5) agreement statement(s)/applications of newly constructed meaning.

This model was originally created to analyze the interactions during an online debate among researchers and education professionals, i.e. with peer experts within an asynchronous setting where the technology is a communication tool. Gunawardena et al. (1997) themselves argued (and encouraged) that the same method could be applied also with non-experts (such as students) and in different CSCL settings. Recently, the IAM has been used to analyze face-to-face interactions of students working in synchronous settings with peer non-experts and using technology as a cognitive tool (see for example Zabolotna et al., 2023). In this paper, we show how tailored inclusive computational practices may provide opportunities for the co-creation of knowledge in Computational Finance in a CSCL environment.

3. Research methodology: setting, data collection and analysis

This research study has been conducted in the AY 2020/2021 in the Computational Finance module ACM30070, core for the stage 3 of the BSc in Financial Mathematics (FM), School of Mathematics and Statistics, UCD. The module is also optional for stage 3 of the BSc in Applied and Computational Mathematics (ACM). In 2020/2021, 50 students attended the module, with 35 FM and 15 ACM. This module was offered as a pilot in 2016/2017. Then, it was redesigned and improved to include labs including computational practices and group activities in a CSCL environment where students actively participate in the co-creation of their knowledge. Those practices are structured to reciprocally use computational thinking to enrich the mastery of FM and the theory of FM to enrich students' computational thinking. An extensive description of the module design and lab activities can be found in (Perrotta, 2021) and (Perrotta & Dolphin, 2021). To facilitate students' learning and ensure engagement and participation, a tutor and a teaching assistant moderated the labs, actively intervening only if needed or required by students. Each lab lasted 2h. During the first hour, students worked in groups on computational modeling, pseudo-coding, data analysis and other related computer-based activities. In the second hour, each group chose a representative to present the group outcomes to the whole class. The tutor guided groups in presenting their results and encouraged dialogue between groups in order to come to a conclusion. The class was divided into 7 groups (6 of 7 students and 1 of 8), which stayed the same for the whole term. Students were grouped according to: their GPA, (homogeneous, i.e. similar GPA on AVG), their pathway (5 FM and 2 ACM), and gender balance (at least 2 women per group). To positively set students' expectation in view of co-creation of knowledge, students were made aware of their similar GPA, so that they were all expected to be able to contribute in the same way within their group. After each lab, students were invited to fill out a Google Form survey to critically reflect on the activities done in class. Each student completed 10 surveys (1 per week). The survey contains qualitative and quantitative questions, their answers constitute the dataset for this research study. In this paper, we analyze the (open-ended) answers to the following questions:

1. Were the expected outcomes and goals of today's lab clear to you? If yes, please list which are, in your opinion, the key concepts of today's class. If not, please state what was unclear to you.
2. Can you describe in detail in your own words how peer feedback and discussions have or have not helped you in supporting your learning today? Please refer explicitly to the exercises we have covered and make examples.
3. How useful do you think the computational part was for improving your understanding today? Please refer explicitly to the exercises we have covered and make examples.

The Survey was filled out individually and it stayed open for one week, so this activity can be classified as an individual, asynchronous, computer-mediated one. We highlight that the dataset refers to the Jan-May 2020 period. Before March 2020, lab activities took place f2f, in Active Learning rooms. When restrictions were put in place, labs were live-streamed on Zoom, with groups working in breakout rooms with shared screens in the first hour.

For the analysis of this pilot study, we selected 6 students out of 50, who worked in 6 different groups. The selection was made in order to represent three different proficiency levels: two high-level students, two medium achievers and two low-level students. There are 5 males and 1 female in the sub-sample. We analyzed the 6 students' answers to the 10 weekly surveys for the question listed in section 3 using the IAM framework. For each student and each survey, one phase of knowledge co-construction was selected, namely the highest phase that could be inferred from all the answers to the questions of the survey. The goal of our analysis was identifying which was the highest phase reached by the groups during one lab, in order to infer the level of knowledge co-construction achieved by that group during the lab. Since the complete discussions were not available and knowledge co-construction is a progressive process, when one phase was identified from the survey's answers, we deduced that the lower phases were covered during the discussion. So, when more than one phase was detected, we chose the highest one. In case of doubts between two or more phases, we chose the lowest one. The analyses were performed independently by the authors, so that all answers were analyzed by two researchers, and then discussed by all the authors altogether. Then, the phases' frequencies in the 10 labs were computed.

4. Results and discussion

Table 1 shows the frequencies of the highest phases occurred during the discussions that we identified from the answers of the three questions listed in Section 3.

Table 1. Phases of knowledge construction reached during the lab discussions.

Phase	Frequency	Percentage
1	20	35.1%
2	11	19.3%
3	13	22.8%
4	2	3.5%
5	12	19.3%

From these results, we can notice that all the phases of knowledge co-construction described in the IAM occurred during the discussions. Phase 1 is the most frequent, which is in line

with similar studies. We assigned to phase 1 those answers which simply show that students compared their solutions or ideas without moving to a deeper discussion. One example of phase 1 is the following, where it seems that during the lab time the group discussion was limited to sharing different points of views.

“As mentioned above, my classmates helped me get a better grasp of the delta of an option. It was helpful to hear their points of view and their thoughts [...]”

Phases 2, 3 and 5 have a similar frequency. We assigned to phase 2 those answers which allowed us to detect disagreement or discussion about different emerging ideas. One example of phase 2 is the following, where it seems that during lab time there was discussion about different ideas and approaches, but students did not reach a common solution:

“Peer feedback was good this week, especially with question 8, where multiple different people brought up differences between the two techniques, so we all learned of differences we wouldn't have thought of. However, with question 7, we were all quite confused [...] and did not get the answer out.”

Phase 3 was identified when there was evidence of common knowledge or an agreed solution achieved through collaborative work or discussion after a deep reflection. One example is the following, where the transition from phase 2 (identification of disagreement) to phase 3 (agreement of an explanation) is clearly visible.

“In Q3, we discussed the different possible parameters and variables. Some said that volatility should be a variable, others said a parameter. We agreed that in the real world, it is of course varying constantly but in the BS model it is treated as a parameter.”

Phase 4 is the least common, maybe due to the fact that many groups that reached phase 4 then moved to phase 5, and therefore they are included in the number of answers assigned to phase 5. The following answer provides an explicit example of phase 4, since we can observe how the students of this group used the technologies to test and find a confirmation of the knowledge shared during the previous discussion:

“We were able to discuss more things about the model. We actually plotted a comparison of the binomial price and the Black-Scholes price for different values of n and saw that as n got larger the binomial price (which is only an approximation) came much closer. We also plotted the error and observed that the binomial price eventually seemed to converge to the binomial price.”

Phase 5 was detected when there was evidence of modification of individual understanding as a consequence of the interaction, such as in the following answer:

“[...] the computational aspect that we focused on was the implementation of Fincad. [...]. The most educational part for me was to notice the vast difference in options prices when the

time to maturity and the spot price is 10 euro above the strike price. The call price was roughly 1 euro and the put price was so small it is almost negligible and can be rounded to 0. This prompted much speculation and debate in our group as to the reason why (We believe it's because the price of the share at maturity was unlikely to fall below the strike price, resulting in most likely a loss). We also used Fincad to evaluate the put-call parity with a time to maturity of two years now. By calculating the respective put and call prices using Fincad, we were able to see this was roughly true to approximately 0.362 of a difference between the two sides of the equation. This computational aspect allowed me [...] to solidify the truth of the put call parity."

This answer perfectly shows all the collaborative knowledge construction process occurred, from phase 1 to phase 5. We can see how the group passed through phases 1 and 2 (comparing and contrasting different ideas on why they found a difference between call and put prices), then moved to phase 3 (agreeing on a hypothesis on why the phenomenon occurred), then 4 (testing the shared solution with Fincad) and lastly to phase 5 (applying the new knowledge that the discussion helped them gain, reaching a more solid comprehension of the theory).

5. Conclusions and future improvements

We performed a pilot study to investigate the effectiveness of tailored inclusive computational practices in providing opportunities for the co-creation of knowledge in Computational Finance in a CSCL environment. We selected 6 students out of 50 and we analyzed the answers to the weekly survey questions listed in section 3 through the IAM framework. The results are shown in Table 1 and are in line with the available literature using the same framework in different CSCL environments. From these results, we can notice that all the phases of knowledge co-construction described in the IAM occurred during the discussions. Despite phase 1 being the most frequent (35.1%), which is in line with previous studies (Lucas et al., 2014), relevant number of discussions which developed beyond phase 3: 3.5% stopped at phase 4, the 19.3% reached phase 5. This result improves the available literature and lets us conclude that the proposed activities have been successful in activating the highest level of co-construction of knowledge. The technology and computation used in this module had a key role, since they mediated and fostered the whole learning process. This result supports Donnelly et al.'s (2012) thesis: the collaboration within specific problem-solving and computational thinking activities creates suitable conditions for co-learning construction in CSCL environments. We are now planning to extend the analysis to the entire dataset to further investigate how computation intended as combined with a collaborative learning environment fostered the whole learning process. Another possible development of our research is focusing on the impact of group composition in the co-construction of knowledge: indeed, we noticed groups constituted by students with lower GPAs collaborated more than students with higher GPAs, and this was reflected in the attainment of higher

phases. This study has a limitation: we have analyzed students' answers instead of recorded conversations, so students may have reached higher phases but without being able to express this in words. For this reason, we are planning to collect a new dataset based on video-recordings of activities and analyze discussions transcripts with the IAM framework.

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Learning agroecology through the serious game SEGAE in an online lesson: unveiling its impact on knowledge articulation

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Abstract

Facing global challenges, the currently dominating agricultural system has shown its limitation. Therefore, agroecology appears as an attractive alternative. Its implementation has been shown to benefit the environment, while harboring economic potential. For a transition towards more agroecology, this new paradigm needs to be taught to students and professionals in the agricultural sector. However, traditional learning methods are not fully adapted to teach these concepts because of the poor interactivity and/or lack of interdisciplinarity.

To help teach agroecology, the “SErious Game for AgroEcology” (SEGAE) was developed. SEGAE is a simulated mixed crop–livestock farm complex models in which players can learn by doing.

To access SEGAE pedagogical interest, university students, coming from four specializations (Agronomy; Chemistry; Environment and Forest) participated to a theoretical class which was tighted to a play session of the game. The students then answered a knowledge survey on agroecology and a feedback survey based on flow theory. Results showed that students did significantly increase their knowledge of agroecology. Students particularly succeeded when answering open-ended questions, which required them to articulate knowledge. Moreover, a large majority of students enjoyed the game (83%) and thought playing this game increased their knowledge (91%).

Keywords: *Serious game; agroecology; interdisciplinarity; farming system.*

1. Introduction

Acknowledging the documented impacts of agriculture (Campbell et al., 2017), the transition towards more sustainable agro-food systems is urgently needed (IPES-FOOD, 2018). One tricky equation in this will be to strike a good balance between warranting sufficient production of food for a growing population and remaining within planetary boundaries (Gerten et al., 2020). Associated with the concept of food sovereignty, agroecology is increasingly advocated as a promising alternative (Wezel et al., 2014). More specifically, agroecology-led initiatives are designed to meet the triple challenge of proposing a food system that is at the same time more sustainable, efficient, and socially fair (Gliessman, 2014; Godfray et al., 2010).

Agroecology is commonly defined as “the ecology of sustainable food systems” (Gliessman, 2014). Agroecology is defined in this article as “the study of the interactions between plants, animals, humans, and the environment within agricultural systems” (Dalgaard et al., 2003, p. 42).

However, even if the advantages of agroecology have already been demonstrated in numerous studies (van der Ploeg et al., 2019; Wezel et al., 2014), it remains a topic which raises many questions in terms of learning, in academic institutions. When it comes to food-related and agronomic purposes, students are indeed still mostly trained to be specialized in particular fields, such as biotechnology, economics, and soil sciences. However, agroecology is a notion that brings together a complex of components in interaction, such as environmental, social, and economic sciences (Francis et al., 2011). Agroecology requires being taught in a different way, in order to give a more systemic view of its various components (Francis et al., 2008). As judiciously pointed to in David & Bell (2018, p. 615), the teaching of agroecology “is not only about content, it is also about process”.

Serious games are a way to satisfy the teaching requirements of agroecology because digital tools allow the simulation of complex models which allow players to develop their understanding of systems approaches (Wu & Lee, 2015). They are referred to as being entertaining tools with an education purpose. They improve the implication, the engagement and the immersion of the players, while having a fun aspect. New skills are acquired by participants who receive immediate feedback based on the choices and strategies adopted.

Accordingly, the serious game SEGAE (SErious Game for AgroEcology learning) has been developed to facilitate the teaching of agroecology, accounting for the need to convey both a systemic, as well as, an inter(trans)disciplinary perspective (De Graeuwe et al., 2020). Within the realm of the present study, the objective is to explore the relevance of using this game in short lessons of 4 hours, with a single teacher. More particularly, we make the assumption that serious games, and more precisely SEGAE, are an effective learning tool, adapted to a short lesson, for improving the agroecological knowledge of university-level students. This

acquisition of knowledge should be more manifest in open-ended questions, which require having acquired a systemic vision. A related and complementary hypothesis is that SEGAE positively contributes to knowledge acquisition through providing fun during the game session.

To determine the performance of SEGAE with respect to the education of agroecology, two types of surveys have been conducted. Firstly, to measure the acquisition of agroecological skills, a knowledge survey was proposed before and after the lesson. Secondly, to assess the student's perception of the serious game, flow theory has been mobilised (Fu et al., 2009) and used as a feedback survey. Both surveys are the replica of those used in De Graeuwe et al. (2020).

2. Materials and method

The study was carried out in Belgium during March 2021. Due to the Covid-19 pandemic, all activities took place online. Students from the 3rd bachelor year, following an agricultural engineering education in four specializations (Agronomy; Chemistry; Environment and Forest) followed this lesson. In a period of 4 hours, several activities were organized (1) a theoretical class, (2) a serious game class and (3) two survey's times.

2.1. Theoretical class

Once the pre-survey was completed, a 2-hour lesson was given to introduce the theoretical notions of agroecology. This introduction contains three distinct modules which are "Soil-Plant-Ecology", "Animal" and "Socio-economic". The goal of this introduction was to give students basic knowledge of agroecology and its effects, introduce a system approach to evaluate a combination of practices on the production system and also to study different options to solve a given problem with limited resources.

2.2. Serious game class

After the theoretical class, another 2-hour lesson was given to the students. This time is dedicated to the handling of the serious game. The whole group was divided into several subgroups from 20 to 30 students, randomly mixing the different specializations. During this class, three scenarios were proposed to them, starting with a "sandbox", followed by a "system approach" and ending with an "indicator oriented" (for more information, see De Graeuwe et al. (2020, p. 6)). After that, a discussion about the results and limits of the serious game with the teacher followed.

2.3. Survey's times

Before starting classes, it was asked to student to fill a pre-survey which was divided in two sections. The first one was about the respondent's profile questions such as age, nationality and specialization of study were asked. The second one contained 15 multiple choice and 6 open-ended questions about agroecology knowledge.

In order to be able to measure the acquisition of competence, the same knowledge questions, as in the pre-survey were asked in the post-survey. Moreover, a feedback section was added to assess whether the SEGAE game was stimulating as a learning tool. It included 4 open-ended questions and 45 statements. The eight factor of EgameFlow were used to characterize the state of flow that student experienced : (1) concentration, (2) clear goal, (3) feedback, (4) challenge, (5) autonomy, (6) immersion, (7) social interaction and (8) knowledge acquisition (for more details, see De Graeuwe et al. (2020, p. 7)). Each flow factor was assessed with 2-5 statements. Students ranked each statement on a 4 Likert scale.

2.4. Analysis of survey results

All the questionnaires were anonymised. The study included 68 students for the pre-survey and 72 for the post-survey. After data cleaning, 50 students were retained for the analysis of knowledge questions (17 from Agronomy; 6 from Chemistry; 10 from Environment; and 17 from Forest). Aberrant data was removed from the database. Students who did not answer all the open-ended questions in both surveys (even if it was required) were discarded for the knowledge section. For the flow assessment, the 72 students of the post-survey were all retained. All statistical data analyses were performed using R software v.4.2.2 (R Core Team, 2022) and a $\alpha = 0,05$ for significance level.

Each student's pre- and post-scores were calculated and registered. For the multiple-choice questions, students received a score of 1 when they had a correct answer, 0 when they did not answer, -1 if the answer was not correct. For open-ended questions, students are given a score between 0 and 3 depending on the number of correct answers given, compared to those expected. They are given a score of -1 for each incorrect answer. The result of each question is added up to calculate the total score. The maximum score that could be reached is 39 and it was converted into percentages. Final scores were used to calculate descriptive statistics (e.g average and median). Then, a paired t-test was performed with the null hypothesis of absence of increase of the scores between the before/after the 4-hour lesson. Subsequently, the scores of each specialization were calculated and the same statistical analysis as previously described was performed.

The score for the feedback questions is calculated by converting all answers to each of the 45 statements with a scale from 1 to 4 (1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree). Each flow factor score was calculated by adding up the results of all statements

corresponding and divided by the number of statements included in the flow factor itself. Final flow scores were used to calculate descriptive statistics. Mean scores were calculated for the group of all students and by specialization.

3. Results

3.1. Results of knowledge acquisition

On the knowledge pre-survey, the student's general mean was 14.7 % of correct answers (Table 1). The scores differ significantly among the type of questions: Open-ended questions reached the highest scores (21.3%), while close-ended questions recorded the lowest (9%). The scores did not differ significantly among the specializations. On the knowledge post-survey, the students' general mean was significantly ($p < 0.05$) higher: 18.5%. Their progression was very highly significant for open-ended questions ($p < 0.001$).

Table 1. Mean of students' scores (% of correct answers) on the knowledge survey during the pre-survey and post-survey, and the increase after the 4-hour lesson (percentage points).

<i>Grouping of Data (and number of students)</i>	<i>Pre-Survey</i>	<i>Post-Survey</i>	<i>Increase</i>
All students	14.7	18.5	3.8*
<i>By specialization</i>			
Chemistry (6)	14.5	18.4	3.9
Forest (17)	13.4	19.1	5.7
Agronomy (17)	16.1	17.3	1.2
Environment (10)	14.6	19.2	4.6
<i>By type of questions</i>			
Close-ended questions	9	9.5	0.5
Open-ended questions	21.3	28.8	7.5***

Legend: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; no symbol $p > 0.05$.

Overall, 31 of 50 students increased their scores, 5 had the same scores, and 14 decreased their scores slightly (Figure 1).

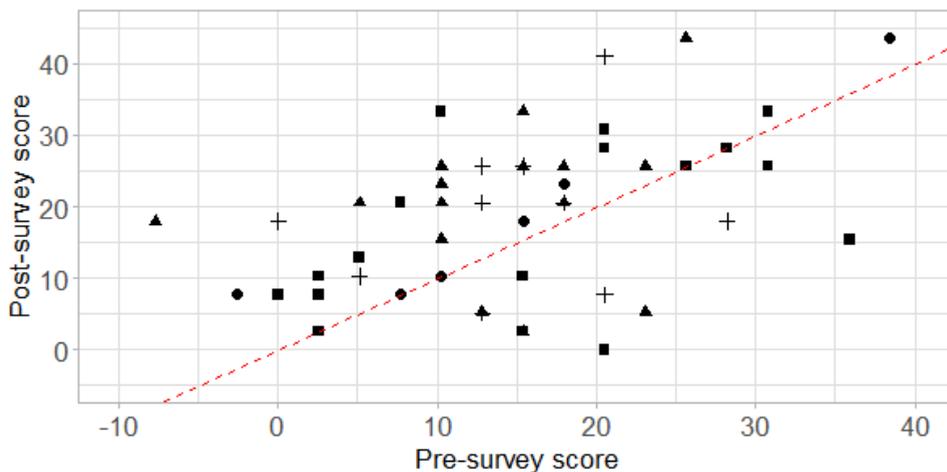


Figure 1. Comparison of students' mean scores on the knowledge pre- and post-surveys, by their specialization: Agronomy ■, Chemistry ●, Environmental + and Forest ▲.

3.2. Perception of SEGAE and its evaluation through flow

In the feedback post-survey, 83% of the students “agreed” or “strongly agreed” with the question “I enjoyed the game without feeling bored or anxious”. Therefore, the SEGAE game is globally appreciated by students. Moreover, 91% of students “agreed” or “strongly agreed” with “The game increased my knowledge”. The eight factors have an average of 2.93 points (i.e., ≈ “agree”) out of 4 (Figure 2). The factors “social interaction” and “feedback” are rated particularly low compared to the others. For each specialization, the flow average was carried out and compared to the general mean. Only chemistry students have a slight difference, with an average of around 3.25 points out of 4 (Figure 2).

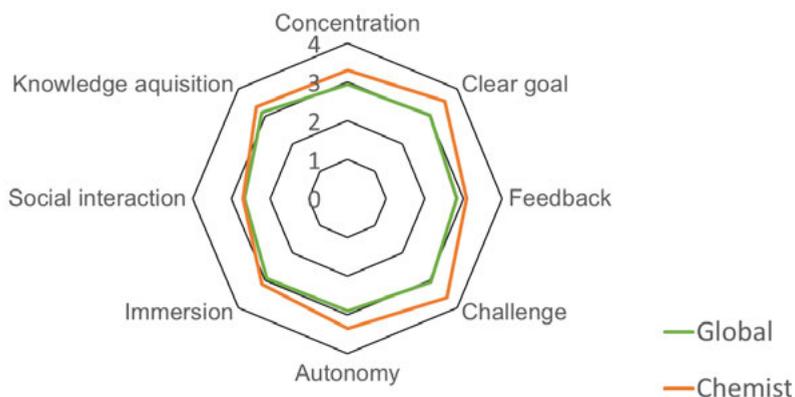


Figure 2. Radar chart on chemist mean scores for the eight flow factors compared to global mean score.

4. Discussion and conclusion

Students significantly increased their knowledge in agroecology using the game. This result corresponds to 60% of the mean increase previously recorded for a 5 day workshop in a similar curriculum (6.4 percentage points for “multidisciplinary” see De Graeuwe et al. (2020, p. 13)). More particularly, students increased their performance with respect to answering open-ended questions, those which required them to analyse problems in their global context and as parts of an interconnected whole. The game thus appears to improve the ability of students to articulate their existing and newly acquired knowledge. The game makes it easier to link different knowledge by mobilizing it simultaneously. However, the metacognitive involvement of each student depends of their profound enjoyment and concentration (i.e. a good level of ‘flow’). The results show that SEGAE provides such a context for metacognitive learning. The knowledge increase recorded in open-ended questions is assumed to reflect the increase in the meta-knowledge of students. Accordingly, following a 4-hour lesson with a single teacher seems promising in terms of learning.

Every specialization increased their mean. The agronomy specialization has the lowest increase. Agronomy students already had knowledge about agroecology and breeding systems. Therefore, it is important to note that their scores were already higher in the pre-survey, thus reducing their possible progression in the post-survey. To the contrary, the other student groups, only had limited knowledge on the fundamentals of agroecology. Therefore, it could be argued that this limited knowledge opened the space for a greater progression, than student specialized in agronomy. Overall, the means pre- and post- surveys are extremely low; particularly for close-ended questions. Two explanations can be highlighted to explain those results.

First, the unplanned digitalization of this lesson due to covid-19 period involved poorer interactions between the students and the teacher. This is reflected in low reported level of flow factors: “social interaction” and “feedback”. Moreover, surveys were done online without any supervision, which caused problems to receive answers of these surveys in time. For further study, the answering time to complete the survey could be analyzed to identify aberrant data. Also, a replica could be performed with a larger number of students to validate results found.

Secondly, low knowledge results and low levels of surveys’ submissions can be explained by the language used for the surveys. They were in English, while most of the students being francophones. As such, this may have created difficulties with comprehension of the questions and thus slowing down the progression rate in the surveys. For further study, 4 steps are recommended: (1) translate surveys in French; (2) select a 5 to 10 % of final sample size; (3) administer the questionnaire to the selected percentage and (4) assess understanding of these students about each question (Roopa & Rani, 2012, p. 276).

Concerning the feedback survey, the height factors of flow showed that students assessed the game positively. A large majority (>80%) of them reported that they enjoyed the game and felt that they increased their knowledge thanks to it. These results reinforce the use of serious games and particularly SEGAE to learn agroecology. Indeed, this game allows students to learn through an active posture which helps to overcome the knowledge-action gap. Especially as this knowledge-action gap has been demonstrated as a critical competence in learning agroecology (Østergaard et al., 2010) .

To conclude, this study confirms that the format of the game SEGAE in a 4-hour lesson with a single teacher is a relevant tool in learning agroecology. Students appreciate learning using this game. Therefore, the development of serious games is an alternative for the future of agroecology learning. As the activities took place online rather than face-to-face (as initially planned), the acquisition of agroecology knowledge might have been impacted. The same study carried out in a non-covid period would allow to determine the influence of online lesson.

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Managing european interuniversity collaboration: a bottom-up approach to identify digital education challenges from below

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Abstract

The European Commission has engaged with cooperation and collaboration between European universities to ensure digital education sustainability. In this study, we research inter-university collaboration from “below”, i.e., considering the actors directly involved in educational activities, such as teachers, students, and academic staff. In this bottom-up approach, and under the frame of an Erasmus+ project, called OpenU, we managed a consortium of European universities which conducted a series of educational experiments that accounted for specific challenges, mainly, from organizational, pedagogical and technological dimensions. Challenges identified in the organizational dimension include HEIs’ information flow, staff mobility, alliances, and multistakeholder content. In the pedagogical dimension, challenges include intercultural and adaptable content, pedagogical support, and diploma recognition. Finally, in the technological domain, challenges include advertising and support, and proper infrastructure. Our research aims to contribute to the discussion about the relevance of evidence-based data to feed education policies.

Keywords: *Digital education; european higher education institutions; inter-university collaboration; bottom-up approach; Open-U project; Erasmus+.*

1. Introduction

The digitalisation of education, fostered by the increasing use of information and communication technologies, has promoted different collaboration activities for higher education institutions (Amemado, 2010). The European Commission has encouraged the creation of “digital programmes” between European universities, through the development of innovative joint pedagogical activities, e.g., distributed learning models. In this context, cooperation activities in the educational field are normally encouraged at the policy level relying on a top-down approach (Carpentier, 2012), which often entails implementation tensions among “down-stream collaborators”, specially when policies “from above” overlook the different contextual realities of education-related stakeholders.

In the present work, we contend that policy decisions affecting educational cooperation may be efficiently fed through a bottom-up approach. In contrast to the top-down perspective, the bottom-up approach implies researching (innovative) pedagogical methods coming “from below”, i.e. the people directly impacted by educational policies, such as teachers and/or headmasters directly (Carpentier, 2012). To research collaboration “from below”, we have managed a consortium network of seven European HEIs, which has allowed us to identify critical challenges emerging from inter-university collaboration in the domain of digital education. As a result, challenges were organized around three main dimensions: *organizational*, i.e., aspects related to the logistical part of the cooperation; *pedagogical*, i.e., aspects related to didactics and learning; and *technological*, i.e., elements related to the technologies used for cooperation.

Through our study, we argue that a bottom-up approach to collaboration may be a powerful evidence-based tool to feed education policy reforms.

2. Theoretical background: Inter-University Collaboration and the Bottom-up Approach

Inter-university collaboration is often implemented following education policies, through a process which is complex since several stakeholders are involved. The diversity of actors, for example, in terms of limited resources and institutional restrictions, can lead to “policy failure” if actors “from below” are not “understood” and “known” properly. In this sense, it is important to understand collaboration, clarify its determinants and explore ways to make it more transparent and effective (Viennet & Pont, 2022).

Effectiveness of education policies is often researched following two approaches: top-down and bottom-up (Napoli, 2021). While the top-down research considers policy from the point of view of decision-making and observes how it is implemented by the actors, the bottom-up analysis considers that policy is first and foremost implemented by the actors who interpret

the decisions in light of the situations they encounter with the beneficiaries of the policies (Napoli, 2021). From this approach, the aim is then to direct attention to the individuals situated “at the bottom of the pyramid”, as they play an active role and exert influence by making changes to the policy (Carpentier, 2012).

In the domain of education, specifically, the bottom-up approach aims to improve everyday teaching practice through participatory research and development (Straub & Vilsmaier, 2020). In this sense, bottom-up approaches emphasize the active participation of teachers and (co-) ownership of the initiation, development and implementation of innovations. Thus, bottom-up approaches are dynamic, iterative-cyclical and open-ended processes.

In line with the literature on bottom-up methodologies, we have empirically researched collaboration among European HEIs to shed light on the challenges related to the creation and implementation of innovative pedagogies, such as online and distributed learning, which are currently at the core of education policies in Europe.

3. Methodology

Our objective was to research collaboration “from below”, that is to say, to identify HEIs’ challenges related to the creation and implementation of innovative pedagogies, such as blended learning, online learning, distributed learning, among other forms.

3.1. Participants

To research collaboration “from below”, we coordinated a network of seven “experimenting partners”, in the framework of OpenU, an Erasmus+ project which aimed to “foster European cooperation, innovation and sustainability in higher education (...), provid(ing) a digital infrastructure for higher education policy experimentation in blended learning, mobility and networking” (see <https://openu-project.eu/>).

To attract researchers from the OpenU network, we designed a “Pre-Call” and a “Call” template, which were revised and iterated at least three times by organizers. The Pre-Call aimed to target internal “experimenters”, either academics or staff participating already in international projects in the field of education (e.g., UNAEUROPA, EIT Digital, among others). The Call aimed to promote the activity at a general level, including researchers from different departments and units. Through both calls, interested researchers had to express their motivation, describe additional collaboration networks, and provide a preliminary description of their potential projects.

As shown in Table 1, 8 projects were finally developed in partnership with contributors from and outside the consortium (marked with *) while four experimentations were developed without partners because they consisted in pedagogical activities whose aspect to be tested

would not require further cooperation. In all experimentations, different actors (teacher, staff, and student) and settings (micro-course, course, program) were considered.

Table 1. Projects including leaders and internal and external (*) contributors.

Projects Under Experimentation Management	Source (leader)	Target (contributor)
1. "Educating the Trainers — Blended Content Production Catalyst"	Aalto	UCM, FUB
2. "Scientific posters across boundaries: design of distributed group research activity"	UCM	Rennes, Trento
3. "Joint digital, interactional teaching formats –How to implement collaborative online and blended courses"	UCM	FUB
4. "eTandem - Online Language Partnerships"	FUB	Bologna, *Edinburgh
5. "Designing and supporting Virtual Mobility activities"	KULeuven	*Others
6. "Definition of users' needs in the digitalization of EU HEIs"	Paris1	JUKrakow
7. "Preparation and delivery of an international collaborative MOOC: an analysis on the pedagogical and technical implementation"	Bologna	KULeuven, *Wurzburg *diParma, *Hamburg
8. "One Health in Bloom"	Bologna	FUB, *Edinburgh, *Helsingin yliopisto, JUKrakow, KULeuven, UCM, Paris1
9. "Gamification tools in Higher Education: Implementation of the Escape Room in the Pharmacy Degree"	UCM	No partner
10. "Students as main actors of European HEIs: general survey of student population in the aim of establish needs, aspirations, fears and hopes in the digital turn of EU HEIs"	Paris1	No partner
11. "Distributed training of students for the quality improvement of their bachelor's and master's theses"	UPM	No partner
12. "Technology Watch to find Solutions to Social Challenges of our Society"	UPM	No partner

3.2. Data and data analysis

Challenges were identified along the experiments conducted by the network of partners. Experiments were conducted directly by the actors in the field (teachers, students, university members, etc.). A wide variety of methodological techniques were included, for example, interviews, focus groups and surveys. Experimenters used different devices (video conferences, platforms) or tests including synchronous and asynchronous activities to achieve their objectives. Experimentation leaders reported on the experiments, following a pre-defined template, including the following information:

- Identification details (leading partner and contributors)
- Experimentation name
- Dates of execution
- Level of application (session, module, course, program, other)
- PAs
- Abstract
- Context
- Research justification
- Questions and objectives
- Methodology
- Results and discussion
- Conclusions

The article-based format of the reporting allowed us to identify three patterns of results in relation to organization, pedagogical and technological aspects. Reported results were analyzed and more specific patterns related to challenges emerging from digital cooperation were identified.

4. Results

The analysis of the experiments conducted within the framework of the Open-U project allows us to clearly identify three dimensions impacting the collaboration between universities in the domain of digital education: organizational, pedagogical and technological.

4.1. Organizational dimension

In the organization dimension, we found four main aspects: information flow, staff mobility, alliances, and multistakeholder content. In terms of *information flow*, i.e the way information moves throughout the education system, researchers at Paris 1 found that students and teachers tend to be unaware of the collaborative projects conducted by the university, which clearly results in a disconnection between academics and students. Regarding *staff mobility*, researchers at KU Leuven observed that an effective e-mobility policy requires an “interdisciplinary approach” articulating systematically actors with different hierarchies and from different departments or faculties. Regarding *HEI alliances*, several experiments (UPM, Aalto, FUB) have revealed the importance of including partners other than universities, with the development of an ecosystem of partners to share relevant information, for example. Finally, *collaborative creation of content and pedagogical activities* was identified as an important sub-dimension to maintain sustainability in the inter-university relationship. Researchers from Bologna and UPM have shown that the creation of educational content

should involve the design of a transnational collaborative environment, involving the best professionals of the partner network, and using distributed repositories accessible to any member of the community, either student, teacher or staff.

4.2. Pedagogical dimension

In the pedagogical dimension, we found three aspects: intercultural and adaptable content, pedagogical support, and diploma recognition. Regarding *intercultural and adaptable content*, Paris 1 researchers found that the adaptability of learning content and assessment methods are crucial for a “digital university”. Interestingly, researchers from FUB, Bologna and KU Leuven argue that networked education implies both new course content and new learning and teaching methods that should take into account language differences and cultural exchanges. Regarding *pedagogical support*, Aalto researchers found that there is a need to support teachers in the design and delivery of e-learning or blended learning activities (e.g. through video recording). They argue that when organisations start to produce their first units of e-learning or blended learning content, they generally do not understand the process involved and the key elements needed at each stage to succeed. With regard to the *recognition of qualifications*, UPM researchers stressed that one of the first steps for the creation and implementation of distributed learning should be the exploration of local regulations on the use of educational infrastructures, such as ECTS, for example. These researchers propose that consortia providing short collaborative modules could benefit, for example, from the use of one ECTS, which could be inserted into pre-existing courses of formal masters courses currently running at partner universities.

4.3. Technological dimension

Regarding technological dimension, we found two aspects: advertising and support; and proper infrastructure. In relation to *advertising and support*, KU Leuven researchers suggested that digital infrastructures could be used to market learning and vocationalization opportunities to educational developers and teaching staff. FUB researchers emphasised the importance of the possibility of offering real-time support to teachers and students. They point to the need for sustainable support services for teachers (technical, didactic and pedagogical) and for student mobility. Regarding *infrastructure*, most researchers (e.g. Paris 1, KU Leuven and UPM) identified the need to develop an infrastructure with a high level of interoperability, i.e. that can be connected to other European platforms, databases and repositories. Easy access to these platforms, “with minimal registration requirements”, was also highlighted by Bologna and Aalto researchers.

5. Discussion

The analysis of the experiences of the Open-U project highlighted a number of challenges of virtual collaboration at the organizational, pedagogical and technological level. In terms of the organizational dimension, Coombe (2015) highlights that the most frequently mentioned barriers to inter-university collaboration are conflicting interests and expectations of partner universities, lack of allocated time, lack of support or inconsistent leadership, geographical distances and incompatible and bureaucratic systems. The challenges related to faculty workload and lack of institutional support seem to be confirmed by the literature. Indeed, Caluianu (2019) showed that increased workload and lack of administrative support are challenges faced by teachers in adopting this type of teaching.

Pedagogically, our findings on intercultural and adaptable online content are confirmed by the literature, which recognizes that there is a need to integrate and connect the inter-university online curriculum with international dimensions through international curriculum, co-design and collaboration (Devonshire & Siddall, 2011). Secondly, about the challenge of multi-actor content, the literature emphasizes that inter-university collaborations from different countries require an additional effort from educational teams, because this implies that they go out of their comfort zone and work against barriers (differences in academic standards, languages, academic calendars and time zones) that hinder this collaboration. Interestingly, the temporal challenges encountered in implementing these innovative modalities are consistent with those identified in the literature.

In terms of the technological dimension, literature has highlighted the importance of instructors and students being familiar with the technology used, as this plays an important role in the success of exchanges (Avgousti, 2018). Among those technological aspects, the platform, ICT tools, student learning materials, software and formats, and characteristics of course management should be considered (Soto-Acosta et al., 2014). As shown from the literature, the quality of the ICT infrastructure and the lack of technical experts may impact the successful implementation of distance education policies.

6. Conclusion

We have explored collaboration among HEIs to shed light on the challenges related to the creation and implementation of innovative pedagogies, which are currently at the core of education policies in Europe. To this end, we have examined European inter-university collaboration from a bottom-up approach, in which a consortium of institutions have accounted for specific challenges emerging from three dimensions: a) organisational (HEI information flow, staff mobility, alliances and multi-stakeholder content), b) pedagogical (intercultural and adaptable content, pedagogical support, recognition of diplomas), and technological (publicity and support, adequate infrastructure). Through our results, our

research aims to contribute to the discussion about the relevance of evidence-based data to feed education policies.

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Deep learning: a study on marine renewable energy and sustainability education in an Irish context

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Abstract

In 2020-2022 a select group of Irish educators, marine renewable energy proponents and sustainability stakeholders entered into dialogue with a view to enhancing post-primary educational resources. The paucity of educational resources in this field was highlighted, most notably Irish language resources. This dialogue led to the development and piloting of a bilingual (Irish and English) cross-curricular programme of learning - a Transition Year Unit - targeted at students aged 15-17. This pilot study aims to evaluate the effectiveness of the learning unit with respect to enhancing knowledge in these novel areas. The methodology is a mixed methods case study. Data gathering processes include student questionnaires, stakeholder focus groups, and expert interviews. The main finding is the importance of stakeholder input into curriculum development to ensure the effectiveness of the Transition Year Unit of Learning, and to enhance learner engagement. Furthermore, the study recommends that dissemination include a web-based 'Deep Learning' educational platform with downloadable resources to enhance nationwide impact.

Keywords: *Global citizenship; marine renewable energy; sustainability education; transition year programme.*

1. Introduction

There is evidence of a growing body of literature in the fields of sustainable development education (SDE) and global citizenship education (GCE) (Gorben & Yemini 2017). Marine renewable energy (MRE) is one dimension of SDE which entails harnessing sustainable energy from wind, tides, waves and ocean currents. MRE is much debated, not least because of the complex technical, ethical, environmental and ecological challenges that it entails (Borthwick 2016; Weiss et al. 2020; Kulkarni & Edwards 2022). MRE education, which addresses the complexities of MRE, is pertinent for Ireland, an island nation with limited energy resources and a view to increasing indigenous production of renewable electricity. Irish MRE research, education and training is currently facilitated by an number of Irish organisations, not least the Marine Institute, BlueWise Marine and Sustainable Energy Authority of Ireland (stakeholders aligned with this study). The Marine Institute (2017), for example, speaks of the ‘marining’ of education. A prior study by the authors of this paper, incorporated exploratory dialogue with these and other selected Irish organisations with an interest in MRE. That study identified the need for educational resources for Irish language medium post-primary schools (*Gaelscoileanna*) and for Irish MRE educational research outputs (Logue et al. 2023). Building on this research, the aim of this paper is to evaluate the effectiveness of one strategic educational initiative pertaining to MRE education, piloted in a post-primary Irish language medium school (*Gaelscoil*), in the west of Ireland, in 2022. The methodology is a case study and the data gathering methods include a stakeholder focus group, student questionnaires and expert interviews.

2. Context

In 2015 the United Nations published ‘Transforming our World: The 2030 Agenda for Sustainable Development’, in which sustainable development goals (SDGs) were identified. Following this, the Irish Government began a process of curriculum reform and re-design in order to incorporate SDE into the Irish curriculum (Department of Education and Skills 2020). The Irish Teaching Council also set out its expectation of GCE training in initial teacher education (Teaching Council 2020, p.14). In light of these developments, in the period 2020-2022, a collective of Irish educators, MRE stakeholders, and academic researchers, in the west of Ireland, entered into exploratory conversations around enhancing bilingual (Irish and English) educational resources, in the areas of SDE, GCE and MRE, in Irish post-primary schools¹. It was established during these exploratory conversations that Irish language medium schools were the most negatively impacted schools, given a significant lack of Irish-language educational resources relating to SDE, GCE and MRE

¹ The project stakeholders and funders are Atlantic Technological University, Marine Institute/Foras naMara, BlueWise Marine Ltd, Sustainable Energy Authority of Ireland, Údarás na Gaeltachta, and Coláiste Chroí Mhuire gan Smal, Spiddal, Ireland.

nationally. This dialogue led to the development and piloting of a bilingual (Irish and English) cross-curricular programme of learning, namely a ‘Transition Year Unit’ (TY Unit), targeted at senior level post-primary students in the Irish education system, aged 15-17 years. The TY Unit was in the form of a 10-week planning scheme, incorporating subject specification learning outcomes, STEM-related curriculum content, teaching and assessment strategies, weekly lesson plans, bilingual lesson resources and wider supporting educational resources. It was agreed by the stakeholders that this MRE educational output would be piloted in one west of Ireland, Irish language medium school (Gaelscoil) in close proximity to a marine research testing site, where MRE public debates are in evidence.

3. Methodology and Methods

A case study methodology was employed and data gathering was a three-phase sequential process involving a stakeholder focus group, expert interviews, and student questionnaires.

3.1. Qualitative Research: Focus Group

Phase one consisted of a stakeholder focus group comprised of six funding representatives from Irish organisations with expertise in marine science, marine renewable energy research, STEM education, and the Irish language. The focus group was held online, using MS Teams. It commenced with a brief presentation on the research aims, after which guiding questions were used to explore participants’ perspectives on MRE education, SDE and GCE educational resource development, and bilingual resource development. As part of the focus group, a first-version TY Unit (iteration one) was critically assessed. This first iteration was informed by literature research and the specifications of the Irish post-primary STEM curriculum. This iteration was circulated to the focus group participants prior to the focus group in order to maximise the quality of the discussion. The primary role of this discussion was to provide guidance on the further enhancement of the TY Unit. Following the focus group, the original TY unit was re-designed by the research team (iteration two).

3.2. Qualitative Research: Expert Interviews

Phase two entailed five expert interviews which were conducted with selected Irish experts in the fields of marine renewable energy, oceanography, and sustainability. The first interview was a pilot interview which was co-reviewed by academics with attention to validation and enhancement. As with the prior focus group, the interviews were online, and recorded, using the MS Teams platform. A primary focus of the interview was a critique of the TY Unit (iteration two), which had been circulated in advance of the interview, along with guiding questions. Subsequently, the TY Unit was amended (iteration three).

3.3 Mixed Methods Research: Student Questionnaire

In phase three, this third version of the TY Unit was further reviewed by representatives of the host case study pilot school (including management, STEM teachers and students). Following this, a final version was drafted (iteration four) that was agreed by all parties. Subsequently, the TY Unit was delivered by a member of the research project team: a qualified bilingual post-primary teacher-researcher. The pilot delivery of the TY Unit took place in the host school weekly, over a 10-week period, February to May, 2022. Purposeful and convenience sampling was employed. The TY students in the pilot school (Gaelscoil) were invited to participate, and all opted in voluntarily as research participants to the study (n=30). Demographically, in terms of nationality, 28 students identified as Irish, one identified as Brazilian and another as Irish/Somalian, the gender profile was 17 female and 13 male, and the age range was 15-18 years. Ethical approval for data gathering was obtained from the host school, in loco parentis, since some of the participants were as yet 'minors'. A student questionnaire, generated using MS Forms, and containing 30 questions, was utilized to capture students' perspectives. The questionnaire included open and closed questions, of a variety of types - Likert Scale, yes/no, selection options, and opinion/example-type questions, including specific questions relating to MRE education- coded below as MREE [Qs 8-19]. The questionnaire, which was anonymous, was distributed at the commencement of the TY Unit (a baseline questionnaire) and again at the conclusion of the unit of learning, (a final questionnaire), in order to monitor learning.

4. Findings and Analysis

A concise analysis of the dominant findings of the study is presented below with reference to the data and to relevant literature. Firstly a brief account of the data analysis methodology is provided with respect to the qualitative research methods in the case of the focus group and expert interviews. Following this, a mixed methods analysis is provided with respect to the student questionnaires. themes and related sub-themes were generated: teaching of MRE, public relations within MRE, marine industry perspectives, and sustainability and society

4.1. Qualitative Research: Data Analysis Methodology

A thematic analysis was applied to the qualitative data arising from the focus groups and expert interviews, based on an adaptation of the inductive six-stage model of coding and analysis articulated by Braun and Clarke (2021). This six-stage model includes: familiarization with data, generation of initial codes and categories, identifying themes, reviewing themes, defining and naming themes and producing the report. Manual colour coding of data transcripts and related notations were used to identify first level codes and categories within the data sets. Co-coding was facilitated by an academic researcher (>10% of data). MS Word and MS Excel tools were utilized to chunk, cluster and refine related

themes to the point of saturation, where all codes were accounted for in a final re-organisation of data. At this point the four dominant themes were generated (see above).

4.2 Qualitative Research: Focus Group and Expert Interviews

In the following discussion of the generated themes, stakeholder participants are coded as S and numbered (S1, S2, S3, etc.), the pilot expert interview is coded as P, and further expert interviewees are coded as E, and numbered (E1, E2, E3, etc.).

With respect to the teaching of MRE in the TY Unit, sub-themes included teaching methodologies, factors in delivery of content, types of resources and important concepts/messages. Active, collaborative and reflective teaching and learning approaches were advocated, as well as field trips and guest inputs, demonstrating an awareness of the target audience (E4). One interviewee emphasised the need for educational programmes and resources to “develop learners’ understanding of the community that they’re in, of the properties of the local environment, the local heritage of how it relates to them, and how they live their lives” (P). This point was built upon by another interviewee who spoke of “thinking global and acting local”(E1). Also, empowerment of learners was highlighted, specifically youth (E4).

Two sub-themes were generated relating to MREE and public relations, namely, the wider promotion of MREE and the need for sensitivity in regard to inter-relations with public stakeholders, e.g. local community representatives, fisheries representatives, local heritage groups, environmental groups. Local sensitivity and the need for local trust-building was identified as a significant factor: one stakeholder spoke of the need to develop learners’ understanding of their community they live in and stressed necessary community education in relation to MRE, including test sites and local heritage interests (S2).

With respect to marine industry perspectives, sub-themes included marine types and technologies, career opportunities, factors impinging the marine environment, and marine legislation and policy. One stakeholder identified specific technological curriculum content, devices and technology necessary to inform learners on the TY Unit (S3). Examples were spelt out: engineering, finance, computers, artificial intelligence, and graphic design (S1). Potential marine careers were highlighted, and the need for the TY Unit to get learners “interested in research and marine careers more generally, and maybe increase their knowledge because a lot of the time they wouldn’t be aware of the different careers that are in the marine area”(S3). The multifaceted and multi-disciplinary nature of MREE was discussed, including the need for integrated mathematics, science, engineering, and local heritage, in the context of a life-long learning model, commencing at pre-school level (E2).

Finally, regarding sustainability and society, two sub-themes were generated: society and the marine, and integrated sustainability factors, the latter emphasising GCE, SDE, the marine

ecosystem and climate action. The need for reformed legislation was noted (E2; E3). One interviewee stated that “Ireland is actually changing at the moment so we're reforming our legislation that covers marine development” (E3). In the context of climate change, local knowledge and local politics was commented upon, in the context of developing the TY Unit: “...try and bring it down to a local level to show students what they can and can't have control over” (E4).

4.3. Mixed Methods Research: Student Questionnaire

Focusing on MRE (Q.s 8-19), it was demonstrated that the TY Unit resulted in increased MRE knowledge, including greater marine or ocean literacy precision. Learners explicitly acknowledged increased learning as a result of engaging in the TY Unit (Q.10). With respect to Q.8, while in the baseline questionnaire students had a vague and somewhat confused understanding of MRE potential, in the final questionnaire, students cited a number of very specific possibilities for MRE in Ireland, given its geographic location, as part of the reason for it being important. In addition, they cited the ability to reduce use of fossil fuels, reduce dependence on other countries for energy, the need for a more sustainable source of energy and the goal to reduce fossil fuel usage in general (Q.12). These more insightful responses accounted for half of the cohort (50%), with the remainder also giving answers containing some insight (Q.12). With respect to the environmental impact of MRE (Qs.13 & 14), in the baseline questionnaire, 70% of respondents indicated that they did not know if there was an impact on the environment, as a result of MRE. In contrast, in the final questionnaire, while there was still no consensus regarding the impact of MRE on the marine ecosystem - with ‘yes’, ‘no’ and ‘maybe’ equally represented – answers were more nuanced. Students could now provide more technical arguments on both sides and certain answers given were more detailed, reflecting increased knowledge in the area: “...some of the underwater equipment can be dangerous for marine life. For example, propellers that use the waves” and “...if anything, some of the machines can serve marine life in an advantageous way such as one machine that acts like a reef and helps ecosystems in that way”. In general, more expanded understandings of environmental concerns (including marine) was in evidence in responses to Q. 17. This more nuanced and informed understanding of the complexities involved mirrors recent literature, where the complexities of sustainability ethics, and the need to negotiate trade-offs between competing sectors and interests are highlighted (Kulkarni and Edwards, 2022; Galparsoro, et. al, 2022). See Figure 1 where non-renewable energy (NRE), offshore fishing (OF), plastic pollutants (PP) climate change (CCC), all /other options are explored and where a shift in understanding is evident.

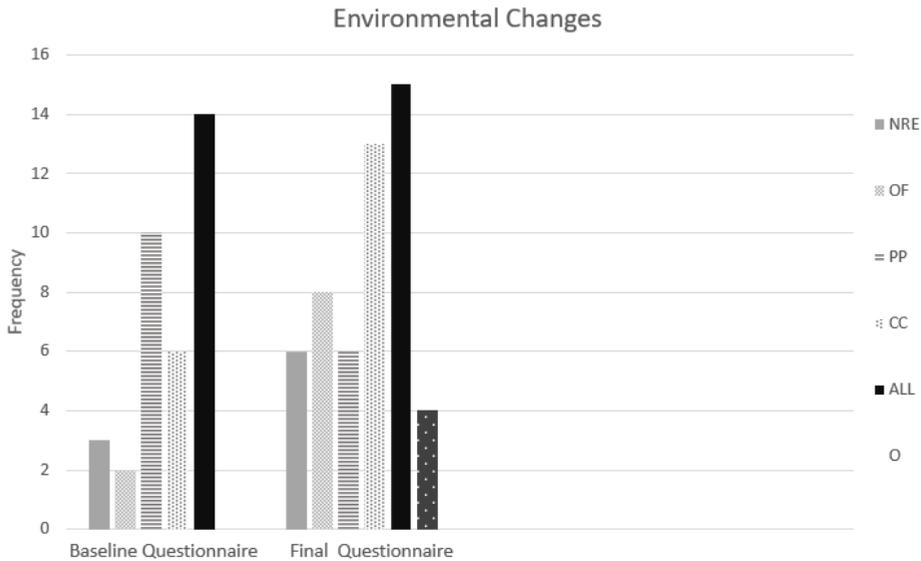


Figure 1. Environmental concerns today: baseline and final questionnaire

5. Conclusions and Recommendations

The main conclusion arising out of this pilot study is the effectiveness, on balance, of the research project's TY unit of learning as a MRE and sustainability education resource. Its overall capacity to enhance knowledge of MRE education among post-primary students in the pilot school (*Gaelscoil*) was demonstrated. This was largely attributed to educational inputs from marine experts and educators, who contributed to the curriculum design and content of the newly-developed TY programme. The study acknowledges the need for a balance between theoretical and practical learning in post-primary educational initiatives. It recommends that the educational resource outputs from the study will be more widely disseminated among Irish post-primary schools, not least the Irish language medium schools (*Gaelscoileanna*), in the form of a web-based 'Deep Learning' educational platform with downloadable resources to enhance nationwide impact. Also, ongoing development of further wide-ranging bilingual educational courses and resources, for the post-primary sector, is recommended, such as first year induction or 'taster' courses, and Junior Cycle short courses on MRE education, in the context of GCE and SDE. While this study goes some way to addressing an identified gap in the literature, and in Irish education, it is acknowledged that the sample size is relatively small and, as a case study, the findings are localized and non-generalisable. Furthermore, the focus of this study is primarily MRE- a specialist environmental area, not readily applied to other environmental contexts. However, many of the research project's educational outputs are flexible and adaptable, and may be readily adapted to other post-primary contexts in Irish education.

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Plant and plan, care and grow. A hands-on exercise using the (inner) sustainable development goals to teach research methodology to final year sociology students

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Abstract

Etymologically, the word seminar comes from the Latin semen, which means “seed”. Inspired by such linguistic archeology this text describes an exercise developed with undergraduate sociology students, who were literally invited to sow a seed and observe its growth over the course of a semester in which they must design a sociological research project. Transversally, the students perceived the exercise of germinating a plant as a metaphor for the development of the research project as a living and dynamic reality, highlighting the beginning, growth and maturation as key moments. Additionally, students emphasized that observing the germination and development of the plant allowed them to critically reflect on the different stages of the research project, while allowing their own inner development, namely with regard to the dimensions of “being”, “thinking”, “relating”, “collaborating” and “driving change”.

Keywords: *Inner development goals; social research methodology; sociology; sustainable development goals; SDG 4 - Quality Education.*

1. Introduction

Higher education is made of many teaching-learning contexts, including seminars. Etymologically, the word seminar comes from the Latin *semen*, which means “seed”. Inspired by such a linguistic archeology, a hands-on exercise was developed with higher education students, who were literally invited to sow a seed and observe its growth. The exercise was carried out with 37 undergraduate sociology students within the scope of the “Research Laboratory: Project Elaboration” (LabEP) course in the fall semester of the 2022/23 academic year. LabEP is a compulsory subject in the final year of the Sociology graduation at the University of Évora. The weekly workload is two theoretical hours and two practical hours, which is equivalent to a total of 6 ECTS, but classes often take the form of a seminar with strong participation by students. According to the study plan in force, the course aims to develop cognitive and reflective skills and its general objective is to serve as a scientific and pedagogical contextual framework for the construction of a sociological research project. The curricular unit is strongly articulated with “Research Laboratory: Project Execution” in the last semester. Both courses aim to support the construction and development of sociological research work and to complement the deepening of general skills, namely: ability to integrate theoretical, methodological, and empirical knowledge towards the identification and resolution of sociological problems; to develop rigorous and innovative analysis; clearly communicate analysis and results, as well as its foundations and justifications, in contexts of research and professional activity; and to stimulate autonomous personal learning processes. In line with the idea that higher education institutions play a key role in promoting sustainable development (SDSN General Assembly, 2017), this course intends to contribute to this, creatively using the sociological literature that recognizes the different ways of telling – and thinking – about society (Becker, 2007), and the power of the sociological imagination (Mills, 1959) to create new and more engaging ways of teaching and learning sociology (Atkinson and Lowney, 2016; Jones, 2017).

2. Context: Looking for deep learning experiences to foster (inner) sustainable development

At present, educating for Sustainable Development Goals (SDGs) is a core objective for higher education institutions (SDSN General Assembly, 2017). The 2030 Agenda envisions a world transformation (United Nations, 2015), that is inseparable from starting at universities (UNESCO, 2017). This appeal comes in the wider context of the important changes that are taking place in teaching and learning environments, namely those that claim the importance of “deep learning” rather than “surface learning” experiences (Atherton, 2009). As the 17 SDGs become widely publicized and increasingly known around the world, the non-profit, open-source initiative “Inner Development Goals” (IDGs) gains visibility as “an essential framework of transformative skills for sustainable development” (Inner

Development Goals, 2023). The IDGs framework consists of five dimensions organising 23 skills and qualities of human growth and internal development. The five-dimensional framework comprises skills related to “Being — Relationship to Self”, “Thinking — Cognitive Skills”, “Relating — Caring for Others and the World”, “Collaborating — Social Skills” and “Acting — Driving change”. According to the initiative, IDGs aims to develop inner abilities to deal with increasingly complex environments and challenges arising from the implementation of SDGs (Inner Development Goals, 2023), thus accelerating the work towards the UN’s Global Goals.

3. Plant a seed to investigate the outside and grow from within

3.1. Planting and planning

At the beginning of the semester, students were invited to carry out the germination experiment of a plant and carefully observe its growth. To carry out the activity successfully, the teacher distributed to each student in the classroom two seeds of a dry leguminous plant (beans), a sheet of kitchen paper and a plastic bag with a zipper closure. Instructions were given in the classroom: (1) students should start by opening the bag to free up space; (2) moisten kitchen paper; (3) fold the kitchen paper up to three times the size of the beans; (4) place the wet kitchen paper in the bottom of the zip-lock bag; (5) place a bean on top of the paper and another bean on the side of the paper that is in contact with the bag; (6) tape the bag to a window that receives a lot of direct light and leave it for a few days; (7) observe the germination and care for the plant, later transplanting it to a pot with soil, water and sunlight. Figure 1 depicts the teacher's exercise, taped to her home office window. A similar project was developed by the students, captured in the form of a photograph and submitted online via Moodle in the course area. This photograph was accompanied by a short reflection text of up to 500 words in which students were invited to reflect on their own research project and its relationship with the SDGs and IDGs.

3.2. Observing and anticipating

The activity instruction given to students in September, specifically asked them to carry out a plant germination experiment, carefully observe its growth, and reflect on the research project and its relationship to the SDGs and IDGs. Three months later, in December, students were invited to remember the exercise, to think about the different phases of anticipation, projection, growth, stagnation and eventual disappearance of the plant and to reflect critically on the elaboration of the research project as a result of academic investment and process of personal development throughout the semester.



Figure 1. Plant germination activity. Source: Photograph by RCosta (September 20, 2022).

Transversally, students perceived the exercise of germinating a plant as a metaphor for the development of the research project as a living reality. Specifically, moments of beginning, growth and maturation were highlighted in their narratives, as shown in the following excerpts taken from student's essays:

“In my opinion, the bean is a metaphor for the project. Just as the bean takes time to sprout and, after that moment, it grows day by day, the project also takes time. It may take a while for us to decide what we want to do, the theme, the approach, the methods, the location, but once the first idea comes to us, whether on a sleepless night or a busy afternoon, I think the project will flow until it is fully prepared to be executed.”

“The seed germination process finds a metaphor related to the elaboration of the research project. By sowing and consistently tending a small seed, a life is created. As in the project, from a small idea, perhaps coming from a moment of inspiration, different ideas and hypotheses are developed that can generate the final project. With patience and consistency, the idea is fed, doing research and working on different hypotheses, which will bring the project to life.”

“[...] in a metaphorical tone, I can associate the germination phases of a plant with the fact that the elaboration of a project is also done in phases, because just as the plant is sown, cared for and develops over time and with the help of some external factors. The elaboration of a project starts from a question at the outset, and then, with time and dedication, it develops through several stages of investigation, until it reaches its result.”



Figure 2. Plant germination. Source: Photograph by CFélix (October 7, 2022).



Figure 3. Plant after pot transplant. Source: Photograph by CCuco (October 21, 2022).



Figure 4. Plant in strong development phase. Source: Photograph by MVaz (October 18, 2022).

The metaphor that associates the germination of the plant with the elaboration of the research project gains strength as time progresses in the semester, since the course included the delivery of three reports in the form of a project in its preliminary, intermediate and final version. The photographs of the different stages of plant germination accompany this process of simultaneous growth and maturation (Figure 2, Figure 3 and Figure 4).

3.3. Caring and growing

Often in their written essays students emphasized how the exercise required them to develop specific skills that, while helping to prepare the research project, ultimately have repercussions in terms of their own inner development, in particular with regard to relationship to self, cognitive skills, caring for others and the world, social skills and driving change. The following excerpts illustrate, consecutively, each of these dimensions.

“[...] the experience of germinating a plant, it is related to the IDG's as it provides us with the opportunity to be present in a project, which obliges us to have an open presence, without judgments, awakening an basic mindset of curiosity, acting on a commitment of responsibility. When carrying out the project, we are under full responsibility for it, ensuring the commitment we have with it. In this investigation, trust is placed in us, the result of a mobilization of a group of people, in this case the class, to engage in purposes shared. A collaborative relationship, on the part of the teacher, in providing us with the necessary materials for its execution.”

“[...] [the project] fits within the competencies defended by the IDGs, due to the fact that both need planning, organization and insight to overcome the obstacles that arise. Both projects “require”, from the people responsible for their elaboration, a more critical type of thinking capable of developing our cognitive abilities, taking different perspectives, evaluating the information and, in a way, giving it meaning as an interconnected whole, also being capable of fostering genuine dialogue and constructively managing conflicts and adapting communication to different groups, transmitting an environment of trust. In short, both the aforementioned organizations and the research project push individuals to develop and deepen their relationship with their thoughts, feelings and body, helping them to be present, intentional and non-reactive when facing some kind of complexity.”

“When trying to put the beans in the bag with the damp kitchen towel and place them on the window, I felt that I would have to take responsibility for taking care of my research project in the same way as this germination, being necessary to be assertive (as in the case of the necessary water) and patience to wait for its growth.”

“Our growth is also dependent on the conditions that we have at our disposal throughout our lives, our abilities (to think, to act, to socialize, among others) being what we work to acquire and, ultimately, they are what define us as human beings. These capabilities are developed through our interaction with the world around us, whether through socialization, observation, among others. And like beans, sometimes it is necessary to change the environment in which we find ourselves so that we can progress in our personal development. The research project is also dependent on this, for its development it is necessary to carry out research and interactions, and the work invested by us is what is reflected in its final result.”

“Relating to the IDGs, this activity also allows us to reflect on how simple it is to generate life and how rewarding it is to accompany its growth and development. During this week I found myself checking over and over again the state of the little bean seed in the hope of seeing a sprout, of observing its development. It's very simple to leave for change, sometimes just a seed.”

The reflexivity around the failure of a first germination appears as particularly heuristic to understand the power of the suggested metaphor to deal with error and frustration, but also with courage, creativity, optimism and perseverance. Through the voice of a student, the following excerpt shows such a connection remarkably.

“The living things we care for eventually grow and “flourish” when properly cared for. Be it a plant, an animal, a baby, or even ourselves. We grow when we learn something new, when we improve our skills and abilities, and for that to happen, we need to take care of our brains and feed them with knowledge. Be there through reading, listening, socializing. We only grow when we care and feed our desire to do so. And at a certain point, this growth becomes invisible to the eyes, but it never goes unnoticed in our lives. Our abilities to be, to think, to relate, to collaborate and to act are always present in our lives and in our actions, projects, work, social relationships, and even in the relationship we maintain with ourselves. They are what define us as human beings and social beings, and we must never stop allowing ourselves to grow in what is our human essence. I planted a bean, placed it inside a very damp piece of paper and later in a closed plastic bag, then stuck the bag to my bedroom window and watched the bean every day. Unfortunately, I didn't see growth, but the appearance of mold. That's when I realized I had put in too much water, and it was too late to save it. Sometimes we want so much that something is not missing, that we end up exceeding the possible limits, and we end up suffocating the things we want to take care of so much. [...] In a second attempt, I put 3 little beans in a glass pot, on top of a damp cotton, and later I put the pot in the kitchen, near the window, where it will catch the sun throughout the day, and with the pot open, it will also catch air. We all make mistakes sometimes, and that's not why we should give up, because starting over is something that makes us grow and teaches us, if not the right path, at least what was the wrong path. So I realized that when we fail once, we can only try again, until it works, even if it takes us a long time. We have to let go of the idea that it's never too late to start over. Then I will look forward to the growth of my beans, and their “blossoming”, as well as I expect the same from myself every day, that it grows, and that it “blooms”.”

4. Conclusions

This article explored the pedagogical value of using a plant germination experiment as a practical exercise in the teaching-learning process of a course aimed at undergraduate

students engaged in developing a sociological research project. Transversally, the students perceived such an exercise as a metaphor for the development of the research project as a living and dynamic reality, highlighting the beginning, growth and maturation as key moments. At the end of the semester, the students emphasized how the observation of the germination and development of the plant allowed them to critically reflect on the different stages of elaboration of the research project while allowing their own inner development, namely with regard to the dimensions of “being”, “thinking”, “relating”, “collaborating” and “driving change”. Interestingly in the students’ narratives, the reflexivity around failure is heuristic to understand the power of the suggested metaphor to deal with error and frustration, but also with courage, creativity, optimism and perseverance.

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Community intervention model: social entrepreneurship education as a strategy for a sustainable development

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Abstract

Social enterprises are born to solve social problems without neglecting their financial, economic, and environmental viability. Consequently, in recent years, these ventures have gained strength as a viable and innovative alternative to achieve sustainable development, capable of combining economic growth, social inclusion, and sustainability for present and future generations. For this reason, this paper aims to identify the effect that community interventions in the teaching of social entrepreneurship aligned with development have had on the intention of providing a sustainable solution to current social problems. Therefore, in the present investigation, a qualitative analysis of the self-assessment texts was done by a sample of 138 young people who, in 2022, was trained. The results show a bigram of positive expressions related to learning the fundamentals of social entrepreneurship. Likewise, the interventions' favorable effect on young people's commitment to their community is confirmed.

Keywords: *Social entrepreneurship education; sustainable development; community intervention.*

1. Introduction

The COVID-19 pandemic hurt the world economy and had an unfavorable effect on social well-being by increasing the levels of global poverty and inequality both between individuals and between countries, thus speaking of a more significant loss of income, particularly in the groups with more vulnerabilities; factors that have increased the probability of economic risk so the households, the private initiative as for the governments (World Bank, 2022). The recovery becomes fragile and asymmetric when adding to the consequences of this health contingency, the current levels of global inflation, the contractions in the supply chains, the pressures on the labor market, and the over-indebtedness of developing countries (UN, 2022). The measures have focused on consumption and production but must address the environmental objectives within the 2030 Global Agenda for Sustainable Development (CEPAL, 2021).

Agenda adopted in 2015 by the 178 Member States of the United Nations, in which 17 objectives were agreed on whose purpose is economic growth combined with the end of poverty, peace, and prosperity for both people and the planet (UN,s.f.). The project seeks an achieve sustainable development that has “the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs” (UN, 1987, p.15).

Sustainable development is a complex global goal that social innovation must address. In this sense, social enterprises represent a possible alternative by attending to problems from a deeper, more effective, and accessible approach (Lubberink, 2019). Type I Social Businesses, following the classification of Yunus (2010), i.e., companies capable of generating economic and financial profitability and sustainable social impact in your communities; because social enterprises provide the necessary added value for economic reactivation post-COVID-19 and incorporate the people who make up the Base of the Pyramid (BoP) as the primary agents of this process (Méndez et al., 2022).

Among the consequences of the pandemic found that the most significant income losses among young people, women, and independent and temporary workers who had a lower level of schooling were registered; Likewise, the loss of learning in childhood is substantial and could increase the disparity in the future (ONU, 2022). Therefore, it is necessary to add to the dynamics of sustainable development the population that conforms to the BoP. That is, those people who live in a context of poverty, marginalization, or vulnerability (Wagner et al., 2018).

Universities play a more active role as social innovators, incorporating teaching models of social entrepreneurship with a focus on sustainable development through academic and service-learning activities and training in social entrepreneurship. The latter is necessary to develop sustainable projects that solve specific social problems (Villa et al., 2021).

From their sense of social responsibility, the universities "must equip students to understand the new economy and react swiftly to its socioeconomic crises" (García & Montoya, 2021, p. 1236). For this reason, the Faculty of Economics and International Relations (FEYRI) of the Autonomous University of Baja California (UABC), located on the northern border of Mexico, started a social service project supporting type II social businesses (social-based microenterprises) in 1999, in line with the proposal of Professor Yunus (2010). The project was transformed in 2017, in UABC-Centro Yunus, for social businesses and well-being; and currently continues to provide micro-business assistance. In addition, since 2021, the Center has been carrying out community intervention projects aimed at children, youth, and groups in a context of vulnerability to promote social entrepreneurship from empathy, following the guidelines of the SDGs. The purpose is to promote present and future actions for sustainable development and integrate the community into the knowledge transfer process in a multidirectional sense. Therefore, this document aims to analyze these interventions' effects on the population served.

2. Social Entrepreneurship by Sustainable Development

The current scenario requires changes in traditional models and generating strategies for constructing innovative ideas that involve communities traditionally excluded from the dynamics of growth and well-being (Méndez et al., 2022). It is not enough to create social value; social enterprises require efficient and effective scaling of value creation and appropriation (Lubberink, 2019). The groups that are part of the BoP must be the primary recipients of the benefits produced by said social innovations. Because, in these cases, the problem that social entrepreneurs want to solve directly affects the community's quality of life, they must use market mechanisms to reinvest those benefits in society (Simon & Rodríguez, 2021). Therefore, the venture must be sustainable to the point where it is possible to identify, build, and consolidate business ideas that involve the creation and incorporation into the market of goods and services, as long as they consider economic, social, and environmental impacts (Villa et al., 2021).

2.1. Social Entrepreneurship Education by Sustainable Development

The reasons why social entrepreneurship education has become popular are related to growing globalization, the rise of the knowledge economy, and the construction of the relationship between the State, the market, and civil society; for its part, in this reconfiguration, education is crucial for the development of skills, competencies, capacities and personal attributes aimed at economic development focused on sustainable development (Roussakis et al., 2020). Therefore, in recent years, higher education institutions have gradually incorporated, within their academic agenda, the promotion of education for social entrepreneurship (García & Ramírez, 2021).

Consequently, through education in social entrepreneurship, the university seeks to impact sustainable development not only indirectly but also actively participates in achieving the objectives. By generating strategies that contribute to achieving objectives, such as objective 4, quality education; goal 8, decent work and economic growth; and objective 10, reductions of inequalities. Social entrepreneurship education comprises co-curricular activities, practices, and internships and does classify into three approaches: accommodating and incorporating social entrepreneurship courses into the curriculum; integrating, adding co-curricular activities; and immersion, which involves students experimenting with reality and interacting directly with the community (Thiru, 2011).

2.2. Community Intervention Model for University Social Innovation

The social entrepreneurship education strategy focused on sustainable development make at UABC-Yunus Centre contemplates the three approaches mentioned above: accommodating, through the offer of a postgraduate degree in social business and the teaching of the entrepreneurship course at the bachelor's level, with a focus on sustainable and inclusive business; as well as integrating and immersion when developing community intervention projects. Table 1 shows the activities carried out in this regard, during the second semester of 2022, with a scope of 1,407 people trained in social entrepreneurship and SDGs, aged 2 to 25 years. In addition, in Table 1, it is possible to identify the Center's community intervention model, which dose made up of five modalities: workshops, short workshops; rallies, circuits of physical activities and reflection; boot camps, massive multidisciplinary training; fairs, self-organized events by students of the entrepreneurship subject, as part of their final project; and community projects, which involve immersion in the community and a direct approach to the problem and the social actors. The model in all its modalities comprises two strategies: gamification and learning by doing; the users of the courses and approaches work as a team to generate ideas of social impact with a vision of the SDGs in a simple, practical, and experiential way.

The approach with the community is in two ways: in one, it is the researchers and the students who perform training in situ, either in schools that locate on the outskirts of the city or in community centers; Likewise, the groups of children and youth in a context of vulnerability, are the ones who attend the center to receive the activities within the university facilities. The interventions are directed towards childhood and youth, as they represent one of the most vulnerable population groups within the BoP, as to promote in them at an early age the importance of generating social innovation consistently from empathy, putting people and the planet at the center; in addition to fostering their self-confidence and creativity. Further, it seeks to bring quality education closer, thereby reducing the inequalities in knowledge access.

Table 1. Community intervention Model of UABC-Yunus Centre, 2022.

Modality and Topic	SDGs¹	BoP²	GS³	LD⁴	Scope
Workshop: Ideas´ Ocean	6: Clean Water & Sanitation	Elementary Schoolers	Snakes and ladders: How to take care of water	Mural of Blue Entrepreneurship Idea	15
Rally with Community Project: Sustainable Stations	17 SDGs	Elementary Schoolers	Snakes and ladders about Blue Ideas, Lottery of financial terms and agricultural products	Scholar Orchard	120
Rally: Entrepreneurship & Sustainable Development	17 SDGs	Middle Schoolers	Statistics: horse race; Sustainable ideas: hot potato; Financial Concepts: Hopscotch	Conscious decision making	659
Rally: Career Plan and The 5 Dimensions of the SDGs	Five Dimensions SDGs: People, Prosperity, Peace, Partnership & Planet	High Schoolers	Roulette: economy and SDGs; Questions and answers: public administration and SDGs, memoranda: international relations and SDGs	Planting sprouts in reused plastic pots	27
Workshop: Build the Idea of Sustainable Entrepreneurship Fair: Start for Empathy	17 SDGs People dimension: 1,2,3,4 & 5	College Students College Students	Ocean of problems Shark Tank Social	Social Canvas Elevator Pitch & Stand	100 64

Workshop: Build the Entrepreneurship Idea from Empathy	17 SDGs	College Students	Design Thinking, empathy awareness	Social Canvas & Elevator Pitch by Team	35
Bootcamp: Entrepreneurship & SDG	17 SDGs	College Students	Design Thinking, empathy awareness	Social Canvas & Elevator Pitch by Team	315
Community Project: Sustainable Fibonacci	SDGs: 3,11, 12,13 & 14	College Students	Interviews and infographics	Self-managed projects: beach cleaning, donation of menstrual products, awareness videos, and paper collection campaign	22
Community Project: Sustainable Christmas	Planet dimension: 6, 12,13,14 & 15 SDGs	Children & Youth: House Home (2 to 25 years)	Paint reusable plastic pots and Lottery of agricultural products	Reusable wooden tree with reused plastic pots; community garden construction	50

Source: Own elaboration

1 SDGs: Sustainable Development Goals, 2 BoP: Base of Pyramid, 3 GS: Gamification Strategy, 4 LD: Learning by Doing

3. Methodology and results

Based on the example, the intervention model in education for sustainable social entrepreneurship needs to do analyzed. Consequently, the research aims to identify the effect of these actions; the first approach is learning. For this, analysis descriptive on the feedback provided by a sample of 138 young people who received the same gamification strategy and learning by doing: Bootcamp and Workshop Build the Entrepreneurship Idea from Empathy; the training consisted of building multidisciplinary teams (university students of economics, international relations, gastronomy, engineering, and enology); agreed on a vulnerable population group, and developed an empathy map; they built a social canvas after receiving the systemic change workshop, designed a prototype using their creativity and presented a pitch. At the end of the interventions, the young people wrote notes with comments about the training. From them, text analysis develops about the most frequent words and the words used with more excellent proximity. In this line, Figure 1 shows the map of the most frequent

The next phase of analysis contemplates the evaluation of the impact of the model on the intention of social entrepreneurship of the groups served, as well as on the materialization of these ideas in the generation of social enterprises, type I.

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Exploring second language viewers' use of cognitive strategies in learning Chinese through multimedia learning resources with captions and social annotations

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Abstract

Although linguistic captions are perceived as helpful in developing L2 vocabulary knowledge, the use of social annotations in video learning remains underinvestigated. This study investigated L2 learners' use of cognitive strategies in learning through multimedia resources in a MOOC context when both caption and social annotations modes were available. Triangulated data were collected from thirteen L2 MOOC learners from Africa, including think-aloud data, post-video interviews, and their notes. Findings suggest that 1) captions and social annotations lead to different cognitive strategies and videos with social annotations are found more engaging, 2) captions facilitate L2 viewers to conduct more bottom-up listening strategies at sentence level, while social annotations facilitate more top-down listening strategies, and 3) social annotations are used not only to enhance and expand the understanding of the video, but also to create a sense of belonging and further motivate viewers to achieve a higher level of engagement.

Keywords: *Social annotation; caption; multimedia learning; cognitive strategies; Cognitive Theory of Multimedia Learning (CTML).*

1. Introduction

This study aims to investigate the cognitive strategies adopted by L2 learners in multimedia learning with captions and social annotations. Social annotations refer to the comments created collaboratively by users on the same online document (Sun, Hwang, Yin, Wang, & Wang, 2022), and they focus on the content of the document. In a digital reading and writing environment, social annotations are perceived as beneficial to learners in terms of 1) increasing motivation and engagement levels (Yang, Zhang, Su, & Tsai., 2011), 2) better conditions for improving reading comprehension and writing quality (Li & Lai, 2022; Yang *et al.*, 2011), 3) better opportunities for peer feedback (Chang & Windeatt, 2016), and 4) promotion of knowledge sharing (Yang *et al.*, 2011). However, linguistic-oriented captions, also known as subtitles, are also widely promoted as pedagogical and scaffolding tools for second language viewers in multimedia learning environments, including L2 subtitles (Mahdi, 2017), hyperlinks (Garrett-Rucks, Howles, & Lake, 2015), and pictorial information (Aldera & Mohsen, 2013). Contributions of this study include 1) a better understanding of how linguistic-related captions and content-related social annotations affect L2 viewers' use of cognitive strategies in video learning, and 2) the development of more effective, engaging, and beneficial multimedia language learning resources equipped with captions and social annotations based on L2 learners' cognitive learning processes.

2. Literature review

Annotations are often used as visual aids to facilitate learning in multimedia learning environments (Unal, 2021; Mohsen, 2016). In the context of applied linguistics or educational research, social annotations refer to 1) personal comments on a specific item and/or peers' annotations (Li & Lai, 2022; Sun *et al.*, 2022; Yang *et al.*, 2011), 2) questions and answers to learning materials (Yang *et al.*, 2011), and 3) spontaneous thoughts and reflections (Li & Lai, 2022). The taxonomy of social annotations includes views (Li & Lai, 2022), judgments and evaluations (Pham, 2021), and emotions and feelings (Chang & Windeatt, 2016). Conventionally, social annotations are examined in the context of digital reading and collaborative writing (Pham, 2021; Chang & Windeatt, 2016). In the fields of computer science and electronic engineering, social annotations are sometimes referred to as 'barrage' or 'bullet screen' (Chen, Zhou, & Zhi, 2019).

There are three main discussion threads in previous studies on annotations in multimedia learning. Apart from the first thread which investigates the link between the incidental learning of vocabulary knowledge and the availability of annotations in a multimedia learning environment, the second one targets annotations based on topic and content, and concludes that 1) topic-level annotations are not as effective as lexical annotations for promoting vocabulary learning (Unal, 2021), and 2) content-related social annotations significantly

improve learners' writing quality and peer commenting skills (Pham, 2021). For example, Unal (2021) investigated how lexical and topic-level annotations and working memory capacity affect incidental vocabulary learning, and concluded that lexical annotations result in better performance in vocabulary meaning recall. Finally, the third thread investigates the impact of social annotations on learners' emotions, motivation, and engagement. Social annotations are found to 1) increase learners' motivation and engagement (Li & Lai, 2022; Yang *et al.*, 2011); 2) develop learners' confidence, a sense of community, and mutual trust (Sun *et al.*, 2022; Chang & Windeatt, 2016). For instance, Li and Lai (2022) compared the effects of social annotations and online forums on L2 learners' online collaborative writing, and found that social annotations not only led to better learning outcomes but also enhanced learners' engagement levels.

To fill the gaps in the research of multimedia learning, this study asked: what cognitive strategies are used by L2 viewers when captions and social annotations are provided in multimedia learning? The Cognitive Theory of Multimedia Learning (CTML), proposed by Mayer (2009), was adopted as the theoretical framework of this study. According to CTML, the cognitive process of multimedia learning includes: 1) selecting, which means selecting relevant verbal and pictorial information from multimedia resources for processing in working memory; 2) organizing, which means organizing the selected verbal and pictorial information into the coherent verbal and pictorial models, thus leading to the creation of internal connections; 3) integrating, which means building external connections by integrating the verbal and pictorial models with prior knowledge.

3. Research design

3.1. Research context

Thirteen (6 females and 7 males) African students from a three-year learning Chinese as a second language program were recruited for this study. The participants were second-year international students from a vocational college, aged between 18 and 24. Their Chinese proficiency level was around HSK level 3 (equivalent to The Common European Framework of Reference for Languages (CEFR) level B1). Based on the MOOC platform, this program is called Improve Chinese Communication through Multimedia Learning. Several carefully chosen Chinese language videos are included in this 8-week program, with the goal of enhancing the communication and proficiency of international students in Chinese. Both linguistic-based captions and social annotations (comments generated by native Chinese viewers) are provided along with the videos. Due to the pandemic, participants had been learning online (on the MOOC platform) for at least 12 months, and they were familiar with the operating system.

3.2. Data collection

The experiment was conducted on a MOOC platform where students voluntarily video-recorded the whole learning and data collection process with an extra phone. Think-aloud interviews, observations, and post-video interviews were used to gather the data for this study. Participants were informed about the purpose of the study and the procedures of data collection, and then demonstrated how to do think-aloud and control the operating system on the MOOC platform. They were required to watch a two and half-minute long Chinese video about spicy Chinese cuisine. With no time limit, they were allowed to pause, rewind, fast-forward, and restart the video, take photos or notes, and use online dictionaries on their cellphones. Moreover, they were given control over access to the type of on-screen text, which means that they could manually switch between two modes: caption mode and social annotation mode. In the caption mode, viewers can see the transcripts of the video, while in the annotation mode, they can access comments made by L1 viewers about the video's subject matter and their feelings toward it.

Post-video interviews were conducted with the same predetermined questions following each participant's completion of the video they had just watched in order to gather information on the participants' cognitive processes. The interview questions were designed based on the cognitive processes from CTML (Mayer, 2009).

3.3. Data analysis

Participants watched the video about four times on average, thus about four short post-video interviews were conducted for each participant. Participants reportedly selected and deselected various types of information in the video while in caption mode and social annotation mode. Based on the three cognitive processes from CTML (Mayer, 2009), think-aloud and post-video interview data were coded deductively first. Observation data such as time spent on each video, the number of pauses, and notes taken were collected and analyzed, as these learning behaviors in two modes indicate different cognitive processes and strategies in multimedia learning. For example, the duration of video learning may suggest learners' motivation and engagement levels under different learning modes.

4. Findings

4.1. Quantitative data

Table 1 presents the results of the descriptive data analysis. Overall, to learn the two-and-a-half-minute-long instructional video, the duration of video learning in social annotation mode was longer than in the caption mode. Post hoc analyses were conducted using Bonferroni's post hoc test. Participants took significantly longer time to learn videos with social annotations ($M = 305$ seconds, $SD = 62.798$) than with linguistic-oriented captions ($M =$

232.32 seconds, SD = 101.584). Moreover, they also paused the video with social annotations more frequently (M = 7, SD = 4.619) than captions (M = 1.62, SD = 1.387). No statistically significant difference was found in the number of notes taken under two different modes. Since participants were encouraged to watch the videos as many times as they wanted, a longer time spent on videos with social annotations may suggest a higher engagement level. Therefore, the descriptive data suggest that captions and annotations lead to very different cognitive strategies, levels of motivation and engagement.

Table 1. Descriptive data

	Mode	N	Mean	SD	Sig.
Duration	Caption	13	232.31	101.584	0.000
	Social annotation	13	305.38	62.798	
Pauses	Caption	13	1.62	1.387	0.000
	Social annotation	13	7.00	4.619	
Notes	Caption	13	1.77	1.878	0.134
	Social annotation	13	3.08	4.132	

4.2. Cognitive strategies to cope with linguistic-oriented captions

The different engagement levels between the two modes can be explained by the different cognitive strategies reported by the L2 viewers during three periods: selecting, organizing and integrating.

As for the caption mode, the viewers reported that in the selecting period, they paid attention to three main resources. First of all, pictorial information from images was used to help them 1) understand the unfamiliar vocabulary and phrases, 2) make sense of the sentence plots, and 3) facilitate their understanding of the details of the video content. Secondly, audio information was selected from the narration to 1) learn the pronunciation of unknown words, and 2) assist in the understanding of video content. Thirdly, textural information from captions was selected to 1) learn the characters of unfamiliar words and phrases, and 2) support their understanding of the details.

In the organizing period, the cognitive strategies mainly involved: 1) organizing textual information from a target word and its surrounding words into a verbal model to make sense of the less familiar words or phrases; and 2) organizing pictorial and audio information with linguistic captions to learn, check, or enhance their understanding of less familiar words or phrases, and content details. For example, one participant reported that:

(S2) When I heard a new word, I paid attention to the images, and focused on what he meant, but I also needed the characters in the captions, otherwise I couldn't understand the new word.

In the final period, what they had newly learned from the video was reported to be integrated with 1) background knowledge, such as already known words and prior knowledge of Chinese cuisine, and 2) personal experiences. The integration helped them to further turn working memory into long-term memory. One participant explained:

(S12) To learn the new word “蒸” (to steam), the images helped me learn the word but I need to listen to it ... When I learned this new word in steamed tofu, I thought about other delicious foods like dumplings and buns, which were all cooked in the same way.

4.3. Cognitive strategies to cope with social annotations

Under the social annotation mode, participants showed great interest in the comments generated by native Chinese viewers. In the selecting period, they paid attention to 1) textual information from social annotations to enhance and expand their understanding of the video, and 2) pictorial information from comment-related images to make sense of the comments. As there were numerous scrolling lines of comments, it was discovered that they selectively read the social annotations and ignored the audio commentary.

In the organizing period, participants were found to organize the verbal information and pictorial information in three ways: 1) organizing textual information from social annotations to understand the content of comments, and learning how to write social annotations properly to communicate with L1 viewers; 2) organizing textual information from contradictory social annotations to evaluate the comments and video content; 3) organizing relevant pictorial information from the images to assist in the learning of social annotations. The quote below demonstrates how the verbal model and pictorial model were organized:

(S9) The comment said: “Tofu sweats a lot.” In the video, I can't see tofu sweating a lot, so it seems that this viewer has tried cooking tofu before and this comment tells you the possible problem.

After the verbal and pictorial models based on social annotations were organized, they were integrated with 1) video content learned earlier, 2) similar or contradictory experiences in L1 and L2 contexts, and 3) cultural and learning experiences. Moreover, more than half of the participants tried to generate comments to interact with the chef and L1 viewers, and reported that they were happy to see others holding the same opinions as their own, which gave them a sense of belonging. The quote below suggests how this external connection was built:

(S7) This comment also questioned the use of sugar. In my country, if we want a sweet dish we only add sugar, and if we want a sour dish we only use vinegar. We don't mix sugar with chilli or vinegar. When I see others having the same question, I feel that I am not alone.

5. Discussion and implications

To comprehend the captions and social annotations, different cognitive strategies were used by L2 learners to select, organize and integrate the textual, video and audio information.

In caption mode, participants selected verbal information and pictorial information, and then organized them into verbal models and pictorial models to learn the unfamiliar words and some details about the content. This indicates that detailed internal connections between the verbal and pictorial models were built at both the linguistic and content levels (Mayer & Moreno, 2003). In relation to the learning of new words, participants were found to select the pronunciation from the audio narration, characters from captions, and relevant images. They then organized this information and integrated it with their background knowledge and personal experience to enhance their understanding of the words. In return, a better comprehension of the details of the captions at the sentence level added more detail to viewers' understanding of the video, such as the ingredients and cooking procedures. In other words, a bottom-up model can be observed when L2 viewers interplay with linguistic captions in instructional videos at the sentence level (Vandergrift, 2004).

In the mode of social annotations, participants selected, organized and integrated information for evaluating the content of social annotations, learning how to make comments in L2 properly, and communicating with L1 viewers. They integrated the verbal and pictorial presentations of social annotations with knowledge learned earlier in the video, personal experiences, and other background knowledge, to further confirm and evaluate the social annotations selected and content details. It suggests that both internal and external connections were made for social annotation learning (Mayer & Moreno, 2003). The overall understanding of the video and social annotations from other viewers, including personal and cultural interpretations of the video, was used to evaluate and confirm some other details in the video, which fits in the top-down model (Vandergrift, 2004). Both quantitative and qualitative data suggest that social annotations lead to higher engagement and motivation levels, which is in accordance with the conclusions of previous studies (Li & Lai, 2022; Yang *et al.*, 2011). For example, longer learning time and more pauses were recorded under the mode of social annotation, serving as evidence of higher learning engagement and motivation. Social annotations can also create a sense of belonging for L2 learners (Chang & Windeatt, 2016) and encourage them to interact with L1 viewers.

At least two pedagogical implications can be summarized. To begin with, giving learners the autonomy to select captions or social annotations based on their needs may accommodate their individualized learning goals. In addition, meaningful, comprehensible, and topic-relevant social annotations can enhance their understanding of video and lead to higher learning engagement and motivation levels.

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Diversity in (word) meaning: reducing the risk of bias in foreign language vocabulary teaching using prototype theory

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Abstract

In multifaceted and pluricultural settings, foreign language teaching is facing new challenges. This paper proposes a way to bring the concept of transcultural awareness to vocabulary teaching through the theoretical framework of prototype theory within Cognitive Semantics. Selected aspects of prototype theory are used in order to find suitable points of contact that can account for diversity in meaning. This paper argues towards an awareness of diversity in semantic meaning, using the understanding of prototype theory that categories are complex and have fuzzy boundaries. Therefore, learners can be taught a different and multifaceted understanding of word meaning on this theoretical foundation. Exploring and using prototype theory in this manner could pave the way towards teaching diversity in the foreign language classroom on a lexical level.

Keywords: *Vocabulary teaching; transcultural awareness; prototype theory; diversity.*

1. Introduction

Foreign language teaching has come a long way since traditional approaches have slowly been replaced by newer methods. In a globalised world, culture and language can no longer be conceptualised within borders of nations. Languages can no longer be restricted to a tangible culture, rather we operate within a network of cultures that do not have clear-cut confines. Traditional language teaching has long ignored these realities or conveyed them in stereotypical ways, but newer approaches start to integrate these inter- and transcultural dimensions. Research in language teaching is now recognising the importance of imparting communicative skills, with critical incultural communication theories paving the way for a transcultural communication approach (Baker, 2022).

Another rather new approach within foreign language teaching on the linguistic side is the adaption of Cognitive Linguistics. There are various studies that apply Cognitive Linguistics to foreign language teaching (e.g. Holme, 2009; Littlemore, 2009; Tyler, 2012). A few of these studies apply Cognitive Semantics to language teaching in general or vocabulary teaching in specific. There is a theory in Cognitive Semantics that appears to be especially interesting in the field of vocabulary teaching: prototype theory.

Prototype theory, originating in the area of psychology, mainly accounts for a new cognitive view on categorisation. Categorisation is an important element within a transcultural approach to language teaching, since learners are taught to maintain a critical position towards common categorisations (Baker, 2022). It can therefore be hypothesized that prototype theory within semantics can account for a form of categorisation as well as word meaning that focuses on diversity aspects. The aim of this paper is to explore how prototype theory can account for a manner of vocabulary teaching that focuses on diversity in meaning and therefore reduces bias in this area.

2. Transcultural awareness in foreign language teaching

In a globalised world, societies are increasingly diverse in terms of culture. This impacts all aspects of society, including education. Nowadays, it is essential to teach diversity in the classroom (Organisation for Economic Co-Operation and Development [OECD], 2010). Since learning about culture is an essential part of foreign language teaching (Altmayer, 1997), referring to diversity becomes central. Studies have shown that students perform significantly better in a learning environment that “treats diversity as a source of potential growth rather than an inherent hindrance to student performance” (OECD, 2010). Hence, diversity should be a central aspect in the foreign language classroom.

This is where the concept of transcultural awareness comes into play. This approach aims to teach the ability to communicate successfully in a transcultural environment, which covers a

much wider field than traditional approaches (Baker, 2022). Rather than being a monolateral approach, transcultural awareness in language teaching is a multifaceted compilation of different strategies. It is based on the relatively new concept of transcultural communication which Baker and Ishikawa (2021) describe as follows: “Transcultural communication attempts to develop more critical approaches to language and culture [...] to better account for the complex and fluid relationships between languages and cultures in interaction [...].” A central idea here is that cultural boundaries are fluid and transgressive and do not conform to national borders (Baker & Ishikawa, 2021). Therefore, language teaching needs to adapt to these new theories, considering the risk of bias and stereotyping while teaching about culture. Bias and stereotyping can be significantly reduced if learners are aware of cultural fluidity and diversity. Baker and Ishikawa (2021) note that we have to “fundamentally rethink” education since especially in higher education settings we are dealing with a “super-diversity”. They emphasize that students need to be prepared for “multilingual and multicultural settings”.

3. Prototype theory in lexical semantics and diversity in meaning

Prototype theory in the field of Cognitive Linguistics can be understood as a theory that accounts for the description of meaning within a holistic understanding of language. Originally it was a theory of categorisation, and it only became relevant on a semantic level with the transfer to semantics (Dörschner, 1996). Rather than a singular theory, it is an accumulation of various ideas within cognitive studies (Schmid, 2000).

A central idea in prototype theory is that categorisation as a basic human thought pattern facilitates a structured perception of the world (Windeck, 2019). In its more modern version, the prototype is defined as the most typical example of a category which is to be understood in a broad sense. A prototype here is an abstract concept that includes the basic meaning of a category; the boundaries of the categories are fuzzy (Mangasser-Wahl, 2000a). Lakoff (1987) notes that linguistic categories work in the same way as conceptual categories, therefore language uses basic cognitive categorisation strategies. It is assumed that prototypes work similar to basic categorisation. Humans automatically categorise when perceiving the world they live in because it works as a cognitive “shortcut” (Mangasser-Wahl, 2000b). Neurological studies show that categorisation functions as a universal principle of cognition so it can be assumed that for something as complex as language there must exist a multilevel and hierarchical system of categorisation (Müller & Weiss, 2000).

Brdar-Szabó and Brdar (2000) assume that a prototype approach can be used in foreign language teaching as “a basic component of the methodological apparatus of a theory” but not as a “self-contained language theory”. This assumption leads to the aim of this paper. We have already seen that prototype theory is a relevant approach to lexical semantics and,

therefore, it can be hypothesized that the application to vocabulary learning in specific can facilitate a more effective understanding and retention of the items. It can further be hypothesized that prototype theory can account for a certain diversity in the meaning of lexical items. This can be accomplished through teaching diversity awareness for word meanings through the findings of prototype theory.

4. Teaching diversity and reducing bias in vocabulary teaching through prototype theory

The goal of a transcultural language education approach is to educate the learners to use the target language effectively in communicative situations that occur in multicultural contexts. This produces a holistic view of communication that entails a greater range of competencies than the communicative approach focuses on (Baker, 2022). When Kramersch (2021) is talking about “Language as Symbolic Power”, this is what we can derive for language teaching: she gives us a new perspective on language education altogether which she approaches from a post-structuralist point of view. Language learning is no longer about the target language and target culture but rather about communicative strategies and seeing what effects an utterance can have in transcultural settings (Kramersch, 2021). Kramersch (2021) summarises: “A post-structuralist/post-modernist approach to language education will require developing learners’ interpretative abilities, sensitivity to context and appreciation of symbolic complexity.” She continues to explain that teachers now are confronted with the task of teaching about “symbolic conditions” and stresses that there has to be a “re-thinking of the purposes of language teaching within a (post-)humanistic education” (Kramersch, 2021).

This paper aims to apply this to vocabulary teaching in specific using prototype theory as a theoretical concept within Cognitive Semantics that is assumed to account for several problems with this proposition. In the following, several aspects of prototype theory that could be used in order to apply transcultural awareness aspects to vocabulary teaching will be presented.

4.1. Categorisation

As illustrated in chapter 3, categorisation is a basic human mechanism when perceiving the world (Kleiber, 1993). Traditional approaches to language teaching, though, use this fact in a way that often reproduces stereotypes. In order to reduce this risk of bias and stereotyping, especially in lexemes which denote or describe humans, human interactions, or cultural practices, this paper suggests a *diversity awareness*. When we talk about human or cultural concepts, categorising is inevitable, but with awareness about the plurality of cultures, cultural practices and human identities, we might be able to gain a less stereotypical view. If we look at, for example, the word *mother* we automatically generate an image in our mind that may be close to a stereotypical understanding. A prototypical understanding of

categorisation can help to guide our imagination: we know that next to the stereotypical mother (e.g. a woman who gave birth to and is raising at least one child) there are also other members of the category (e.g. a woman or a non-binary person who is raising an adopted child) that we are aware of in a setting of diversity awareness.

Prototype theory here has to be applied in a very broad sense. Referring to findings within this area, it has only been proven that it can be applied to concrete objects. However, there has been evidence that typicality effects are also found for verbs and abstract notions (Lehrer, 1990). Prototype theory negates classic Aristotelian categorisation and offers a theoretical frame where the existence of common attributes is not necessary for all members of a category. Rather than assuming logical categories, categories are described as natural. Criteria for categorisation are not structured in a binary way, rather it is about variation, global similarities and a comparison with referential prototypes (Kleiber, 1993). Prototype theory assumes categories with fuzzy boundaries where members are arranged on a scale from core to periphery; a category has a prototypical inner structure. The decision that an entity is a member of a certain category is always made globally and not analytically (Kleiber, 1993). If we adapt this manner of thinking to categories that refer to humans or cultural practices, we automatically create the possibility of more diversity in our conceptual categories. This is a kind of awareness that should be taught in the foreign language classroom in order to help create diversity awareness.

4.2. Semantic explanations

Wierzbicka (1990) observes that within linguistics, it is often assumed that abstract concepts such as emotions cannot be explained but only be felt. She gives the example of *envy*. Within traditional, structuralist approaches, a full semantic description is difficult since it has been a difficult task to properly describe emotions. Wierzbicka (1990) argues that prototype theory can resolve this problem. If we grasp emotions through a prototype approach, we do not have to construct unwieldy traditional definitions. Rather, we can explain the concept using prototypes. Recipients then can compare their emotions or their understanding of them to the prototypical description and hence get closer to the semantic meaning. Wierzbicka (1990) concludes that concepts are often vague but according to prototype theory, the explanation of semantic meaning does not have to be. These assumptions can be used for vocabulary teaching. Prototype theory here can pave the way to a construction of semantic explanations within teaching contexts that are concrete and understandable but also leave room for possible other meanings in other contexts.

4.3. Economy in speech

The tendency to use language in an economical way is as elemental in human cognition as is the tendency to categorise. It can often be observed that humans tend to choose single lexical

items over long phrases when it comes to their language usage (Lehrer, 1990). Lehrer (1990) explains that prototype theory plays a vital role here since “it facilitates this kind of economy”. Furthermore, Rosch (1978) explains the concept of “cognitive economy” as a basic principle of category formation. Roelcke (2002) corrects this principle and introduces the principle of “efficiency of communication” which explains that within communicative processes we tend to either optimise the effort or the result in order to reach efficiency. Within prototype theory we can see that the goal is to reduce the high number of characteristics that we would have to assume in traditional semantics. This kind of economy could be an aspect taught to language learners. If they are aware of human tendencies to use speech economically, a better understanding for a possible multitude of word meanings is created. This means that when learners are aware that economy principles are used when substituting a bulky phrase by one or more lexical items, it is logical to assume that these items can adhere to meaning in a broad sense with fuzzy boundaries. The contribution towards diversity awareness here is similar to the one mentioned above: the learners are made aware of diversity in meaning.

4.4. Social stereotypes

Lakoff (1987) points out the risk of social stereotypes being used as prototypes to represent entire categories. Nevertheless, he remarks that such social stereotypes are mostly conscious and change with time. Because they “define cultural expectations”, they are often used as arguments in debates. A goal in a transculturally aware language classroom would be to identify these stereotypes and analyse them critically. Prototype theory can help with this since it offers a way to identify prototypes. Prototypes in this respect are cognitive reference points that are identified by speakers in a cultural realm and therefore the typicality judgements will match. It is then the task of critical analysis within a transculturally aware classroom to work towards plurality and against stereotyping.

4.5. Diversity in meaning

The assumptions of prototype theory enable the re-integration of aspects of meaning that a traditional approach to word meaning sees as irrelevant, since in that theory they are not relevant for categorisation (Kleiber, 1993). Lehrer (1990) argues that an important consequence of prototype semantics is that “concepts, and therefore word meanings do not (always or even often) have sharp boundaries”. She further deduces that prototype theory leads to the assumption that vocabulary is flexible. This enables us to use a finite number of lexical items to account for an indefinite number of senses and meaning and it also means that word meanings are often extended for non-prototypical meanings (Lehrer, 1990).

This finding is an important connecting point for transcultural awareness in vocabulary teaching and therefore for diversity awareness. If we assume that categories and word

meanings have prototypical members we automatically surmise the existence of non-prototypical members as well. Fuzzy category boundaries assume a certain diversity in the members that we can count to those categories. In this theoretical framework, we do not need a checklist of characteristics anymore to count an entity as a category member or not. This can be especially important when talking about lexical items that refer to humans or cultural practices. Diversity awareness, that prototype theory can account for, can nurture a sense of diversity in meaning which fosters a broader view on people and culture in multicultural settings.

Certainly, this entails the danger of further establishing binary oppositions that are explicitly contrasting with the aims of a diversity approach to education. It has to be the task of language teachers who enforce diversity awareness to educate the learners towards plurality and not towards newly created binaries.

5. Conclusion

Baker (2015) proposes a radical change of foreign language teaching in the light of “post-normative and intercultural perspectives”. He argues that language teaching has to move away from teaching static linguistic forms and rather needs to equip language learners with communication strategies that help them communicate in a multifaceted environment. This paper proposed the idea of bringing this goal to vocabulary learning through the theoretical framework of prototype theory. It was argued that certain findings of prototype theory, mainly within categorisation and cognitive economy, can be used to work towards teaching diversity awareness within vocabulary teaching.

Further research is needed in order to find out how this can be applied in practice and to build a broader theoretical foundation. Another question of importance will be the didactic implementation of teaching a variety of meaning and senses within word meaning so that diversity can be applied beyond the focus on only prototypical members of categories. Answering these questions is part of a bigger project in form of a doctoral thesis where a model of vocabulary teaching based on selected theories of Cognitive Semantics is proposed.

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Enhancing language self-efficacy of EFL university students through experiential learning: a study of the learning league project

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Abstract

The Learning League project aims to study the improvement of language self-efficacy among English as a foreign language (EFL) university students in Hong Kong after delivery English language classes to secondary school students in a 12-week programme. The project adopts a blended learning approach, utilizing the learning-by-teaching pedagogy and gamification to enhance students' motivation and English speaking skills. 13 university students were recruited as student tutors. They received teaching training before teaching English to 63 secondary school students. English speaking-related weekly tasks and selected materials were provided to the student tutors to complete and read before they taught. The language self-efficacy of university students were measured using language self-efficacy scale (Wong, 2005). The programme evaluation showed positive results for the university students' English speaking skills and language self-efficacy.

Keywords: *Experiential learning; English proficiency; language self-efficacy; tertiary education; gamification; blended learning.*

1. Teaching and Learning English as a Second Language (ESL) Under the Pandemic

1.1. Impact of the Pandemic on ESL Teaching and Learning

The Hong Kong education sector has been facing significant challenges under the COVID-19 pandemic. Despite the government's support for funding e-learning initiatives since the 1990s by funding such as Teaching Development and Language Enhancement Grant (University Grants Committee, 2022), Quality Education Fund (Hong Kong SAR Government, 1997), Quality Enhancement Grant Scheme (Legislative Council, 2008), schools and universities were unable to fully utilize these resources during the pandemic. The transition to online teaching and learning was difficult as existing resources were often inadequate and led to extra preparation work for educators (Tang, 2020). The learning of foreign language speaking skills by Hong Kong students, especially English which is highly valued in both education context and workplace, was hindered (Ching, 2020) because e-learning has been assistive. The switch from face-to-face to online classes is beyond change of mode of lesson delivery. Both in-class and out-of-class learning opportunities need to be redesigned. It was challenging for university and secondary schools to create contexts for their students to use the language beyond regular classroom when students stayed home for lessons (Mok, Xiong, and Bin Aedy Rahman, 2021) where even opportunities for English corridor talks were gone. The English speaking assessment of university entry examination (Hong Kong Diploma of Secondary Education Examination, HKDSE) was cancelled for three consecutive years due the pandemic (Tsang & Yiu, 2022). There were less opportunities and motivation for both university students and secondary school students to learn and practice speaking English. There is a need for continued effort to motivate and create opportunities for students to speak the language beyond the classroom.

1.2. Secondary and University Students' Motivation Learning EFL Speaking Online

The motivation for learning English speaking among university and secondary school students declined when learning happened behind the camera during the pandemic. Social-economic issue had the most impact on students' learning motivation. Yau, Yeung and Lee (2022) suggested that camera use concerning teachers' and students' presence is an important factor influencing students' online experience possibly due to the fact that most Hong Kong students lived in crowded space with family members. It was even more difficult for students to concentrate during real-time online teaching (Yeung & Yau, 2022) when students encounter IT problems such as unstable network connection and device problem. Students also reported that interaction with other students was rather limited and hence it was difficult to connect with their peers socially and academically. All these issues in online teaching discouraged students to improve their English speaking skills.

Since the English speaking assessment for the university entry examination (HKDSE) was cancelled for 3 consecutive years due to the pandemic, the secondary school teachers spent more time on training other English skills than speaking in online classrooms. Opportunities for using English outside classroom, which excite some students, was forgone. According to the survey and interview conducted by Hong Kong Association for Academic and Teaching Exchange (Lam, 2022), out of 510 secondary school respondents, 70% of students were most anxious about English. One of the interviewees said, "When I was in Secondary two, our school would take us to Stanley to interview foreigners. But the activity was cancelled due to the pandemic... Since I mostly speak Chinese in daily life, my English pronunciation has gotten worse." The situation for the underprivileged ones was even worse for schools was probably the only channel for most of them to expose to English. While the development of speaking proficiency is related cognitively to other proficiencies of the English language, the insufficient support has a negative impact on underprivileged students' English language public examination results and possibly the chance of entering university.

The lack of meaningful opportunities to speak English, low motivation and insufficient support exacerbate the problem of low spoken English proficiency among university students and secondary school students, making it difficult for them to achieve their full potential in education and beyond.

1.3. Project Needs

The *Learning League* project aims to address the challenges of lack of opportunities and low motivation in practising English speaking. The learning-by-teaching program utilized the skills and knowledge of university (higher EFL proficiency) students to support secondary school (lower EFL proficiency) students. Through completing online tasks, reading materials about learning ESL speaking and teaching speaking to secondary school students, the university students could realise their language gap and improve their English speaking skills. At the same time, the secondary school students benefited from additional support to improve their proficiency through practising with the university students. The project has given both groups an opportunity to use the language in a supportive and empowering environment.

2. Project Design

13 university students were tasked to teach 63 students from three local secondary schools, ranging from secondary 1 to 5. Each student tutor was assigned 4-6 secondary students to teach, using materials designed by the project team. The university students delivered 12 face-to-face lessons of 1.5 hours each over a 4-month period.

2.1. University Students' Profile

13 students from the Hong Kong University of Science and Technology (with IELTS overall score of at least 6.5) were recruited as student tutors. Among the 13 students, 5 students were undergraduate students while 8 were postgraduate students. The project had been promoted to them as a service-learning project which they signed up as voluntary teachers.

2.2. Language Teaching Support for University Students

Prior to their teaching, the university students received training from three University Lecturers specialising in English Language (the project team) on contrastive linguistics of Chinese and English and teaching pedagogy. The training enriched the university students' English language knowledge, helping them to understand rationale of the teaching materials design for effective lesson planning and delivery. During the programme, the project team and their colleagues (also University Lecturers of English Language) observed university students' classes at least twice during the teaching period and provided them with feedback on English language knowledge and teaching technique.

In addition to in-person coaching, the university students acquired English language knowledge and additional teaching skills through completing tasks and reading selected resources on an online platform at their own pace. They then applied teaching skills and English language knowledge they had learnt in their weekly teaching. The learning-by-teaching pedagogy applied by the project allowed university students to consolidate their English language knowledge while providing academic support to secondary school students and improved their language self-efficacy.

Such design aims to provide university students with a well-rounded educational experience, both as English language learners and as educators.

2.3. Design of Learning Materials for Secondary School Students

The design of learning materials for secondary school students included gamification elements to enhance their motivation and engagement. Gaming was the theme of the course learning materials. This theme is popular among teenagers and it is easy for both secondary school and university students to relate and motivate them to participate actively in lesson activities. Selected newspaper articles and TED talks were included in lesson materials as content input so both the secondary school students and university students read and listened to authentic English materials. The activities for lessons incorporated gamification elements such as rewards for completing tasks, process tracking, and narratives for higher learning motivation and engagement in class.

2.4. Data Collection

The university students were required to complete a self-efficacy survey before and after the 12 lessons. The project team studied changes in language self-efficacy of the university students by comparing pre-teaching and post-teaching surveys.

3. Implementation

The table below summarises the key implementation details of the project.

Table 1. Key Implementation Details.

Month / Year	Content / Activity / Event
Feb – Jun 2022	Reconfirm with the participating local secondary schools and recruit other possible schools. Confirm logistics and programme timeline with partnering schools.
Jun - Aug 2022	Design materials for student tutors' small-class teaching training, peer teaching and other project-related tasks.
Sept 2022 - Jan 2023	Recruit university students as student tutors. Project team offers teaching training for student tutors. Conduct orienteering activities for student tutors and secondary school students.
Feb – May 2023	Student tutors teach in secondary schools. Project team observes student tutors' classes regularly, write log for record and discussion with student tutors. Project team updates teaching materials from the student tutors' teaching experience and class observation.
Jun – Jul 2023	Hold evaluation meetings among secondary school teachers and student tutors. Conduct survey for teaching and learning effectiveness among student tutors and other secondary school students.
Aug – Sept 2023	Programme evaluation.

4. Discussion

As mentioned in 1.3, the *Learning League* project aimed to improve language self-efficacy of EFL university students after teaching English language to secondary school students. This section discusses how the strategies implemented address challenges related to the improvement of students' speaking competency and low motivation in learning English speaking.

4.1. English Language Proficiency of University Students for Lesson Delivery

One of the biggest challenges was to ensure that the university students had sufficient spoken English competency to effectively teach the secondary school students. To address this issue, the project team had introduced topics in contrastive linguistics in teaching training and designed English language knowledge materials relevant to lessons they taught to enrich their knowledge. In addition, the blended learning approach adopted in the project design proved to be successful in providing a comprehensive learning experience for both the university and secondary school students. It has several advantages, including increased student engagement and motivation, improved access to resources, and personalized learning experiences. The online resources allowed university students to access learning materials at their own pace, they can look for further information about lesson content and related lesson content before teaching in classroom. Some university students highlighted they had learnt new language knowledge from the blended learning materials and also new vocabulary during lesson preparation.

4.2. Low Motivation Among EFL Secondary School Students

With the cancellation of English speaking assessment in university entry examination, the secondary school students were less motivated to practise English speaking skills. The project team prepared interactive English language activities in the orienteering day and gamified tasks in the weekly teaching materials to raise EFL secondary school students' interest in speaking the language. The secondary school students even gave speeches to their peers which was new experience to some and had boosted their confidence in using English for communication.

5. Conclusion, limitation, and future direction

The *Learning League* project was successful in addressing challenges of improving language self-efficacy of university students and the low motivation of secondary school students to learn English. The blended learning approach, which combined online resources and in-person sessions, provided a personalized and engaging learning-by-teaching experience for university and students. Additionally, incorporating fun and gamified activities, service-

learning and a learning-by-teaching pedagogy helped to increase motivation and improve the language skills of all participants.

5.1. Project Limitations

The project has certain limitations that could impact the validity and generalizability of the results. One limitation is the sample size, with only 13 student tutors and 63 secondary school students, it may not be possible to generalize the findings to a larger population. Additionally, the 12-week study period may not be long enough to fully gauge the effectiveness of the teaching and learning of the programme. Furthermore, the study is limited to EFL context in Hong Kong and may not be applicable to other language acquisition setting.

5.2. Future Directions

While the project is a step towards promoting education equity and improving English proficiency, there is still room for improvement and future directions. For example, the project could be expanded to include more universities and secondary schools in Hong Kong for a larger sample size, providing a more comprehensive picture of the programme's effectiveness. Additionally, the project can be extended to other foreign languages and cultures, allowing a wider reach and impact. Aligned with the use of technology in education, the programme could be modified to incorporate additional forms of technology, such as virtual and augmented reality in teaching training, to enhance the university students' learning experience. These modifications will contribute to the further development and refinement of the project and its potential impact on EFL learning in Hong Kong higher education.

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Data-driven project-based learning in specialized translation classes – the case of comparable corpora

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Abstract

The aim of this study is to contribute to data-driven project-based learning in Translation Studies in the context of Higher Education. Based on the implementation of a corpus-based project, a group of second year Master's students in Specialized Translation was actively involved in the compilation and exploration of comparable text corpora in vulgarization of medical science. Comparable corpora are becoming increasingly significant in the field of Language Technology and represent an essential basis for the extraction of terminological and phraseological units. The study falls within the scope of medical eponyms in English and Portuguese corpora. In this context, special attention was paid to the importance of corpus building for the dissemination of medical information to the general public. Against this backdrop, the project enhanced proactive learning by familiarizing students with corpus methodologies, textual conventions, style and register. By compiling and analyzing comparable corpora, students became autonomous researchers and developed skills and competencies for their future professional practice.

Keywords: *Data-driven project-based learning; specialized translation; comparable corpora; medical eponyms; Portuguese-English.*

1. Introduction

The aim of this study is to present a data-driven project-based learning approach based on the implementation of a classroom project in a higher education setting. The idea of adopting a project-based learning (PBL) approach is to provide students with real-life work environment, introducing them to a more dynamic and motivating learning setting. We explore how PBL can contribute to students' professional preparation and show how data-driven work can add value to language learning.

Data-driven learning has been widely investigated in the field of Language Pedagogy and Learning. The term is commonly used to describe "tools and techniques of corpus linguistics for pedagogical purposes" (Gilquin & Granger, 2010, p. 359). According to the authors, data-driven learning provides several advantages, such as confronting the learner with authentic language, as well as giving them access to "a large number of authentic instances of a particular linguistic item" (p. 359). In this respect, Lenko-Szymanska & Boulton (2015) claim that

learners can benefit tremendously from the direct use of corpora. They gain access to authentic language, which they can query in a variety of ways for the information which is interesting and relevant to them at a particular moment and which allows them to refine their understanding of how language really behaves (p. 3).

The present study aims at applying a data-driven learning approach within the scope of a translation project on the construction and exploration of comparable corpora, and intends to contribute to the implementation of innovative learning resources in Higher Education.

2. Project-based learning

Over the last decades, there has been an increasing interest in the study on project-based learning (PBL) in higher education settings. According to Thomas (2000, p. 1) "Project-based learning (PBL) is a model that organizes learning around projects" that focus on "questions or problems that 'drive' students to encounter [...] the central concepts and principles of a discipline" (p. 3). This model came up as a response to the need of engaging students in authentic activities, reflecting real-world challenges and needs. Higher education institutions must be aware of these changes and come up with adequate solutions in course design. With respect to this, Uden & Beaumont (2006) believe that "[u]niversity education should, ideally, provide students with the necessary skills, values, and attitudes that are essential to cope with the dynamic complexities of the modern world. [...] there is a lack of deep learning about the complex issues and problems that graduates have to face in

the real world” (p. 26). Due to a terminological fuzziness, PBL is herein used as an umbrella term for innovative teaching activities that center on learning through projects. In the present study, data-driven learning is implemented in the broader context of PBL and provides a specific focus on corpus-guided decision-making / construction and exploration.

3. Comparable corpora in the translation classroom

Due to the importance of Specialized Translation in today’s globalized world, translation classes have to respond to a diversified professional reality, preparing students to actively deal with different communicative situations. According to López-Rodríguez & Tercedor Sánchez (2008), “getting familiar with corpora and annotation” ranks among learner-centered activities that help to develop and promote the learners’ autonomy. In Applied Linguistics, the collection of textual data has long been fundamental for the study of specific lexico-grammatical phenomena and patterns, in order to obtain a better understanding of different language registers and varieties. In the field of Translation Studies, Baker (1993) already predicted, in her seminal work on Corpus Linguistics, “that the availability of corpora and of corpus-driven methodology will soon provide valuable insights in the applied branch of translation studies” (p. 242). Since then, research on corpora in Translation Studies has developed at a fast pace and has become fundamental both in theoretical and in applied studies. Molés-Cases & Oster (2015, p. 204) present a detailed overview of practical fields of application of corpus-driven work in translation training. According to Krüger (2012, pp. 507-508) corpora “allow for a better contextualisation and control of the texts to be investigated and provide a higher representativeness [sic], generalisability [sic] and replicability of the findings”. Depending on the research field and objectives, different types of corpora are used. Translation Studies mainly distinguish between comparable and parallel corpora. Due to advances in Machine Translation, the importance of collecting comparable data is getting more and more significant. Comparable corpora are an essential basis for the extraction of bilingual dictionaries, because, unlike parallel corpora, there is no influence from the source text structure. According to McEnery & Hardie (2012, p. 20), a comparable corpus contains “components that are collected using the same sampling method, e.g. the same proportions of the texts of the *same genres* in the *same domains* in a range of different languages in the *same sampling period*” [emphasis in the original]. In this sense, Mikhailov & Cooper (2016, p. 217) also define comparable corpora as text collections that were compiled “on the same principles (size of the collections, size of the samples, topics covered, chronological period, etc.) in different languages, or different variants of the same language: e.g. texts on atomic energy in French and Spanish, or texts in the German of Germany, Austria and Switzerland”. According to Bernardini, Stewart & Zanettin (2003, p. 6) comparable bilingual corpora are important for translation students in that they provide

them with an understanding of both target and source texts, “allowing them to compare terminology, phraseology and textual conventions across languages and cultures”. In the field of Specialized Translation comparable corpora assume a fundamental role as they provide evidence of specific lexico-grammatical structures, as well as information on the frequency of linguistic patterns in specialized domain texts.

4. Motivation for the Study

In times of unlimited access to information through the internet in form of online dictionaries, databases, or machine translation systems, translation students need to be aware of the challenges arising from the amount of available data. In order to choose suitable texts for the compilation of ad-hoc corpora in the field of medical science vulgarization, students are required to assess the quality of online-texts according to the purpose of the task and to apply a set of criteria to ensure the usability and reliability of the respective data. Against this backdrop students were familiarized with the advantages of corpus compilation and exploration for their future professional work. Another motivation for the study results from the fact that the source language of a text available on the internet is not always obvious, due to a growing amount of machine-translated texts. Therefore, it is a fundamental requirement to make sure that the source text is authentic and that it is not the result of a translation.

5. Method and Study Design

The aim of this study is to actively involve a group of 12 MA students of Specialized Translation in the compilation and exploration of comparable text corpora in the field of vulgarization of medical science in Portuguese and English. The corpus analysis was carried out with the help of the concordance program AntConc (Anthony, 2022). The project was subdivided into three stages, which will be presented in the following.

Stage 1 - Project preparation: Contextualization and pre-corpus building stage

In this preliminary stage, students learn to search and select websites from the field of medical sciences in Portuguese and English by using a specific set of criteria: i) websites belong to the same domain; ii) texts belong to the same genre; iii) texts aim to address a general public on health issues; iv) texts are written by health specialists or technical journalists; v) texts belong to the same sampling period, and vi) texts are written in English / European Portuguese.

1.1 Corpora in specialized translation

a) Identifying different types of corpora (monolingual, bilingual, multilingual, parallel, and comparable) with the main focus being on comparable corpora;

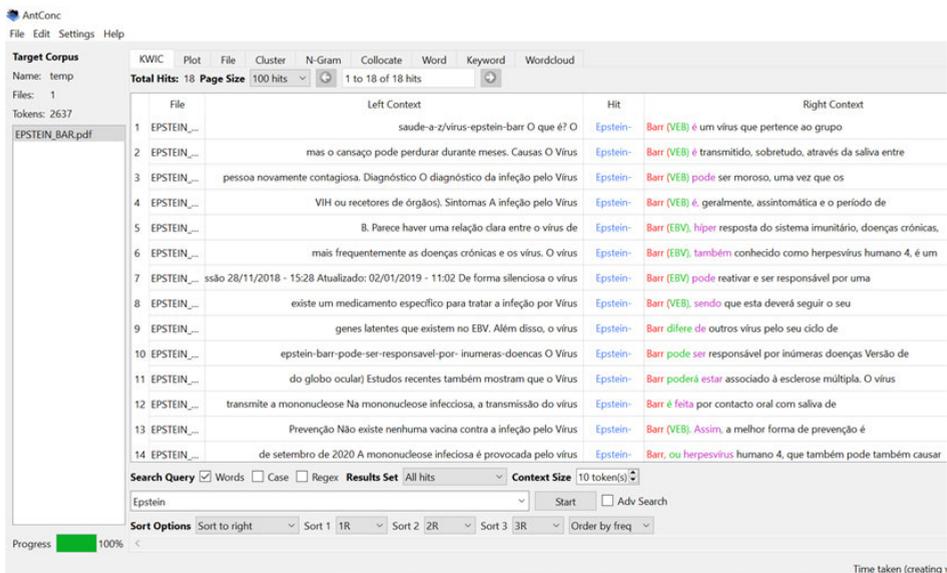


Figure 2: Results of concordance search on Epstein-Barr in AntConc.

c) Results discussion and group reflection on the variation of eponyms in both corpora.

Stage 3 - Evaluation

- Evaluation of the project by means of a portfolio, including results from the eponym concordance search, extraction of relevant text segments and respective analysis, as well as reflection on the importance of comparable corpora in Specialized Translation;
- Online questionnaire (ongoing) on students' perceptions regarding the data-driven project work.

6. Results and Discussion

This paper explored a data-driven project-based learning approach in Specialized Translation and aimed at familiarizing a group of 12 MA students with the compilation and exploration of comparable corpora in the field of medical science vulgarization. Data-driven learning based on projects actively involved students in corpus-based research related to eponyms in medical science vulgarization texts for a large audience. The enormous amount of available texts on the internet bears several challenges for translation students, who are required to apply a set of specific criteria to ensure the usability and reliability of the respective data. One of these challenges consisted in identifying a specific communicative situation and defining the target audience for corpus building. Another challenge involved the validation of the selected texts as original, non-translated items. The project consisted of three stages that aimed at developing students' research and analytical skills by involving them actively in the process of searching and compiling comparable

corpora. The first stage consisted of project preparation, giving students an overview of context and pre-corpus building requisites. The second stage (project execution) was dedicated to the compilation of ad-hoc corpora, as well as concordance search and extraction of eponyms. At the end of this stage, students were actively engaged in discussion and group reflection on the challenges and opportunities of comparable corpora. The third and last stage entailed evaluation by means of a portfolio and a submission of an online questionnaire (ongoing) to assess students' perceptions. The project enhanced proactive learning by familiarizing students with corpus methodologies, textual conventions, style and register. By compiling and analyzing comparable corpora, students became autonomous researchers and developed skills and competencies for their future professional practice. The results of the survey questionnaire will help to identify possible limitations and make subsequent adjustments with regard to the design and implementation of future projects.

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Cultural heritage and its dissemination through linguistic and technical learning in Higher Education

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Abstract

This paper presents the first results of the innovation and educational improvement project FUSIONA, which combines the transversal learning of German as a foreign language (GFL), the interdisciplinary learning, the cultural and scientific-technical heritage protection and its social dissemination. The principal objectives of this service-learning project are, on one side, to redesign a practical task of the course of GFL and, on the other side, to spread the cultural heritage of the four museums of Universitat Politècnica de València (UPV). Transversal skills, like effective communication, teamwork or social and environmental commitment are enhanced, and collaborative learning is put into practice by the design and edition process of informational videos. Thereby, GFL and Audiovisual Media students and teachers work together in order to create and evaluate the outputs. The currently quantitative and qualitative results show that interdisciplinarity is also feasible when language learning, media technique and culture join together.

Keywords: *Interdisciplinarity; German as a foreign language; scientific-technical heritage; transversal skills; collaborative learning; service-learning.*

1. Introduction

One of the high-impact educational practices (Kuh, 2001a; 2001b; Kilgo et al. 2015) put forth and endorsed by the Association of American Colleges and Universities (AAC&U) is service-learning (SL) (Tapia, 2007; Battle, 2011). The SL project presented, combines the transversal learning of German as a foreign language (GFL), the contents and techniques of the course Audiovisual Media (AM) and the interdisciplinary learning methodology, with the aim of detecting the cultural and scientific-technical heritage protection and fostering its social dissemination. The main goal of the project, named FUSIONA (fusion of art, science, technology, society and German language) is to develop effective oral communication in GFL, thus enhancing the interaction of the students who carry out an interdisciplinary task. The task consists in the design and edition of an informational video about the cultural heritage of their university.

In the last years, the idea of diversifying the practical tasks of the course Academic and Professional German A1 (from now on, German A1) attending to new contents and formats, such as video recordings had grown up among some course teachers. At the same time, we got the perception that the UPV cultural heritage and its four museums are really unknown by the society and by the students themselves. This fact has been demonstrated with the responses of a questionnaire, which was passed before the experience. During two hours 144 students from different bachelor and master degrees at the UPV answered to the question: Do you know about the museums at the UPV? 72,9% negatively, and 27,1% positively. These figures were our starting point.

The paper is structured as follows: in Section 2 we describe the interdisciplinary innovation approach to teaching; in Section 3 we describe the methodology followed in the experience; in Section 4, we summarize the results; and some conclusions are arisen in the last Section.

2. Interdisciplinary innovation

The Project involves two aspects. On one hand, it is necessary to remake the format and content of the practical tasks, which are fundamental for students' performance. They prepare them not only for the academic tests that evaluate the different linguistic skills (speaking, listening, writing and reading), but also for their future professional lives. However, these tasks should also help students to become social responsible citizens, as the University Social Responsibility (USR) points out (Ali, Mustapha, Osman, & Hassan (2021) and is stated in the UNESCO with its call for pursuing the 17 Sustainable Development Goals (SDGs) of the 2030 Agenda.

Traditionally, all the four practical tasks have been oral presentations. According to the opinion of students and teachers, other outputs could be introduced, as for instance, videos

or audios. This is the reason why we started the project together with other lectures of the subject Audiovisual Media, in which the quality of these formats is taught, contents that are impossible to be dealt with in GFL. The teachers of Audiovisual Media transmit some basic theoretical knowledge to the students of GFL and the students of Audiovisual Media evaluate the videos.

The project involves the development of three of the skills our students are required. Graduates of the Polytechnic University of València official degrees must show that they are capable of: (1) Demonstrating proficiency in digital communication using a variety of support media adapted to the situation and audience (effective communication); (2) Helping find solutions to challenges or projects, showing empathy and assertiveness when sharing ideas, reflections and arguments within collaborative work (Teamwork and leadership); and (3) Contributing to the design, development and implementation of solutions that meet social demands, taking the Sustainable Development Goals as a reference (Social and Environmental commitment).

On the other hand, we want to enrich the learning of the foreign language together with that of the artistic, scientific and technological heritage of our university. The professional work of the museums management teams aims to pursue the SDG 11, as they protect the cultural heritage, the education for the sustainable development supporting research and cultural participation.

The course German A1 is transversal for all the Polytechnic University of Valencia degrees, that is, students of different degrees and grades meet together for this course lectures. In the project 90 students of four German A1 groups (two in the Autumn semester and two in the Spring semester), and 60 students of Audiovisual Media (course of the Design and Creative Technologies Degree) participated during the first year of the experience.

3. Methodology

As a previous step to this experience, the team conducted a study about the knowledge of the museums among the students in the campus. The team carried out a random poll in the leisure area of the campus to establish a starting point for the project. The results, as mentioned before in the first Section, demonstrate that the majority of the students at the campus did not know about the existence of the museums. Those who did know about the museums, informed about which of them they knew (Q3), and which of them they did visit (Q4). The results are summarized in Figures 1 and 2. The answers show that the most known museums are the Informatics and Telecommunications ones, despite the fact that the Sculpture museum is an outdoor museum placed in the same leisure area where the poll was passed.

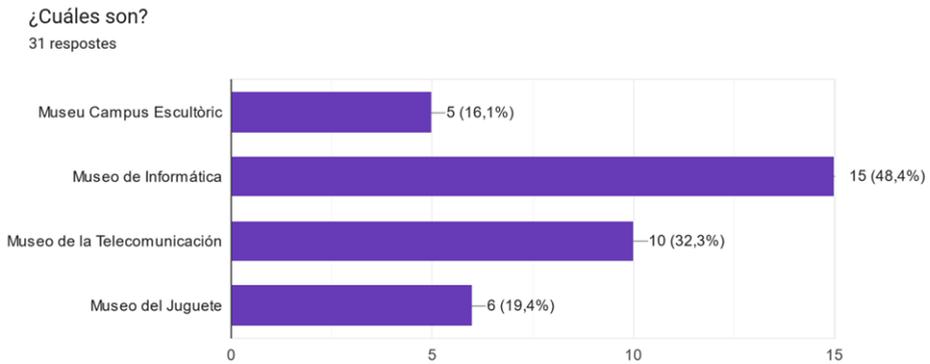


Figure 1. Previous questionnaire Q3: Which museums do you know?

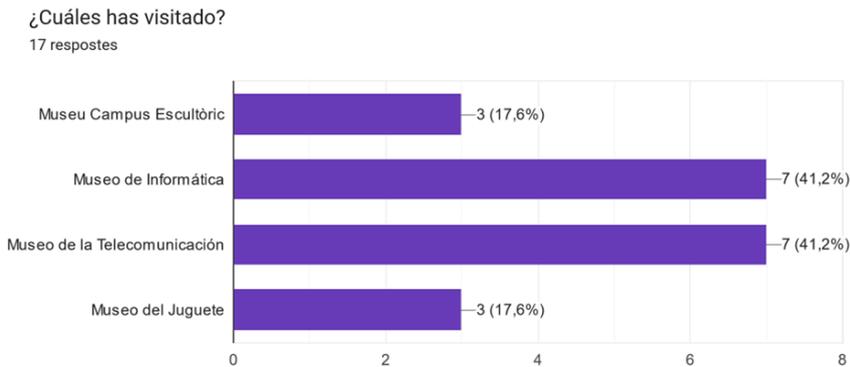


Figure 2. Previous questionnaire Q4 Which ones have you visited?

In order to fulfill the general goal, three specific objectives are outlined:

- To design a new practical task integrating information about the location and one example of the pieces exhibited in the (name of the university) museums.
- To enhance the collaborative (Johnson y Johnson, 1991; Kagan, 1994; Morales, 2007; Prieto, 2007) and interdisciplinary (Fernández et al., 2017) work, both among teachers and students.
- To disseminate the best outputs on social media and in the (name of the University) museums webs, only once after a selection process composed by museums staff, students and teachers.

Table 1 shows the different linguistic structures and possible vocabulary that is expected to be used for the museum description included.

Table 1. Linguistic resources

Introduction	<i>Hallo, heute besuchen wir das _____ (Name vom Museum) / Hallo, wir präsentieren heute das _____ (Name vom Museum).</i>
Location	<i>Das _____ (Name) Museum liegt im Gebäude (Gebäude), an der _____ (Hochschule). / Die Skulpturensammlung liegt in den Gärten von der UPV, es ist eine Open-Air-Galerie.</i>
Area / sections	<i>(Name vom Museum) _____ ist _____ m 2 groß und hat _____ Sektionen. Historia y piezas Das Museum gibt es seit _____. Hier findet man _____ (Geräte / Spielzeuge, Apparate / Skulpturen, usw.).</i>
Example piece	<i>Zum Beispiel, das ist ein/-e _____ (Nomen). Das ist kein/-e _____ (Nomen). Es ist _____ groß / breit / etc. Cierre Wir finden das _____ (Museum) _____ sehr interessant! Komm und besuch es!</i>
Schedule	<i>Das _____ (Name Museum) ist von _____ Uhr bis _____ Uhr geöffnet. Am _____ (Wochentag) ist es geschlossen. Entrada Der Eintritt ist frei.</i>

The document handed to the students, which explain the new practical task, describes also the steps to follow, and the necessary linguistic elements of the German language to accomplish it. The five steps are: (1) Choose a museum (better if it is not the one of your faculty); (2) Write a brief description of the museum (name, location); (3) Choose a piece in order to present it; (4) Write a brief description of the piece; (5) Express in an oral way the written description and record it in video format.

Two or three students at most of a group have to present contents orally and are also video recorded. If they are three, more contents have to be prepared. Linguistic structures and resources needed for oral discourse are shown in Table 1.

The highest grade to be obtained in this combined task is 0,75 points (video recording: 0,25 + oral expression: 0,5) from a total of 10 points of the final grade of the subject.

The new rubric for assessment has include oral expression, pronunciation, vocabulary used and grammar correction. The teachers of GFL design and implement this rubric.

To complete the assessment of the practical tasks of the Project, the teachers of Audiovisual Media devise a rubric related to technical aspects. This rubric serves as a tool and a guide to record videos, and an assessment tool for the students of the Audiovisual Media subject, who will be in charge of evaluating this aspect.

In order to select the best products to be disseminated on social media and webs, those people representing the museums of the UPV will meet the teachers of the two subjects.

In addition, once the Project is finished, each person participating in the team will be capable of assessing the process followed, so as to improve the implementation of each phase. This discussion among the agents of the project is crucial for its quality. Perception of students, teachers and service beneficiaries –museums in our case- are crucial. This evaluation happened the day of the final presentations, after their assessment and selection in front of a public audience, as is suitable for a project of ApS. In this event, certificates from museums and teachers were given to students participating in both subjects; they certify the participation in an ApS project, including two subjects and four UPV museums.

4. Results

Table 2 summarizes the museums selected by the different groups. It can be noted that Informatics and Toys museum were only selected by four and eight groups, while Telecommunications and Sculpture museums were selected by twelve and ten groups respectively. This does not fit the distribution of general knowledge of the museums previously analyzed (Figures 1 and 2). Hence, possibly, the practice has improved some general knowledge of museums in the campus.

Tabla 2. Museums selections

Museum	Group A1A1	Group A1A2	Group A1A4	Total
MUCAES	2	2	6	10
TELECOM.	4	6	2	12
JUGUETE	3	3	2	8
INFORMÁTICA	1	1	2	4

Additionally, students took a questionnaire after the delivery of the practice. The answers show that the experience is positive, and highlights the possibility of changing the room by an outdoor activity. The answers also show that students appreciate the opportunity of improving their knowledge of the cultural heritage exhibited in the University museums.

5. Conclusions

The implementation of this project started during the first semester of the academic year 2022-23, so it is not yet concluded. A second experience is needed to compare and better evaluate if the collaboration has been profitable for as many students as possible. The objectives and the methodology of this project could be transferred to other GFL levels, like A2, B1 or B2 also offered at the UPV. Given the transversal kind of the course, that is, a foreign language, it could be also implemented in other languages like French or Italian. We do not mention here English or Catalan, because the museums already offer their information in these language on their webs.

It could be also interesting that other courses, different to those of foreign languages would incorporate information about the cultural heritage in order to enrich the students education. The history of the diverse disciplines is essential to understand the current achievements; a historical point of view is necessary to better understand the present, in all fields, even in the artistic, scientific and technological ones. This kind of transdisciplinary task opens the problem to set the balance in the assessment of the different skills, it is a challenge to develop a transdisciplinary output performing all the skills with similar proficiency.

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Institutional influencers and support for tutoring in a South African higher education institution

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Abstract

Tutoring contributes to student performance. However, the institutional factors that affect tutoring effectiveness have been explored to a limited extent. This study assessed institutional factors affecting tutors' effectiveness and support strategies to improve their function. Interview data among twenty tutors in the Business and Economics faculty in a higher education institution in South Africa was analysed using inductive thematic analysis to output themes emerging from the data. Findings revealed that technical issues, unclear instructions, inadequate resources and training influenced tutors' performance. Regular engagement/communication, tutor workshops, training tailored to specific tutors' needs and challenges, timely provision of tutorial materials, incentives and supporting infrastructure could improve tutors' effectiveness. The findings are beneficial to higher education stakeholders in developing measures to ensure effective tutoring for students. There is scope for future studies on the same topic to elicit views when tutoring is conducted face-to-face as this study was impacted by the covid-19 pandemic.

Keywords: *South Africa; student performance; institutional factors, tutoring, university.*

1. Introduction

Poor student performance in terms of dropout and failure rates is a problem that policymakers are constantly addressing (Sibanda et al., 2015). The overall dropout rate for undergraduate college students in the United States is 40%, with over 30% of college freshmen dropping out before their sophomore year (Hanson, 2021). This percentage is now hovering at 10.3% in the European Union (Rita, 2020). About 50-60% of first year university students in South Africa drop out (Dyomfana, 2022). Low educational accomplishment results in poverty, unemployment, and inequality (Mlachila & Moeletsi, 2019). Therefore, emphasis should be placed on designing effective means and providing the necessary resources and infrastructure to assist students who require further assistance (Fluke et al., 2014). Extra help and support are some of the methods utilized to help pupils enhance their academic performance in higher education. An efficient way to improve completion rates and academic performance of students is through tutoring (Guerra-Martin et al., 2017; Karpur, 2018).

Tutoring of different forms, including one-on-one, peer, group, cross-age, and online tutoring via email or discussion forums, entails assistance and support by non-professional teachers in an engaged, intentional, and methodical manner (Mckay, 2016). Traditional tutoring involves a more experienced student working with less experienced students in a planned and organized manner, which could be face-to-face or online; however, the quality/expertise may be lower than a professional teacher's (Mlika et al., 2022). Hence, the efficiency of the strategies utilized in the tutorial process needs to be continually revisited to ensure that the needs of all involved are met. McKay (2016) investigated the relationship between tutor effectiveness and student performance using a pre- and post-test and found that students who attended tutorials improved their grades by 20%. Students' academic competence, conceptual knowledge and understanding are increased with tutors' active facilitative and guiding role (Mlika et al., 2022). Guerra-Martin et al. (2017) demonstrated the effectiveness of formal tutoring to improve the academic performance of at-risk nursing students in Spain using a pre and post-test.

Although studies exist on tutoring effectiveness, limited studies have focused on tutoring in business and economics. Extant studies focused on tutoring effectiveness in nursing (Guerra-Martin et al., 2017), and engineering (Mckay, 2016). Finance-related modules are technical, and several students find them challenging at an academic and professional level of study (Olokoyo & Oyewo, 2014). Therefore, there is a need to evaluate the factors that contribute towards the effectiveness of tutoring in the context of the social sciences. Further, limited studies have investigated institutional influencers from tutors' perspectives. Furthermore, this study was undertaken during the pandemic in 2020; thus, some findings were focused on the experience of tutors during this period. Therefore, the study's objectives were to explore the institutional factors that affect tutoring effectiveness and support strategies to improve

effectiveness. Using thematic analysis of qualitative data, the critical factors and suggested support strategies were identified to aid in improving the learning experience of students.

2. Tutoring Effectiveness

Guerra-Martin et al. (2017) indicated that the effectiveness of a tutoring program could be established by improved student performance. Koehler (2018) also identified the preparedness of the tutor as a measure of effectiveness. Tutoring effectiveness can also be measured by comparison with the desired outcomes and expectations of the lecturer and tutorial program (Bixby et al., 2011). If the desired outcomes of the tutoring program are communicated, the tutor can perform as expected. On this basis, this study reflects on how tutors performed in their role of assisting lecturers and students to improve teaching and learning.

Mlika et al. (2023) evaluated the effect of tutors' expertise and active guidance on students' learning using meta-analysis. Holiday (2012) assessed the test scores of students before and after tutoring; however, focusing on peer tutoring. McKay's (2016) study assessed the impact of tutors on first-year academic performance in Geography at a South African university. Therefore, although research on the effectiveness of tutoring has been undertaken, it is not as widespread as the use of tutoring (Holiday, 2012). This research is therefore important because strategies can be developed to improve tutoring effectiveness and in turn student performance.

3. Institutional Factors affecting Tutoring Effectiveness

Factors affecting the effectiveness of tutors include the materials and time available for preparation (Koehler, 2018). The more time a tutor has to prepare for a tutorial and having access to the material required for preparation all contribute to the effectiveness of a tutor. In addition, a supportive environment through providing institutional infrastructure and support in various forms such as training and communication helps tutors to excel in their function (Joubert & Snyman, 2018). Thorburn (2021) identified that the online learning environment was fraught with connectivity issues and indicated that the COVID-19 pandemic has exposed significant connectivity issues in South Africa and worldwide. Joubert and Snyman (2018) stated that restricted access to online platforms, administrative problems, limited or no interaction between lecturers and tutors, inability to make use of online platforms and insufficient training are some of the institutional factors that restrict the effectiveness of tutors in an online environment. Yusuf and Ahmad (2020) added that a lack of necessary tools and equipment for learning, and inadequate infrastructure in terms of computers affect tutors. Further, tutoring effectiveness may be hampered by the tutorial delivery, what materials or medium used and subject technicality (Currey et al., 2015).

4. Research Methods

A qualitative interpretive approach, where a social phenomenon is understood from the eyes of the participants rather than the researcher, was used (Cohen et al., 2007). Interviews were used to obtain in-depth information about tutors' opinions, beliefs and experiences (Rahman, 2016). Semi-structured interviews were used as they allowed flexibility and augmentation with follow-up questions, probes and comments (DeJonckheere & Vaughn, 2019). The research was undertaken in 2021 using virtual engagements on Microsoft Teams and Whatsapp, after institutional ethical clearance. Convenience sampling was used to identify tutors from four departments including Finance, Economics, Management, and Accounting (Barratt, 2009). These were initially identified and approached through the educators they worked with. Willing and available participants were then interviewed. Twenty tutors comprising twelve females and eight males participated. Most (eight) of them were in their second year of tutoring; 11 were students at the Honours (fourth) level of study.

Data analysis was undertaken using inductive thematic analysis to detect emerging patterns and analyze, organize, characterize, and report identified themes (Braun & Clarke, 2006). The process was as follows: familiarisation and developing potential themes, initial coding, searching and reviewing potential themes, categorization, consensus-seeking and writing.

5. Findings and Discussion

5.1. Factors affecting Tutoring Effectiveness

The following factors were identified as institutional factors influencing the performance of tutors during the period investigated:

Materials available for preparation - The availability of materials for preparation is critical in the tutor being effective in performing their role. This includes getting access to memos and explanations, textbooks and other materials to facilitate preparation before the tutorial sessions. Tutors explained: *"They made sure that we had all the resources that we needed to conduct the tutorials; discussing the work chart at the beginning of the week; the materials that we use for tutorials and practicals, getting papers, the markers; The memo should be clear; I think they should give us the memos and explanations"*.

Tutor training - Tutor training is a vital function provided by the university to enlighten them on tutoring strategies, handling challenges, and treating students. *"They once provided some training and provide proper support; tutor training, because you learn how to improve; The training at the beginning of the year is worthwhile; effective; sometimes, you think you're being professional when you are being unprofessional, that training helps"*.

Communication from lecturers and head tutors - Poor communication was identified by tutors as a factor that affects them in performing their duties, for example, unclear and untimely

instructions and lack of communication of expectations. As a result, delays in marking assignments were experienced: "... clearer instructions on tasks upfront; not being able to communicate with the lecturer to know that this is what he or she taught." On the contrary, weekly communications and meetings with head tutors were productive and helpful: "... with the head tutor, it was really good, we had meetings on Mondays which helped us prepare; discuss what we will do that week and if you have any questions, you ask."

Technical and infrastructure support - Technical issues were faced by tutors as they conduct their tutorials, for example, data, connectivity, and difficulty with the learning platforms. Data was allocated by the institution; however, there were delays in the process, which sometimes affected how tutorials were done. "Data allocation, it began timely. When the lockdown started it was delayed, but eventually, it came through". Some tutors also reported lacking suitable devices to conduct the tutorials; they used tablets and phones, which do not have the screen share function. Yusuf and Ahmad (2020) also identified factors such as lack of necessary tools and equipment for learning, and inadequate infrastructure in terms of computers as factors affecting tutoring effectiveness. Others were located in areas where connectivity was poor: "WIFI, network, by the time you come back you find that some students are gone". This aligned with Thorburn's (2021) findings that the pandemic exposed significant connectivity issues in South Africa and worldwide. Further, some tutors were unable to effectively use online platforms and applications, for example, Blackboard collaborate and Zoom. "... others do not know how to share screen." These challenges were also identified by Joubert and Snyman (2018) who amongst other factors, indicated that the training that tutors received on how to navigate online platforms was limited and thus should be improved. In addition, the lengthy administrative process of appointments for remuneration was highlighted as a problem. This deviates time for learning as tutors spend time filling out forms and following up on appointments.

5.2. Towards improving Tutors' Effectiveness

The strategies recommended were mainly related to the online learning environment in which the tutors were operating during the lockdown. These include:

More frequent communication - Information flow from the lecturer is critical to the effectiveness of a tutor as they clarify what the tutor is supposed to do. As reported, "I would suggest that the department is more involved with tutors". Improving tutor-lecturer relationships through meetings and frequent engagements was suggested, a view supported by Joubert and Snyman (2018), who found that tutors' feelings of isolation, and limited or no interaction between educators and tutors were some of the factors that affected the effectiveness of tutors.

More support with the relevant infrastructure and resources - The provision of more materials could assist in the preparation for tutorial sessions: "Possibly provide some devices; or

another application that allows us to use the screens of our phones because Blackboard only supports the use of laptops or tablets; I think lecturers can just try to offer more support to tutors with the material". Further, the provision of devices to facilitate the use of these platforms, and recording tutorial sessions in case of network issues were suggested, as supported by Yusuf and Ahmad (2020). Additionally, availing materials (timeously) for preparation was highlighted as they need materials like textbooks, memorandum of activities, class notes, and slides, as supported by Olugbenga (2020); they have to be provided with high-quality instruction material to assist in preparing for executing tutorial sessions in the appropriate language of instruction.

Training and workshops/seminars - Receiving more training so that the tutors can get the best out of the various platforms was highlighted: *"Tutors should be taught more on how to use Blackboard, create the whiteboard, and navigate that, so that we know how to share a screen, and attach documents."* Tutors should undergo continuous training, as supported by Joubert and Snyman (2018). Further, workshops for tutors would be beneficial. Holding meetings and briefings more frequently can keep tutors updated on the developments within the tutoring landscape. *"What should be done is to have workshops; I think it is time to start incorporating more of the courses and training that you have to do for online learning because if you look critically, at the courses we did, they were based on the in-person basis of learning and looking at the knowledge now, it is outdated; training that has to do with this [covid-19] change"*.

Incentives for tutor role - Tutors can perform their role more effectively if they are provided with incentives that contribute to their motivation. Tutors at the university are remunerated for the services they render. One tutor noted: *"... incentives like money, that matters; tutors may be more willing to work"*. This view was shared by Jayachandran (2014), which opined that one of the reasons for low quality of education in developing countries is that teachers lack strong performance incentives. Therefore, remuneration can incentivise tutors to perform well.

6. Conclusion

The study sought to identify institutional factors influencing tutorial effectiveness within higher education in South Africa. Results from interviews revealed that the online environment was not easy to navigate. Inadequate communication and support with material resources impeded tutors' progress. Regular engagement/communication of the lecturers' intentions, workshops and training, timely provision of tutorial materials, and supporting infrastructure could improve tutors' effectiveness. The study adds to the existing literature on tutoring in higher education, and in particular, factors affecting tutoring effectiveness. The findings will be beneficial to higher education policymakers and authorities in designing

effective tutorial and infrastructure structures to support the function within institutions. The structure of the tutorial system should be remodelled to ensure tutors work in the most conducive environment. Further studies could include more diverse representation with more faculties to see if different views will be elicited. Other studies could also be conducted to reflect tutors' experiences during face-to-face learning as these might yield different results from the current one conducted during the covid-19 pandemic; thus, influenced by the online learning environment. Further, studies could consider other aspects of tutoring such as personal attributes, and the effectiveness of various tutoring strategies and techniques.

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Globalisation vs diversity in national languages in HE context: case of Estonia

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Abstract

Given the rapid globalisation since the 1990s and the rising support of a culture of internationalisation in higher education across Europe, the position of national languages in academia deserves more attention. The “Strategy for the Internationalization of Estonian Higher Education 2006–2015” has diminished the role of Estonian by removing the requirement of the existence of Estonian-medium education from doctoral education.

In 2011–2012 we surveyed Estonian doctoral students’ opinions and stances about their usage of academic languages. Only a minority of doctoral students claimed to be always unrestricted in their language choice, and many veered towards using primarily English.

Recent strategies in education, research and language aim to advance Estonian-medium HE, and in 2022 we conducted a re-survey to see how the situation has changed. This paper presents some results and implications of our two studies, discussing the current academic language situation and policies.

Keywords: *Globalisation; intercultural strategies; linguistic diversity; academic Estonian; internationalisation of HE.*

1. Introduction

Rapid globalisation since the 1990s has significantly impacted national languages used by scholars, and the language situation in academia has been somewhat contradictory. In the realm of education, the institutional strive towards internationalisation of higher education has been supported across the EU, either with specific mobility supporting schemes at the European level, with national strategies that aim to increase competitiveness in the global market of education, and with institutional policies that set the goal to benefit from exporting education by increasing international students has resulted in a culture of internationalisation within higher education (see discussion in Abdulai et al. 2021). This has increased the demand for instruction in the English language in higher education institutions across European countries. Meanwhile, the parallel trends of measuring academic excellence in citations have privileged publishing in English-language academic journals and rendered academic writing in any national language with lesser potential readership somewhat less relevant for aspiring academics.

Those trends are visible in all national contexts, especially the smaller countries. At the same time, language diversity is a well-grounded principle in the EU: “Article 165(2) of the Treaty on the Functioning of the European Union (TFEU) emphasises that ‘Union action shall be aimed at developing the European dimension in education, particularly through the teaching and dissemination of the languages of the Member States’, while fully respecting cultural and linguistic diversity (Article 165(1) TFEU).” (EU Language policy)

This paper explores the case of higher education in Estonia, a country with a population of 1.3 million. The Development Plan of the Estonian Language 2011–2017 stated:

““The Estonian Higher Education Strategy 2006–2015” aims to ensure the existence of Estonian-medium education on all educational levels in all fields of study, thus creating a possibility of using foreign languages for the teaching of most specialities within the same field of study. The “Strategy for the Internationalization of Estonian Higher Education 2006–2015” diminishes the role of Estonian-medium education further by removing the requirement of the existence of Estonian-medium education from doctoral education.”

Choosing a language is not so straightforward as academics, and students indeed feel increasing pressure to use English instead of Estonian, given the culture of internationalisation of higher education. In 2011–2012 our team of linguists and sociologists from Tallinn University accomplished the study “Estonian as a language of higher education and academic research” supported by the EU. As a part of this, in 2012, the team surveyed Estonian doctoral students’ opinions and stances about the usage of academic languages (Roosmaa et al. 2014).

Given that recent education, research and language strategies for 2021–2035 again aim to advance Estonian-medium higher education, we conducted a re-survey in 2022. This paper presents two studies' key results and implications, discussing the current academic language situation and policies.

2. Research design and material of the study

2.1. Research methods

In designing the research project, our primary research questions were:

- How do doctoral students in Estonia experience the issue of language choice?
- What kind of difficulties have they experienced in academic work – incl. reading and writing – both in Estonian and English?
- How much is the Estonian language used for doctoral dissertations in Estonia?

We applied the concept of *intercultural strategies* introduced by Berry (1997) as an extension of his earlier concept of acculturation modes.

Doctoral students, like any academicians, live in an intercultural environment, being at the same time part of their domestic research culture, tradition, and language, as well as of the international academic arena – the latter most often colonised by English-language research, some of which published by speakers (or, rather – writers) of English as a second language. From two fundamental issues – Cultural Maintenance and Contact-Participation – the four strategies have been derived, facing all peoples living interculturally: integration, assimilation, separation/segregation and marginalisation. Cultural Maintenance: is it considered valuable to maintain one's identity and characteristics? Contact-Participation: is it considered to be of value to maintain relationships with larger society?

These issues are based on the distinction between orientations towards one's group and those towards others (Berry 1997). This distinction is rendered as (i) a relative preference for maintaining one's heritage culture and identity, and (ii) a relative preference for having contact with and participating in the larger society along with other ethnocultural groups. It has now been well demonstrated that these two dimensions are independent (see overview in Kruusvall *et al.* 2009). In this model, the English-language (and ESL) academic culture can be viewed as the larger society, and national academic languages as ethnocultural groups, while different ethnocultural groups develop their strategies. However, in terms of intercultural studies, it is maintained that the best-working strategy relies on both preferences being strong – that means we assume that the most fruitful integration to the academic world occurs only when academic thinking is possible, and happening, in the Estonian language just as well as in the dominant language.

In the broad and representative surveys of doctoral students in Estonian universities, we were interested about what are their experiences and motives concerning language choice.

2.2. Material of the study

The amount of doctoral students has diminished. In 2012 we had 2,926 doctoral curricula in Estonian, while this year, there are 1,775 Estonian and Estonian-English curricula in total.

The sample description in table 1 accounts for self-selection – respondents are those who care about the issue. A vast majority have Estonian as their first language.

Table 1. The sample of 2012 & 2022 surveys.

Sample description	2012	2022
No. of universities participated	7	6
Respondents N	240	101
Gender, % of females	70%	70%
Average age (min/max)	33 (23/64)	37 (24/57)
Estonian as the first language	92%	92%
Main activity: doctoral student	40%	36%
Main activity: employed	54%	49%
Studies are related to work, yes %	80%	75%
Studying social sciences, culture, humanities	49%	61%
1 st –2 nd year of studies	33%	32%
3 rd –4 th year of studies	51%	43%

Source: own analysis

We categorised the respondents into two subgroups: doctoral students of social sciences and culture, incl. humanities (SCH), and those of natural sciences and technical disciplines (NT). We asked if they have participated in five types of academic activities and in which language:

- (1) writing academic research texts to publish,
- (2) writing popular science texts,
- (3) reading academic research publications,
- (4) reading popular science publications,
- (5) participating in academic conferences.

SCH doctoral students appear to participate in research or scholarly communication **in the Estonian language** in more academic activities than NT doctoral students do. Among both research classes, the variety in types of scholarly work communication in the Estonian language has increased from 2012 to 2022, especially among the NT students and particularly regarding publication writing. In 2022, we observed a significantly higher rate of SCH doctoral students, 92%, participating in academic conferences held in the Estonian language, compared to 82% in 2012. Among NT students, there appear to be more writers of academic (65%) and popular science publications (70%) in 2022, compared to 52% and 50%, respectively, in 2012.

Comparison over time shows relatively stable results for engaging in academic communication **in English**. Overall, differences between the two research classes are minor, yet interestingly, among NT students, we observe a substantial rise in writing popular science publications, from 23% in 2012 to 62% in 2022. However, in both research classes, students write popular science publications in English to a lesser degree compared to other types of participating in scholarly communication. More SCH doctoral students have mentioned writing academic publications in 2022 (93%), compared to 78% in 2012.

3. Doctoral students' opinions on language use

We were interested in what aspects of language have bothered doctoral students when using one or another language for their academic activities. Results are presented in Figure 1.

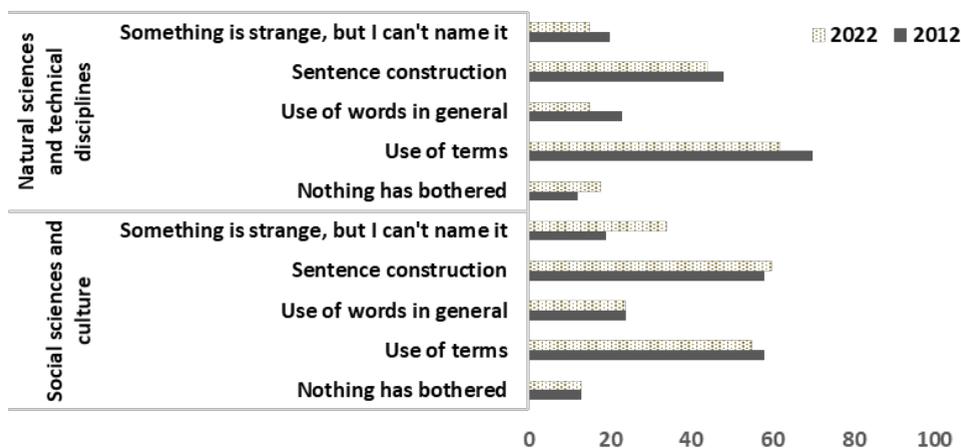


Figure 1. Aspects of language use which have bothered doctoral students when reading a text in one's study field in Estonian. Source: own analysis

It appeared that when **reading** a scientific or study text in one's field **in Estonian**, doctoral students of all domains are mainly bothered by terms used and sentence constructions. There are no notable changes between the two surveys. However, among SCH doctoral students, a rise in feeling that something is strange occurs, but they cannot name what exactly is strange. When **writing in Estonian**, NT doctoral students encounter more difficulties, particularly in the usage of terms: 58% in 2012 and even more of them, 73% in 2022. The percentage of those who have no difficulties has further diminished in 10 years, from 17% to 12%, while more SCH students in 2022 (38%) experience no problems in Estonian writing, compared to 32% in 2012.

3.1. Difficulties in finding appropriate terms

As a part of the study, we focused on two aspects of the usage of terms by doctoral students:

- How do they assess their possibilities to find appropriate terms in the current academic environment?
- How do they perceive the appropriateness of terms they use in their research?

Firstly, there are two main tendencies in doctoral students' opinions on terms usage:

1. The share of SCH doctoral students who often cannot find a suitable term in Estonian has diminished in 10 years from 57% to 48%, while the percentage of NT postgraduate students who often cannot find a proper term in Estonian has increased from 71% to 77%. The share of those who never have difficulties finding an appropriate Estonian term has increased among SCH students. Still, the low (3%) in natural and technical sciences is unchanged.
2. The share of SCH doctoral students often experiencing difficulties with English terms has increased; however, the percentage of such NT students has diminished. Furthermore, the share of those who never have difficulties finding an appropriate English term has been smaller among SCH students in 2022 (11%) but larger among NT students (28%).

Secondly, how do doctoral students perceive the appropriateness of terms they use in their research? Some felt it was best to adopt English terms into Estonian. Twenty-five respondents argued that a uniform and univocal specialised vocabulary existed in English: *"I know English terms best because I mostly read texts in the same language, and my working language is English."* Among others, 36 students considered Estonian terminology deficient, hard to find, and lacking uniformity. On the other hand, such term adoption was criticised as well, explicitly by seven students: *"There are many anglicisms instead of correct terms in Estonian."* Doctoral dissertation was suggested to be the means to introduce new Estonian terms.

4. Conclusions and discussion

The analysis of the data from this survey led to the conclusion that it is easy for newcomers to academic writing to assimilate into the mainstream host culture of English and give up "boring" Estonian writing, especially since

- the norms and behaviour patterns of others support this,
- the regulatory practices or research evaluation and standards support this,
- the organisational space where professors and graduate students meet – guidelines – support this by overlooking the potential incentives to use Estonian.

Estonian doctoral students of every field have difficulties finding appropriate terms and sentence constructions in 2022, unchanged from 2012. It may indicate that more systematic courses in academic Estonian and terminology are needed at all higher education levels to advance clarity of the codification of knowledge and specialised communication. Improved skills in expressing academic ideas in Estonian may positively impact the educational system. Hence, the motivation to publish in Estonian should be improved. For now, these possibilities are few, almost lacking in natural and technical sciences.

The Estonian Language Strategy 2021–2035 does have the general objective to ensure the vitality and function of the Estonian language as a primary language in every sphere of life in Estonia, to guarantee everyone the right and opportunity to use the Estonian language, to preserve and strengthen the status and reputation of the Estonian language and Estonian cultural and information space, and to value knowledge of other languages. One of the strategic objectives of this plan includes coordinated terminology planning as a part of research on the Estonian language to achieve up-to-date specialised vocabulary in every field of scientific research and every area of life. Another strategic objective for education aims, among the rest, in collaboration with universities to apply language use and internationalisation principles in higher education which will grant the functioning of the Estonian language for higher education and academic research. These objectives are in harmony with the goals of Education Strategy 2021–2035 to promote the development of Estonian as a language of higher education and research, including developing and introducing Estonian terminology; support the maintenance and development of Estonian-language higher education curricula; reinforce the learning of Estonian by international students and academic staff. It is also a prerequisite for increasing the knowledge transfer capacity of research institutions and higher education institutions, set as an objective by the Research and Development, Innovation and Entrepreneurship Strategy 2021–2035 (RDIE Strategy).

While perceived as not in line with the culture of internationalisation in higher education, we claim that implementing these plans will advance language diversity in the globalised world. Parallel use of national and international academic languages is inevitably needed, advancing

diversity of thinking. Sharing knowledge internationally is also possible in other broadly spoken languages than English, e.g. Spanish, French, German, and Portuguese – not to forget regional languages like Swedish in the Nordic countries.

Likewise, a clear academic national language positively impacts general education through HE, especially with the help of teacher training. Any advanced language promotes the proper functioning of the society where this language is mainly used.

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Bottom-up curriculum innovation through grants for lecturers

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Abstract

The aim of this case study is to evaluate the bottom-up approach of curriculum innovation in higher education through the implementation of Teaching Innovation Grants (TIGs). Through the TIGs, lecturers were granted hours to innovate their course. Of the 81 applications, 52 were granted. The TIGs were implemented in BSc and MSc courses on topics in economics and business. Each grant touched upon one or more of the educational themes - (1) internationalization, diversity & inclusion, (2) ethics, responsibility & sustainability, (3) digital business & data science, (4) employability, and (5) active & blended learning – the faculty board has formulated as ambitions for improving and renewing what and how we teach in our degree programs. Overall, the TIGs has facilitated lecturers in innovating their teaching. They perceived the workload as manageable, but intensive. Support by teaching assistants and/or educationalist was an important factor for a successful implementation.

Keywords: Curriculum innovation; higher education; teaching grants; bottom-up approach.

1. Introduction

A sound curriculum - set of courses - of a degree program ensures that learners gain knowledge and skills they need to succeed in their future career. Currently, the tremendous advancement in science and technology and the economic and social changes, necessitates timely revision of a curriculum to avoid learners to gain obsolete knowledge and skills. Consequently, the curriculum has to change from time to time to achieve the current and future needs of a sector.

Curriculum innovation is a complex and multi-faceted endeavor. Several processes and procedures involved and issues of concern in managing curriculum innovation are known (Law, 2022). Furthermore, several internal and external factors cultivate innovations (Bajada et al., 2019). Combining a top-down strategy (e.g. emphasizing the operational aspects of the strategy, effective communication and consultation at all levels) with a bottom-up approach (e.g. initiatives led by lecturers) will likely lead to success (Lisewski, 2004; Zhu & Engels, 2014). As part of the bottom-up approach, for lecturers (1) involvement from the start of the curriculum innovation project, (2) time allocated for curriculum innovation, and (3) support by educationalists seem to be key factors for success (Cooper, 2017; Hurlimann et al., 2013; Kirkgöz, 2009; Law, 2022).

One bottom-up approach to stimulate and facilitate lecturers in developing and improving their teaching in higher education is by allocating time and creating support through teaching innovation grants (TIGs). Namely, each lecturer is an expert in their course and is in the best position to design and implement change to teaching and assessment. By providing a clear top-down strategy by the faculty board on its ambition for improving what and how to teach, lecturers are able to tailor-made this ambition for their own teaching practice.

The aim of this case study is to evaluate the effectivity of the bottom-up approach to foster educational innovation by using TIGs for lecturers. The procedure of the TIGs is described in section 2. The questions we want to answer are:

1. How many of the TIGs were received, approved, and implemented?
2. What are the characteristics of the implemented TIGs?
3. What is the outcome of the implemented curriculum innovation perceived by the lecturers?

2. Setting-up the Teaching Innovation Grants

2.1. Context

The curriculum innovation procedure took place at the Faculty of Economics and Business (FEB) of the University of Groningen, the Netherlands. FEB's educational portfolio consists

of four broad bachelor's degree programs, twelve specialized master's degree programs, and one research master program. Yearly, the total number of students is around 8000. In FEB's Strategic Plan 2021-2026, the faculty board has formulated ambitions for improving and renewing what and how we teach. They want to implement or strengthen the following educational themes in the degree programs: (1) internationalization, diversity & inclusion (ID&I), (2) ethics, responsibility & sustainability (ERS), (3) digital business & data science (DB&DS), (4) employability, and (5) active & blended learning. A projectteam of academic staff and educationalists was installed to manage this project. The project is financed by funds from the government. The outline of the project was communicated to all staff. For each degree program a curriculum working group (CWG) consisting of the program management and lecturers of that program, was installed to innovate the curriculum of their degree program and implement the above-mentioned themes according to the model described by Wolf (2007). Besides this top-down approach, bottom-up individual lectures could apply for a teaching grant if they wanted to innovate their course.

2.2. Teaching Innovation Grants: procedure

The *call for proposal* for a Teaching Innovation Grant (TIG) was published on January 6th, 2021 on the website of FEB and send by email to all program directors. The proposal should (1) consist of a concrete improvement in teaching or assessment of a course; the improvements should relate to changes in teaching and assessment methods, or topics prioritised in the Strategic Plan (see above), (2) be for innovative ideas beyond regular course maintenance and updates, that require a more substantive time investment than a change such as introducing a new textbook, (3) introduce an improvement that can be sustained after the initial time investment, and (4) envisage concrete improvements in learning outcomes that will be evaluated. A requirement for submitting a proposal was that it had been discussed with the relevant program director and that the applicant would evaluate and report on the implementation of the proposed change. The number of hours allocated for an approved proposal was 50 hours for the applicant (with the possibility for more if necessary). The deadline for submission of the proposals was March 1, 2021. The decision was published before March 31st 2021, so that approved grants could be implemented in the hours allocated for regular teaching for the academic year 2021-2022.

The *evaluation process of the proposals* consisted of the following steps: (1) Two project members, one staff member and one educationalist, read and evaluated each proposal individually. The evaluation consisted of pass or not pass on the four criteria (a concrete improvement, a substantive time investment, a sustainable plan, and a change that can be evaluated), its link with the Strategic Plan's topics, and the overall quality. All submitted proposals were divided between three staff members and two educationalists; (2) the final recommendation to award a grant was made together by one staff member and one educationalist; they checked all proposal assessments to guard consistency; (3) the steering

group of the curriculum innovation project had to approve the recommendations; (4) as a final step, all applicants were notified about the final decision. During the evaluation process, the project team concluded that there was substantial variation in the substantiveness, with some proposals requiring considerably greater time investment than others, but several of the smaller proposals would still be very worthwhile. As a consequence, the final recommendations could be a) award of a full grant (50 hours or more), b) award of a small grant (25 hours), c) revise or d) decline.

During *the implementation* of the TIGs in the academic year 2021-2022 (as of September 2021), support was offered by educationalists. An evaluation form was sent out to the lecturers who received a TIG after the implementation of the innovation (see section 3).

3. Methodology

This paper presents the results of the TIGs implemented in the academic year 2021-2022 from the call of proposals to the evaluation of implemented granted TIGs as a case study. To describe the characteristics of the approved TIGs, all information, such as in which degree program the innovation took place, which educational themes of the strategic plan were addressed, and amount of granted hours, were analyzed. The lecturers filled out an evaluation form consisting of open questions: questions (1) whether they were successful in implementing the change or whether they need to make adjustments, (2) what the impact of the improvement was, (3) whether the workload was manageable, and (4) what they have learned from potentials and pitfalls of the innovation, whether they will keep it next year, and what advice they could provide to colleagues. These qualitative data were analyzed and repeated elements in answers of different questions were grouped and extracted from the data. The presented results are grouped by educational theme.

4. Teaching Innovation Grants

4.1. Call for proposals

A total of 81 proposals were received. On March 15 all individuals who submitted one or more proposals were notified about the recommendation including a brief motivation by the project team. Those who we recommended for a small grant were asked whether they would carry out their project with the smaller number of hours and all agreed. Those who we declined were offered the opportunity for further communications on their proposal. Of those 81, the project group proposed granting 52 proposals for a total of 2345 hours. This is about 10% of all courses and 0.3% of the total number of FTE of academic staff at FEB. The granted hours per TIG was 25 (n=13), 50 (n=37), 80 (n=1), and 90 (n=1) hours. The steering group agreed to this proposal.

4.2. Characteristics of the granted TIGs.

Of the 52 TIGs that were granted, 25 concerned BSc courses and 27 concerned MSc courses (Table 1). All the BSc degree programs contained courses that were granted a TIG, of the MSc degree programs, only the research master and one regular economic-related master degree program did not have courses that were granted a TIG. The BSc Business Administration had the most TIGs (n=12). The implementation of the TIGs took place in semester 1 (n=33) and semester 2 (n=19).

Table 1. Level and topics (business or economics) of the degree programs the courses of the TIGs were implemented.

level	Economics (n)	Business (n)	Total (n)
Bachelor	10	15	25
Master	8	19	27

The distribution of the TIGs among the five educational themes are listed in Table 2. Multiple themes could be addressed in one TIG. In case of addressing multiple educational themes in one TIG, it mostly was a combination of active & blended learning with another theme.

Table 2. The distribution of the implemented TIGs among the five educational themes.

Educational themes	n
Internationalization, diversity & inclusion (ID&I)	5
Ethics, responsibility & sustainability (ERS)	4
Digital business & data science (DB&DS)	6
Employability	9
Active & blended learning	30

4.3. Evaluation

Of the 52 grants, two grants were returned by the applicant and five grants were delayed due to organizational or personal reasons.

Five TIGs on *internationalization, diversity & inclusion (ID&I)* were implemented, except for one. One of the implemented TIGs combined this topic with employability. In two of the TIGs, the tool CATME was implemented to support group formation. Both lecturers stated that the initial investment to get to know CATME is considerable. One lecturer plans to use the tool in the future, because CATME offered very useful insights about the interaction between the team members and team satisfaction. In the other course, the lecturer is still in

doubt of using the tool again, since it is extra work, and the advantage is hard to measure. In another course an assignment on deep democracy was implemented. The lecturer learned that students do have an interest to learn about diversity and inclusion. As the lecturer has left and the costs of execution are high, the assignment will not be adopted structurally. In the fourth TIG, the implementation was more focussed on using cases to bring ‘practice’ closer to students in a group assignment.

Only four TIGs included the theme *Ethics, responsibility & sustainability* (ERS). Three of the TIGs combined this with active & blended learning, and one was combined with the themes employability and DB&DS. Looking at the evaluation of these TIGs, actually only one of these TIGs really focused on developing content on sustainability within a course. This course was changed considerably adding new video content and a practice-oriented ‘free’ assignment (output could be e.g. a podcast, video, report, etc). The staff member involved was very pleased with the results indicating that sustainability was integrated in much greater depth.

TIGs in the theme *Digital business & data science* (DB&DS) implement one or both of the following types of innovations: (1) providing students with more interactive tools, to enhance their ability to practice and learn material outside the classroom, e.g. use SOWISO to generate practice material for mathematics and statistics (all TIGs), and (2) have students engage with new tools to strengthen their digital competencies, e.g. use Python to do optimizations (three TIGs). In terms of implementation, a common theme is the setup costs of many of these tools, e.g. developing tips for every question in a course or developing new quizzes and in some cases, the technical aspects were a barrier.

Nine TIGs related to *employability*. These TIGs address: (1) introduction of tools and training for employability skills, and (2) development of material to bring “business life” into the classroom. Both types of projects benefit from the use of videos, for example as a way to provide information about different skills, to enable peer review of presentation skills, or as a way to show how processes work in a business. The evaluations of the TIGs relating to employability skills are positive about the TEL-tools that are used. Due to changes in available budgets, one tool will not be used further, for another tool technical problems need to be resolved for using it next edition of the course. Interestingly, two TIGs that were implemented in courses of the same program intentionally addressing a different skill, resulted in a optimal program-level alignment.

Of the 30 executed TIGs related to the theme *active & blended learning*, 22 were on active learning only, the other combined active learning with employability (3), ERS (3), or DB&DS (2). 23 of the 30 TIGs were implemented as planned, seven TIGs were partly implemented due to COVID measures (3) or changing insights (4). The plans to implement active and blended learning improvements were very diverse, e.g. using technology-

enhanced learning (TEL) tools, flipped classrooms with knowledge clips, team assignments, weekly quizzes, and interactive tutorials. In all TIGs students were more engaged (e.g., watched video lectures to learn content before plenary session, SOWISO), active (e.g., asked more questions, weekly quizzes), and interactive (e.g., giving peer feedback using FeedbackFruits, working in teams on cases or assignments, discussions in Q&A sessions/lectures).

Overall, most lecturers stated that the newly developed tools/assignments/teaching methods will be kept and improved if applicable. The workload of the innovations varied from manageable to manageable due to support of colleagues, teaching assistants or educationalists.

5. Discussion and Conclusion

The aim of this paper is to evaluate the bottom-up curriculum innovation through the implementation of Teaching Innovation Grants (TIGs). The TIG scheme has stimulated and facilitated lecturers in developing and improving their teaching and implementing the faculty board's ambitions for improving and renewing what and how we teach through five educational themes. Of the 81 applications, 52 were granted, but due to organizational or personal circumstances two grants were not executed and five were delayed. The implementation took place in BSc as well as MSc courses of different degree programs. Each grant touched upon one or more of the educational themes. Lecturers perceived the workload as manageable but intensive. Support by teaching assistants and/or educationalist was an important factor for success. Both factors have also previously be shown to contribute to the success of curriculum innovation (Cooper, 2017; Hurlimann et al., 2013).

Due to the success of this first round and to further implement the educational themes in our degree programs, we continued with granting TIGs in the following academic year. Again, allocating time for lecturers and support by educationalist and/or teaching assistants will be offered to contribute to its success. Based on the experiences in the first round, applicants will be advised about the good practices as well as potential pitfalls through a repository that will be developed of the first TIGs to share experiences. This repository will contain information about e.g. the type of curriculum innovation, the link to the educational themes, and how it was implemented. This will allow other lecturers to find specific types of newly-developed teaching practices to be used in their own courses.

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Designing a Metaverse for an Immersive Learning Experience

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Abstract

This paper shares preliminary findings of a pilot project to study the potential of the metaverse as an option for course delivery in an immersive learning environment. As part of a first-year seminar course on the metaverse, the authors identified and applied design principles for building an effective immersive learning space to create a virtual space that mirrored a popular campus technology learning center. After learning about the metaverse throughout the course, students attended a class session online to experience this virtual environment, and then reflected on their own interest in and perceived value of immersive learning spaces.

Results from a student survey suggest that while students are skeptical about their own continued involvement with the metaverse after the course is over, many recognize potential of the metaverse as a social platform that fosters engagement and collaboration.

Keywords: *virtual reality; metaverse; immersive learning spaces; collaboration; online learning; emerging educational technologies.*

1. Introduction

In the years since Neal Stephenson introduced the concept of the metaverse in his novel *Snow Crash* (Stephenson 2003) in 1992, technology has advanced to turn his science fiction vision of living in virtual worlds into reality with the development of virtual reality (VR). The novel's characters visited an alternate world while wearing goggles and experienced it through the eyes of their avatars, just as people engage with the metaverse of today.

A single definition of the metaverse does not exist, and the use of the term often differs based on context. The metaverse is not one unique virtual space; today the metaverse is a collection of decentralized virtual spaces, or worlds, such as Meta Horizon Worlds, Roblox, Decentraland, and the Sandbox, where people gather synchronously online to conduct business meetings, play video games, attend social events, purchase real estate, and visit destinations they may not be able to get to in real life. Many metaverses have their own digital economies. Avatars or digital twins form a person's online identity across metaverses. (Kshetri 2022). At its most basic level, the metaverse is the next iteration or future of the Internet (Ramesh et al. 2022) as a Web3 application that brings value to the user generated content that characterizes Web 2.0 (Suderman 2022).

The advent of the COVID-19 pandemic accelerated the introduction of immersive virtual environments for educational purposes (Duan et al. 2021). Three-dimensional, immersive virtual learning spaces often reflect physical campus locations creating a stronger connection to the university campus; participants interact with each other through their avatars, causing students to consider issues of identity and how they wish to be perceived in the metaverse. They may also interact with elements of the virtual learning spaces, such as writing on virtual whiteboards or sharing websites on virtual browsers. They can communicate in real time through voice or chat, or share a webcam, as in most web-based video conferencing applications. Such spaces and their content persist from one visit to the next, and as such, foster the development of virtual communities (Kye et al. 2021), and some educational metaverses may offer the purchase of digital goods.

This paper describes preliminary results and the experiences of incoming first-year students enrolled in a discovery seminar studying the metaverse from multi-disciplinary perspectives. As part of the course, the authors designed and created an immersive virtual learning space modeled after a campus learning space. During the last class meeting, students visited this virtual space using VR headsets or web browsers to experience the metaverse's potential as a viable course delivery platform. Questions guiding this research are:

RQ1. What principles should be considered when creating an immersive virtual learning space designed to resemble a campus physical learning space?

RQ2. After experiencing a class in an immersive learning space, what potential values do students see for learning in such an environment?

2. Immersive Educational Environments in the Metaverse

Many educational institutions are exploring virtual immersive environments (Hassanzadeh 2022; Hedrick et al. 2022) yet “few ... have taken steps to offer courses in [a] metaverse (Hassanzadeh 2022:10).” Such environments can improve learning, empower students, and create a sense of presence among students (Hassanzadeh 2022). Virtual reality enables users to experience immersive spaces that cannot exist in reality (Kye et al. 2021). Several digital tools, including Alakazam, AltSpace, Frame, Gathertown, and Zepeto, facilitate the process of designing immersive virtual spaces.

Duan (2021) created a model of the Chinese University of Hong Kong, Shenzhen (CUHKSZ) as a metaverse for social good, “a mixed environment where students’ actions in the real world could correspondingly affect the virtual world, and vice-versa.” Location based sensors allow students in physical locations to interact with students in equivalent locations in the corresponding virtual world. Such worlds require significant usability testing to be effective (Lee and Gu 2022).

The use of immersive classrooms also requires significant onboarding and training. When using Meta’s Horizon Workrooms as a virtual classroom, Hedrick (2022) found that gathering in a virtual space complete with desks, a whiteboard and a projector had its limitations in group size, ease of setup, and lack of documentation for a beta product. Still, they found that collaboration was possible and successful in such a virtual environment after the group acclimated to the user interface.

A goal for creating an educational metaverse is to provide a sense of community and link back to a familiar classroom or physical learning space. How one joins an educational metaverse has an impact on the user experience and participant retention. While a fully immersive experience with or without VR headsets may be preferred, “whether it satisfies students who want to experience learning that does occur in the same place or at the same time with other peers, is still unanswered (Lee and Hwang 2022)”. Students sitting at computer screen or wearing VR headsets with pre-designed digital content “are less likely to experience the psychological sensation of being in a communal space (Lee and Hwang 2022)”.

3. First-Year Discovery Seminar: Living in The Metaverse

This study, conducted at the end of the Fall 2022 semester, involved students enrolled in two sections of a first-year discovery seminar (FDS) course. These sections were taught by two

different instructors who followed the same schedule, assignments, topics, and readings. FDS is intended to help students acclimatize to their new surroundings in college and learn about research by exploring complex problems and themes from multidisciplinary perspectives. The theme of the two sections discussed in this paper is “Living in the Metaverse.”

The course presented an overview of the metaverse from business, social, and technology perspectives, and provided several hands-on opportunities to explore various metaverses both in a browser and wearing VR headsets. Students attended events in AltSpace, designed virtual worlds and games in Roblox, created avatars in ReadyPlayer.Me, and investigated metaverse features in Decentraland. Their research papers focused on issues from governance to the impact of the metaverse on mental health.

During the final two-hour class session, students met in a virtual learning space modeled after the university’s technology learning center. Before the class, students added slides summarizing their research papers, to a common PowerPoint Online slide deck. The instructor showed the slide deck on one of the floor-to-ceiling displays, as students maneuvered their avatars around the virtual space to see it. They listened to their classmates present their work in real time.

Many students participated in the metaverse activity using both their laptops and wearing VR headsets. Students joined on their laptops, positioning themselves in hallways and classrooms in the building where the class was held or wearing earbuds to avoid audio interference and feedback from students nearby. At 15-to-20-minute intervals, students proceeded in assigned groups of five to the nearby technology learning center, where they wore Quest 2 headsets to join the class for an immersive VR experience, until the next group arrived for their turns. This process allowed students to experience the immersive learning space in two different modalities. Students then gathered back in person in the physical classroom to debrief about their experiences for the last 15 minutes.

4. Designing an Immersive Metaverse Learning Space

Frame (<http://framevr.io>) is the development tool chosen for the design and implementation of a three-dimensional immersive social virtual meeting space replicates the university’s technology learning center. Visitors can explore spaces created in Frame using mobile devices, laptops, or desktop computers through a browser, or by wearing a VR headset (such as Oculus Quest), making Frame a popular choice for prototyping, or developing virtual spaces. Frame metaverses support accessories such as floor-to-ceiling displays, live web browsers, and interactive whiteboards. Frame is persistent in that content added remains in place from one visit to the next. “Frame is widely used as an adaptive learning space suitable for educational purposes as it allows teachers and students in the same place to freely upload a wide range of content to deliver curriculum” (Lee and Hwang 2022). This proof-of-concept

immersive metaverse learning space was designed to stimulate the sensory input of the participants. The process was implemented in three phases: creating a shared experience, extending realism, and incorporating gamification, each abiding by principles of human-computer interaction. (Lee and Gu 2022; Terblanche 2014).

4.1. Phase 1. Creating a Shared Experience

Phase 1 emphasizes creating a shared experience and maintaining a sense of individualism. Every participant in the metaverse can fully-customize their 3D avatar and choose their clothing, accessories, body color, hairstyle from a collection of preexisting assets in Frame. The virtual space also enables participants to create digital identities by designing personalized avatars or linking their ReadyPlayer.Me avatars, created by generating 3D models from 2D photos captured through a webcam. This enables students to maintain their individual identity in the mirrored digital classroom.

4.2. Phase 2. Conveying Realism

Phase 2 extends the concept of realism as cues to educate the participants, thereby setting the FTUE (first-time user experience) for the metaverse. The essence of maintaining these real-world cues for a student participant goes beyond humans to virtual environments and objects. The color theme of the walls in the room, placement of smart screens, tables, monitors, and keyboards, to the most vital element of the present time – sanitizer bottles on a table, all resonate to create a sense of attachment which delivers an exceptional, easy-to-adapt human-centered FTUE. Figure 1 compares the mirrored virtual metaverse (top) with the physical space of the campus learning center (bottom).

Users entering the virtual classroom for the first time rely on these cues to navigate a virtual space that resembles the physical world. One significant difference between physical and virtual spaces is the absence of seating in the virtual environment. To create a more open space, moveable chairs are not included in this design because avatars do not need to sit.

4.3. Phase 3. Gamification

Phase 3 targets practical features by gamifying the new age of online learning enabled by gathering in the metaverse. Adding gaming elements into non-gaming sectors intrigues users to take part and perform (Groh 2012). “Gamified elements used in the Metaverse allow immersive and engaging ambiance, positively influencing the user mindset for social interaction (Tayal, Rajagopal, and Mahajan 2022:1598).” This immersive space features a floor-to-ceiling fully functional web browser displaying actual online content, a whiteboard to sketch, and an ultrawide floor-to-ceiling LED screen that everyone within the shared environment can view. These elements provide engaging, interactive, intuitive learning tools

within the immersive learning space. Figure 2 is a snapshot of a live session conducted with students and shows the use of a metaverse platform as a shared learning environment.

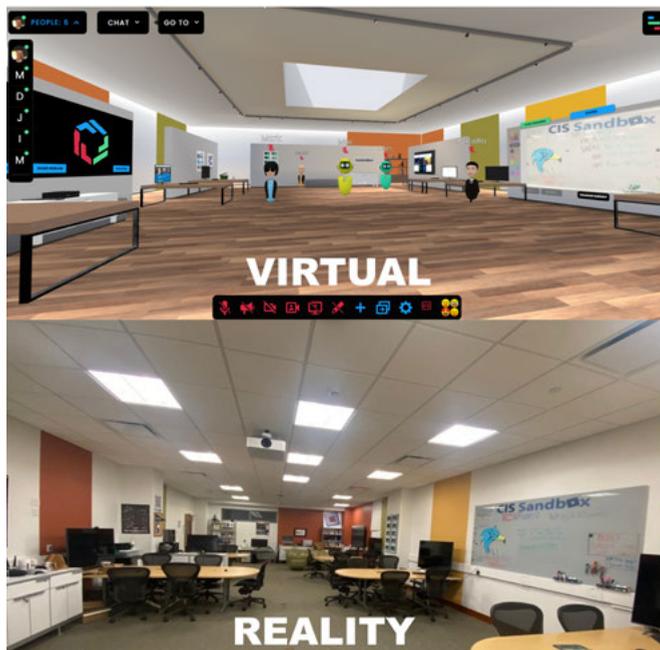


Figure 1. Top: Virtual metaverse; Bottom: Physical campus learning center



Figure 2. Live class session

5. Results

The authors administered a survey to 44 students in two synchronized sections of FDS, taught by two different instructors, on the last day of each class meeting. Two students were under 18 years of age, so their responses were not included. The remaining 21 students from each section were between 18 and 21 years old. All had used Quest headsets while completing two assignments earlier in the course. Responses showed that 27 of the 42 eligible students agreed or strongly agreed that they would like to explore VR more with headsets, 20 agreed or strongly agreed that VR environments offer a sense of place and connection to a physical

environment. Still, they were divided on their future level of participation in the metaverse. Only 12 agreed or strongly agreed that they could see themselves involved in a virtual community, and only 13 agreed or strongly agreed that they could see themselves attending an event in the metaverse. See Figure 3.

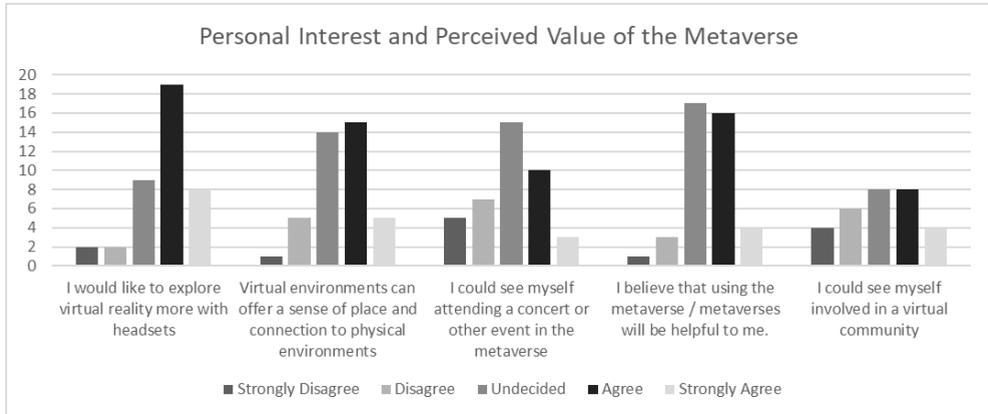


Figure 3. Survey data of participants

These results suggest that learning about the metaverse was fun and engaging, but many students are still skeptical about their personal involvement for extended periods. Students realized how the metaverse can provide new opportunities for doing business and interacting socially, but they also commented on social concerns related to increased engagement with the metaverse (abundance of virtual meetings, lack of social skills and lack of motivation). Said one student, “People may not be as willing to interact and speak with one another, whether online or in-person. The possibility of harassment [increases] because of the lack of authority in the metaverse... With no bounds to hold them accountable for their actions, people might freely bully and act harshly in the metaverse.”

6. Conclusion

The ability to create immersive and interactive learning environments that simulate real-life experiences could significantly enhance student engagement and comprehension. Preliminary results suggest that students find the idea of learning in the metaverse to be compelling, providing access to educational resources and experiences that may not be feasible in traditional classroom settings.

Students experienced that meeting in the metaverse may change the future of instruction, and these interactions can benefit them in the real world. Exploring an immersive learning space was new for most students and provided a tangible way to relate to the conceptual knowledge gained by studying aspects of the metaverse. After the course, several students reflected that

they would have liked fewer readings, more activities using VR headsets, and more opportunities to explore and design virtual worlds. The need for technical infrastructure and digital literacy among educators and students are potential challenges. As technology advances, increased accessibility of hardware and the influx of human-centered interfaces will influence the design of a new kind of digital classroom.

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Technology-enhanced learning: Cloud Computing to implement cooperation among schools

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Abstract

In this article we describe an interdisciplinary laboratory implemented thanks to the technology designed as part of the activities elaborated in the Mathematical High School Project by the research group of the Department of Mathematics of the University of Salerno. Four classes of different schools, led by their teachers and coordinated by university researchers, have produced an educational computer game by sharing the various statuses of the work in the cloud. The teaching activity was aimed at deepening literary texts concerning mathematics transformed into a game thanks to the skills acquired by the students in computer science in which the advancement in the various levels required the resolution of enigmas and mathematical riddles. In this work, we will also present the topics that lead us to evaluate in an extremely positive way the use of cloud computing in curricular teaching in a wide vision of knowledge.

Keywords: *Interdisciplinarity; cloud computing; education; technology; mathematical language.*

1. Introduction

Contemporary society is defined as "global" because every action, every cultural, economic, social, and political choice has repercussions that are independent of the context in which it took place and determine effects and interrelationships in much broader contexts. The school must therefore encourage students to carry out collaborative activities both in the form of group work also through the structuring of paths that involve wider networks, for example between geographically distant schools. In this way, in addition to broadening the cultural horizon of the participants, a sharing of good educational practices is developed. Technology is certainly an extremely effective tool to encourage these interactions even at a distance because, in economic terms, it allows the meeting, exchange and share processing through computer tools and programs. This has therefore led to the design of experimental laboratory paths oriented in this educational direction. The use of technology is natural to high school students who are part of that category called "digital natives", therefore the choice to exploit tools close to the daily life of youngsters leads them to feel like main actors, the protagonists of the formation of their knowledge with an active role in the construction of their skills. Consequently, it is important to observe and analyze the educational effects of activities that are developed in collaboration among different schools and research institutes, sometimes very far both for the distance and for the educational paths, thanks to virtual platforms.

In the "Sustainable Development Goal 4 - Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" of the 2030 Agenda for Sustainable Development, that is guided by the purposes and principles of the Charter of the United Nations, we read: "The spread of information and communications technology and global interconnectedness has great potential to accelerate human progress, to bridge the digital divide and to develop knowledge societies... By 2030, substantially increase the number of youth and adults who have relevant skills, ...substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries,..." (Agenda 2030).

Sharing and collaboration become more difficult to manage when institutions are placed in distant locations. In these cases, the technologies are powerful and effective tools for cooperative work and the Cloud is a widespread methodology for managing the administration of educational institutions: the electronic register, which is also accessible to students and parents, database files and material sharing in the various departments are all in cloud mode. The use of these powerful tools for sharing in educational activities is much less widespread even if it could become extremely powerful. In fact, with Cloud Computing, teachers and students may implement collaborative learning thanks to the use of archiving, exchange, and online document editing (Alabbadi,2011), (Dmitriev et al., 2012), (Sultan, 2010). Generic software, like Google Apps for Education or Microsoft Office, offers online productivity applications such as word processing, spreadsheets and functions that can be

used in the classroom (Bennett, Pence, 2011), (Bonham, 2011), (Nevin, 2009) (Rienzo, Han, 2009). This provides to work and share progresses or results in real-time. Cloud services become a powerful architecture for performing complex large-scale computing tasks and a wide range of IT functions, from archiving to computing, database and application services. The cloud is also convenient for teachers as it does not require complex software operations, it is enough to connect to a web browser and learn simple instructions to access shared platforms. It is even economical because last-generation software is used without having to buy it. The schools are very sensitive to this theme because of the scarce economic resources available, so the business model of sharing through the cloud may offer excellent insights into the world of school and, even if it has only been talked about for a few years, it is not a recent idea (Baldassarre, 2018), (Katiyar, 2018).

In our research-work, we choose the Cloud platform as a privileged tool for the development of a teaching model that is oriented to a cooperative-metacognitive approach that encourages students to improve study and learning strategies, the management of variables involved in the construction of their knowledge, the social mediation and positive interdependence. The elaboration of students' responses to the experiential stimuli favored by teachers, highlights the production of skills in individual cognitive potentialities that are particularly enriched by the exchange in different school contexts. As Vygotskij (Vygotskij, 1934) argues, cognitive development theory focuses on the important contributions made by society to individual development. This theory emphasizes the interaction between developing individuals and the culture in which they live and considers human learning as a social process. Therefore, social interaction between students is effective for developing skills and strategies and the interaction between students and teachers is fundamental for cognitive development since teachers are more competent people in different contexts.

The choice of the theme for the laboratory activities is linked to the desire to develop the entire relationship between language and thought in the various areas of knowledge and with different communication channels. The narrative book with mathematical content has been deepened, analyzed in the various literary and scientific fields, dissected and subsequently reconstructed to be reproduced in the context of a video game (with various narrative moments in the form of a short cartoon). The whole process was developed through a careful analysis of the different languages to be used in different contexts. The contents of the book, as cultural mediators, have also been developed through the use of various languages and this led students to enhance critical thinking through processes of analysis and synthesis at a high level of skills.

The decision to remotely share the materials on the platform led students to improve digital skills with a specific language; the need to discuss via the web about the choices to be implemented for the activities, required the commitment of the students to pay particular attention to reciprocal communications to avoid misunderstandings in the activities to be

carried out. The development of computer works close to the habits and lifestyles of youths led them to acquire transversal skills and experiences without a specific added effort.

2. Cloud Computing, a powerful didactical tool to develop transversal skills

2.1. The background: the project “Mathematical High School”

The "Mathematical High School Project" (MHS) is a project developed by the Department of Mathematics of the University of Salerno in 2015 in collaboration with several Departments of the same University. Currently, the project has expanded nationwide and involves 26 universities and over 160 high schools. The activities are developed during extracurricular hours and are presented in collaboration between university researchers and teachers of the schools involved. The MHS activities aim at building interdisciplinary skills that go beyond the fragmentation of knowledge into the various school subjects and make use of the full potential of technology in the educational domain by exploring innovative experimental paths (Tortoriello, Veronesi, 2021), (Bimonte et al., 2022). Mathematics becomes the universal language that is declined in various areas and is the link between the two cultures, the humanistic and the scientific ones (Rogora, Tortoriello, 2021). The digital platforms that facilitate the sharing of materials have opened up new avenues for fostering collaborative networks between universities and schools, thereby enabling a more comprehensive and inclusive approach to collaboration. This has resulted in the creation of diverse pathways in MHS schools that emphasize the use of innovative technologies to promote an interdisciplinary approach underpinned by constructivist pedagogy.

2.2. Our research – a “digital storytelling” experience

In this paragraph, we report the experience of an activity developed within the MHS project starting from the school year 2017/18. In that year the project envisaged the participation of university researchers, school teachers of Italian literature, Math and Computer Science and four 10th-grade classes from MHS schools located in different cities in South Italy. About eighty students participated in the activities.

The aim of the Laboratory was to develop an interdisciplinary path between literature and mathematics through the reading of famous books that dealt with mathematical ideas and contents in narrative form, to transform the plots into a serious game with enigmas and mathematical riddles to overcome the levels and continue the narration of the stories. In this way, mathematical literary contents and computer skills become both the object of the study and the development tool of a path that is certainly fascinating and captivating for students. The researchers divided the activities to be carried out among schools to develop the video game with the Skretch software, choosing for each school the best area in which to produce materials consistent with what has been done in the activities of the MHS. In particular, a

group of students choose within the plot of the book which moments to develop in the activity, another group of students developed the backgrounds and the play environments, and the last group of students built the actions on the characters designed by students from other groups. Upstream of computer programming activities, students with their Italian literature professors read books that had become a curricular subject of teaching activities. In the various passages with references to geometry and mathematics, mathematics teachers joined colleagues realizing activities in didactic cooperation designed by the teaching team through online meetings and sharing of material and exchange of ideas on Cloud platforms.

The books, in the form of a fictionalized adventure, deal with many maths topics that students face in their school curriculum of the upper two-year course and which have been the starting point for developing collaborative didactic laboratory activities and for designing skills tests to advance in the educational game path. In a meeting on an online platform, the researchers and teachers of the schools shared a development plan for the entire course. Firstly, the cultural moments of the educational path were outlined: the reading of the book in class, the discussion of the mathematical themes addressed and the use of the language used by the authors, the synthesis of the contents of the book reworked as the plot of a video game. Subsequently, the scanning of the contents to be developed for each group of students and the realization times of the various components of the videogame were defined.

Students worked under the supervision of their teachers, who provided them with help and support following the schema:

Step 1: brainstorming - The first phase of the activity was dedicated to reading books in Italian, including "What is the name of this book?" (Raymond Smullyan), "The Parrot Theorem" (Denis Guedj), "A Tangled Tale" (Lewis Carroll). During the teaching activity in the classroom, the teachers created working groups in which the students deepened the analysis of the texts, focusing on the characterizing passages and subsequently the reduction of the plot in the form of video game levels

Step 2: creating scenes - In this step, whose duration is 2 weeks, the students worked on the direction and screenplay: they wrote the storyboard, built the sequences and described the contents and scenarios of the various levels. The activities have been organized as follows: during the curricular time, in the classes, teachers helped their students to arrange their ideas, write the storyboard and organize the story sequences; at home, students collaborated in writing scenes using cloud resourcing and storing them in a repository on a shared drive. Periodically teachers organized online briefings with students to verify the work in progress.

The skills that the students had to put in place in this didactic moment consisted precisely of the use of language. They had to read books and narrative texts with numerous mathematical references recalled with rigorous sectorial vocabulary. They then had to synthesize the plot, break it down into sequences and define the main ones to be selected. For the design and

development of the video game, they had to rework the texts transforming them into short dialogues in a theatrical readjustment. All this had to happen without losing the plot of the book, thus keeping the product rich in content but fluid in its playability to stimulate interest in the mathematical contents of the game. Obviously, the answers to questions, riddles and route choices can be found right in the book mentioned so players are encouraged to read or re-read the book in the various steps to look for key clues that allow progress in the game levels. We chose to use narrative text because it is widely used in literature as a powerful tool to implement the achievement of mathematical objectives, now it is common practice to contextualize mathematical problems in contexts of reality that are perceived as less "abstract" and closer to the fields experience and knowledge of the students and thus diminishes the fear of trial and evaluation. Students also demonstrate that coordinated logical-mathematical thinking and narrative thinking cooperate more effectively through the narrative tool because intuition and creativity make it possible to convey arguments that are subsequently structured with the formal rigor of the scientific sphere through a rational analytical development.

Step 3: creating the digital story - In this phase, lasting about a month, under the guidance of teachers and researchers developed the video game with the Scratch software using the materials that had been produced in advance and saved in Drive, then created the scripts of the various phases and the various levels of the game, processed the backgrounds with the scenes, built the characters adding the music and videos. They developed the activity so that the player is the protagonist that advances in the game through challenges to be solved with different skills: cultural and scientific skills, mathematical logical skills, speed and dexterity, visual and spatial memory exercises and logical reasoning.



Figure 1. Two scenes from the digital story

Step 4: presentation - The presentation of the work took place at two different times. First, in each school involved in the project, the teachers of the classes organized a seminar in which the students presented the video game they had produced to other boys and girls of their Institute. Subsequently, during the National Seminar of Mathematical High Schools at the University of Salerno a workshop was organized in which students presented to their peers (with a "Peer-to-peer" education model) and subsequently to the teachers who attended the conference (with a "flipped classroom" approach) the activities they had carried out and the result they had obtained, that is the videogame.

3. Conclusions

In our educational path, we have chosen to develop a constructivist learning model which through the use of technologies has intended to develop interdisciplinary paths with close interconnections between the mathematical area and the humanistic area in which students have been made protagonists of their process of learning both as videogame directors and developers and as gamers. We also wanted to develop a collaboration path between students from different schools and cities through cloud computing platforms to create virtuous connections and circuits for sharing good educational practices. since this path was started two years before the covid forced us to carry out distance learning, we believe that it was a far-sighted starting point for the development of the mathematical high school.

In this paper, after a careful examination of the various definitions of cloud computing and an introduction to the implementation of cloud computing in education, the digital storytelling activity carried out with crowdsourcing and cloud techniques is presented. the use of a constructivist approach enhanced with technologies has shown that the participation of students and the quality of the video game as the final product of the course were qualitatively excellent thanks to the use of the cloud and the sharing of results step by step, above all, the students' skills on the topics addressed are superior to those obtainable with traditional teaching. According to teachers' support, we can conclude that this model allows students to learn by doing, enriching the path with active participation.

The experimental laboratory offered teachers and researchers the opportunity to observe the didactic impact on students. Various aspects emerged that deserve emphasis:

- The path develops in the literary, mathematical and computer fields and allowed each participant to deepen the topics covered by choosing the cultural environment most congenial to their study preferences, so each student has always felt involved and interested having been able to evaluate how to work in the project;
- The students worked in groups within their class and compared with other classes interacting thanks to the cloud for sharing materials and remote online meetings. This allowed them to develop soft skills such as communication, respect for other points of view, team collaboration, designing with teamwork through the sharing of skills and expertise;
- The choice to center the entire project around the construction of a Scratch videogame allowed to convey information and knowledge of less attractive disciplines such as mathematics and literature through the semiotic mediation of the artifact in the interaction of tools, methods and languages that enabled the strengthening of students' skills in an interdisciplinary key.

The activities did not include a formalized assessment mechanism to stimulate students' participation. The reports generated by the students at the completion of the project indicate

a profound sense of contentment with the activities undertaken, evincing a strong inclination towards future participation in similar ventures.

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Inverting the classroom using on-demand lightboard micro lecture films (learning glass)

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Abstract

Critical thinking and self-directed learning are corner stones to prepare first year mechanical engineering students for the demands of the employment market. Creating a positive learning environment presupposes solutions to mechanical engineering problems related to material science. The blended learning environment embeds inverted classroom teaching scenarios as the opportunity to gain higher learning outcome and self-reliant study skills. Inverting the classroom is a method to let the students study the basic scientific background of engineering materials on their own and then work practically during face-to-face time. Because during digital self-study periods (especially during the Covid-19 pandemic) students often feel lonely lightboard videos were provided in addition to traditional lecture material. Short lightboard videos (<10 min) are produced easily on student demand on a glass panel (learning glass). Here, the lecturer always keeps eye contact with the audience and students feel addressed in person. As students were able to manage the input the learning outcome is directly related to the teaching material.

Keywords: *Light board, inverted classroom, flipped classroom, blended learning, first year students.*

1. Introduction

Nowadays information is readily accessible and not centered in one expert or lecturer. Decentralization and globalization expects students to acquire autonomy and to appropriate their own learning process: Huguet et al. (2017). Problem-solving and communication skills are already important for first year students, because collaborating, thinking innovatively and knowing how to solve problems are considered to be 21st century essential skills: Efstratia (2014). One constructive teaching approach is the inverted classroom teaching model: Berret (2012), Brame (2015) having positive effect on self-efficacy beliefs and intrinsic motivation: Thai et al. (2017). *The flipped classroom constitutes a role change for instructors, who give up their front-of-the-class position in favor of a more collaborative and cooperative contribution to the teaching process: Educause (2016) (Figure 1).* Students are given more of the responsibility for the learning process and therefore engage in critical thinking: Kaya et al. (2014), Pfennig (2017). Students take over active parts in hands-on work and communication and become devoted to their learning and even determined activators of the face-to-face time. Deeper learning outcomes: Simon et al. (2010) are produced. *What the flip does particularly well is to bring about a distinctive shift in priorities—from merely covering material to working toward mastery of it: Educause (2016).* However, Setren et al. (2019) assign success only for MINT courses and show no evident success of the method for economic related teaching.

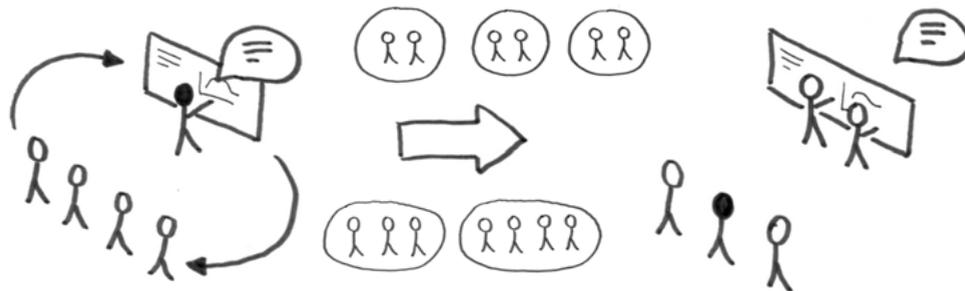


Figure 1. The principle of inverting the classroom. Instructors give up their front-of-the-class position in favour of a more collaborative and cooperative contribution to the teaching process

Inverting the classroom comprises of the scientific input during defined self-studying phases. During face-to-face time more time is given to explore science, to raise questions and discuss details as well as to communicate in an appropriate scientific pathway in equal measure: Pfennig (2016), Pfennig (2019), Pfennig (2022), Setren et al. (2019), Berret (2012), Brame (2015). Lively taught science as means of medium to catch and/or raise students' attention may result in good grades. This paper discusses the advantages of lightboard (learning glass) videos as means of teaching material in inverted classroom teaching scenarios over lecture capturing: Crooka and Shofield (2017) or even lecture videos: Pfennig (2019).

2. Setting of inverted classroom scenarios in first year materials science

Material science for first year mechanical engineering students at HTW Berlin is taught via the “design-led” teaching approach: Ashby et al. (2013) that has been explained in detail by: Pfennig (2016), Pfennig (2022). Because blended learning reveals a higher learning performance compared to the e-learning setting: Thai et al. (2017) the best teaching environment was provided implementing a blended learning setting. Micro-projects were combined with inverted classroom teaching scenarios and were included in the blended learning materials science course: Pfennig (2016), Pfennig (2019), Pfennig (2022) described the course structure and the alternative grading system based on a portfolio in detail.

The inverted classroom teaching method requires and at the same time enables individual self-directed, location-independent and asynchronous studying. To most of the students the important advantage are the teaching materials provided online and the possibility to study the science on their own independent from place and time and according to their individual tempo in self-chosen study groups. Simple methods such as “Think-pair-share” or “peer instruction”: Simon et al. (2010) and (digitalized) classroom response offer a quick overview of students’ state of knowledge enabling the lecturer to respond easily to the needs of the class. During face-to-face time students and lecturer discuss difficulties and thoughts, answer questions and work on engineering related problems (Figure 2).



Figure 2. Change of roles: Students learning session and presentation in class after preparing scientific backgrounds at home.

3. The importance of teaching material

Teaching first year students challenges lecturer, because diversity of the class is high. Besides the different educational and family backgrounds offering various level of understanding some students ignore the significance of the scientific basics. To motivate students and guide their learning progress seems to be one of the main outcomes of a first year class. Students motivation, performance and learning outcome is directly related to the teaching material provided Pfennig (2019), Pfennig (2022), Kaya et al. (2014). This unconditionally has to be congruent with the class progress and learning outcome. Otherwise students do not relate the study material to their personal success and knowledge.

Teaching material was partly generated by higher class students (peer-to-peer approach): Pfennig (2019). Generally, it is provided online via Moodle to offer all students the same preconditions. The teaching material addresses many learning styles, all focusing on the same learning outcome. However, different students show manifold learning preferences that have to be met to succeed in a blended learning setting. Figure 3 visualizes the teaching materials and activities offered in the first year material science course. This Figure emphasizes the strength of visualization – that can be of high use in a first year class. Learning outcome of certain themes is much higher when difficult scientific explanations, especially models, are visualized and assigned to distinct symbols and proceedings.

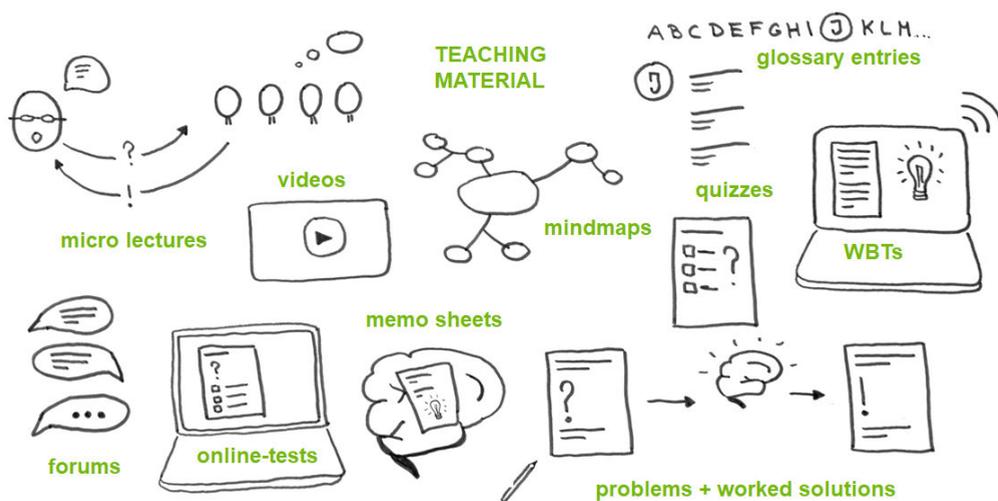


Figure 3. Teaching material

4. Advantage of lightboard videos

Micro lectures with self-guiding tests: Pfennig (2018) offer high quality self-study material. However, most inverted classroom lectures will be accompanied by lecture videos, such as lecture capturing or demonstrating videos: Pfennig (2019). Capturing lectures seems to be a low-threshold method to provide lectures and content to students although recordings of lectures comprise at least five different techniques: Crooka and Shofield (2017). Lecture videos provide an audio and visual stimulus covering different learning methodologies: Gulley and Jackson (2016). Presupposed the video included is analogous to the desired learning outcomes of the lecture: Al-Jandan, Farooq and Khan (2015) lecture videos are definitely a reinforcement, rather than a replacement for lectures: Havergal (2015).

However, the biggest disadvantage is that the lecturer generally turns her or his back towards the students. From earlier surveys it is known that students prefer lecture videos where human

contact is made: Pfennig (2019). Therefore, lightboard teaching videos offer a successful solution to teach short sequences online and face students directly at the same time (Figure 4). The lightboard at HTW Berlin was successfully designed and developed in a mechanical engineering student peer-to-peer project.

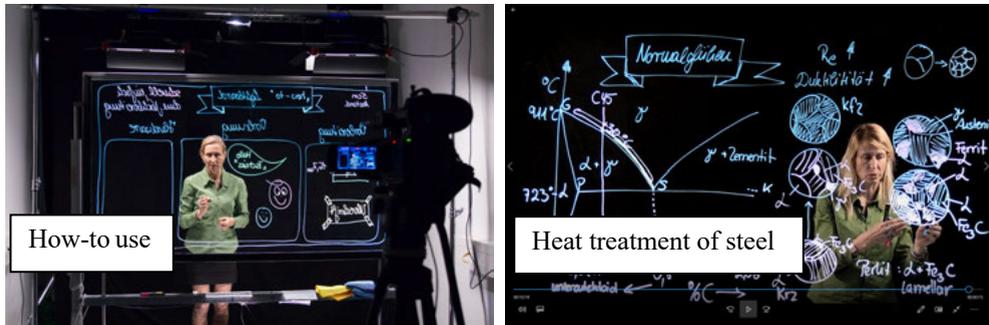


Figure 4. Examples of lightboard videos at HTW Berlin.

A lightboard consists of a high quality optiglass panel which is surrounded by LED lights. Extra strong lights enable for high quality contrasting and clear colors of the video. Fluorescent pens highlight the writing that is done in light absorbing surrounding. A camera is positioned properly (centered on the entire glass board) before the lecturer. The video is inverted after filming either using camera software or post production software. The production of lightboard videos is of low threshold. The contents of the lecture should fit on one 16:9 screen – just as the black board offers in ordinary class rooms. They are easy to make, because a lightboard video is a replica of a scientific panel painting such as usually developed analogously in class. The equipment is easy to use. However, there are a couple of recommendations to be met:

- Plan on less than 10 minutes for one video, best is 4-5 minutes. Otherwise divide in 2 parts
- Face forward as much as you can
- Smile as much as you can
- Leave 5 cm spacing from the edge to ensure your writing fits the screen
- Use proper spacing, colors and distinct headings
- Do not erase errors (it appears human) and students feel addressed personally
- Do not plan on 2 panel screens. One should do to cover your contents
- Speak slowly and clearly
- Introduce the video and finish with a “good bye”
- Wear solid and middle dark colors (green, dark red), no patterns

4. First evaluation of implementing lightboard videos

Material science has a high work load for first year students and a very theoretical subject. However, most of the students rate the different learning materials beneficial for their learning progress. The lightboard videos were considered as bridge between the self-study period at home and contact time in class. Joy of studying is enhanced when students feel addressed in person, because the lecturer always faces the audience and “keeps eye-contact” with students – especially during the Covid-19 pandemic (Figure 5). Also, the restriction to one blackboard panel picture and time limit less than 10 minutes have a lasting effect in terms of facilitation and personal learning progress. Students feel secure with the quantity of the material as well as the quality because delivered directly by the lecturer similar to in-class lectures. Therefore, most of the students studied widely using the ca. 50 lightboard videos even suggesting themes and questions they came along during preparation time. Because more students were engaged in the learning procedure the class was more homogeneous. The most important advantages mentioned by the students (besides eye-contact) is that the lightboard videos (along with other digital teaching materials) are independently reusable. Another advantage is that students may post technical terms or sequences of the lecture they considered difficult and a lightboard video can be made right away without any preparation and very little post production. Lightboard videos may be produced on-demand and are therefore considered very powerful and successful teaching material. Note, that after the pandemic students did not relate to the lightboard videos as important because they experienced face-to-face time again.

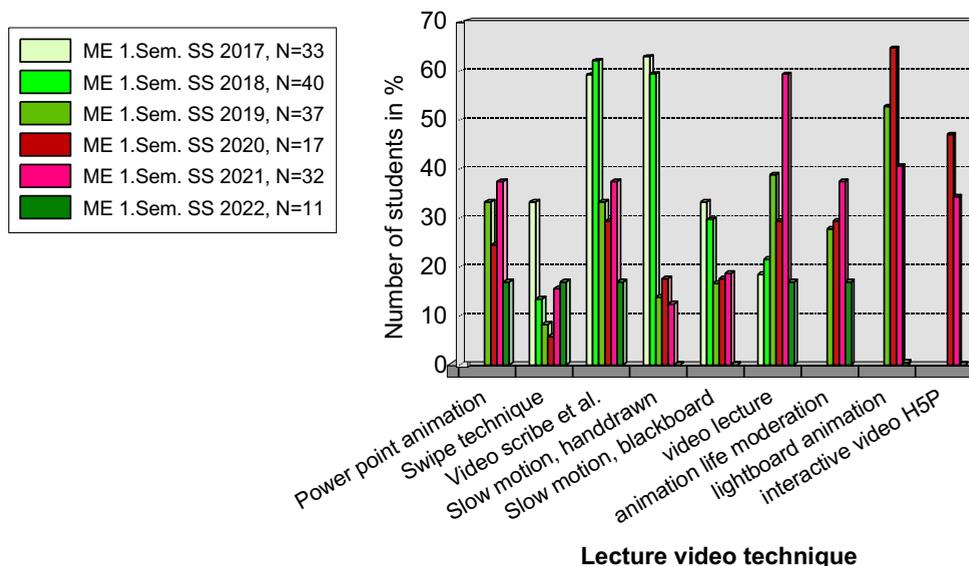


Figure 5. Preference of video technique. Lightboard videos were established first in SS2019. SS2020 and SS2021 were taught fully online.

During plenary sessions students acted lively and were eager to dispose and share their knowledge, collaborate and learn more of the details. During face-to-face time a strong structure of the problem based work (e.g. templates, clear work order) and always transparent and steady course demands are essential regarding learning outcome and better grades: Efstratia (2014). Drawback of this modern teaching method is the very high preparation time. Venturing into an alternative method may discourage lecturer because they are expected to manage additional activities, demands and collaboratitive student work: Efstratia (2014). There is always the risk of losing students who are not willing to study at home. Implementing lightboard videos as teaching source however showed that more students were prepared and also positively willing to work with other material provided online.

5. Conclusion

Inverting the classroom involves students to take over the responsibility for their own learning process. This modern teaching method is assessed as beneficial in terms of student grades, learning output and understanding of scientific background, concentration and attentiveness as well as both joy of studying and teaching. However, the success of the method is directly related to the teaching material. During self-study periods students need strong guidance, transparency of the grading system and to overcome the feeling of loneliness. Therefore, lightboard teaching videos are a good alternative to conventional lecture capturing videos because the lecturer always keeps eye contact with the audience and students feel addressed more personally. Lightboard videos bridge self-study periods at home and contact-time in class. Provided directly by the lecturer and restricted to one blackboard panel of less than 10 minutes teaching students feel secure with the quantity of the material as well as the quality.

Most important advantages comprise of 1. the low threshold – everyone can start right away, 2. lecturers “keeping eye-contact” with students, 3. offering good pace for student learning (short in-put videos that are less than 10 minutes long), 4. being immediately producible on student demand, 5. only little post production time being necessary. Overall lightboard videos are attributed to a lasting effect in terms of facilitation and personal learning progress.

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Let's experience learning in the metaverse

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Abstract

The metaverse and learning experience design (LXD) are shaping the future of learning and teaching in higher education. The metaverse is a virtual extension of the physical world that frees learning from time and space constraints while LXD is a learn-centric approach to design technology-mediated learning. LXD focuses on cognitive and affective engagement of learners with the learning experience; and the metaverse promises the adaptive infrastructure and flexible design space to realize digital learning as a journey of a series of ongoing, intensively personalized, immersive, adaptive, and competency-based experiences. In this paper, we discuss and reflect on how the potentials of metaverse can expand the effectiveness of LXD to address certain aspects of learning experience such as the influence of prior experiences, emotions, motivation, and attention. The metaverse presents unique opportunities to manage these aspects and to offer more attractive environments for learning activities.

Keywords: *The metaverse; learning experience; learning experience design; empathy mapping; cognitive engagement; affective engagement.*

1. Introduction

The metaverse is the new virtual universe for us to connect, socialize, play, share, experiment, create and trade. It is an online, collective, immersive, and interactive space that represents a digital extension to everything we experience, including learning. While it is still not fully developed, metaverse is constantly evolving with more potential applications to improve education and learning (Hwang & Chien 2022). The creation of learning experience (LX) in the metaverse is discussed in previous work (AbuKhousa et al., 2023) as the process that involves the development of 3D virtual learning environments and the creating of virtual representations of learners (avatars). It also includes designing and implementing learning activities which users can access and interact with through immersive interfaces and controls. While more frameworks are emerged to describe the technological aspects of metaverse education (e.g. Dahan et al., 2022; Cui et al., 2023); still little attention is paid to address cognitive and affective aspects that drive individuals to access the learning experience on metaverse to learn what they need verse what they want and to keep them engaged in the learning process. On the other hand, learning experience design (LXD) is an emerging area of learning design and technology (LDT) that integrates modern methods and processes such as design thinking, user experience (UX) and human-computer interaction (HCI) to focus on all the aspects of the learner's interaction with the learning tasks during technology-mediated learning. This includes the cognitive engagement as well as the affective response and subsequent engagement (i.e., level of involvement and participation) with the learning context (Tawfik et al., 2022).

The objective of this article is to explore how principles of LXD can inform the creation of learning experience on metaverse; and how the adaptation capabilities of metaverse may contribute into expanding the LXD to create multiple, equally effective learning experiences to support diverse and emerging cognitive and emotional needs of the learners. What faculty and learners in high education want in their virtual learning experience is not only a personalization of the content but also an adaptive competency-based learning process with more personalized assessment of the outcomes (Shearer et al., 2020). The autonomy and individualism focus should not be limited to the "pace" learners need to complete the learning tasks or to achieve certain level of learning outcomes. Learning journey should be designed as a set of ongoing experiences until desired competence is achieved (Clark, 2022; AbuKhousa et al., 2023).

In the following sections, we present a discussion of design thinking process in LXD and the potentials of the metaverse to enhance the creation of effective learning and growth-production experiences.

2. Learning Experience Design (LXD)

The dictionary by Merriam-Webster defines experience as “act or process of directly perceiving events or reality.” Learning is also a process during which learners develop perceptions and responses as result of their presence and interacting with the learning environment. They notice, interact, and interpret events in the physical and social surroundings and make changes in accordance with their intents and resources available for them in this process (Boud, 2008). It is the never-end situated sensing and doing activity with outcomes that remain in the memory and affect our behavior. Understanding the influence of the affective context on learning leads to designing good learning experiences that encourage and sustain learning (Clark, 2022). On the other hand, and according to common elements theory, learning happens through a series of experiences that engage learners in inferential reasoning and metacognitive activities to produce adaptive responses to problems in their environment (Butterfield & Nelson, 1989). Investment on these cognitive efforts is influenced by personal mental frameworks and associated with dispositional individual differences in self-control and goal-directed behavior (Kührt et al., 2021). For example, learners high in cognitive motivation, i.e., who have a high tendency to engage in and enjoy effortful cognitive tasks, will require integration of additional motivational attractions into their learning experience to avoid cognitive boredom. Other learners are subjected to the risk of cognitive overload if they are required a high interaction to complete the learning task (Wang et al., 2014). Thus, designing effective learning experiences requires understanding not only of learners, their needs, and the context in which they are embedded, but also the concepts and theories of learning, attention, memory, cognitive efforts, engagement; then making empirical evidenced decisions on how to create learning experiences that stick.

Based on a qualitative content analysis of 15 book chapters, Schmidt and Huang (2022) introduced a definition of LXD that is “*a human-centric, theoretically grounded, and socio-culturally sensitive approach to learning design, intended to propel learners towards identified learning goals, and informed by UXD methods.*” The authors also proposed a conceptual model of LXD that presents the complex nature of LXD as a convergence of design, disciplinary, theoretical, and methodological perspectives, with a central focus on learning. Another present LXD as a confluence of two major constructs: (a) interaction with the learning environment focusing on UX elements and learner’s utility of technology such as interface customization, content placement on the interface and functionality of presented components; and (b) interaction with learning space focusing on engagement elements and how learners perceives the interface items and interact with the content (Tawfik et al., 2022). Learning is already a challenging process and LXD is all about making the efforts to consider the socio-cultural, design and technological influences and factors to encourage effortful and long-term learning; or as Clark (2022) states “it is a matter of design for both head and hear.”

In their open-access book “*Learner and User Experience Research*,” Schmidt et al., (2020) put significant efforts into presenting theories, methods, and design models of LXD as well as examples of applied LXD processes to create digital learning experiences. Such work serves as an essential guide for the learning designers on how to design and operationalize learning experiences for a variety of contexts.

3. Design Thinking Process in (LXD)

Design thinking emphasizes empathy, i.e., develop an immersive understanding of the users for whom the products, services, or learning experience are being created, and combines it with rapid prototyping, and abductive reasoning to deliver the best possible evidence-based solution (Siricharoen, 2021). The design thinking process in LXD goes as follows:

1. **Empathize:** This stage involves understanding the learners, their needs and emotions, and the problem space. Learners are not approached as a population but as “personas” i.e., specific segments of learners who share goals, motivations, behavior patterns and challenges. Empathy involves research, observation, and interaction with learners to experience their feelings and understand what it is like to have their learning needs or challenges.
2. **Define:** In this stage, the learning problem is defined based on the insights gathered during the empathize stage. This involves understanding the opportunities and constraints presented by analyzing the learner, learning context, and learning task.
3. **Ideate:** The ideation stage involves generating potential solutions or experiences to the learning problem.
4. **Prototype:** The prototype stage involves creating virtual representations of the most promising ideas for the learning experience generated during the ideation stage.
5. **Test:** In this stage, prototypes are tested with real learners to validate or invalidate assumptions and to gather feedback. Based on the results, the design process may loop back to any of the previous stages or move forward to the implementation stage.

Schnepp and Rogers (2022) described the above design thinking framework as an effective and accessible method to produce effective learning experiences; and suggested a practical straight-forward steps on how to implement it for LXD in higher education. However, it is a more complicated matter as the design thinking with its sensitivity to learners and their needs may potentially undermine the perspectives of learning theories and how learning occurs (Clark, 2022). Plus, the testing part will involve assessment of many technical aspects and their influence on cognitive efforts, affective engagement and learning outcomes achievement. Not to mention the learners’ desire to be able to negotiate assessment expectations and to incorporate their input in the design, evaluation and evolving of their

learning experiences. Professionals in higher education will be required to develop a wider set of knowledge, skills, and competencies across a range of disciplines to be able to incorporate LXD into their practices (MacLean and Scott, 2011; Olney, 2023).

4. LXD in the Metaverse: Expanding the LX

The metaverse provides an adaptive infrastructure and a flexible design space that enables creation of interactive and customizable profiles (i.e., avatars), and opportunities for considering not only sociocultural factors but also the physical biometric markers and track their influence on cognitive performance; all of which are required to meet the demands for learning experiences in the digital age (Shearer et al., 2020). In the adaptive learning environment, the learning context and elements are dynamically adjusted according to the outcomes of learner's behaviors and actions while providing instant feedback and support. The artificial intelligence (AI) component of metaverse provide capabilities first to gather insights about the learners; second to create the problem space (i.e., simulating a real-life situations and learning tasks) including the generation of the non-player characters (NPCs) to interact with learner and augment the learning experience; and third to track and analyze the learner 's behaviors and actions while solving the problem (living the experience and engaging with the space objects); and finally to adjust the learning space and experience according to the outcomes of learner's solution to the problem (Hare & Tang, 2022; AbuKhoussa et al. 2023).

Clark (2022) states that the art and science of LXD lies between three words: emotion, motivation, and attention. The empathy mapping in LXD focuses on understanding and articulating the thoughts, feelings, and behaviors of a particular persona of learners. The goal is to emotionally motivate learners to engage actively in the experience. Boud (2008) argues that for maximizing learning from any experience, the new experience should be based on personal foundation of learner's feelings and prior learning experiences. The challenge remains for online learning experience is how to use learners' prior offline experiences to design the new experiences and how to link these new experiences to the learners' emotional drives. Moreover, how to analyze the emotions and feelings presented during and after the experience to seize the opportunities for further learning or understand enhancements for the experience growth-production. Prior experiences also influence attention and the attempts of LXD to sustain learner's attention. Attention of learners is mostly affected by their personality characteristics (Van Calster, 2018). The efficacy of external attention technique (e.g., sound cue, visual cue, etc.) may increase the individual's focus and stay on the task, but it does not indicate the learning happens.

In the metaverse, the virtual world and physical world will interact at the highest level of independence, i.e., changes in one of world will be reflected in the other world. The real time

synchronization between the two worlds will enable the achievement of experience-duality, where learners use avatars to experience situations and find solutions in virtual spaces that are closely paired-up with their real-world counterparts. On the other hand, and as in real life, they will experience events in virtual space that are out of control and where learning happens unintentionally as they experiment solutions to handle these events. Lifelong learning is that exact informal learning that occurs through interests, practice, and self-development (Clark, 2022). Learning experience design in the metaverse is envisioned to deliver learning as a situated practice within environments prepared to present the real practice space and the networks of actions and interactions among human and non-human objects. Besides the BIG data and AI capabilities to profile learners (i.e., develop empathy based on online/offline repository of life-time data) and to produce learning scenarios that serve the unique, multiple and the continuously changing individual needs and interests, learners will be driven to immerse themselves in the learning experience as part of living their life! The emotion, motivation and attention aspects are addressed by the reciprocal intentions in the space, i.e., understanding the actions of other players and the ability to interpret surrounding signals and manage unforeseen events as they arise from the context. The component of the metaverse where learners generate and trade digital content or assets; and where they can gain tangible (e.g., private space, premium avatar customization, virtual merchandise) and intangible rewards (e.g., social status in the virtual community, unique experiences, access to exclusive virtual spaces or the ability to interact with NPCs in new ways) can drive the engagement and interaction with the learning experience environment.

5. Concluding Remarks

The emerging LXD approach adopts empathy mapping technique to understand the perspectives, needs, and motivations of learners; and to identify challenges, and opportunities for creating learning experiences that meet their needs. The challenge lies in the complex relationships between the individual learner, learning tasks, technology and learning context; and how the elements of these constructs are influencing the cognitive and affective aspects of the learning. To maximize learning, more emphasis should be put on motivation, attention, engagement, and practice. In the metaverse, the experience is a series of immersive real-time social activities where learners with their unique identities in the virtual world connect, communicate, practice, exchange, trade, and share contents within a context that is governed by rules and norms, just as in real life communities. In this essence, the metaverse offers unique opportunities for LXD to generate more engaging learning experiences that can be customized to meet the needs of individual learners. Also, it offers opportunities to manage attention such as the ability to switch/teleport between different environments and activities in real-time. It is expected that the metaverse will continue to evolve and to offer more realistic and immersive virtual spaces that is more to be a more attractive alternative to

physical environments for many activities including learning. It is time for higher education to consider living and teaching in the metaverse.

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Innovation in education by design thinking

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Abstract

The dynamic changes currently caused by various megatrends challenge the educational sector. Prospective strategies are required to cope with these issues. This is where the innovation methodology of Design Thinking comes in: it can be described as creative thinking in heterogeneous teams to develop creative solution ideas for complex challenges. This approach helps to initiate new or adjusted strategies for special target groups in the context of education. In this article, essential aspects of Design Thinking are introduced, and references to innovations in the field of education are presented. Two examples from the higher education sector are then used to illustrate the practical implementation.

Keywords: *Design thinking; innovation; megatrends; higher education.*

1. Introduction

Megatrends "describe extremely complex dynamics of change and are a model for the transformation of the world" (Zukunftsinstitut, 2021). According to the Zukunftsinstitut, 12 megatrends can be identified, e.g., the megatrends neo ecology, new work and connectivity (ibid.).

Megatrends ensure that a variety of innovations will also be necessary in the field of higher education, such as the derivation of future skills according to Ehlers (2020), the examination of new topics in terms of content, the optimisation of digital teaching-learning scenarios, the development of new target groups and new types of programme designs.

2. Design Thinking

While solutions to manageable questions can be explored and solved with known problem-solving strategies, the complex challenges described above cannot be mastered in this way (Rittel & Webber, 2013). Buchanan sees the opportunity to develop new solutions through Design Thinking (Buchanan, 1992).

Today's understanding of Design Thinking as a methodology for initiating target group-oriented innovations can be traced back significantly to the d.school founded in 2005 at Stanford University (Meinel et al., 2015). Since 2007, Design Thinking has also been taught at the d.school of the Hasso Plattner Institute in Potsdam. Both institutions cooperate closely and conduct joint research programmes in the field of Design Thinking (Meinel & Leifer, 2011). In the meantime, Design Thinking has established itself internationally at other universities and colleges in teaching and research.

According to Meinel and Leifer, Design Thinking can be characterised as follows: "Its human-centric methodology integrates expertise from design, social sciences, engineering, and business. It blends an end-user focus with multidisciplinary collaboration and iterative improvement to produce innovative products, systems, and services" (Meinel&Leifer, 2011, p. 8). These essential characteristics of Design Thinking can be similarly found in other definitions (Uebernicketl et al., 2015, p. 16; Lockwood, 2009, p. xii; Plattner et al., 2009, p. 59; Brown, 2008, p. 86).

Design Thinking has already proven its value in the development of product and service innovations in well-known business enterprises. Also in Education Design Thinking is applied in various contexts and several universities, such as the Massachusetts Institute of Technology (MIT), Stanford University, the University of Potsdam and the University of St. Gallen, have made Design Thinking an integral part of their management training and research (Eppler & Hoffmann, 2012). Furthermore, Ehlers (2020) underlines the importance of Design Thinking by including it among the 17 Future Skills.

2.1 Key Elements

The essential key elements of Design Thinking are collaboration in a multidisciplinary team, a variable workspace and an iterative process flow (Plattner et al., 2009).

Multidisciplinary teams can draw on different professional qualifications. Through this broad range of expertise on the one hand and the profession-related different approaches on the other, a greater diversity of perspectives can be achieved, which expands the solution horizon (Page, 2017). "The evolution from design to Design Thinking is the story of the evolution from the creation of products to the relationship between people and products, and from there to the relationship between people and people" (Brown, 2019, p. 47).

A **workspace** that can be flexibly designed opens atypical uses and stimulates creativity. Variable furnishings such as high tables, stools and furniture on wheels are suitable for this purpose. In addition, pinboards and flip charts should be available for knowledge communication and documentation and prototyping materials are also needed (Plattner et al., 2009). With the help of sticky notes, the writable surfaces can additionally be extended to windows and cupboard doors (Lewrick et al., 2018).

The **Design Thinking** process comprises several phases that build on each other. The six-steps according to the HPI School of Design Thinking (2023) are presented in figure 1:

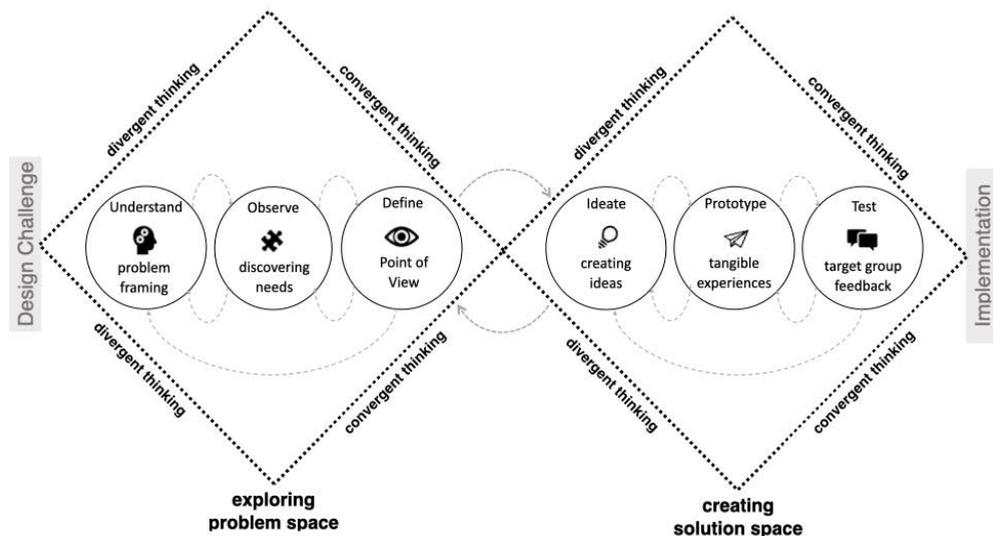


Figure 1: Problem space and solution space in the iterative Design Thinking process (Schmidberger & Wippermann, 2022, p. 40).

The Design Thinking process aims at finding a solution for a so-called Design Challenge. The Design Challenge presents a target group-oriented question for a complex problem and

is the starting point of the Design Thinking process. A unique feature of the process is the iterative, nonlinear approach, which is a result of its exploratory nature. In this way, the results obtained can be reflected upon, and questions that arise can lead to the further development of the solution idea (Lewrick et al., 2018).

The Design Thinking process moves between two fictional spaces. First, the focus is on exploring the problem space. Only then is the focus on developing new solution ideas for the design challenge. This separation between problem space and solution space is called the double diamond and represents an important aspect of Design Thinking (Design Council, 2007).

In this way, a detailed consideration of the problem is made possible without hastily trying to find solutions. This detailed clarification of the actual problem creates the basis for the development of target group-oriented solutions to complex challenges. At the beginning of the process, the focus is on divergent thinking. This means that the problem is approached as openly and unbiasedly as possible. To find out for which concrete challenge the target group needs a solution, different perspectives of the target group are included, and the Design Thinking team's own view is critically reflected on.

When evaluating and classifying the target group observation, the focus is then increasingly on convergent thinking. The results of this exploration phase enable the definition of a common point of view. This is crucial for a transition into the solution space. Here, divergent thinking is called for again, creating new solution impulses and enabling initial prototypes to be developed. When it comes to concretising the solution ideas, making decisions, and putting them into practice, convergent thinking is increasingly required. Throughout the process, the connection to the problem space is always maintained. This iterative procedure is intended to ensure that the solution finding corresponds to the actual needs of the target group (Design Council, 2007).

But tools, methods and processes alone do not fully unlock the potential of Design Thinking. The team's mindset is also important. It determines whether a team can successfully collaborate across disciplines, move through complexity, or inspire others to learn experimentally in order to think out of the box to create extraordinary solutions. Individuals with a human-centered mindset are open and non-judgmental towards people with different backgrounds. They are able to empathize with the emotions and needs of others and they feel comfortable taking on other perspectives, even if they don't correspond with their own experiences. These team members discover the problem space with curiosity and take every opportunity to improve, adapt or refine their own understanding, even if that means deviating from the original plan or redefining the problem to solve (Graves & Fuchs, 2022).

3. Innovation in Education by Design Thinking

To illustrate how innovation in education can be fostered by Design Thinking, two examples of the Ludwigsburg University of Education in Germany are described.

3.1 Seminar on the topic "Education for Sustainable Development (ESD)"

In the summer semester of 2022, students from various master's degree programmes (Early Childhood Education, Adult Education and Cultural Education) took part in the seminar "Education for Sustainable Development" at the Ludwigsburg University of Education, Germany. The seminar aimed at developing solutions for challenges in the field of education for sustainable development through Design Thinking. It started with a kick-off event that allowed the students to get to know each other personally and introduced them to the basics of Design Thinking. Furthermore, the students were given access to various learning media such as videos, study texts and literature on the topics of Design Thinking and ESD via the online learning platform of the University. During this asynchronous self-learning phase, the students dealt with in-depth impulse questions and used the online learning platform as an exchange forum. Subsequently, the acquired learning content was discussed and critically reflected upon during synchronous classroom sessions. An essential aspect was the gathering of practical experience in the application of Design Thinking in the context of ESD. For this purpose, the students formed four multidisciplinary teams (each consisting of approx. 10 participants), each of whom worked on a design challenge, both synchronously in classroom sessions and asynchronously (e.g., in the interview phases) throughout the semester. Due to the importance of the Design Thinking mindset, several aspects of it could be experienced by the students, e.g., by Impro Theater exercises. Special attention was paid to adopting a positive attitude towards mistakes in the sense of failing forward to include them as a necessary part of explorative learning.

During the Design Thinking process, two teams were accompanied by a lecturer who took on the role of the Design Thinking coach. The Design Challenges were developed in cooperation with the Office for University Didactics and the Office for Sustainability and Mobility at the Ludwigsburg University of Education, Germany. The Design Challenges were as follows:

How could we make learning even more attractive for students in the future, considering the quality criteria of ESD?

How could we motivate students to support sustainability issues at our university?

Based on the six-step Design Thinking process presented in this paper, the students first explored the problem space. For this purpose, interviews were conducted with the target group, and the results were evaluated using an empathy map. Then, with the help of creative techniques, solution ideas were developed, and the first prototypes were created. The

reflection at the end of the semester showed that the students had dealt intensively with the learning content. Through the methodology of Design Thinking, a creative approach to the Design Challenges in the field of ESD was supported, and innovative prototypes were created that can be tested in practice in the next step.

3.2 Development of a new profile for a master's degree programme

Since 2003, the Ludwigsburg University of Education in Germany has offered a master's degree programme in Educational Leadership that prepares educational leaders for their complex tasks against the background mentioned above (Iberer & Müller, 2012). The participants from all fields of education learn with and from each other. Against the backdrop of massive changes in the educational landscape, Design Thinking was used to develop a blueprint for the future curriculum and to find concrete levers. There was a particular focus on the composition of the study content, the design of the methodology and didactics, and an even more effective approach to the target group. The design challenge was: "How can the curriculum (objectives, content, methodology) of the master's degree programme in Educational Management be even more closely aligned with the needs of the participants?" The interdisciplinary teams consisted of members of the institute, current students, alumni and cooperation partners. During a one-day workshop, various prototypes (e.g., as video) were designed and concrete impulses for further development in terms of content, methodology and processes were collected.

4. Conclusion and critical reflection

Design Thinking might be a powerful methodology to develop extraordinary solutions if the required resources are matched, e.g., time slots for coaching and for iteration phases. It is also necessary to explore the problem space, e.g., by conducting interviews with the target group as well as testing the prototypes with the user in the solution space.

To fully unlock the potential of the methodology, an additional crucial resource is the person's mindset. Therefore, the development and support of a Design Thinking mindset needs to be addressed because not all persons may feel comfortable creating solutions in the described way. Nevertheless, according to our experiences, the structured design process is helpful for most team members.

The Design Thinking concept itself is not new and it describes the typical design process. But as soon as all described resources are met, Design Thinking can be used to tackle wicked problems and complex challenges. However, the strength of this methodology is its user-centeredness which supports creating innovations that are tailored to the target group's needs.

According to our expertise, the initiation and implementation of innovative ideas can be supported by Design Thinking in Education (Schmidberger & Wippermann, 2022;

Schmidberger & Wippermann, 2018). In this article, two examples show how solutions to complex problems in higher education can be developed with Design Thinking. Furthermore, Design Thinking is applied in various international contexts in Education and is among the 17 Future Skills. However, there is a lack of evidence regarding the impacts of Design Thinking on Education on the one hand and of systematic approaches to evaluate it at a large scale across sectors on the other hand. Therefore, further research on Design Thinking could focus on these aspects.

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Combining integrated curriculum and project-based learning: a short film case study from media and communication students

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Abstract

Undergraduate students in media-related fields expect their courses to be focused on real-world work environments, ultimately producing media products that can be proudly shared on social media and become part of their CV. The present paper presents a combination of integrated curriculum (IC) and project-based learning (PBL) to design a year-long activity that traverses various courses through an academic year to produce a quality media outcome. It utilizes face-to-face group interviews with the students and the instructors involved in the experience, survey questionnaires, as well as a comparison of the grades before and after the implementation of the project. The results show that the quality of the media products rised, that overall satisfaction of instructors was high, but students had mixed feelings. The lack of self-assessment tools and the emergence of group conflicts considering the length of the project were cited as the main limitations.

Keywords: *Media; project-based learning; integrated curriculum; film studies.*

1. Introduction

Higher education is in constant search of new learning methods that can capture and maintain the attention of students, maximizing class attendance and student adherence to the programs, while minimizing dropout rates (Aina et al., 2022; de Oliveira et al., 2021). Among the various ways to achieve such goals, in recent years some pedagogical approaches have gained momentum, including integrated curriculum models (IC) and project-based learning (PBL).

IC is an all-encompassing umbrella term that, generally speaking, views courses and modules from a university degree not as independent entities but as lego pieces which converse between them to build a common strategy (Drake & Reid, 2018). IC aims at dissolving the artificial separation between subjects, setting up a framework that brings together the contents, abilities, and fields shared by all of them. Therefore, fusion and interdisciplinarity are frequent buzzwords in IC studies. Although IC is not exclusive of any developmental stage of children, adolescents, or adult education, it has been more often applied in contexts of secondary rather than higher education (Alonso-Sáez & Berasategi-Sancho, 2017).

On the other hand, PBL, although originally conceived in the 1960s (Graaff et al., 2007), has become a well-established learning method that is based on the idea that students pursue their own interests towards the completion of a project that requires learnings from different fields (Krauss & Boss, 2018). PBL also relies on the assumption that as students engage with their own projects, their involvement and overall satisfaction will consequently be higher, and they will feel empowered (Guo et al., 2020). A meta-analytic review of the available evidence about the true impact of PBL on academic achievement showed that PBL usually works, with a moderate-to-large effect size, especially in social science contexts, and in Western educational systems (Chen & Yang, 2019).

Although IC and PBL have been widely used in separate, few previous experiences blending IC and PBL have been reported in the scientific literature. Scholars from Lapland University of Applied Sciences in Finland report a blended learning experience using IC and PBL in combination, indicating that the vast majority of students found it pedagogically motivating (Mielikäinen, 2021).

The present paper reports the design and some preliminary results from a learning innovation project blending IC and PBL (referred to as “IC+PBL” in the following pages), carried out within an undergraduate program in media studies at a higher education institution. Students from media-related areas often complain about the little connection between course contents and real-world work environments, and also expect to produce high quality media materials that can be shared on social media and become part of their portfolio. The aim of the project was to develop a learning activity that will require media students to apply knowledges from various fields and during two consecutive semesters in order to come up with a finished, well-rounded media product.

2. Method

2.1. Participants and aim

The project was carried out with first-year undergraduate students enrolled in a BA in media and communication studies at a large public university in Spain. The BA comprises four academic years and each year consists of two semesters of 30 European Credits Transfer System (ECTS). In total, 230 first-year students distributed along three years have taken part in this IC+PBL.

Students from this BA had typically complained about the lack of connection with reality of the offered courses. Specifically, they had felt unprepared to develop large scale media projects once they graduated. An additional source of dissatisfaction had to do with a general lack of motivation to engage in long-term projects.

In order to tackle these issues, the IC+PBL was designed in a way that could boost motivation by giving the students the chance to design their own long-term project, voted by all classmates. The IC+PBL was also structured so that it could realistically replicate the environment of a real-world media production, including all phases from creation, pre-production, production, postproduction, and communication.

2.2. Design and procedure

The IC+PBL was defined as a year-long group project starting in September and ending in May. Teams of about 8 members were randomly allocated at the beginning of the year. All teams had to make a short film about a topic previously decided by the whole class. Each team pitched different proposals, everybody voted, and the most voted proposal was the compulsory topic for every team.

The IC+PBL needed three years to be fully developed. In year one (2019-20), the IC+PBL was in pilot version, and only lasted one semester. In year two (2020-21), the IC+PBL traversed two semesters, with one course from each semester. In year three (2021-22), students had one course from the first semester and two courses from the second semester partially or fully devoted to the IC+PBL. For 2022-23, it is scheduled that the IC+PBL will involve a total of four courses.

The workload was distributed along the courses involved. Typically, first semester courses were used to select the proposals, to look for similar successful projects (i.e., benchmarking), to coordinate between teams in order to produce content and elements that needed to be used by every team (e.g., opening credits, visual style, typography fonts...). The first version of the IC+PBL product was shown in class at the end of the first semester, and the final version at the end of the academic year.

2.3. Assessment tools

The assessment of the development and efficacy of the IC+PBL was based on four criteria:

- A face-to-face group interview with the students to examine their opinions. These interviews were conducted twice in the process, between the first and second semester, and at the end of the academic course.
- A face-to-face group interview with the professors involved in the teaching of the courses that comprised the project. This took place once at the end of the academic course.
- An analysis comparing the students' grades of the main module from the previous academic year and the years after the project was implemented.
- A survey questionnaire shared with the students six months after the completion of the project. The questionnaire asked students about their (i) overall satisfaction with the experience, (ii) the in-group conflicts that the project caused, (iii) how often they shared the media materials that resulted from the projects on social media, (iv) whether they liked that a project traversed two consecutive semesters, (v) if they were proud of the final result.

2.4. Ethics

The project obtained permission from the universities' centre for learning innovation (REF 2021PID-UB/013). Two revisions of the original project draft were submitted until final permission was obtained. As per university legal requirement, the students involved in the project had the right to abandon it during the first month of each semester and be evaluated by means of a traditional written exam. Students received no compensation.

3. Results and discussion

The qualitative data from face-to-face group interviews showed an overall satisfaction with the PBL. Students appreciated engaging with a project that lasted longer than usual and allowed them to put into practice knowledge and skills obtained from various disciplines and courses. The real-world connection of the IC+PBL was among its most valued characteristics. The students found attractive the idea that the IC+PBLs were discussed in class and that the common topic for everybody was decided by means of a vote.

Students showed criticism towards two main aspects of the IC+PBL. First, they mentioned the lack of self-assessment methods as a limitation of the project. Self-assessment tools were important for some students because, in their opinion, they allowed them to root out students with little implication with the project. This was particularly relevant for teams in which conflicts abounded. Self-assessment tools, as explained by students, would have increased the overall perception that the IC+PBL fairly evaluated each member group, and that the

group as a whole was not penalised for including unmotivated members. Second, the random allocation to groups worked fine during the first semester each year, but by the time the second semester started, some teams began to show disruptions. Students felt that it was ok for first year students to see their teams picked by the professors, as they have not acquainted with anybody yet. However, as the course progressed, they missed some kind of mechanisms to change teams or to stop working with specific individuals.

From the instructors' point of view, the IC+PBL was also satisfactory, but with a number of limitations. The duration of the IC+PBL (one academic year) added an extra difficulty in terms of coordination. The professors whose courses started on the second semester were not as familiarised with the project as those professors with courses in the first semester, and this resulted in some confusion about the progress of the projects, and the assessment.

Concerning the adequacy of the IC+PBL to achieve the aims promised in the syllabus, the results are promising. The students outperformed the grades of similar students from the previous editions of the same course. Table 1 shows a comparison between the grades obtained by students pre and post IC+PBL implementation. The average mark showed a significant increase from $M = 7.93 - 8.25$ (in the pre-IC+PBL period two different assignments are considered) to 8.41 in the year 2021-22. Arguably, the interpretation of these results is that the quality of the deliverables increased after the implementation of the IC+PBL. No correlation analysis was carried out because the assignments that comprised the final mark were not comparable. Repeated means procedures were not suitable as these were independent samples. No causal relationship can be established from average grades and IC+PBL implementation.

Table 1. Grade comparison for the course “Audiovisual Language” before and after the implementation of the IC+PBL

	Pre-IC+PBL period		IC+PBL period →	
	2019-2020	2020-21	2020-21	2021-22
Academic year	2019-2020		2020-21	2021-22
Assignment	Short film	Script	PBL	PBL
Assessment weighting	20%	20%	60%	60%
Average grade	7.93	8.25	8.56	8.41

Source: Own data. Notes: Assessment weighting refers to the percentage for the final grade that the IC+PBL represents. Average grades computes only grades for the specific assignments listed above on a scale of 1 to 10.

However, the results from the survey questionnaires somehow contradicted the overall satisfaction of the students expressed in the face-to-face interviews. Table 2 shows the items asked. Considering the score of 3 as the threshold of neutrality, students indicated relatively negative emotions towards their final product, as seen in the fact that they were not especially proud of it ($M = 2.67$, $SD = 1.50$), and that they very rarely shared it on social media ($M = 2$,

SD = 1.48). This item is very important because it showed the lowest scores from the survey and it does not only capture a perception but a behavioral dimension. Opinions about the IC+PBL lasting two semesters instead of one also attracted relatively negative scores. On the other hand, the overall assessment of the experience was relatively positive (M = 3.25, SD = 0.87), and students appreciated the fact that the same project traversed different courses (M = 3.58, SD = 1.16). These results are preliminary and they only cover the opinion of 12 students. Not only the small number of respondents but the potential bias in self-selection (Bethlehem, 2010) for responding (i.e., did the students who had a worse experience self-select for participating in the questionnaire?) call for further assessments of the experience in the future.

Table 2. Students' assessment of the IC+PBL experience (N = 12)

Item	Mean (SD)
Fights in my team were frequent	3 (1.04)
I am proud of the final product delivered by my team	2.67 (1.50)
I liked the fact that the project lasted two semesters and not just one	2.75 (1.29)
I have shared on social media my team's work so others could see it	2 (1.48)
I liked the fact that different courses were part of the same project	3.58 (1.16)
Overall assessment of the experience*	3.25 (0.87)

Source: Own data. Notes. Items were assessed on a 1 to 5 likert scale (1=totally disagree; 5=totally agree). SD = Standard deviation. *This question asked for a 1 to 5 overall assessment of the IC+PBL experience (1=very negative; 5=very positive).

4. Conclusion

The present paper introduces a combination of an integrated curriculum (IC) and a project-based learning (PBL) experience with undergraduate students from a BA in media and communication. The experience was designed to increase motivation by creating a project that connected real-world tasks in a media production environment with class activities. As an IC experience, it integrated skills and abilities from different courses in a way that students were able to produce more sophisticated products than in one course, one semester situations. Students and faculty staff alike expressed positive opinions about the IC+PBL, while acknowledging a series of limitations such as the lack of self-assessment tools and the difficulty to form groups that stay in good terms and motivated for the duration of an entire academic year. Survey questionnaires indicated that some students had more mixed opinions about the overall experience.

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Teamwork and student engagement during practical sessions in laboratories

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Abstract

Teamwork is an important pedagogical approach which equips students with the necessary skills required for their learning and develops their employability. This research focuses on teamwork in practical sessions, and it investigates the factors that facilitate students' engagement during practical sessions, the optimum group size and how teamwork contributes to student learning. Students were asked to complete a questionnaire after a team working activity in the laboratory. The responses were quantitatively and qualitatively analysed, and it was found that communication is the most important element which enhanced the team's performance and engagement. The collaboration, discussion and interaction between the members were also found to be important to student engagement. The optimum group size was dependent on the complexity and the nature of the activity. It was found that effective teamwork contributes significantly to the enhancement of student learning and to developing required employability skills.

Keywords: *Teamwork, soft skills, engagement, practical education.*

1. Introduction

Active learning and effective engagement are important, interrelated factors in any higher education institute, requiring students to be engaged in an activity related to a learning outcome to develop their understanding of any given topic. The active learning approach is known to be more effective at engaging students in their learning compared to traditional lectures (Prince, 2004). Although active learning sometimes refers to the instructional activities that are happening inside a classroom, it also includes practical sessions in laboratories since students are actively engaged and thinking about what they are doing.

To ensure that the learning outcomes are delivered, and students gain the required skills in the practical sessions, students need to be engaged in the session. Some articles have reported on the performance of students during practical sessions, however, there is limited research on the extent of engagement of students during those same activities.

Teamwork has many advantages including creating an active and positive learning environment if used effectively. However, there are also some disadvantages of group or teamwork. It is vital to understand the advantages and disadvantages of group work before designing any activity to maximize the benefits and create an effective learning environment. Beebe and Masterson (2003) summarised the advantages of group work saying that groups have more knowledge and members are actively involved in discussion and contribution to decisions and therefore more interaction with others. The disadvantages of this approach include pressure from one group member on the others to agree on a decision to avoid conflict. This might lead to a bad decision and therefore affect the outcome. The dominance of a single individual in the discussion can also lead to dissatisfaction from other members as they feel isolated from the discussion and final decisions. This may also result in other group members relying heavily on the active members and acting as free riders either through choice, dwindling motivation or lack of confidence to put themselves forward.

Despite the disadvantages, group work remains a popular approach in higher education settings to facilitate student application of knowledge. Group work activities result in excellent learning outcomes if there is effective student participation, and the activity is properly designed by the teacher to ensure a positive learning environment is in place.

Group size should be selected carefully based on the complexity of the activity and the time available. According to Beebe and Masterson (2003), a small group is considered to have three members or two. A group size of four and more is large and difficult to coordinate. Research articles reported a different optimum group size, some suggested 3-4 members be the optimum size (Csernica et al., 2002) and others suggested 4-5 to work best (Davis, 1993). The optimum group size depends on the nature and complexity of the activity and the available time. It was reported that a smaller group size works best when the time available is short (Cooper, 1990; Johnson, 1991). However, research suggests that it is important to

create a group with mixed ability levels of skills and experience. This means that the groups are more effective when formed by the teacher or randomly allocated than groups formed by students' self-selection (Felder & Brent, 2001).

Some articles in Engineering education have reported that students liked working in teams and agreed on the benefits of teamwork. Freeman and Greenacre (2011) found that 78% of students agreed that teamwork helped them to learn and gain skills from others. The result (Williams, 2011) also suggested that students learnt more when working on group tasks compared to the traditional tutor presentation. Hammar Chiriac (2014) attempted to investigate group work in higher education settings. They found that 97% of students from a total of 210 students who participated in the study from two different universities, agreed that working in groups facilitated their learning by improving both their knowledge and their collaborative ability.

However, Freeman and Greenacre (2011) have also reported that a significant part of students also voted against the benefits of teamwork due to the existence of what is called the free riders who rely on others to get marks and rewards. The free rider issue can be overcome through self and peer assessment where each member assesses themselves and other members in the group which then will be considered when determining the final individual mark.

Multidisciplinary Engineering Education (MEE) is a dedicated department in the Faculty of Engineering at the University of Sheffield which is responsible for delivering all practical activities to undergraduate and postgraduate students from all departments at scale. To provide the experience and the required skills to large cohorts, students often work in teams to perform the activities in the laboratories. However, the approach needs to maintain the required level of engagement from the team members to ensure the learning outcomes are met. Some works in the literature investigated teamwork in different fields and others work on group sizes and the advantages and disadvantages of working in teams, however, there is no explicit research on which elements of the teamwork approach help and encourage students to be engaged in the session. This research aims to investigate the factors and elements of teamwork that facilitate student engagement during practical sessions in laboratories.

2. Participants and Methods

Participants in this study were students from Chemical and Biological Engineering at the University of Sheffield. It included students from the foundation year (13.8%), postgraduate taught PGT (25.9%), and 4 undergraduate cohorts UG (60.3%). In these courses, practical activities in laboratories are essential and students must work in the lab to collect data which is then used to complete the post-lab activities. In all the practical activities used in the study, students worked in groups of different sizes (ranging between 2-5 students per group)

depending on the complexity of the activity and the capacity of the laboratory. In the majority of these activities, students self-selected their groups from their peers in the laboratory. These groups only functioned during the lab session and all post-lab activities were based on individual student work. However, students from 2nd year were assigned to groups randomly by the teacher and these groups were functional in the lab and outside the lab throughout the semester. The members of each group met before the practical session to plan the activity, then executed the experiment in the laboratory together, and finally analysed the data.

In this research, data from students was collected using a structured questionnaire, which was ethically approved following the research ethics approval procedure at the University of Sheffield. The questionnaire focused on students' experience while working in laboratories and not outside the lab. It included multiple choice questions about the format of the group, year group and other background information as well as open-ended questions concerning the students' experience and their perceptions of group work. In total, 58 students from different cohorts responded to the questionnaire.

3. Results and discussion

The questionnaire and the data analysis were conducted based on the following research questions:

1. What is the optimum group size for a practical session in a laboratory?
2. What factors of teamwork facilitate students' engagement in the lab?
3. What positive experiences did students gain while working in groups? And how does this contribute to their learning and future?

Students were asked about their views of working in teams in the laboratory. Most students (86%) agreed that working in groups is better and more efficient to complete the tasks in the laboratory than working alone. Only 4% of students suggested that working alone in the laboratory would be more efficient. However, 10 % of students said that this depends on the type and complexity of the activity.

These answers indicate that students value teamwork during practical activities as it is more efficient, bringing more ideas and better chances to solve problems, as evidenced by this student's comments "Team, more ideas and solutions to potential issues". This agrees with the findings of others, where teamwork was found to be a good approach to gaining skills and facilitating students' learning and improving their knowledge and collaborative ability (Freeman & Greenacre, 2011; Hammar Chiriac, 2014; Williams, 2011). This is because teams have more than one way to solve a problem due to different experiences and knowledge of various team members, which results in improving students' performance in the session.

Some students (a very small percentage) preferred working alone, however, looking into the details of their comments, it looks like they wanted to be active all the time and to be more efficient. This indicates that the number of students in the group might have been more than what was required to complete the tasks in the experiment. When investigating this further, it was found that one of the responses came from a PGT student who was experimenting with a team of 3. The reason for their response might be that PGT students are more experienced than UG students and therefore they might be able to carry out more tasks in a shorter time frame.

One of the aims of this work was to gather students' views on the group size and identify the optimum size of a group. A majority of 83% confirmed that the group size (between 2 and 5 for different activities) was appropriate to complete the task in the laboratories. However, the remaining 17% suggested that the group size was not appropriate for the practical activity.

The engagement in the laboratories was investigated, by asking students in each group to rate their engagements between 1-5, 1 being "poor" and 5 being "Excellent Engagement". The majority of 95% have rated this between 4 and 5, which means that their engagement was good or excellent (Figure 1). The average engagement rate was 4.4/5 for the self-selected groups and 4.1/5 for the teacher-selected groups, which could suggest that students are slightly better engaged in groups of their choice. It is believed that better engagement results in better student performance in the session and therefore better learning experience (Crown, 2007).

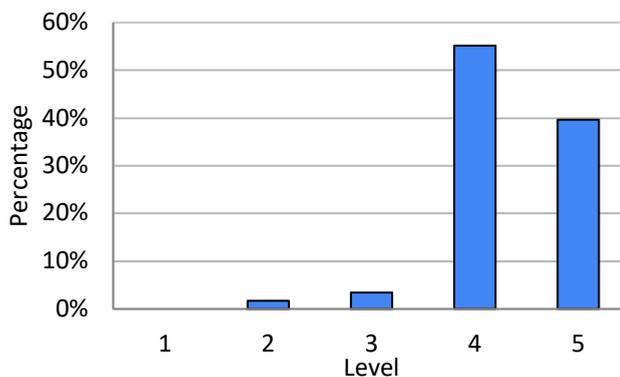


Figure 1: Percentage of students rating their engagement between 1-5, 1 being "poor" and 5 is "Excellent".

The group size can affect the student's engagement during the activity. Some comments suggested reducing the size for the simple experiment to keep everyone engaged and other comments suggested increasing the size for the complex activities. As mentioned earlier, the group size in this study was between 2-5 in each group and 83% confirming that the set group size was appropriate with a higher percentage of them being engaged, indicating that, from

the students' perspective the optimum group size is around 2 to 5 students. This agrees with the findings from others in the literature who reported that the optimum group size is 4-5 (Davis, 1993) and 3-4 (Csernica et al., 2002). However, the definite group size is difficult to determine as it depends on the complexity of the activity and tasks the group must complete during the session.

To explore the factors that enhance students' engagement in the laboratories, students were asked to rank the importance of different elements of teamwork to their engagement based on their experience in the laboratories. The average responses for each element were calculated and are shown in Figure 2. The element that scored 4 and below on average was important, between 4-5 was considered not to be significant and above 5 is not important.

From the results from the survey, it can be concluded that communication, collaboration, interaction, and discussion are found to be important factors/elements of teamwork which enhance students' engagement. On the other hand, punctuality and motivation from peers were found not to be important. There were no clear trends for the categories of feedback from peers, suggestion solutions, and enthusiasm and participation from other team members toward enhancing the engagements within a practical session.

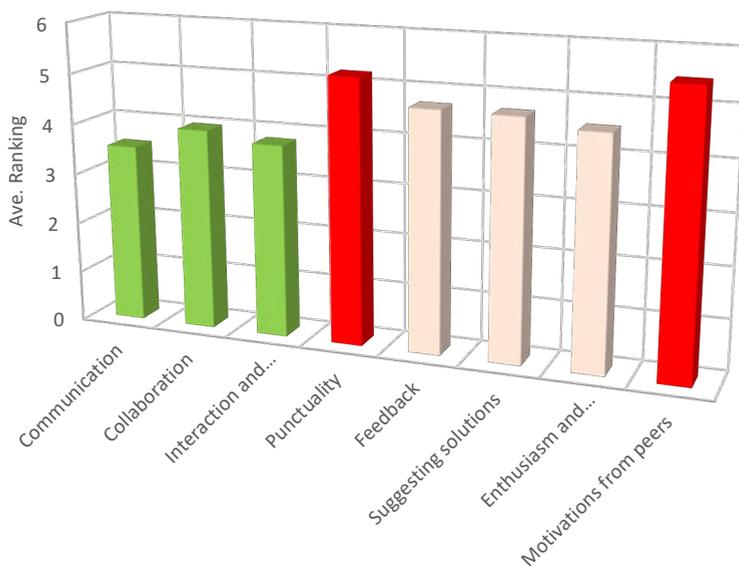


Figure 2: Average ranking of the importance of each of the different elements in teamwork on a 1-8 scale (1 is most important and 8 is least important).

Communication was found to be the most important factor in engaging students in practical sessions. The success of a group in achieving quality work depends on the way the group members communicate, their personalities and how motivated they are in contributing to the

group work. There is clear evidence in the literature that effective communication improves the performance (Beebe & Masterson, 2003). Teams with good communication and clear aims are known to perform better compared to those without clear aims (Crown, 2007).

In order to explore whether teamwork facilitates student learning and helps them gain transferable skills, the questionnaire in this research also included a question on how teamwork contributes to student learning. The responses to this question were also qualitatively analysed and were divided into two categories. As expected, most students confirmed that working in teams during the practical sessions helped them develop employability skills (communication, leadership, time management and problem-solving). There were also a lot of responses which confirmed that teamwork during these sessions improved their understanding and enhanced their knowledge of the subject. Enhancing student learning and helping them develop these soft skills are the reasons why a teamwork approach is used during practical sessions in laboratories.

When the responses were analysed, it was found that 62.5% of the responses were related to employability and other soft skills. Students confirmed that teamwork helped them develop the skills required for their life after university. Students appreciated that teamwork tasks at university address a requirement for this type of skill from industry amongst other contexts they are likely to encounter. The remaining responses (37.5%) were related to enhancing the knowledge of students. Students benefited from the ideas of different members to enhance and reinforce their knowledge. They also valued the diversity in the groups and appreciated the fact that the diversity came from different cultural backgrounds which benefited all team members. A comment about diversity can be seen in one student's comments below:

“Different people come from different backgrounds and have different values. Coming together with all of these traits gives us more diversity. People generally like to invest in something different that would benefit them.”

Gaining employability skills is important for graduates. Skills such as communication, networking, collaboration, and leadership are important attributes which the activities in laboratories provide an opportunity for students to develop. The comments and the feedback received from students suggest that students are aware of the importance of communication, discussion, interaction, and collaboration and how these help enhance their learning.

The fact that this study included participants from different year who were doing different experiments at different levels of difficulty, makes the findings easily applicable to other laboratories. In terms of group size, a size between 2-5 was found to be good (83% agreed on their group size). For example, 2 students per group will be optimum for activities which involve one setup where students only measure a variable. For activities which involve using more than one piece of equipment and students have limited time, then 3 students per group will be optimum to complete the tasks. However, when a pilot scale rig (or industrial scale

equipment) is used in an activity where different unit operations are working simultaneously, then at least 4-5 students are required to complete such an activity. It is also recommended to ensure elements such as communication, collaboration and discussion are properly utilised during the activity to maximize students' engagement. This can be done by incorporating some activities, such as asking questions to encourage team discussion and interactions.

4. Conclusion

Teamwork is an important approach used in universities to enhance student learning and provide the required skills. However, students must be engaged to maximise their learning. The research in this paper investigated the factors in teamwork that will facilitate student engagement and how teamwork contributes to their learning. It was found that communication between the team members is the most important factor to keep students engaged in the session. Good communication between team members enhances team performance and therefore their engagement. Collaboration, discussion, and interaction between team members were also found to be important for student engagement. The optimum group size was also investigated, and it was found that a size between 2-5 students can be considered optimum, however, the exact group size will always depend on the nature of the activity and its complexity. Finally, teamwork makes a significant contribution to student learning, and it helps develop employability skills.

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The impact of practical training on student understanding of plagiarism

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Abstract

In order to develop an understanding of plagiarism and how best to avoid it, a workshop was conducted with masters' students. They took part in a 4 hour interactive session that covered types of plagiarism, appropriate acknowledgement of sources, paraphrasing and contract cheating. They also completed a literature review afterwards for which they received two rounds of feedback on plagiarism issues. Students completed a survey assessing their understanding of plagiarism pre and post the workshop. A paired samples t test showed a significant improvement in student understanding of plagiarism as a result of the intervention. It is planned to roll out the initiative to other student groups in the coming academic year.

Keywords: *Plagiarism; academic integrity; student understanding; plagiarism prevention.*

1. Introduction

During the height of the Covid-19 pandemic, educational institutions around the world pivoted to online teaching and assessment without warning or preparation. Despite this, most universities managed to quickly adapt, albeit in many cases in an ad hoc manner. In the University of Galway, the institution in which this study is based, teaching staff moved to a combination of live and recorded lectures via Zoom or similar. The experience and support of the university's Centre for Excellence in Learning and Teaching meant the many queries of the teaching staff regarding technology and teaching approaches were quickly answered, resulting in a different, but largely educationally successful, experience for staff and students.

A more difficult issue to resolve was that of assessment. Unlike physical exams, online evaluation and submitted assignments provide significant opportunities for students to breach academic integrity (Amzalag *et al.*, 2022). Students can easily access the internet, consult with classmates and quickly copy material from a variety of sources (Mbhiza, 2021; Peytcheva-Forsyth *et al.*, 2018; Sarwar *et al.*, 2018). By necessity, written assignments and timed online exams took the place of formal written exams. However, in common with many other institutions (Meccawy *et al.*, 2021; Mokdad & Aljunaidi, 2020), this did result in increased reports of plagiarism within the School of Business in which this study took place.

With the relaxation of Covid-19 restrictions, in-class teaching and physical exams returned. However, as is happening elsewhere (Jena, 2020; Mbhiza, 2021; Pettit *et al.*, 2021), a discussion on retaining the benefits of alternative assessment methods, whilst minimising academic integrity issues, is ongoing. In person exams, the traditional approach to assessing student knowledge, have the benefit of being administered in a secure environment where students do not have access to materials other than those specifically allowed. However, this approach can result in passive, rather than active, learning on the part of the student (Altay, 2013) with students simply memorizing the material for the exam (Flores *et al.*, 2014), and frequently forgetting what they have learned shortly afterwards (Rawson *et al.*, 2013). In contrast, approaches such as authentic assessment which increase realism are shown to promote active learning by providing cognitive challenge and requiring judgement and analysis, this improving learning outcomes for students (Hogan, 2020; Villarroel *et al.*, 2020).

Based on academic integrity issues with students over the years, and in common with findings elsewhere (Aasheim *et al.*, 2012; Ali *et al.*, 2012; Dawson & Overfield, 2015; Marshall & Garry, 2005), it is clear that many students have a poor understanding of the ways in which a student submission can be considered to be plagiarized. Thus, it was decided to take a proactive approach to educating the students with the aim of reducing plagiarism incidents and facilitating assessment integrity outside the exam hall.

2. What is Plagiarism?

According to Cambridge Dictionary plagiarism is “the process or practice of using another person’s ideas or work and pretending that it is your own”. On initial reading, it would appear to be a relatively simple, clear-cut concept. However, it is not as clearcut as it may initially appear (Aasheim *et al.*, 2012; Ali *et al.*, 2012; Dawson & Overfield, 2015; Marshall & Garry, 2005). Students tend to have a clear understanding that cutting and pasting without acknowledgement or purchasing an assignment, constitute plagiarism (Ali *et al.*, 2012; Marshall & Garry, 2005). However, actions such as lack of paraphrasing or citing sources they have not read, are less likely to be considered to be plagiarism by students (Marshall & Garry, 2005).

2.1. Education on Plagiarism

There is much academic discussion on how best to teach students about academic integrity. Löfström *et al.* (2014) stress the importance of developing an understanding of the concepts, rather than just informing them of the rules. Bertram Gallant (2017) discusses the benefits of education rather than relying on sanctions. Other approaches include that of Brown and Janssen (2017) who developed a workshop which facilitated students exploring the concepts relating to plagiarism and the development of a joint integrity code. They noted a decrease in plagiarism cases consequent to the workshop. Fenster (2016) reported positive results after their students took part in a one hour workshop focused on paraphrasing. However, not all education is equal. Holt *et al.* (2014) found no improvement in students’ knowledge following an online training course. They did, however, find a significant improvement in those who completed a relatively high stakes homework plagiarism assignment.

3. Design of the Training

Given the documented success of various workshops on plagiarism knowledge, it was decided to develop a workshop that covered academic integrity from a number of perspectives. The workshop consisted of the following elements:

Student discussion on their understanding of plagiarism. A ‘Think-Discuss-Share’ approach was used where students spent some time making note of what they believed was meant by plagiarism. They then discussed their thoughts in groups of 3. Finally, they shared the group consensus. Students were also presented with a series of scenarios, ranging from clear and obvious plagiarism to no plagiarism (Carroll, 2022, p. 52) and asked to identify where the line is for plagiarism.

Discussion on types of plagiarism. The many ways in which students can plagiarise were presented and discussed in groups.

The difference between collusion and collaboration. As groupwork is so prevalent, the differences between collaboration and collusion were discussed. Students examined various scenarios in small groups and were tasked with identifying the line between collaboration and collusion (Carroll, 2022, p. 19).

How and why we credit sources. The reasons we credit our sources were discussed as were the rules for doing so.

Paraphrasing. Poor paraphrasing is a major cause of student plagiarism. Strategies for effective paraphrasing were discussed and students practiced paraphrasing with feedback.

Contract cheating. The final section of the workshop covered contract cheating and involved the students in discussions on various scenarios relating to contract cheating.

Following on from the workshop, the students wrote a 2-page literature review on a topic relevant to their major project. They received feedback on any plagiarism issues, such as poor paraphrasing. They corrected and re-submitted the document and received further feedback.

4. Methodology

Students completed a survey (see Table 1) prior to participating in the plagiarism workshop. This survey, adapted from those of Marshall and Garry (2005), Clarke *et al.* (2022) and Kokkinaki *et al.* (2015), was created to gauge student understanding of what constitutes plagiarism. They were asked how capable, on a scale of 1-5, they believe themselves to be of avoiding plagiarism in assignments. They were then asked to examine a number of scenarios and answer yes, no or don't know as to whether they believed them to be plagiarism. After completing the workshop and the literature review practice, the students completed the survey a second time to see had their understanding improved. A total of 60 students took part in the workshop, with 32 completing both the pre and post workshop surveys. They were all students on a Masters in Information Systems Management. Of the 32 students, 14 were female and 18 were male. Of those, 5 had English as a first language, with the majority of the remaining students being from India (17) or China (9).

5. Results and Discussion

Students were initially asked to indicate their confidence levels in their ability to avoid plagiarism on a scale of 1-5, with 1 being very unconfident and 5 being very confident. Students were confident going in, with a mean value of 4.09. Post workshop, that confidence increased to 4.16. However, there was no significant difference in the values. That confidence

may have been misplaced in some cases as the number of correct identifications of plagiarism pre-workshop had a mean of 11.06 correct and ranged from 1 to 14 correct.

The individual who only got 1 correct describing themselves as ‘neither confident non unconfident’. That individual rated themselves as ‘fairly confident’ after the workshop and got all 16 correct in the post-workshop survey. For that individual at least, the workshop appears to have greatly improved their knowledge of what constitutes plagiarism.

The descriptions of potential plagiarism can be seen in Table 1. The mean pre-workshop value was 11.06 correct and improved to a mean of 13.28 correct post workshop. Paired samples t-test was conducted. The results indicated a significant difference in the number of correctly identified examples of plagiarism pre ($M=11.06$, $SD = 2.663$) and post ($M=13.28$, $SD=1.631$) workshop; $t(31) = -3.738$, $p \leq 0.001$. As can be seen in Table 1, the number correctly identifying plagiarism increased post-workshop for each scenario presented.

The lowest number of correct responses both pre and post was Q.3. This suggests, and is supported by most cases of plagiarism encountered with the School of Business, many students struggle to understand what paraphrasing means. While they did get some practice, along with examples and discussion, the time devoted to it was insufficient. They also got feedback on their paraphrasing in the submitted literature review. In future workshops, more focused time will be spent on paraphrasing. There is, however, also the possibility that, given the number of students whose first language is not English, the subtleties of the difference between “changing several words” and paraphrasing may have been missed.

Quite a number of students believed there was plagiarism in Q2, Q5 and Q6. It is not clear why this is the case but the phrases “copying”, “same theme as an existing one” and “someone else’s work” may have triggered a gut feeling that it was plagiarism. The numbers recognizing that these are not plagiarism post-workshop increased significantly.

Ultimately, the workshop seems to have improved students awareness of what constitutes plagiarism. They had an opportunity to practice academic writing and received feedback on errors in paraphrasing and appropriate acknowledgement of sources. Verbal feedback from the students was positive, with many stating the workshop and subsequent literature review helped to clarify their thoughts on how best to refer to other people’s work in their writing.

Table 1. Is this plagiarism?

	Correct	
	Pre	Post
1. Translating information from a source in a foreign language without appropriate acknowledgement of the source (Y)	25	30
2. Copying exact words from another source but placing them within quotation marks and with appropriate acknowledgement of the source (N)	18	28
3. Taking a section of text from another source, changing several words in it and acknowledging the source (Y)	9	10
4. Rewriting a piece of text from another source in your own words and only acknowledging the source in a reference list at the end of your paper (i.e. no in-text citation) (Y)	13	25
5. Creating a new piece of work on the same theme as an existing one but in a new context and without copying the existing one. (N)	22	27
6. Rewriting a short section from someone else's work in your own words and including appropriate acknowledgement of the source (N)	17	25
7. Copying short sentences (less than 50 words) from another source without appropriate acknowledgement of the source (Y)	29	32
8. Paying someone to write part or all of a piece of work that you then submit as your own work (Y)	31	32
9. Working with other students on an individual assignment and submitting it as your own work (Y)	27	29
10. Using another piece of work to identify useful secondary sources that you cite in your own work, but without reading the secondary sources (Y)	18	20
11. Copying exact words from another source with appropriate acknowledgement of the source (Y)	15	19
12. Resubmitting an assignment (or part of an assignment) previously submitted in one module for assessment in another module (Y)	24	30
13. Copying exact words from another source without appropriate acknowledgement of the source (Y)	30	31
14. Copying a web site and putting your own words and name into the content part of the pages. (Y)	27	27
15. Copying the ideas from another piece of work and writing about them in your own words, without appropriate acknowledgement of the source (Y)	26	30
16. Using pictures from the internet without appropriate acknowledgement of the source (Y)	23	30

6. Conclusion

The students on a masters' course participated in a half-day workshop on plagiarism. The workshop allowed practical opportunities to discuss the nuances of plagiarism and to practice the skills necessary to avoid it. This intervention improved student understanding of plagiarism. While it can be deemed a success in that regard, the ultimate test will be its impact on the number of plagiarism cases this academic year. They are being tracked and will be compared with previous years. To date, there have been 3 cases, all of which involved the use of paraphrasing software by students whose first language is not English. While this was discussed during the workshop as being plagiarism, perhaps there was insufficient focus on the issue. This will be addressed in future iterations.

Overall, the students were extremely positive about the experience and actively participated. Perhaps the best feedback relating to the workshop was being approached by a student in a different programme asking why they did not also get this opportunity. If plagiarism numbers are reduced, the workshop will be rolled out to other programmes on an ongoing basis.

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Evolution of a continuous assessment and feedback concept in a computer science 101 course

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Abstract

Teaching first semester students in fundamentals of computer science is challenging due to the heterogeneous group. For the last three years we explored different methods of continuous assessment in the course. One main goal for this group of students is to encourage participation in the classroom while also being able to continuously monitor the learning outcomes of the most recent topics. All three methods: repetitive oral assessment, partial exam and online quizzes received good evaluation results from the students, showed an increased engagement and better examination results. However, continuous assessment also increases the workload for both groups: the students and the teachers. The combination of a partial exam (midterm) and continual online quizzes showed a good compromise with respect to the effort on both sides and reveals good examination results. This work describes a fine granular technical and didactical workflow of the lecture suitable for first semester students and discusses the evaluation results.

Keywords: *Computer science education; continuous assessment; online quiz.*

1. Introduction

Teaching first semester students is a special joy and challenge because they start a new chapter in their life and teachers have the chance to offer new methods of learning. For the last three years a continuous assessment and feedback approach with different methods has been used to encourage participation in the classroom and to increase learning outcome in a foundational computer science 101 course. Continuous assessment (CA) works for both groups in the class room – the students must engage with the materials longer and on a regular basis and teachers are able to monitor the process and can guide the learning process in a timely manner (Sun, 2018). However, continuous assessment also increases the workload of the lecturers (Serrano et al., 2018). Therefore, this work shows how a combination of methods leads to more engagement and class room attendance on the students side resulting in better exam grades and describes a fine granular technical and didactical workflow to achieve the above mentioned goals. Furthermore, the feedback of students' course evaluation reveals indicators how the teaching concept can be adapted to other courses.

According to da Silva Burke (2022) CA is an integral part of the Bologna process with the focus on increasing students' engagement and distributing the workflow from a single examination phase to a continuous learning and assessment phase. Different methods of CA have evolved and been established in higher education, like a portfolio of homework assignments, partial exams, exercise assignments, online quizzes, presentations, compare e.g. Day et al. (2018), de Sande and Murphy (2014). In STEM education, traditionally lab courses request a continuous engagement of students and, as Wolf (2010) proposes, modern concepts offer virtual labs for training and/or additional assessment. Without doubt, CA increases the engagement of students, but there is no general agreement in research, that CA is beneficial for all types of curricula and students. Several studies show, that CA is especially supportive for better performing students, while less good performing students might be overwhelmed by the workload during the semester compare e.g. Day et al (2018), Merello and Zorio-Grima (2018). A CA based approach therefore shall be adjusted to find the right balance of work load throughout the semester. An important factor for a successful implementation of CA is the feedback given to the students. While the correction of written homework assignments and partial exams might be time consuming and leading to a delayed feedback, the use of an automated test and feedback system helps to report immediate individual feedback and to lower the workload of the lecturer. As Baleni (2015) emphasizes, such tests can be performed in a much shorter period allowing an immediate monitoring of the students' achievements. We examined different methods of CA, starting with continuous oral assessment at the beginning of the course and now using a mixture of real-time formative assessment through online quizzes and assessment by a partial exam (midterm) with a focus on the feedback to the students.

2. Lecture Setup

2.1. General Setup

Every year about 70 students start their studies of electrical engineering and computer science at our faculty. The students are divided into two groups and taught a foundational computer science course two times per week for 90 minutes. The lecture setup is as follows: Twelve different topics are covered during the semester, for example, introduction to computer arithmetics, data structures, basics of computer networking, operating systems and computer architectures. Additionally five lab exercises are given.

2.2. Course Assessment

Each lecture starts with revision questions covering the subjects of the last lecture. During the Covid Pandemic in 2020 and 2021 these revision questions were given directly by the lecturer and oral participation and correct answers were awarded. For exam preparation a list of all questions without solutions were given to the students. Similar questions are part of the final exam. The differences in the course setup over the years are shown in Table 1.

Table 1. Different methods for continuous assessment from 2020 to 2022.

Year	2020	2021	2022
List of Quiz Questions	Orally discussed in classroom	Orally discussed in classroom	Converted to online quizzes
Quiz Conduction (at beginning of lecture)	ca. 15 min. oral discussion	ca. 15 min. oral discussion	ca. 5 min. online plus 2-5 min. discussion
Assessment of Quiz Questions	Answers graded	Answers not graded	Answers not graded.
Written Midterm Exam	None	30 min. Graded	30 min. Graded
Feedback	Directly by the lecturer during oral quiz	Directly by the lecturer during oral quiz and graded midterm	Direct quiz feedback via LMS and graded midterm

Due to the smaller groups because of hybrid teaching during the pandemic it was feasible to orally discuss and grade these revision questions in a timely and fair manner. This proved to be more difficult with a full classroom in 2021, therefore answers were not graded then. In 2022 the questions were converted into more structured online quizzes, which will be described in section 2.3. The students can access the quizzes with a mobile device, tablet or

laptop via the learning management system (LMS). The online quizzes take about five minutes each and are not repeatable but the questions and (correct) answers remain visible for the students throughout the semester. The students and the lecturer receive the results instantly and can use the results for a short discussion about knowledge gaps or misconceptions.

After half of the semester a voluntary midterm exam is conducted, enabling the students to collect points towards the final exam. Within a week the students receive individual feedback of their midterm results.

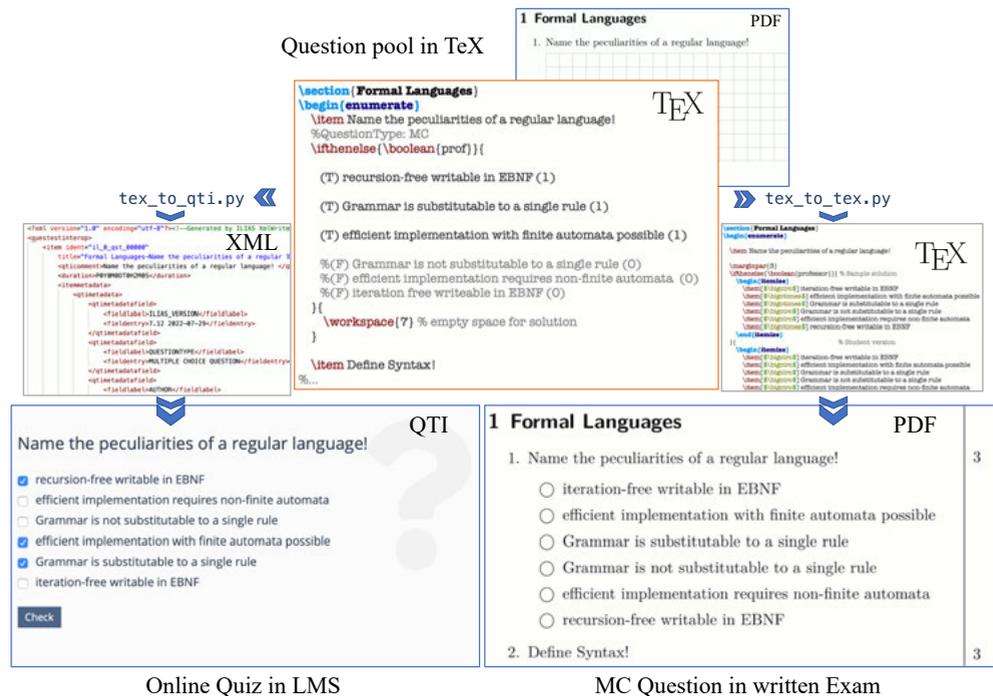


Figure 1: Technical flow – Conversion of questions from LaTeX via QTI import into LMS as online quiz, as standard PDF or as a MC question for the exam.

2.3. Technical Setup

Figure 1 shows the technical flow for creating the different document types for the questions and quizzes. An important goal was the independence of the underlying LMS achieved by the following setup: Starting point for all quizzes is a pool of questions written in LaTeX. This document has two display options: a students' version with a space left to write their solutions and a teacher's version with a sample solution. Converted to pdf format the students' version can be applied to discuss questions in classroom and solutions can be added by the teacher using e.g. a tablet connected to the video projector. For the online quizzes we

defined a fixed format for the sample solution in order to convert the questions automatically into a corresponding XML file necessary for the *IMS Question and Test Interoperability* (QTI) format, which is required for the import into the LMS. For single or multiple choice (SC/MC) questions, the proper answers are prefixed with a (T), whereas wrong answers are marked as a LaTeX comment starting with %(F). Points or negative points can optionally be given in rounded brackets. The question itself is marked with a comment defining the question type. A python script `tex_to_qti.py` converts the questions from LaTeX to QTI. Other supported questions types are: cloze questions, numerical answers, short answers, text matching, sequencing/ordering. Another python script `tex_to_tex.py` generates a proper LaTeX output that can be included in the final exam. Although questions can be created and maintained directly in the LMS, setting up questions and maintaining the questions in LaTeX significantly simplifies the work flow, especially as the same questions can be used in different formats and use cases. Furthermore, the LaTeX documents can be managed and maintained in a version control system.

3. Evaluation

3.1. Course Evaluation Methodology

In addition to a standardized online course evaluation in week 10 of the semester, an online evaluation of the course's assessment (midterm and online quizzes) has been conducted in the last lecture using the LMS. The evaluation period for both evaluations was scheduled for a week, but for a better response rate both online evaluations were conducted during the lecture. The response rate were about 60 % and 58 % respectively.

3.2. Evaluation Results

An important result of the standardized online evaluation is that 74 % of the students perceive the workload of the course adequate as defined in the module description. Only 5 % state a too high workload, which is comparable to other course evaluations in the first semester. With respect to the evaluation of midterm and online quizzes, all participants of the evaluation agreed or fully agreed that the voluntary midterm exam should be graded and account to the final grades as well in the future. "Midterm is a valuable concept and helps to assess current learning outcome" is one of the open feedback results in the evaluation.

Figure 2 shows an excerpt of the students evaluation with respect to the online quizzes. The opinions differ with respect to grading the online quizzes. While about 50 % would like the possibility to voluntarily collect points for the final exam (Q1), 50 % disagree on a mandatory grading of the quizzes (Q2). The majority (60 %) agree to continue with the quizzes mainly as a self-monitoring tool (Q3). Some students even stated in the open feedback question, that they would not like the quizzes to be graded as the cloze questions a hard to answer properly.

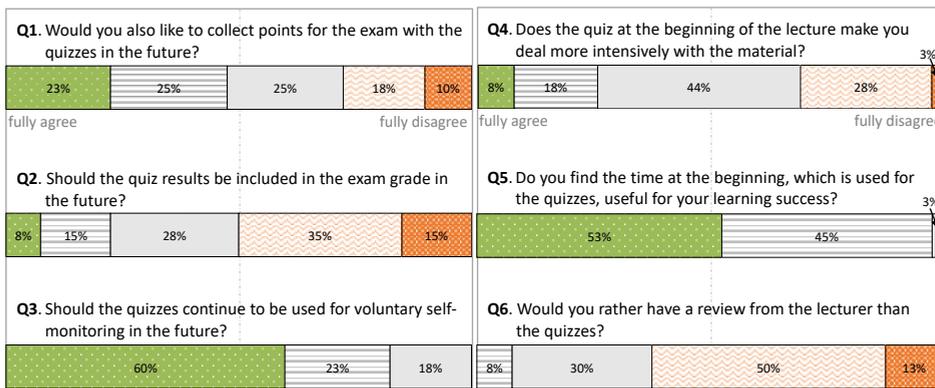


Figure 2: Students' evaluation results for the appliace of quizzes in the course (5 point Likert scale).

In opposite to our expectation only 26 % of the students stated that they prepared more for the lecture due to the tests (Q4). About 98 % of the students agreed or fully agreed that the time used for the online quizzes are useful for their learning success (Q5). Only a small group of students (8 %) would rather prefer a review by the lecturer instead of doing the online quizzes (Q6). Quotes from the evaluation confirm this impression. Several students wrote in the free form of the evaluation that doing online quizzes was fun and a good repetition. Critical responses came with respect to technical improvements of the LMS necessary to run the tests on some mobile operating systems and partly, that questions were too easy.

4. Discussion

Figure 3a) depicts the participants in the class over the course of the semester in 2021 (blue dots) when the tests were given orally and discussed directly in class. The orange crosses indicate the actual participants of the online quizzes at the beginning of the lectures in 2022. Both curves show a decline in the number of participants. The slope of the curve in 2022 is actually flatter than in 2021 and for both curves we see a decline after the midterm exam. With the online quizzes in 2022 more students attended the lecture and the quizzes compared to the year before where only a minority of the students actually participated in the classroom discussion. So it can be concluded that higher involvement in the class, as well as more continuous and intense work with the course materials can be achieved through continuously conducting online quizzes. In Figure 3b) we can see a generally high level of the actual quiz results with an overall mean value of 74 %. Although we tried to provide a proper distribution of questions types and consistent difficulty level for each quiz, the average results vary from quiz to quiz. One reason is certainly that on some mobile devices the text matching questions did not work properly, and another, that cloze questions and short answers allowed only for

small spelling mistakes. Interestingly there is no rising trend during the course and towards the exam but rather a constant moving average.

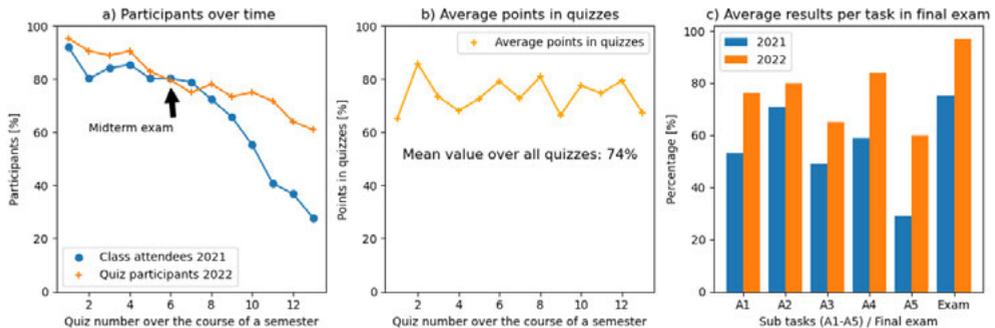


Figure 3: a) Participation vs. Class Attendance b) Average Points in Quizzes c) Exam results per sub task A1-A5 and overall exam pass rate.

Table 2 Overview of the received average grades and pass rates of the last four years.

Year	2018	2020	2021	2022
Final Grade [1.0 = best, 5.0 = failed]	3.7	3.4	3.3	2.4
Final Grade with Midterm	-	3.4	3.1	2.2
Average Grade of Midterm Exam	-	3.0	3.1	2.2
Percentage of Students passing the Exam	64%	76%	82%	97%

Table 2 shows the development of the exam and the midterm exams and the percentage of students passing the exam since 2018 while Figure 3c) details the average results of the final exams in 2021 and 2022. Throughout the years the structure of the exams and its grading scheme has been identical. The only difference between the last two exams (comp. Fig. 3c)) was that we used two multiple choice questions in the first sub assignment which were similar to the questions the students saw during their quizzes. This accounted for an average of two more points for this sub assignment which is only 3 percent of the total reachable number of points in the exam. Notably, every exam sub task in 2022 showed better results than the year before. It also has to be considered that there are always differences between the years regarding the level of achievement of the particular group of students. We see that over the course of three years the average grade of the midterm and final exam improve by nearly one grade. Additionally, the pass rate of the final exam increases with the introduction of CA.

5. Conclusion

On a more personal level, after two years of online and hybrid teaching setups, both students and the lecturers were happy to be back in the classroom. With the evolution of the course

through the online quizzes enabled by the technical workflow shown in Figure 1 more interaction and engagement with more students were possible. The technical workflow enabled an independence from the current learning management system while keeping maintenance of the pool of questions on low administrative level and putting the focus on the content of the quizzes. The concept proves to be valid for first semester students, who are entering the university system and can be guided into the learning methods that are necessary here, compare Jimaa (2011). We conclude that continuous assessment through online quizzes and the midterm exam supports developing continuous studying habits, which is a major achievement for first semester students. The positive development of the exam results over the years indicate improved understanding of the topics by the students.

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Black student achievement plan evaluation and assessment

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Abstract

The study analyzes focus groups and individual interviews with 179 adult participants and 116 student participants during the 2022-23 academic year. Adult participants included principals, administrative coordinators of instruction, teachers, staff members and parents of students within a large school district in California. All of these adults and students were active benefactors and staff members of a Black Student Achievement Plan (BSAP), an initiative created to foster educational equity and college preparedness for schools with over 200 Black students or a document history of academic underperformance for Black students. We examine the implementation of the Black student achievement plan i.e., the adoption of culturally sustaining curricula and instruction, the allocations of funds to hire necessary staff, funding of culturally enriching activity and experiences, etc. The findings suggest that BSAP hires are serving as invaluable support systems for many students and often serve as respite for students experiencing adverse conditions. Findings suggest that BSAP is a crucial part in increasing students' college readiness and provides students with supports and educational experience e.g., field trips that increase their likelihood for attending college. This research informs districts and college readiness programs about the necessary supports to provide to Black and historically underrepresented students.

Keywords: *Assessment; educational equity; learning outcomes; curriculum alignment; postsecondary completion.*

1. Introduction

In February 2021, a California School Board committed to significant investments in Black students' education and emotional wellbeing by establishing the Black Student Achievement Plan (BSAP). BSAP addresses Black students' unique needs related to historic and ongoing inequitable educational opportunities, particularly as it is paired with engaging "the current landscape of local and national advocacy for racial equity have served as the inspiration to act now" (Black Student Achievement Plan, 2021, p.1; Ladson-Billings, 2006). A-G completion, California's required courses for high school college entry, sits among the top of the 16- success metrics identified by the district. BSAP intends to remove barriers to postsecondary completion by championing "high academic performance, social-emotional awareness and management, and a positive cultural identity" for Black students. (Black Student Achievement Plan – Board Amended, 2021).

In January 2022, the school board approved an evaluation proposal submitted by USC's Center for Education, Identity, and Social Justice and the RAND Corporation. The core objective of the BSAP evaluation is to examine implementation of BSAP across school sites to determine the extent to which the BSAP levers improve higher education for career success among Black students. We designed this research to provide actionable formative feedback to inform operations of and implementation changes to the ongoing plan. Our evaluation is driven by the following research questions:

1. How does BSAP improve or hinder Black students' academic success, particularly considering access to diverse representation, high-quality curricula, and culturally-relevant teaching?
2. How does BSAP improve or hinder students' access to a supportive school climate and mental and social-emotional supports?
3. How does BSAP improve levels of engagement between parents/guardians and schools, Black students' engagement with extracurricular activities, and the presence of community organizations on campus?

2. Methodology

2.1. Logic Model

The logic model highlights three key levers of inputs: (1) curriculum and instruction, (2) school climate and wellness, and (3) community partnerships. Within each of these levers, we outline more detailed supports designed to palliate the systemic barriers to the pursuit of postsecondary certificates and degrees. Within our research team, we used the model to inform development of our interview and focus group protocols and to indicate which forms of secondary data we would need to collect in order to track trends in outcomes over time.

Our evaluation strategies and research tools are sensitive to how identities such as race, ethnicity, gender, sexual orientation, religion, and disability can highlight systemic issues, inform solutions that create equity, and foster shared values and democratic ideals.

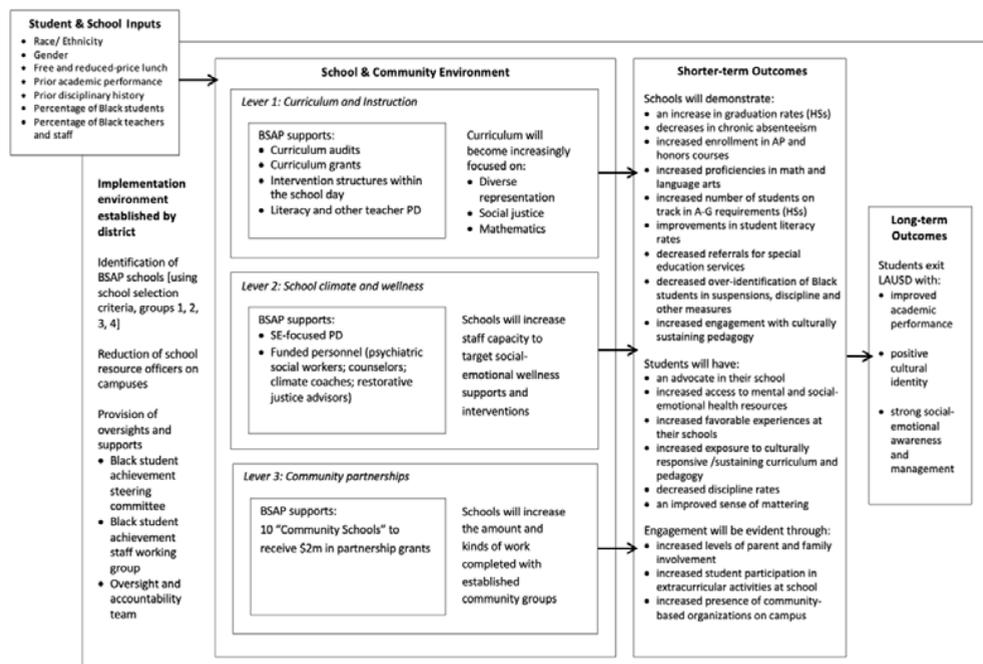


Figure 1. BSAP logic model

2.2. Case Study Method

While we do not outline the full design of the BSAP evaluation plan in this short paper, we explain methods as conducted thus far. We collected data from different groups of high schools for the two primary sides of the evaluation—implementation and impact. We initially selected 15 schools from the 53 Group 1 schools for more in-depth qualitative data collection; we are calling these 15 our case study schools. Case studies utilize a wide range of data types, and allow us to narrow in on how features of an intervention might operate differently in different school environments (Yin, 2018; p. 3). Case study methodology is particularly useful for evaluating educational program implementation, as it allows us to obtain rich data that capture teachers’ and students’ perspectives on the processes of teaching and learning. Such data can allow for unexpected insights to emerge, and inform future refinement of the program.

2.3. Case Study Site Selection

The research/evaluation team selected case study schools based on various factors, and in consultation with the BSAP team. For the purposes of this short paper, we analyzed data from 5 high schools from our 15-school sample to resemble the larger group of 53 Group 1 BSAP schools. We used criteria including: racial/ethnic composition of student body, percent of students qualifying for free and reduced-price lunch, graduation rates and percent of students fulfilling A-G requirements, and school model (e.g., traditional, magnet, charter). We matched these criteria across our case study schools and the full sample of 53 BSAP schools, aiming for a sample that would closely mirror the larger group of schools.

2.4. Data collection

The 15 case study schools are receiving a greater degree of qualitative attention than the remainder of the BSAP Group 1 sites. In September and October of 2022, our research team visited each of the case study school campuses for a full day, during which time we conducted multiple interviews, focus groups, observations, and gathered documents. Through these various data collection methods, our team spoke to principals, ACIs, BSAP staff, teachers, students, parents, and community organizations. Approximately 54% of the adult participants identified as African American/Black, 10% identified as Latinx/Hispanic, 2% identified as Mexican American/Chicano, 3% identified as Other Hispanic, 2% identified as Asian, and 13% identified as White. Nearly 71% of the adult participants identified as women, 28% as men, and 1% marked Other. All participants have also been assigned a pseudonym to protect their identity. All interviews and focus groups were audio recorded and transcribed. The table below presents all the data collection tasks completed at the sample school sites during Fall 2022.

3. Findings

3.1. Lever 1: Curriculum and Instruction

Implementation Strengths

3.2. Diverse representation in learning materials

One dimension of BSAP Lever 1, as illustrated in Figure 1, is to build greater diversity of representation in curricula that Black students are exposed to. Across 11/15 sites, adult or student participants shared that there had been a noticeable increase in culturally relevant books, pedagogy, and educational experiences. Students and parents especially observed the presence of historical Black figures in hallways and classrooms. The reading areas were often filled with books that featured Black protagonists and included a diversity of plot lines that students might relate to. A father of an elementary school child noted that his children were

responding well to seeing themselves in the lessons, “They can see themselves in the lesson, they can see themselves on the board, they can see themselves in the books to actually help them and encourage them to actually read and be involved in the classroom.”

Like other parents at the sites, this father found that the reading material in the classrooms and posters in the hallways had more of a positive impact on the cultural identity of his children than the negative stereotypes they were used to seeing in the media.

One high school principal echoed the importance of providing Black students with positive, diverse representation in their reading material. Describing his approach to aligning his school’s curriculum with the goals of BSAP, he said:

One of my goals right now is to ensure that every English class...has a culturally relevant novel that every grade level will read...So, what they do is they read the book with a facilitator from [community-based organization], who is our partner, and they go over to their [center], which is right next to our campus, and they perform either a little skit or a vignette or a monologue. So they'll actually act out a scene that really resonated with them.

By bringing in a facilitator from a community-based organization and giving students an opportunity to perform a monologue, this principal is providing a wide range of ways students can engage and make sense of diverse representation in their reading material.

A notable strength of BSAP is its initiative to increase the diverse representation in books, posters, and curriculum that students are exposed to. When the curriculum is implemented, it can significantly correlate with students’ sense of belonging on campus and their academic engagement in the classroom. Moreover, other cultures stand to learn and benefit from curricula that discusses Black experiences and history. Another elementary teacher described the enriching nature of culturally relevant curriculum for all students when he said, “It not only impacted my African-American students, but also some of my other students, my Hispanic students...I had one of the Hispanic students who was like, my favorite thing was learning about all the different African-American people this year.”

Critical opportunities for improvement

3.3. Adopt culturally relevant pedagogy in classrooms

In the previous section, we unpacked diverse representation and culturally relevant curriculum as a strength. In the 11/15 instances where sites adapted and taught with the new, Black-centered reading material, it certainly is. However, we found that across 4/15 schools, there still is a lot of progress to be made toward establishing compliance with BSAP’s mission to incorporate culturally resonating and sustaining pedagogy in all schools. For instance, multiple teachers at one school felt that the initial rollout of BSAP was rushed and

did not allow teachers to incorporate culturally relevant units in an impactful way. A science teacher described her frustration with adding cultural relevance to her lesson, saying:

Even though the idea of the unit plan was to integrate it deeply, because of the timing, the roll out and the people, it became something tacked on top. And so as a science teacher, the example I always use is, it's like the Black astronaut, the Black astronaut lesson where you're like, "Okay, be culturally relevant. Here's a Black astronaut. They did this. Isn't that cool?" Move on to the next thing. And that is not an authentic way of empowering our students to feel like they belong in an underrepresented field to understand the history...

This teacher expressed discontent with taking a previously constructed lesson and incorporating race as an afterthought. She would rather make the lesson relevant to students' environment in a meaningful way than spotlight the race of the subject or author as a garnish and hope that the students will relate. Teachers shared that the rollout simply did not permit them enough time to produce a curriculum that would be culturally relevant and impactful.

One parent of an elementary student shared that she felt that a lack of Black-centered instruction was derived from non-Black teachers' preferences to center their own respective histories. When asked if she believed the curriculum was relevant to her child, she responded:

No, absolutely not. No sir...But sometimes I think that the teachers, they still kind of intertwine to tweak whatever that they want to teach their own kind. So it's basically like the black kids are going to get left out because now you're over here tweaking the curriculum for the other children, but not tweaking it for the black children because they can teach about they [sic] heritage.

This parent believed that teachers might have been asked to teach a certain curriculum, but they may have refused to do so because they were reluctant to prioritize the stories or needs of Black students. As a result, Black children's history remained tangential to many lessons.

3.4. Culturally resonant math education

Math education is another critical improvement opportunity. A high school counselor presented site-specific data that spoke to the need for improvement in math education for Black students when she stated, "Last year 23% of our students were either proficient or above in math. That means that 77% were not...only 7% of our Black students met that goal, and zero of them exceeded the standard." She conveyed disbelief that only 7% of Black students were sufficient in math, and suggested providing professional development that was more focused on students' varying learning styles.

In the achievement plan, a local district states that they are committed to providing students with learning opportunities that "validate and affirm who they are" honoring the "cultural heritages, languages, and histories" of its students and their families. The district also lists

“dismantling racism in mathematics” as a part of its instructional foci. We found, though, most case study schools (8/15) have not started or are resistant to BSAP’s mission to make math curricula more culturally resonant for Black students. One elementary principal shared, “typically the math problems...may not reflect some of the cultures that we have represented.” Concerning the implementation of culturally resonant math, a high school principal stated “I think it was a lot to ask... [teachers] were having a hard time fitting in where that made sense.” Further, another principal echoed the sentiment of time being a limitation when he shared, “I think it's still a work in progress. It's been a challenge to find time during the school day to do it.”

Increasing proficiency by way of ensuring equity in mathematics instruction is listed as a key initiative in the district’s achievement plan. We found that several schools encountered limitations when attempting to adopt the curriculum. Therefore, we assert that supporting teachers and schools to make math instruction more culturally resonant is a critical improvement opportunity.

3.5. Lever 2: School Climate and Wellness

Implementation Strengths

3.6. BSAP staff as support system and advocates for Black students

Across all 15 case study sites, there was evidence that BSAP staff played a vital role in Black students’ lives, learning, and experience in school. BSAP staff also demonstrated care and familiarity with students and their lives outside school, allowing them to advocate for students in ways other educators could not. BSAP staff were often like parental figures to students and were very aware of life circumstances that could impact students’ experience in school.

Students at one middle school described their relationship with one BSAP staff member—we will call him Mr. Nathan Blue¹—whom they spoke with daily. One of the students said he was his “brother, uncle, nephew.” Another student responded, “Mr. Nathan Blue is my dad.” A third clarified, saying, “He's just like a father figure.” One student reassured, “That's my dad. You know, when I call him my dad, he calls me his son. Why? Because me and him have a great, strong relationship and we always share things with each other.” Mr. Nathan Blue was not related to any of the students at this school but had built such a strong relationship with students that he became like family to them.

Parents at an elementary school felt similarly about Ms. Williams, one of the BSAP staff members at their campus. Parents described Ms. Williams as “the school” and “part of the

¹ Any names used are pseudonyms, selected by participants.

village” because she knew all the students and everything about the school to support students and their families. Parents reassured us that she had a high level of care for students and that they knew if their children were with Ms. Williams, they would be comfortable, safe, and happy. Ms. Williams cared so deeply about students that she fostered children that attended the school, and they referred to her as their other mom.

Critical Improvement Opportunities

3.7. Language that minimizes advocacy for racial equity

Some ACIs, principals, teachers, and BSAP staff utilized language that communicated that BSAP was a program for only Black students, or a student club, alienating students from the broader campus community. The use of this language further reinforced the idea that BSAP could go away after a period of implementation, and may have contributed to a lack of investment by some teachers. One high school ACI expressed frustration at how schools were adopting BSAP, saying:

One of the biggest disdains I have is schools and folks identifying students as BSAP students. I hate it. And I feel like some of us ACI's are guilty of it because we almost made it like a club, like it's a frat, like it's a sorority... We have a shirt that says BSAP. But they like wearing it like all the BSAP kids got the BSAP T-shirt. So it's like a club. So now I'm finding and this is my big disdain. Do not call these students BSAP students. Don't do it. We don't call them GATE-ers and we don't call them ELL-ers and we don't call them SPED-ers because they are being supported by a plan. So why are we call them BSAP students? We should not be identifying students, calling them out or categorizing them by race, language acquisition or level of intellect or ability.

Addressing students by the plan that supports them rather than as students, further minimizes BSAP's advocacy for racial equity and fosters an environment that otherizes students. This is equivalent to defining students with disabilities by their disability, calling them disabled students. Such that when teachers, school staff, and leaders reference students only within the context of their disability, not only is that a reductionist view of who they are and a slight or insult, but also it minimizes how and why an institution should respond to the full humanity of these students. In this case, an educational institution is responsible for addressing more than a student's disability. A parallel construction exists for ESL (English as a Second Language) students, who are now referred to as ELL (English language learners). We suggest referring to students with BSAP support might be a more useful reference. Additionally, using such language indicated that these students were BSAP's responsibility, and may have decreasing some staff members' sense of responsibility in supporting them.

3.8. Districtwide and schoolwide hiring and staffing challenges

Non-BSAP leaders and staff at 9/15 schools struggled to fully understand the roles of BSAP staff members and how to best leverage their support. The lack of clarity at times created tension between BSAP staff members and other staff members at the school sites. To complicate matters further, several schools had unfilled BSAP positions and incomplete teams to carry out the plan with limited support.

Although the plan includes several school-level roles with specific goals and duties at Group 1 schools—i.e., Administrative Coordinator of Instruction, Pupil Services & Attendance, Psychiatric Social Worker, and Restorative Justice Teacher—once on site, BSAP staff found themselves performing additional job duties that were not part of the original plan. Several BSAP staff members shared that principals and other school leaders often asked them to perform unrelated tasks and duties. BSAP staff members obliged because they cared about Black students' well-being, even when these tasks were beyond the scope of their jobs. Two BSAP staff members at a high school explained how difficult it was to get time for planning programs and initiatives when administrators consistently called them to perform other duties. One explained their challenges, saying:

We get pulled in two different directions. I think a lot of that is definitely tied to the sense that overall, it's not like they would look at us as working on “just BSAP”, like this is what they do. It's more so like you're [a restorative justice teacher], you're basically the “mini dean”. You're school climate, you're campus aid. We need you to go get these kids from these classes and bring them over to the mini dean. And that's not really what we're supposed to be doing.

BSAP staff members at other campuses also felt like the disciplinarians at their schools; some wore yellow “campus aide” vests and walked through the hallways making sure students got to class on time.

The lack of understanding of the plan and BSAP staff members' roles and responsibilities prevented many of them from providing better support for Black students. Additionally, it created additional work for ACIs to support their BSAP staff members and communicate with principals and school leadership regarding how they should utilize their BSAP staff members at their schools. Tina, the ACI at Promise Elementary, explained:

I spent more time this year pouring into my team, making sure my teams knew what their roles were, making sure they understood our 16 indicators, our success indicators, and how those relate to their jobs. And how you know, every day, this is what this is your focus, you know, as it relates to the black students and with the principals as well, making sure that they understand that their PSA isn't just a PSA.

Similarly, BSAP staff at several sites mentioned that school leadership often did not recognize that some staff members were specifically designated for BSAP and not for the rest of the school community. Several BSAP staff members performed duties far beyond their scope, so ACIs needed to continually refocus them to ensure that the plan's goals were understood and met.

4. Conclusion and Recommendations

While the above findings are preliminary, and will continue to develop over the course of our research, they do point to some specific and actionable recommendations for LAUSD leadership, school leaders, and school-level BSAP staff members.

We provide these recommendations not only to evaluate the program and make suggestions that will better serve Black students, but also to bring awareness to the legal liability associated with a racially hostile environment. Above all other recommendations below, we want to highlight a critical first step for school and district leaders: to better understand what constitutes a racially hostile educational environment and how it may open the individual, the school, as well as the district to legal liability. We included this early in the report to demonstrate its urgency. School leaders would benefit from assessing ways that their own schools may have hostile environments for Black students, and working with other staff members to address these concerns.

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Reflective practice ePortfolios: a digital teaching tool to enhance third year BA culinary and gastronomic science students' professional learning experiences

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Abstract

The aim of this research was to explore the use of reflective practice eportfolios as a digital tool to enhance BA Culinary and Gastronomic Science students' professional learning experiences. A deductive approach was applied to the data where the participants reflective practice entries were coded using Braun and Clarke's framework for thematic analysis. In line with Vygotsky's (1978) social constructivist theory, the results depicted the participants were able to learn through social interactions with their lecturer and peers, who assisted with scaffolding knowledge and skills, until the participants were more confident in their learning. By using the reflective practice eportfolio meant that the participants were able to track their improvement and growth related to their reflection process. The results are far reaching in the context of culinary arts education and offer significant insights into embedding a reflective practice eportfolio into the culinary curriculum.

Keywords: *Social constructivism; reflective practice; eportfolios; culinary arts education; professionalism.*

1. Introduction

Professionalism is critically important for the culinary industry, however the difficulty with attracting and retaining highly professional personnel makes it problematic to implement. Higher education is expected to prepare graduates for the professional workforce, yet Ryan (2018) argues that higher education institutions are failing to adequately prepare graduates for employment, particularly, in professional (soft) skill development. In a study by Lazíková, Takáč, Rumanovská, Michalička, and Palko (2022) a significant gap between the skills that graduates acquire and those that employers require was reported.

Reflective practice has been defined as “a process for the learner to integrate the understanding gained in one’s experience in order to enable the better choices or actions in the future” (Rogers, 2001, p.41). Heymann et al. (2022) insists that central to becoming a professional is the ability to be able to reflect. Embedding reflective practice into culinary arts may enable the student to think about and reflect upon their studies, identity, and futures, thus integrating theory into practice, to the point that students recognise the theoretical constructs underpinning professional development in a culinary arts context. The Reflective Cycle by Gibbs (1988) has widely influenced the broad field of education. Gibb’s model presents six stages of reflection, from the description of the problem to action planning. It presents a framework for examining experiences. Adie and Tangen (2015) assert such professional skills can be enhanced using self-reflection, and that reflective practice is essential in higher education for effectively preparing graduates for their future professional lives.

According to Abrami and Barrett (2015) the utilisation of reflective practice aligns to social constructivism. Social constructivism is a learning theory developed by educational psychologist Lev Vygotsky. Social constructivism theory contends that a student’s cognitive ability is gained through collaborative social guidance and construction. One of the core constructs of Vygotsky’s theory of social constructivism is the zone of proximal development (ZPD). Vygotsky (1978, p.86) defined ZPD as “the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers”. In line with Vygotsky’s (1978) notion of providing instruction within the ZPD, it was expected that scaffolding would decrease over time, as the students’ understanding increased. This research focuses on culinary arts education from a holistic perspective, meaning education is not only a process of transmission, but that students learn knowledge and skills through different pedagogical methods in a social setting. Language also plays a significant role in learning development and how individuals view the world. This means that learning is transmitted via language and interpreted by experiences in a social setting as argued by Vygotsky (1978). Part of the preparation for a career in the food product development sector involves an understanding of sensory analysis. Specific language and

concepts such as olfactory and gustatory senses, chemesthesis, discrimination and hedonic sensory testing are of critical importance in the lexicon of terminology needed by sensory professionals working in the food product development sector. Without an understanding of such a lexicon, the subject has no value or application for the students. Furthermore, Vygotsky (1986, p.148) stated “Scientific concepts develop earlier than spontaneous concepts because they benefit from the systematicity of instruction and cooperation”. This suggests that learning is best accomplished through co-operative instruction between the lecturer and more experienced peers. Thus, assisting a student’s movement through the ZPD from novice to expert with the use of tools such as language-based tools (i.e., ePortfolio) and physical tools such as Compusense.

An eportfolio is a digital tool that has been successfully used to promote employability skills and self-regulated learning in Ireland (Farrell, Buckley, Donaldson, and Farrelly, 2021). A portfolio has been defined “as a collection of documents that provide tangible evidence of the wide range of performances, essential knowledge, critical dispositions and experiences that you possess as a growing professional” (Campbell, Cignetti, Melenzyer, Nettles and Wyman, 2014, p.3). By using a reflective practice eportfolio, the student is afforded the opportunity to document their thoughts and actions, whilst reflecting on the link between what they learn in the classroom and what they do in practice. Through interactions with the lecturer and the students’ peers, the student acquires specific knowledge and skills.

The aim of this research was to explore the usefulness of a reflective practice eportfolio as a digital tool to enhance BA Culinary and Gastronomic Science students’ professional learning experiences. This study also focused on supporting the student in reflective practice, so that the theory they learned in their lectures would be reinforced through the direct application of practice.

2. Methodology

Social constructivism was deemed to be the most suitable research philosophy as the research question and aim aligned with the key principles of the social constructivist paradigm. The choice of this research philosophy allowed for the use of data collection methods that facilitated the achievement of the research objectives to explore perspectives of third year BA Culinary and Gastronomic Science students’ professional learning experiences of using a reflective practice eportfolio. A case study methodology was chosen as the methodological framework for the study. Atlantic Technological University (ATU), in Galway, Ireland was chosen as the research site and third year BA Culinary and Gastronomic Science students, studying the module Introduction to Sensory and Consumer Science were selected as the research participants for this research. The module was chosen as it is used to develop the learners’ knowledge of, and ability to use, sensory science and consumer, preparing the

students for internship in the food product development sector. Eleven BA Culinary and Gastronomic Science students volunteered to take part in the study.

The participants in the study were required to undertake a team sensory analysis report and a reflective diary, of which the outputs were displayed in their eportfolio. Participants submitted three reflections in their eportfolio as specified in the module. The data collection methods for this case study included analysis of the participants' reflective practice entries in their eportfolios using Braun and Clarke's (2022) framework for thematic analysis. This approach allowed the researcher to interpret the participants' learning experiences through the data. Ethical issues in terms of privacy and general data protection regulations (GDPR) were acknowledged. To protect the identities of the eleven participants who had volunteered for the study, pseudo-names were used to identify the participants. In addition, power implications that could have existed between the researcher and the participants were considered.

3. Results and Discussion

This research paper presents selected findings of the thematic analysis of the participants' reflective eportfolio entries. For this research paper, only one of the core themes will be discussed, namely Development of Awareness of Self.

The subthemes that emerged from the core theme of Development of Awareness of Self are depicted in Table 1.

The results highlight eighteen percent of participants in this study mention in their reflective practice eportfolio having learned from their past experiences. Those participants indicate that they were able to reflect on their past experiences of working in teams. They were able to critically appraise what they had experienced, and this suggests that they were able to improve their experience this time around. As asserted by Vygotsky "The child's memory not only makes fragments of the past more available, but also results in a new method of uniting the elements of past experience with the present" (Vygotsky, 1978, p.36).

Table 1. Core theme, sub-themes, and key quotations from participants on their learning experience of the usefulness of a reflective practice eportfolio (n=11)

Core Theme	Sub-Theme	Key Quote
Development of Awareness of Self	Learning from Past Experiences	“In the past, I have been in groups where there was disunity...working with Emma, the work was always equally divided. In addition to this, we communicated frequently during the week (twice minimum) to track our progress and to ensure that any difficulties were resolved quickly.” (Ella) “I have fallen short in the past in terms of third level education.” (Elijah)
	Acknowledging Struggles	“I felt confused when it came to writing the research report as our course had been so practical heavy for the first two years.” (Noah) “I did feel better and confident using Pebble-pad once I contacted my lecturer and they helped me out further.” (Emma).
	Celebrating Successes	“I now have a greater understanding of how to design a digital questionnaire, and move data seamlessly through the Microsoft suite, which in turn improved my digital competences. Additionally, this lent to my problem-solving abilities.” (Ella) “The collaborative work this semester helped me work in a team with another student and allowed a different perspective into my work and helped me think differently.” (Levi)
	Taking Responsibility for Learning Motivation for the Future	“I felt I had to take a leadership role to ensure the project got done in time and everything was correct.” (Charlotte) “It is now a new skill set that I look forward to utilising in the future.” (Emma)

Regarding the theme Acknowledging Struggles, a little under a third of the participants (27%) said they struggled with the academic writing that was expected from them and twenty-seven percent of participants acknowledge having difficulty using the eportfolio software Pebblepad. Culinary arts students often find the theoretical aspects of the curriculum challenging. This can be problematic as students, when on internships, may be working in product development, so knowledge of terms and processes are required. By using Vygotsky’s theory of social constructivism, the lecturer-researcher developed a lexicon of terms appropriate to sensory analysis. The lecturer-researcher instructed and assisted the student so that their movement through the ZPD from novice to expert was supported. It was evident over time that the participants had internalised this new sensory language, which became their internal speech. Vygotsky (1978) highlights the importance of speech for one’s cognitive development and states “Sometimes speech becomes of such vital importance that,

if not permitted to use it, young children cannot accomplish the given task” (Vygotsky, 1978, p. 26).

Ninety-one percent of participants celebrated the successful collaborative relationships they developed with their team, learning new digital skills, specifically relating to the eportfolio digital tool, independently planning, delivering, and analysing the results of sensory testing. This is in line with Vygotsky’s social constructivist approach. The participants demonstrated in-depth knowledge of their market sector and showed they could critically reflect on sensory concepts and theories, thus improving their ability to communicate which would prove important for internships in the product development sector.

By acknowledging the need for self-improvement, the participants were taking responsibility for their own learning and their professional development. Six participants (55%) in this study also provided examples of them taking responsibility for their own and others learning throughout the study. This reflects their moving from novice to expert learner as articulated in Vygotsky’s metaphor of the ZPD. Using reflective practice eportfolios means that the participants would now be able to track their improvement and growth related to their reflection process. This is critically important for the participants of this study to continue using their reflective practice eportfolio as it will improve their learning but may also enable them as graduates to progress quickly in employment in the future. It could be argued that by using the reflective practice eportfolio, the participants were better able to link theory and practice effectively. The participants were able to learn through social interactions with their lecturer and their peers, who assisted with scaffolding the knowledge and skills, until the participants were more confident in their learning. This is consistent with the social constructivist theory. Finally, the findings from the research revealed sixty-four percent of participants believe that self-reflection enabled them to learn from experience and apply that knowledge to future experiences such as being able to effectively design, deliver and analysis the results of consumer sensory panels. Participants communicated how these skills would benefit them in the future. Moreover, the findings of this research concur with Farrell et al. (2021) that it is reasonable to suggest that reflective practice eportfolios should be viewed as an important teaching and learning digital tool in higher education in Ireland.

4. Limitations

This was the BA in Culinary and Gastronomic Science 3rd year students’ first engagement with reflective practice eportfolios and, although the sample size was small, it reflected the class group. It was not the intention to generalise the results to the wider culinary student population, rather to trial a new type of assessment, with a view to embedding it in future years.

5. Conclusions

The findings of this research showed how the participants learned to use language and skills gained from social interactions for sensory analysis through co-operative instruction between the lecturer and peers. The participants' movement through the ZPD from novice to expert was also reflected in the results. By using a reflective practice eportfolio, the participants are afforded the opportunity to document their thoughts and actions, whilst reflecting on the link between what they learn in the classroom and what they do in practice.

6. Implications of this Research, from a Pedagogical Perspective

The implications of this research indicate that the application of reflective practice eportfolios in a culinary arts context may assist students to construct meaning from their theoretical, practical, and individual experiences in a social setting. The learning experience provided by internship for the student is highly significant, hence, the language and skills used in the classroom needs to be mirrored in the food product development industry. By taking a social constructivist approach, the culinary arts lecturer and more experienced peers will help scaffold the knowledge and skills for the student so that their movement through the ZPD from novice to expert will be supported.

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Job demands and resources in the work of university teachers in central and eastern Europe

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Abstract

The situation of higher education as a workplace as well as that of the academics has changed significantly in recent decades. Earlier, compared to working in other fields, teaching at a university was considered to be a predictable, calm, relatively stress-free, flexible, autonomous, and socially recognized profession. Teachers and colleagues were protected from many sources of workplace stress, such as uncertainty, work-related ambiguity, or low job control, but today this is no longer the typical case (Kinman, 2014). The expectations (or needs) related to these roles and activities put strong pressure on the teachers, they are serious sources of stress that have a negative impact on their health, well-being (Kinman et al., 2006; Kinman, 2014). Based on the job demands-resources theory (JD-R theory) this paper investigates the workplace factors affecting the health and well-being of Central and Eastern European (CEE) university teachers.

Keywords: *Job demands and resources; university teachers; central and eastern Europe.*

1. Introduction

The situation of higher education as a workplace as well as that of the instructors has changed significantly in recent decades. Earlier, compared to working in other fields, teaching at a university was considered to be a predictable, calm, relatively stress-free, flexible, autonomous, and socially recognized profession. Instructors and colleagues were protected from many sources of workplace stress, such as uncertainty, work-related ambiguity, or low job control, but today this is no longer the typical case (Kinman, 2014). The workplace characteristics that used to protect the university workforce from certain sources of workplace-related stress seem to have disappeared by now, following the expansion of university education (Malik et al., 2017). As a result of the expansion, diversification of higher education, and the shift in the direction of being regarded as a service provider, university teachers have to perform multiple tasks and roles at the same time: lecturers, researchers, mentors, and sometimes they even have to fulfill the function of pastors (Bell et al. 2012; Kinman, 2014;). The expectations (or needs) related to these roles and activities put strong pressure on the university teachers, they are serious sources of stress that have a negative impact on their health, well-being (Kinman et al., 2006; Kinman, 2014).

In our study, we examine the workplace factors affecting the health and well-being of East-Central European university teachers. Our main question is what difficulties the teachers of the region have to deal with during their work, and what are the resources that contribute to their well-being. We used the job demands-resources theory (JD-R theory) as a theoretical background to examine this issue. The JD-R theory is a theoretical framework that helps to explain and understand the relationship between workplace characteristics and employee performance and well-being. It classifies the workplace characteristics into two categories that are negatively correlated: (negative) work requirements and work-related resources which have a direct impact on the employee's stress level, motivation, health problems, and numerous organizational outcomes. Workplace resources are the characteristics of the workplace that are necessary to achieve the work goals set, contribute to work enjoyment, motivation, and engagement (Bakker and Demerouti, 2014). Based on the JD-R theory we also examined the job demands and the workplace resources among university teachers in CEE. Earlier research primarily took a psychological approach and examined psychological stress sources and resources, and showed their correlation with regard to work performance, workplace and psychological well-being, or even burnout. But in our exploratory research, we examine difficulties and resources related to the work of the instructors from a higher education research perspective and using a qualitative method (focus group interviews). Previous empirical works that utilized this theory applied the correlations of stress and resources primarily for different aspects of well-being; as the first step of our study, we would like to identify these factors based on the experiences of the teachers in the region under investigation. The geographical area (Central and Eastern Europe) can be considered a

novelty, as it is a region that contains several countries that have similar cultural roots and historical antecedents and are in a similar social-economic situation but at the same time, they have many peculiarities. The applied method is suitable for getting to know the characteristics and challenges of teaching work in the countries and institutions examined in a close-up, valid way, over a broad basis, based on the opinions and experiences of those affected, laying the foundation for further quantitative research that reveal correlations.

A portion of the sources of stress are related to workplace requirements (long working hours, administrative burdens, providing academic and mentoring support, carrying out and fulfilling tasks required for quality assurance, pressure for grants and publications, managing a large number of e-mails, etc.), another portion to the factors limiting efficiency (ineffective management, the lack of administrative and technical support, poor communication, rushed work pace, frequent interruption of work, conflicting roles and limited opportunities to prepare for teaching, research, and professional development), and other problems (such as lack of respect, harassment, interpersonal conflicts, or job insecurity). The high workload also significantly affects the health of the instructors, which is related to and can be manifested in symptoms of depression, aggressiveness, impatience, rejection, and procrastination (Iyaji et al., 2020).

1.1. Health-behavior, physical activity among the instructors

Several studies draw attention to the unhealthy lifestyle of university teachers, employees (inactivity, unhealthy diet, high stress, etc.) which also leads to loss of life among them in many cases (Iyaji et al., 2020). Still, only a few studies deal with the physical activity of the academics, the problem of inactivity, while compared to the average population, they are more likely to be familiar with physical activity's importance and its beneficial effects on various dimensions of health, especially those who work and do research on this field. But this knowledge is not always followed by the activity (Kwiecień-Jaguś et al., 2021), while physical activity plays an essential positive role in health promotion and wellbeing (Cooper & Barton, 2016; Lotan et al., 2005). Practicing organized physical activity contributes to the treatment and prevention of mental illnesses and disorders, and increases the level of physical and mental well-being among both the mentally ill and the general population (Fox, 1999). Research conducted at a South African university came up with devastating results about the health status of the teachers: the majority of the respondents are overweight or obese, generally, the colleagues are not healthy, a great portion of them feel that they are under a lot of pressure, so they are exposed to a lot of stress at work, though they are looking for opportunities that would support their health and well-being. 63% of women and 48% of men did less than the recommended 150 minutes of moderate-intensity exercise, so they can be characterized as having an inactive lifestyle. Negative behavioral patterns can also be observed among them when it comes to nutrition: low fruit and vegetable consumption and high consumption of sugary soft drinks. Overall, the respondents feel that they are

undervalued by their colleagues, they are undermotivated at work and they are dissatisfied with the management, the opportunities, and the wellness initiatives at their faculty (Koen et al., 2018).

In a comparative study, one fifth of Australian and only 18% of British academics participated in at least 150 minutes of moderate-intensity physical activity, and a similar proportion did at least 90 minutes of more vigorous exercise. The vast majority of them (77.4% of the Australians, 88.2% of the British) did not participate in the health-oriented programs and events organized by their university. In both countries, approximately 10% indicated that their institution does not even provide such opportunities. At the same time, we are well aware that an organization has to provide its employees with access to wellness programs that encourage them to participate. Behavioral changes brought about as a result of these programs can be useful for the development of institutional culture, reduce absenteeism, medical expenses, and contribute to the well-being of the employees. (Koen et al., 2018).

Among Cameroonian academics, a positive correlation was found between inactive lifestyle and burnout, while the opposite, i.e. a physically active lifestyle, especially sports, function as a protective factor against numerous diseases (cardiovascular diseases, diabetes, obesity, cancer, metabolic syndrome, stress, depression, aging, dementia, etc.). (Ngalagou et al., 2019). In a Nigerian study, it was found that although physical activities and recreation are positively correlated with quality of life, unfortunately, university teachers do not make use of the sports facilities and infrastructure provided by their institution, the majority of respondents spend their free time with passive activities, mostly due to work requirements (Omolawon et al., 2011).

2. Methodology

In our research, we used a qualitative method, focus group interviews, to reveal the workplace stress and resources affecting the well-being and health of Central and Eastern European university teachers. For the analyses, seven focus group interviews were conducted with academics from nine higher education institutions in five countries, online between July and October 2022. The length of the interview material is about eight hours, which was transcribed into a total of 168 pages of written text. The interview outline broadly examined the work and situation of the academics along the following dimensions: introduction, dimensions of teaching effectiveness, challenges of higher education pedagogy, the impact of teaching work on well-being and health, institutional culture, leisure time and cultural consumption, experiences and attitudes towards disabled students, religiosity, language and ethnic diversity in higher education, the role of the institution in preserving and developing the health of the university teachers.

The number of participants in the focus group interviews was between four and eight from the following institutions (41 people in total): University of Debrecen (UD), Reformed Theological University of Debrecen (RTUD), University of Nyíregyháza (UNY) (Hungary); Sapientia Hungarian University of Transylvania (branch Miercurea Ciuc, SAPI, Romania), Partium Christian University (PCU, Romania); Ferenc Rákóczi II. Transcarpathian Hungarian Institute (THU, Ukraine), J. Selye University (JSU, Slovakia), University of Novi Sad (UNS), Subotica Tech - College of Applied Sciences (STCAS) (Serbia). The Hungarian universities are institutions from the North-Eastern region of the country, where the proportion of disadvantaged students is overrepresented compared to other regions, so the teachers have to deal with special challenges. From the other countries, we have picked the higher education institutions of the Hungarian minority, so the teachers and students are also in a special situation, due to being members of a minority. The interviewees were selected in such a way as to obtain heterogeneous groups according to gender, age, and position, as well as field of study (faculty). In terms of position, there were participants from all levels, from PhD students who are part-time teachers to full professors, several interviewees also holding senior positions (department head, institute head, doctoral program president, dean, assistant dean, assistant rector). Based on the age known, the youngest respondent was 31 and the oldest was 65. 18 men and 23 women participated in the interviews.

During the analysis, we used deductive and inductive coding: we examined the difficulties and resources related to work in connection with the JD-R theory (deductive), and we looked for other sources of stress and supporting factors inductively. Based on the answers, we performed a type analysis to typify the difficulties and resources, and a thematic analysis was performed regarding the coping strategies used to overcome stress, sports and other activities related to health behaviors, institutional contributions, and expectations. The codes are: 1. work-related difficulty, stress, and 2. resources; 3. individual protective factor, coping strategy; 4. institutional supporting factor and 5. expectations, that could promote the well-being of academics.

3. Results and conclusions

Similarly to research conducted among university teachers in Britain, Australia (Kinman et al. 2006; Bell et al., 2012; Fetherston et al., 2021), Pakistan (Aziz and Quraishi, 2017), Saudi Arabia (Alqarni, 2021), China (Han et al., 2020) and Nigeria (Iyaji et al., 2020), the most important workplace difficulties, challenges, and resources are related to teaching roles, interpersonal relationships, support by the management, and infrastructural conditions. Difficulties that came up with regards to teaching include that it is undervalued compared to research performance, even though it takes a lot of work and energy to prepare, be up to date in the course material, to organize the classes, and pass on practical, but always professional knowledge. However, student feedback is not always adequate in this regard, especially

during the time of COVID, when there was no personal contact, so university teachers got feedback neither from the students, nor from the institution in general about how well they were able to deliver the study material to the students. Hungarian institutions of higher education do have a mostly voluntary feedback system, as well as a completely informal website (markmyprofessor), where the work of a given academic can be evaluated anonymously, but these are not necessarily objective, as students are influenced by the difficulty and importance of the course material, and of course the grade received. This way the measurement of the quality of education itself can also be problematic. They deal with the workplace stress by playing sports, physical activity and quality, active time spent with the family in order to preserve their health and well-being. At the same time, in accordance with earlier studies (Kinman, 2014; Koen et al., 2018; Iyaji et al., 2020), the vast majority of subjects do not play sports or perform regular physical activity (only 13 people do). Significant differences can be observed between the institutions (countries) examined; among the subjects in Ukraine, no one mentioned physical activity or sports, while when it comes of gender, there was an equal proportion of active teachers.

The most important message of our study is that the institutional environment is key to both the effective work and well-being of the instructors. This requires well-functioning technology and suitable infrastructure (PCE), financial remuneration independent of external grants for existential security. Meanwhile, it is even more important to define predictable, transparent institutional goals, strategy, and jointly agreed values, to create a predictable and controlled system of evaluation and rewards, which do not change according to the whims of the current leadership or with the change of leadership (in Serbia and Romania). For this reason, constant and effective communication between the leadership and the smaller subunits is very important. Although a stable, predictable system of evaluation already exists in several countries (Romania, Ukraine), and compliance with it is another source of stress, but it has only been introduced into the operation of the institutions examined in Hungary during the recent changes in higher education. Thus, its effectiveness is not yet known, but at the same time it promotes predictability and transparency, which go hand in hand with the differentiation of wages. This could result in a kind of competitive situation within the teaching community, which can negatively affect interpersonal relationships. Among the resources related to work, a good community or team within the faculty or with colleagues from other institutes stands out, so it is extremely important for the management of the institution to support these common, grassroots teambuilding programs. In addition, institutions can contribute to the well-being and health of the instructors primarily by offering free or at least discounted participation in sports, cultural and leisure events, as well as mental health counseling, but it is important for these not to be self-serving (the colleagues from the university should not participate in the programs to make up for the missing audiences of the otherwise overfunded organizations of the institution) and haphazard: without a targeted health strategy, these are not sufficiently effective. These team-building informal programs

were also greatly affected by COVID: they were either forced back into the online space, or they were completely stopped, or they are being revived currently, so in this case, too there appears the need to support grassroots initiatives (department excursions, playing football, theater, etc.).

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From training practice in the professional world to university: characterization of Vocational Training students to retain them in university studies

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Abstract

This paper analyses the Vocational Training students who enroll at the School of Economics and Business Administration of the Public University of Navarre. For this purpose, a descriptive study of this admission profile has been carried out. In addition, their educational strengths and weaknesses have been studied, as well as whether accessing a Degree after having studied vocational training affects their performance and dropout.

According to the results, students mostly choose the Bachelor's Degree in Business Administration and the Bachelor's Degree in Economics, with a better performance in the subjects that are similar to those previously studied in Vocational Training. At the same time, they show deficiencies in the quantitative area, being the access route a determining factor in the result.

Keywords: *Mathematics; economics; business; vocational training.*

1. Introduction

The Lisbon Strategy (European Council, 2000), revised in 2004, was set with the intention of generating Europe as the most competitive and dynamic knowledge-based economy environment in the world, based on a sustainable growth model. To do so, modernisation had to be achieved through active investment in education and training systems; i.e., educational programmes had to be designed to ensure the employability, productivity and income-earnings of the target groups. Subsequently, the European Credit System for Vocational Education and Training (Official Journal of the European Union, 2009) was regulated, formalising the recognition and accumulation of learning outcomes in order to generate a qualification and, therefore, the inclusion of skills in the labour market.

The promotion of Vocational Education and Training (VET) means that, in the coming years, a greater number of Higher VET graduates will be able to access University through this type of non-university Higher Education. For this reason, facilitating the transition between VET and University is one of the goals on the agendas of educational institutions.

From an institutional perspective, efforts are currently being focused on the development of a regulatory framework that promotes the recognition of credits between both programs. Thus, the Public University of Navarre (UPNA) and, in particular, the School of Economics and Business Administration (FCEE), already have agreements binding both Higher VET programs. While this is an excellent measure to avoid duplicities and shorten the time in which students who have previously studied VET obtain a university Degree, it is necessary to complement these measures with others that facilitate the process of integration of the VET student into the university environment. (García et al., 2017; Panera et al., 2004).

To achieve this goal, it is necessary to evaluate what type of initiatives can be implemented by universities. The design of specific tools to strengthen the weaknesses of this less frequent student profile can help these students on starting university with a similar level of knowledge as their classmates who have completed their Baccalaureate studies. In this way, they will be able to achieve the potential student profile set out in the White Paper on Undergraduate Degrees in Economics and Business (2005). Educational innovation projects promoted by universities and other institutions can be decisive in achieving this goal.

In order to know where these kinds of measures should be considered, it is necessary to know which is the profile of students who enroll in university after completing these previous studies and which are their strengths and weaknesses regarding the Degree they are studying. This is precisely the objective of this work: analyze the profile of the students of the FCEE of the UPNA who access through VET. With this objective, the aim is to answer four fundamental questions: What is the profile of FCEE students who enroll in UPNA through VET? Which is their performance in the subjects throughout the Degree? Is admission

through VET a determining factor in passing the subjects of the first semester? Does having enrolled in the university through VET influence the dropout rate of students?

These questions will be answered through descriptive statistics and econometric relationships applied to the data provided by the Integrated University Information System for this purpose.

2. Methodology

Firstly, a quantitative analysis of the data provided by the Integrated University Information System (SIIU) and the internal data collected by the UPNA on academic performance per subject and Degree is done, on a sample of 3662 students.

For this purpose, there is one database with general information on students who have studied Bachelor's Degrees at the FCEE and another database on student performance in the subjects of the offered Degrees. Both databases have information from the academic year 2010/11 to 2019/20. For data analysis, R-Commander, Gretl and Excel were used.

2.1. Descriptive analysis of student profile

Univariate descriptive statistics are used to analyze individual variables such as gender, age or vocational group. In addition, frequencies and percentages of the students that enter university through the VET route of each Degree are calculated and it is determined if this type of student is distributed homogeneously among those Degrees or if it is concentrated particularly in some of them.

2.2. Performance analysis by subject

The analysis of performance by subject; that is to say, the pass rate, the success rate and the no-show rate are evaluated for the Bachelor's Degree in Business Administration (BBA) and the Bachelor's Degree in Economics (BEcon).

Subjects with success rates lower than 60%, pass rates lower than 50% or no-show rates higher than 35% will be reviewed. In addition, those subjects in which students coming from VET obtain better success rates than those coming from Baccalaureate are also reviewed.

2.3. Analysis of the relationship between VET access way and the passing of subjects.

The five subjects evaluated are those corresponding to the first semester of the Bachelor's Degree, since they represent the first challenge of their university academic career and which will determine the continuation of their studies. An econometric model with a limited dependent variable is proposed to determine the probability of failing each subject:

$$Pr (Y^j = 1) = \frac{1}{1 + e^{-(B_0 + B_1 \times VET + B_2 \times Country + B_3 \times Age + B_4 \times AccessMark + B_5 \times Non-passedECTS)}}$$

In this model, $Pr(Y^j = 1)$ appears as the dependent variable, which is interpreted as the probability of failing the subject Y^j (one model per subject), and the regressors are dummy variables ("VET" and "Country") and continuous qualitative variables ("Age", "Access Mark" and "NP ECTS"). VET is the variable interest and the remaining regressors are control variables that have a significant impact in the model, so their exclusion could invalidate the results. The model will be estimated by Maximum Likelihood.

2.4. Analysis of VET access way as a determining factor in dropout.

The following econometric model with a limited dependent variable is used to explain students' dropout from the BBA and the BEcon, according to the access route:

$$Pr(Dropout = 1) = \frac{1}{1 + e^{-(B_0 + B_1 \times VET + B_2 \times Non-passedECTS)}}$$

In this case, $Pr(Dropout = 1)$, is interpreted as the probability of dropping out from the studies by students while "VET" is the variable interest and "NP ECTS" is the control one of the model. The model is also estimated by Maximum Likelihood.

3. Results

3.1. Descriptive analysis of student profile

Since 2010/11 and up to 2019/20 academic year, 422 people have accessed the School through a VET Degree. This is the second most frequent route, after the Baccalaureate (3097 people). About 60% of these students are women and the average age at which they access the studies is 22 years old, above the Baccalaureate students, who access between 18 and 19 years old. This profile is mostly enrolled in the BBA and the BEcon, with 79.62% and 18.48% of the total number of VET students, respectively. In contrast, this profile is quite infrequent in double Degrees and international programs. This may be explained, among other factors, by the fact that the admission grade for both Degrees is lower than either in double Degrees or in international programs.

The Vocational Groups with the highest frequency among VET students are Administration and Management (167 students) and Commerce and Marketing (61 students). These fields are the most similar to the Degree studies offered by the FCEE and those with the highest number of credits recognized between both Higher VET programs.

A total of 160 students, out of the 422 who entered the FCEE through VET access, have completed their Degree and 146 have dropped out, which represents a 34% of the students who are admitted by this route. This rate is significantly high and ten percentage points greater than the dropout rate for Baccalaureate students, who have a 24%. Regarding the data

by Degree, the dropout rate among VET students is 31.55% for Business Administration and 44% for Economics.

Among VET students, the average time to get the title is 4.77 years, which is similar to the average time of students with a Baccalaureate Degree. However, it is common for VET students to have ECTS credits recognised at the beginning of their studies, so it can be concluded that VET students find it more difficult to complete their Degree. The rates of graduates among VET students are better in the case of Business Administration than in Economics, with a percentage of 41.37% and 24.36% of graduates, respectively. In both cases, the rates are lower than those obtained by students who enter with a Baccalaureate Degree, whose graduation rates are 44.54% and 37%, respectively.

3.2. Performance analysis by subject

Graduates coming from VET show a notably good performance in accounting subjects in both Degrees, with 9 percentage points higher pass rates than those coming from Baccalaureate. The same results are obtained in the case of the subject of Financial Operations for the BBA, although the difference is more tenuous, around 5 percentage points.

However, the performance of those whose access is through VET is clearly lower in the subjects of Mathematics in the BBA and Mathematics I in the BEcon, with lower pass rates than those coming from the Baccalaureate (-14% in both cases), as well as higher no-show rates (about 13% in both cases).

Particularly, in the BEcon, negative results are transferred to subjects such as Introduction to Economics, Microeconomics, Mathematics II and Finance, because of the mathematical background they have.

3.3. Analysis of the relationship between VET access way and the passing of subjects.

From the five models proposed for each grade in Section 2.3, Table 1 shows only those in which the VET variable is statistically significant at a significance level of 5%. As it is a logit model, the slope column must be studied, due to the fact that it shows the marginal effects when the rest of the variables take their mean value.

Table 1. Results of the analysis of the subjects.

	Vocational Training Access Students				
	Degree	Coef.	Signif. (5%)	Slope	R2 McF
Mathematics I	BEcon	1	True	0.287	0.589
Mathematics	BBA	0,630	True	0.131	0.596
Financial Operations	BBA	-0,787	True	-0.155	0.559

In the BBA case, the analysed subjects are financial Operations and Mathematics, where the signs of the coefficients are as expected: in the case of Financial Operations, the sign is negative, which implies that having studied VET previously increases the probability of passing, a result consistent with reality, due to the training context of the VET Degrees from which the students come. Specifically, coming from VET makes the student 15.45% more likely to pass this subject than a student who enters university through other studies, keeping the rest of the variables at their averages.

In the case of Mathematics, the effect of accessing university through VET has the opposite effect. The sign of the coefficient is positive, so that, in accordance with the slope, entering university through VET increases the probability of failing the subject by 13.07%, if the remaining variables of the model keep at their mean values.

The same effect happens in the subject of Mathematics in the BEcon; i.e., the sign of the coefficient is positive, since accessing university through VET causes an increase on the slope of 28.75% of failing this subject, compared to those who come from another educational pathway, with all remaining variables constant.

3.4. Analysis of VET access way as a determining factor in dropout.

In the BBA, the coefficients of the two regressors of the *Section 2.4* model are statistically significant at a significance level of 5%. Therefore, accessing university through VET studies influences the probability of the student dropping out; in this sense, given that the sign of the coefficient of the variable "VET" is positive, access through VET increases the probability of dropping out by 4%, keeping the rest of the variables constant.

For the BEcon, the variable VET is not statistically significant at 5% nor 10%, so it cannot be said that it is different from 0. This indicates that the VET access way has no effect on the probability of dropping out.

4. Discussion

Firstly, according to the descriptive analysis in *Section 3.1* of the students' profile, at least one out of ten students who entered the FCEE between 2010/11 and 19/20 did so with a VET qualification. Their minority position in mainly Baccalaureate formed groups means that their potential and shortcomings often go unnoticed. The analysis of the provided information builds an image of the students who access the UPNA's FCEE through this pathway, as well as identifies their educational strengths and weaknesses. In this way, the areas of knowledge in which actions can be carried out so that VET students can integrate into the university in an appropriate way and develop the syllabus satisfactorily have been discovered. This student profile essentially opts for the BBA, followed, distantly, by the BEcon.

In relation to their performance, these students present good results in subjects close to the modules taken in the Higher VET programs of the Vocational Groups of Administration and Management and Commerce and Marketing, the most common Groups of those who enter the Faculty. As can be seen in *Section 3.2*, they stand out in accounting subjects, presenting better results than their counterparts in the Baccalaureate. In this sense, similar results are obtained to those presented by García et al. (2017) in another branch of knowledge: students who come from Higher VET programs obtain good grades in specific subjects related to technical Degrees and lower grades in theoretical subjects.

In this line, the *Section 3.2* shows that VET students have greater difficulty in subjects related to the quantitative area, in which a high level of mathematical skills is necessary to pass them satisfactorily. Specifically, Mathematics subjects in the BBA and in the BEcon are those with the lowest pass rates and high failure rates. Comparing the data with those obtained from students who access the Degree through the Baccalaureate, it is shown that, although the results of the second one are not good either, they are substantially better, which is in line with the literature (Fernández et al. 2001, Gil et al. 2014, Pérez et al. 2013).

This deficit may be because some of the VET students have not taken Mathematics subjects since the 4th year of Secondary Education, either because they entered the following year to an Intermediate VET program or because they did not choose Mathematics in the Baccalaureate (Gil et al. 2014). Such shortcomings may condition performance in other subjects, as pointed out in the White Paper on the Bachelor's Degree in Economics and Business (2005). This is evident among VET students studying Economics, who have greater difficulties in subjects such as Introduction to Economics or Microeconomics, where functions and other mathematical tools are constantly used to build models.

The same conclusions are obtained in *Section 3.3* by studying the influence of the entry route on the probability of passing or failing a given subject. Coming from VET makes the probability of not passing the Mathematics subject significantly higher than coming from the Baccalaureate access way. This difference may be due to the fact that in Economics the admission marks are historically lower and, in addition, it has fewer similarities than Business Administration with Higher VET programs, so students who have enrolled in this Degree have done so with lower marks and, probably, it has not been the preferred option.

For this reason, it is considered that the main point of improvement should be to put on the same level the mathematical competences as those of their counterparts who entered by the Baccalaureate pathway, thus, covering the training deficit prior to the start of the Bachelor's Degree and, in this way, avoiding the deficiencies in the rest of the subjects.

For that purpose, an educational innovation project has been developed with the aim of creating a virtual platform to cover individualized training needs through gamification. The project *Digital Gamification to address pre-university mathematical training deficiencies in*

students of *Economics and Business Degrees* of the UPNA will be promoted during the following two years. The improvement that will be entailed by the implementation of the virtual platform may help to reduce the drop-out rate of these profiles, evidenced in *Section 3.4*. This is particularly of paramount importance in a context where greater accessibility to Higher VET programs and the expansion of their training offer will lead to an increase in the critical mass of students with Higher VET Degrees who enter university through this route.

Finally, note that the study was carried out at a single university and, therefore, the sample size in some cases did not provide conclusive results. There are also two future lines of research, one related to the replicability of the study in other universities and the other to the analysis of the impact of the virtual platform as a way of alleviating detected deficiencies.

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An examination of significant factors influencing college student employment cognition

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Abstract

The increasingly severe employment problem of college students has become a public concern in China. The literature review suggested that college students' employment cognition play a major role in this issue. To improve students' employment cognition thus becomes important. The paper argued that the first step in the improvement of students' employment cognition be knowing the key factors that might influence one's employment cognition. Through literature review, this paper identified three key influential factors, i.e., professional training, academic satisfaction, and word-of-mouth. Empirical data were then collected to test their relationships with employment cognition. SEM analysis revealed that these factors were significantly and positively related to employment cognition. These findings provide Chinese educators and potential employers with insights on how to help college graduates broaden their job search scope and match their majors with ideal jobs. In a broad sense, these findings could significantly contribute to the wellbeing of the Chinese society.

Keywords: *Academic satisfaction; employment cognition; professional training; unemployment.*

1. Introduction

With the expansion of colleges and universities in China in the recent years, the number of students who successfully complete their higher education has greatly increased. This is good news for the Chinese society on one way. On the other hand, it has simultaneously brought some “negative issues” to the attention of some educators and researchers.

One of these is high pressure on the newly graduated students since competition for job opportunities seems to have been mounted and many of them struggle to find jobs. The high competition in the job market is argued to also come from the economic situation in China. Reuter (Polland, 2022) revealed that China’s economy has been weakened by the Covid-10 Pandemic and the youth unemployment, as of June 2022, is already more than three times China's overall joblessness rate, at a record 18.4%.

Another “negative” observation of the job market is the mismatch between the college student major and actual employment. Anecdotes and news reports show that many graduates have entered professions unrelated to their majors. To seek job security, many graduates aim for or accept governmental positions, regardless of their majors (Polland, 2022).

It looks like that the “golden employment age” for college graduates in China has been over. However, the recent call by President Xi Jinping on the nation's youth to seek out new opportunities in “the west of the country” reveals deeper insights into the “college graduate unemployment” issue (Shan, Zhang, & Hu, 2022). Relevant literature reveals that most college graduates desire for positions in large companies located in cities and governmental agencies, particularly those large cities located in relatively developed east regions. It also casts doubts on Chinese college students’ overall employment cognition, which greatly influences college students’ career choices (Lent, et al, 2000; Gushue, et al, 2006). Chinese students’ employment cognition seems to be low. Studies show that many students are not clear about their future career paths; they do not have their own opinions, but blindly follow the advice of their parents, friends, or strangers (e.g., Glewwe, et al, 2011; Munir, et al. 2022).

This paper supports the Chinese government’s viewpoint regarding the “real cause” of “college graduate unemployment” and “job mismatch” issues and argues that improvement of student employment cognition be an effective solution to these issues. To get started, this study aims to investigate key factors that might significantly influence college student employment cognition.

2. Conceptual Model

A survey of the relevant literature reveals that college student employment cognition might be influenced by multiple factors, including professional training, academic satisfaction, and word of mouth (WOM), and others. This study focuses on testing and reporting the direct

relationship of student employment cognition (as a dependent variable) and three independent variables, professional training, academic satisfaction, and WOM, as figure 1 shows. Although the authors did investigate the interrelated relationships among the independent variable, this paper only reports the direct relationships as shown in the framework. Figure 1 serves as a guide for literature review and data collection.

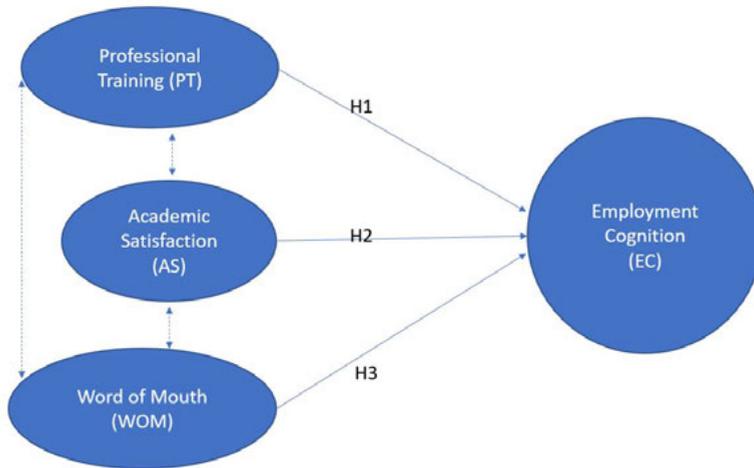


Figure 1. The Proposed Theoretical Conceptual Framework.

2.1. Professional Training and Employment Cognition

College student professional training is found to influence student employment cognition by a number of research studies. For instance, Monteiro, et al. (2020) found that career advice services provided by colleges and universities were positively correlated with student employment cognition. Álvarez-González, et al. (2017) contended that skill development, academic performance, personal environment and contacts, and cognition of the labor market increase students' self-confidence, which is positively reflected in how they perceive their employment cognitive ability. This view is supported by Tymon, et al. (2020). Through a sample of employed and unemployed job seekers, Zikic, et al. (2009) found that people who spent more time exploring careers and participating in more training programs reported higher job search clarity and self-efficacy.

In addition, mentors play an important role in professional training and development. Using a web-based descriptive survey design, Adeniran R.K et al. (2013) detected significant differences in the mentoring role and certain professional development and career advancement measures between colleges and universities, and concluded that mentors are role models, mentoring relationships are important for professional growth, and standardized

professional development structures are needed to facilitate professional growth. Based on the evidence in the literature, the following hypothesis is thus proposed:

H1: Professional training has a positive impact on Chinese college student employment cognition.

2.2. Satisfaction of College Students

A number of studies show that students' academic satisfaction seems to have positive effects on student employment cognition. Yun, et al. (2019) surveyed more than 120 Chinese college students and identified significant relationships between academic studies, and student satisfaction and employability. Liu, et al (2021) found that compared students who know their employment status to those who do not know their employment status, the latter have lower academic satisfaction. An empirical study done by So, et al (2014) indicated that student academic satisfaction has positive effects on goal selection, job information and future plan, which is helpful for college students to establish correct employment cognition. Thus, this study proposes the following hypothesis:

H2: College students' satisfaction has an impact on their employment cognition.

2.3. Word of Mouth

Huete-Alcocer (2017) found after reviewing relevant literature that word-of-mouth is the oldest medium for sharing opinions on products or services, and it is also the medium most likely to influence consumer behavior because of the high reliability and credibility through family and friends' transmission. Yim, et al. (2010) found that customers' online and offline word-of-mouth had a statistically significant impact on their evaluation of a restaurant's brand equity. Their results also show that customers' evaluation of the three dimensions of brand equity has a significant impact on their return intention, and the online and offline word-of-mouth of stable brand equity for family restaurants. Similar to the situation that consumers face when choosing which products to buy, college graduates are also influenced by the information spread by the surrounding people. College graduates will pay attention to the information passed on by others, analyze and judge the quality of their employment situation according to the information obtained, and then make their own employment choice. This study thus proposes the following hypothesis:

H3: Word of mouth plays a role in establishing correct employment cognition.

3. Methodology

Research publications that systematically investigate the key factors that significantly influence Chinese student employment cognition are very limited. Therefore, this study collects its own data through a survey to test the proposed hypotheses. This questionnaire is

divided into two parts, the first part is the basic characteristics of the respondents, the second part is to measure the variables of the conceptual model, and the variables are measured through questions derived from the literature. The dependent variable of the questionnaire is employment cognition, the independent variable is college students' academic satisfaction, professional training, and WOM. We used a set of 5-point Likert scale to state the questions, with "1" = "strongly disagree" and "5" = "strongly agree".

Before the formal survey, this paper first conducted a pilot study and used Cronbach α coefficient and factor analysis to test the reliability and validity of the questionnaire structure, which was found to be good. Through principal component analysis, it is found that the individual questions of college students' satisfaction and employment cognition in the rotated component matrix have unclear attribution, so the questionnaire is modified and improved for these questions. In the pilot study, a total of 102 questionnaires were distributed, and 97 valid questionnaires were screened out, with an effective rate of 95.1%. Formal questionnaires were distributed to about 350 college students.

3.1. Participants

An online survey was conducted among Chinese college students across the country. The basic information of demographic characteristics included gender, age, education level, type of school, living area, future employment, and whether they would choose a job in line with their major. The questionnaire was released on April 24, 2022, and closed on August 6.

A total of 358 questionnaires were collected, and the invalid questionnaires such as too short time and illogic were screened out. A total of 307 valid questionnaires were retained, with an effective rate of 85.76%. In this formal survey, 68.70% respondents were female and 31.3% male. Most of the participants were between 18 and 22 years old, accounting for 82.08%.

3.2. Data Analysis Procedure

The data analysis was carried out in four steps, similar to the previous research. First, descriptive statistical analysis was carried out to calculate variable mean value, standard deviation and correlations with the help of SPSS26.0 statistical tool. Second, Reliability and validity test was tested with the help of SPSS26.0 and AMOS23.0 statistical tools. Reliability analysis is measured by Cronbach α . Third, Structural Equation Model (SEM) analysis was conducted. Measurement error control and model fitness test were included to predict the influence of professional training on establishing correct employment cognition. AMOS23.0 statistical tool was used in this part. The was followed a test by using the Bootstrap Method to see if college students' satisfaction has any effect in the process of establishing correct employment cognition. These analyses identified many significant relationships among independent variables, which will be reported in a follow up study.

4. Results

4.1. Preliminary Analysis

The absolute values of skewness (<2) and kurtosis (<4) of all observed variables were normal distribution. The mean value, standard deviation and mutual coefficient matrices of the variables are shown in Table 1.

Table 1. Basic statistics of variables.

Variables	MD	SD	PT	AS	EC	WOM
PT	3.65	.66	—			
AS	3.92	.57	.568 **	—		
EC	4.01	.56	.512 **	.602 **	—	
WOM	3.70	.57	.475 **	.447 **	.568 **	—

Note: PT = professional training; AS = academic satisfaction; EC = employment cognition; WOM = word-of-mouth.

Table 1 shows that the overall employment cognition of Chinese college students is above the average, but not super. Their professional training is only 3.65, the lowest score among all the variables examined. This indicates that word of mouth communication and academic satisfaction do have greater influence on student employment cognition than their professional training. In addition, the results show that all the variables are significantly correlated, which confirmed the literature information.

4.2. SEM Analysis

The identification index of the model (see Table 2) and the identification model were obtained as follows. Table 2 shows that the index fit is very good, indicating that the model has a high fitting degree. The path coefficients of the structural equation model are shown in Table 3.

It is inferred that professional training significantly but weakly influences employment cognition ($r=0.187$, $P<0.05$); academic satisfaction significantly and strongly influences employment cognition ($r=0.598$, $p<0.000$). The significant and strong relationship between professional training and academic satisfaction is apparent ($r=0.658$, $p<0.00$). This is Further identified by Bootstrap method with 5000 sampling times, the results are shown in Table 4.

Since the direct effect of professional training on the establishment of correct employment cognition is relatively small, but the total effects are big, it seems to indicate that college students' satisfaction has mediating effect between PT and EC. Hierarchical moderated regression was used to verify whether word of mouth plays a role in establishing correct

employment cognition. The results confirmed that WOM has significant and positive influence over Employment Cognition.

Table 2. Goodness-of-fit indices summary of the SEM.

Fit Indices	Baseline	Estimated value
χ^2/df	< 3.00	1.712
GFI	> 0.90 (good)	0.933
	> 0.80 (reasonable)	
AGFI	> 0.90 (good)	0.909
	> 0.80 (reasonable)	
RMSEA	< 0.1 (reasonable)	0.048
	0.05 or less (good)	
RMR	< 0.05 (good)	0.022
	< 0.1 (reasonable)	
NFI	> 0.90	0.935
TLI	> 0.90	0.966
CFI	> 0.90	0.972
PNFI	> 0.50	0.787
PGFI	> 0.50	0.693

Table 3. The path coefficient values of the SEM.

Path	Unstandardized path	Standardized path	S.E.	CR.	P
	coefficients	coefficients			
PT→AS	0.638	0.658	0.071	9.027	***
PT→EC	0.165	0.187	0.067	2.458	0.014
AS→EC	0.546	0.598	0.082	6.633	***

Table 4. Total effects.

Model Pathways	effects	Point estimation	Bootstrapping			
			Bias-corrected 95%		Percentile 95%	
			Lower	Upper	Lower	Upper
	Total effects	0.514	0.346	0.696	0.352	0.704
PT→EC	Direct effects	0.165	0.020	0.322	0.021	0.323
	Indirect effects	0.349	0.201	0.536	0.201	0.536

Table 5. Effects of WOM.

Model	Variables	Unstandardized coefficients		standardized coefficients	T	SIG.
		B	S.E.	Beta.		
1	Constant	.981	.185		5.313	.000
	AS	.367	.046	.374	8.036	.000
	WOM	.427	.046	.434	9.337	.000
2	Constant	.937	.182		5.154	.000
	AS	.374	.045	.382	8.338	.000
	WOM	.438	.045	.445	9.721	.000
	AS*WOM	-.185	.054	-.142	-3.452	.000

This test reveals that word of mouth significantly influence one’s employment cognition as $r=0.343$, $p < 0.000$. At the same time, it significantly but negatively interacts with academic performance, indicating that the higher of a student’s academic satisfaction, the less likely the student uses “word of mouth” as a career information source.

5. Conclusions

The key findings of this study are that each one of the independent variables, i.e., professional training, academic satisfaction, and word-of-mouth, has a significant and positive effect on college students' correct employment cognition. However, academic satisfaction has the

strongest impact on employment cognition, followed by word-of-mouth. It is interesting to see that the independent variables are significantly correlated with each other. For instance, word-of-mouth mediates the relationship between academic satisfaction and employment cognition negatively, indicating students with higher academic satisfaction are less likely to turn to word-of-mouth for career information. These findings provide the Chinese educators and potential employers with insights on how to help college graduates broaden their job search scope and match their majors with ideal jobs. Colleges and universities should strengthen professional training, improve student academic satisfaction, and effectively manage word-of-mouth channels. This study has two major limitations. One is the nature of an online survey, which might automatically filter out those college students who do not go online often. Another is that only three independent variables were tested and direct relationships were reported in this study. The immediate future study of this research is to identify more independent variables and examine how they are correlated with each other or if any mediating relationships exist between them.

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Holey molely guacamole! Understanding foreign currency exposure

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Abstract

International financial management refers to the investment and financing decisions that managers of a multinational company face in the international context that they engage in in business. Breuer and Ruiz de Vargas (2021) highlight the high demand for practical applications in this area. The purpose of the current work is to introduce undergraduate students to the concept of currency risk and hedging through a case study on currency risk of the firm Holey Moley Guacamole. Students analyze the benefits and drawbacks of different hedging alternatives for the firm's operating currency exposure. The exercise here developed is geared towards the introduction of the topic of currency risk to undergraduate students in a finance cases class, upper level financial management class, or international financial management class. In addition to developing this exercise and implementing it in class, student learning is assessed.

Keywords: *International financial management; operating currency exposure; hedging strategies.*

1. Introduction

International financial management refers to the investment and financing decisions that managers of a multinational company face in the international context that they engage in in business. Breuer and Ruiz de Vargas (2021) talk about the importance of International Financial Management as a special discipline in the broader finance field and they bring to light the fact that this is an area of ongoing research with a high demand for practical applications.

One of the most challenging topics for undergraduate students to grasp in international financial management is currency risk. This topic is very important in the context of a company's international financial management because it has been proven that currency exposure hedging adds value to a firm (Geyer-Klingeberg et al.; 2020). In addition, existing finance applications or cases on this topic are dated and geared towards graduate students (see for example: Porsche Exposed, 2004; BMW Currency Hedging, 2007; and Foreign Exchange Hedging Strategies at General Motors: Competitive Exposures, 2005). The most recent example is McCarthy (2016), also geared towards graduate students.

The purpose of the current work is to introduce undergraduate students to the concept of currency exposure and hedging through a case study on currency exposure. Specifically identifying and proposing different hedging alternatives for a firm's operating currency exposure and analyzing the benefits and drawbacks of each alternative. The exercise here developed is geared towards the introduction of the topic of currency risk to undergraduate students in a finance cases class, upper level financial management or international financial management class. In addition to developing this exercise and implementing it in class, student learning is assessed.

2. Currency Exposure

Most International Financial Management textbooks (see for example Madura, 2016 and Eun and Resnick, 2021) and studies on firms' foreign currency exposure identify three types of currency exposure: transaction exposure, economic exposure and translation exposure.

Transaction exposure is defined as the sensitivity of a firm's contractual cash flows on a foreign currency to unexpected changes in those foreign currencies. This type of exposure occurs because contracts are set at a fixed price and exchange rates change in time, causing the value of these set contracts to increase or drop based on changes in the exchange rates.

Economic exposure refers to changes in the value of a firm based on unanticipated exchanges in exchange rates. Changes in exchange rates can affect a firm's operating cash flows as well as the value of the firm's assets and liabilities such a firm's receivables, payables and foreign

currency loans. This is why transaction exposure is many times considered a specific form of economic exposure.

Lastly, translation exposure refers to the potential effect that unanticipated changes in exchange rates can have on a firm's consolidated financial statements. Where consolidated financial statements refer to the translation of all foreign subsidiaries financial statements from local currencies to the parent's home currency. This is, when a foreign subsidiary's assets and liabilities denominated in foreign currencies change from the perspective of a parent company, due to unanticipated changes on exchange rates.

2.1. Operating Currency Exposure

The focus of this current exercise is on identifying and hedging operating exposure, an extremely important part of economic exposure, and the most challenging type of currency exposure to identify and to hedge in a firm. Operating exposure or exposure from its operations is defined as the impact of unanticipated changes in the value of foreign currencies on a firm's operating cash flows. Operating exposure is much more challenging to identify than exposure on a firm's assets and liabilities. In addition, it cannot be readily obtained as a line in a financial statement but must first be estimated. This is, operating exposure depends on a firm's competitive position in the market in which it sells its product and sources its inputs as well as the firm's ability to reduce the currency change impact by adjusting markets in which it sells its product, its product mix, and its sources of inputs. In sum, the more sensitive a firm's costs and/or sales are to exchange rate changes the higher the degree of operating exposure that a firm faces.

It is important to note that changes in exchange rates may not always cause operating exposure. When changes in exchange rates are offset by the inflation differential between two currencies, this change in the exchange rate will not cause operating exposure. In this case, we say purchasing power parity holds or the change in the exchange rate is exactly offset by the inflation differential.

2.2. Managing Operating Currency Exposure

A firm can use operational or financial hedging strategies to reduce or eliminate their operating exposure. Financial hedging strategies would include using contracts such as forwards, futures, options or swaps on foreign currencies. For example, if a firm incurs costs in a foreign currency, as the foreign currency appreciates those costs will increase. A firm could set up a forward contract hedge in which they sell the foreign currency forward, such that as the foreign currency appreciates, they will lose net cash flow (NCF) but gain in their forward contract position offsetting the NCF loss. The challenge of setting up a financial hedge is determining the date for which to hedge as well as the amount of foreign currency that needs to be hedged. In the case of operating exposure the challenge of identifying these

two variables many times lead companies to use operational hedging strategies. In addition, since currency exposure in a firm's operations is ongoing, in these circumstances financial hedges are not a one time deal such as in the case of transaction exposure, but need to be constantly rolled over or reset to continue to hedge the company's operating currency risk.

Operational strategies refer to strategies that help firms match assets and liabilities in the same or correlated currencies to eliminate or reduce the firm's operating exposure. This is, by matching exposure of inflows and outflows in the same or correlated currencies, or reducing that inflow and/or outflow in the foreign currency, we are effectively canceling out or reducing the effect of the foreign currency change on our cash flows. For example, if a firm's source of operating exposure are sales in a foreign currency, the firm could reduce this exposure by increasing or starting production of goods in that foreign currency such that the expenses in the foreign currency offset the revenues in the currency thereby reduce or eliminate the currency exposure. Our focus in this example will be on operational strategies that help reduce or eliminate the firm's operating currency exposure. This will become much clearer through our example of Holey Moley Guacamole.

3. The Exercise: Holey Moley Guacamole!

The objective of this exercise is to determine in which areas of the firm's cash flow Holey Moley Guacamole has exposure to foreign currency risk and discuss how they can reduce this exposure.

Assume you are the owner of Holey Moley Guacamole, a firm that produces and sells guacamole in the U.S... Your main input are avocados, which you import from Mexico. You have been operating for 12 years.

Your guacamole sells in major U.S. supermarkets for a price of 6.5 USD for each 8 oz. guacamole tub. Each avocado crate containing 25 lbs. of avocado costs 800 Mexican Pesos (MXN). Thus, your guacamole production cost is 64 MXN per guacamole tub, or approximately the cost of 2 lbs. of avocados. You sell Holey Moley Guacamole only in the U.S... Your current sales of guacamole are 1,000,000 tubs annually.

Besides the avocados you import from Mexico, you incur an additional 300,000 USD cost of materials to produce the 1,000,000 tubs guacamole which include other vegetables and spices needed to make the guacamole and its packaging, among other items. In addition, other operating expenses include a fixed cost of 100,000 USD and a variable cost of 10% of sales. Your depreciation expenses are 175,000 USD a year. You currently have 5,000,000 USD worth of debt that charges a 3.25% interest annually, and your corporate tax rate is 21%. Lastly, the elasticity of demand for Holey Moley Guacamole is minus 1.5. This is, a one

percent increase in price of Holey Moley Guacamole, decrease the quantity demanded by 1.5%.

To study the sensitivity of Holey Moley Guacamole's net cash flow (NCF) to changes in the value of the MXN, we look at the net cash flow assuming the MXN appreciates against the USD from 0.5 USD/MXN to 0.7 USD/MXN, a 40% appreciation. With this information, we construct the firm's net cash flow under the base case scenario and develop alternative strategies to reduce the firm's operating currency exposure.

3.1 Identifying Operating Currency Exposure

As we can see in the base case, the net cash flow changes from 1.685 million USD to 674,675 USD when the MXN appreciates from 0.5 USD/MXN to 0.7 USD/MXN. As the peso appreciates against the dollar, we observe net cash flow decreases. No other items except the exchange rate between the MXN and the USD change in the base case. We can observe that the increase in our cost of materials incurred in MXN is the source of the lower NCF. Although we continue to produce and sell the same amount of guacamole, the appreciation of the MXN causes an increase in the cost of production thereby reducing the NCF by 60%! This is a clear sign of operating currency exposure. How can we reduce or eliminate this type of currency exposure?

In the case of Holey Moley Guacamole, the firm's operating exposure is in its production expenses, which is a negative cash flow since it represents a cost for the firm. We will analyze different ways in which Holey Moley can reduce or eliminate their operating exposure.

appreciates, our cash flows drops by only 30% compared to the 60% drop in NCF in the original scenario. Thus, substituting 50% of our avocados from Mexico with U.S. avocados reduces our exposure to the MXN by 30% and decreases the fluctuation in our net cash flow.

3.2.2. Pass on 50% of the Cost Increase to Consumers via a Higher Guacamole Price

The company's ability to pass on the higher cost of producing guacamole to consumers via a higher guacamole price will depend on the price elasticity of demand for Holey Moley. We assume that demand elasticity of Holey Moley is -1.5. This is, a 1% increase in the price of guacamole reduces the quantity demanded by 1.5%. Given an MXN appreciation of 40% (from 0.5 USD/MXN to 0.7 USD/MXN), if we pass 50% of this increase in cost to consumers, and given a price elasticity of -1.5, the price of guacamole would increase by 20% from 6.5 USD to 7.8 USD per guacamole tub, and the quantity demanded would drop by 30% ($-1.5 = \Delta Qd/20\%$). Thus demand for guacamole will be 700,000 tubs instead of the original 1 million tubs. However, the price per tub in USD will increase to 7.8 USD. Therefore, total sales in USD are expected to be 5,460,000 USD. This is 1,040,000 USD less than in our base case scenario. To produce 700,000 guacamole tubs at 2 lb. of avocado per tub priced at 64 MXN per every 2 lb., the cost of Mexican avocados is 44,800,000 MXN, or in USD at an exchange rate 0.07 USD/MXN, 3,136,000 USD ($44,800,000 \text{ MXN} \times 0.07 \text{ USD/MXN}$). Assuming the rest of the costs remain constant, with the exception of the variable cost which is 10% of sales, our NCF drops by 41% in this alternate scenario. This compares to an NCF drop of 60% in the base case scenario at an exchange rate 0.07 USD/MXN.

When passing on higher costs of production to consumers, the price elasticity of demand plays a very important role in the outcome. If the price elasticity of demand were lower, the reduction in quantity demanded due to the higher prices would also be lower .

3.2.3. Sell Guacamole in Mexico

If it makes sense for the firm's overall business, they could generate a positive cash flow in MXN by selling guacamole in Mexico and offset the negative cash flow in MXN from importing avocados. Assume Holey Moley can sell guacamole in Mexico at the same price than in the U.S. Also, assume they can generate 10% of U.S. sales in Mexico. Suppose they will need to increase production by 10% to meet additional demand for guacamole. In this scenario, we observe the NCF drops by 54% as compared to a drop of 60% in the base case. In the same vein, exposure to the MXN decreases only slightly from 4.480m USD in the base case with 0.07 USD/MXN to 4.278m USD in this scenario, given that we would need to import more avocados from Mexico. Thus, the effort to offset inputs from Mexico with sales in Mexico is thwarted by the need to import more avocados from Mexico to produce the added guacamole.

3.2.4. Pass on 50% Cost Increase to Consumers via Higher Guacamole Price and Substitute 50% of Mexican Avocado Imports with California Avocados

Just like the second scenario, passing on 50% of this increase in price to consumers, and given a price elasticity of -1.5, increases the price of guacamole by 20% (from 6.5 to 7.8 USD per guacamole tub). Quantity demanded drops by 30% and the demand for guacamole will be 700,000 tubs instead of the original 1 million tubs. Total sales in USD are expected to be 5,460,000 USD. Moreover, to produce 700,000 guacamole tubs Holey Moley will import half of the avocados needed from Mexico and source the other half from the U.S. They need 700,000 lb. of avocado from the U.S. at 1.6 USD per lb. for a cost of 1.12m USD; and 700,000 lb. of avocado from Mexico at a cost of 32 MXN per lb. or 1.568m USD at the 0.07 USD/MXN exchange rate. In this scenario NCF drops 20% and the exposure to the MXN is -1.568m USD.

3.2.5. Substitute 50% of Mexican Avocado Imports with California Avocados and Sell Guacamole in Mexico

Assume you have 10% additional guacamole sales coming from Mexico and 50% of your avocado comes from the U.S. The avocado price in the U.S. is 1.6 USD per lb. of avocado and Mexican avocados are 32 MXN per pound. We increase avocado inputs to account for the additional production needed to sell guacamole in Mexico. Thus, Holey Moley generates 7.15m USD in sales: 6.5m USD in U.S. sales and 0.65m USD in Mexico sales. Avocado inputs are 2.2m lb. of avocados needed to produce 1.1m guacamole tubs: 1m tubs in the U.S. and 0.1m tubs in Mexico. Half of the avocados come from Mexico and half from the U.S... In this scenario, NCF drops by 21%. The second smallest drop in all scenarios analyzed here, and second lowest MXN exposure (1.8m USD) out of all scenarios. Overall, the fourth and fifth scenarios seem to be the best alternatives. They show the smallest drop in NCF and the lowest MXN exposure out of the five scenarios analyzed.

4. Student Learning

Students worked on a set of two pre and post exercises on economic exposure. The first exercise in each set was moderately difficult (#1) and the second was difficult (#2). Students answered the pre-exercises after discussing theory and examples on the topic in class. Then students worked on the Holey Moley Guacamole Case. Lastly, they worked on the post exercises. In the pretest, 92% and 28% of students got the correct answer on problems #1 and #2, respectively. In the post-test, 48% of students got the correct answer on #1 and 76% obtained the correct answer on #2. This is, students' scores for the difficult question improved considerably from the pre to the post-test; however, scores for the moderately difficult question fell. Thus, overall results from the pre and post-tests are mixed. Further feedback from students may lead to more clarity in this outcome. Still, cases have shown they add

value beyond traditional lectures. Kester et al. (2005) points out traditional teaching methods like lectures, may be more efficient in transmitting knowledge. However lectures are not effective in helping student learn to deal with the unstructured problems they will face in their professional careers, as cases do. Moreover, Trahan (1993) suggest integrating lecture and cases into the same courses combines the strengths of both methods and may be superior to each method individually. Perhaps here lies the answer.

5. Conclusion

Students learn about operating currency exposure through the analysis of scenarios in the Holey Moley Guacamole case. Results on the effectiveness of using cases vs. lecture are mixed. Gathering further student information may clarify this issue.

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Creating a bridge to post-traditional male student success at a community college

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Abstract

Post-traditional students appear to be the highest growing population of students on American college campuses. Post-traditional students are 24 years of age and older. Frequently referred to as adult students or nontraditional students. About 1/3 of the people, who are working and learning in the U.S., are over the age of 30, which is a very substantial increase over what we saw in the 1980s and 1990s. Carnevale (2015). Since the enrollment in colleges has been favoring females since the 1970's (Borzelleca, 2012), this paper is solely focused on the post-traditional male students as they attempt college level learning. This research paper investigates what supports and services are necessary for male post-traditional students to attain success. During the fall of 2022 a comprehensive qualitative research study was conducted involving 8 post-traditional male students at a community college in a suburban New York location.

Keywords: *Post-traditional students; male students; adult students; transformation.*

1. Introduction

This paper is the result of a qualitative research project which took place fall 2022 through spring 2023. A total of 8 Post-traditional male students over the age of 24 were interviewed to learn about their community college experience. For this research we classified post-traditional students as students over the age of 24 and any age beyond 24. According to the National Center for Education Statistics, non-traditional students are usually 24 and older (2002). A post-traditional student who returns to college is accepting a very real challenge. These students understand their life will be changed as they enter a new phase of their educational journey. This research study examined the supports and barriers post-traditional males, in particular, experience after they decide to attend higher education. The post-traditional students involved in this study are working to transform their careers through their educational journeys. Though all were very busy they generously participated in this research project.

A review of the current landscape of higher education across the United States reveals a changed demographic that has been increasing in number. (Stone, et al., 2016). Ellis (2019) states this demographic of adult learners displays characteristics unlike traditional students, and correspondingly this group is called nontraditional (post-traditional) students. The conceptual framework of this research was guided by Transformative Theory. Creswell and Poth, (2018) describe the basic principle of Transformative Theory as knowledge not being neutral and mirrors the power and injustice in society. This research study examined the transformation process for post-traditional male students. The researcher looked to discover what this population of male post-traditional students is experiencing at a community college. In addition, this research study has the potential to develop supportive measures from an institutional lens.

Considering all the life responsibilities of post-traditional students it becomes important to examine what are post-traditional male students facing. Goncalves and Trunk (2014) begin their article *Obstacles to Success for the Nontraditional Student in Higher Education* addressing the importance of engagement activities to support college retention. They specifically focus on the ability or lack of ability of nontraditional students to become an active part of the college campus. Yet with their schedules how is college engagement even a consideration? In general, according to Goncalves and Trunk (2014) post-traditional students are highly motivated by their desire to acquire an education. They suggest their motivation is intrinsic in nature (Goncalves & Trunk, 2014). Overall, post-traditional students are motivated by their desire for self-improvement. They compare traditional age students who feel forced to attend college by their parents and suggest post-traditional students are more intrinsically driven for many reasons (Goncalves & Trunk, 2014). Post-traditional students, in particular, are motivated by the ideas of enhancing their self-image and heightening their self-esteem. This motivation to improve aligns closely with the

Transformative Learning Theory described by Mezirow (1991) as a critical assessment of oneself and recognizing a change that needs to occur. This feeling of wanting to achieve more, steered Goncalves and Trunk (2014) to ascertain post-traditional students appreciate communication with their faculty members and would highly benefit from this type of interaction. However, based on scheduling and hectic lives post-traditional students do not engage frequently outside of the classroom, (Goncalves & Trunk, 2014). Post-traditional students are described as exhausted learners who are stretching work -life boundaries and enduring economic struggles (Arnold, et al 2021).

2. Theoretical Framework

Transformative theory speaks to the change that is possible while examining what needs to occur to make the change possible Creswell and Poth (2018). During these 8 interviews the researcher looked to discover what supports need to be in place for a post-traditional male to be successful attending college. Creswell and Poth (2018) continue stating, qualitative research should have an action-based agenda that has the propensity to change the lives of the participants and others like them. The males involved in this research were all hoping their educational experience would transform their lives in one way or another.

The Transformative Theoretical framework, outlined by Creswell and Poth (2018), and Transformative Learning described by Mezirow (1991) align with the transformative process and action needed by post-traditional students to achieve success. This transformative process worked well with this research project to examine the self-reported experiences of post-traditional male respondents. The goal of this research was to discover ways in which institutions can have a positive or negative effect on post-traditional male students. Fleener and Barcinas (2021) suggest a transformation occurs when adult educators explore how individuals and groups of individuals come together to engage and enact reasonable, possible, probable and emerging futures. They continue this thought; where a person's passions are unveiled, especially as it relates to personal transformation and lifelong learning that includes openness to new and diverse ideas. (Fleener & Barcinas, 2021). This transformation allows the individual post traditional student to envision their own future and to create the life they want. Creswell and Poth (2018) describe the transformative framework to research as a method for educators to allow the participant to embrace the process while taking an active role.

3. Methodology

In his section the researcher describes the methodology and research process. The research study was IRB approved and conducted over the fall and winter semesters. Eight Post-traditional male students volunteered to participate.

3.1 The Process

The researcher spent the semester investigating the barriers and bridges that are in place for male students involved in this research. We look to understand what the experience was like as they returned to college as adult students with life experiences and obligations. The experience for a male as he attempts to balance work, school and other responsibilities can be complicated. There are significant financial implications to attending classes. Zaft, (2008) described the financial constraints adult students feel as they return to college, as difficult. Congruent with Zaft, Hittepole (2016) notes males often cite finances as impacting their decision to withdraw. In addition, she notes the lack of support within higher education is having a significant impact on the success of these male nontraditional students possibly hindering the transformation to a successful more lucrative career (Hittepole, 2016). Also, Goncalves and Trunk (2014) described the many responsibilities of older students, that may hinder success. This research examined the perspective of the nontraditional males as the researcher intently listened to their stories.

This study's theoretical framework looks through the lens of a higher education leader to assess the policies and resources that support or interfere with the successful completion the higher educational pursuits of these nontraditional male students. The goal of this research project is to understand the extent to which institutional supports may bring about transformative change and a heightened awareness of a population that may be overlooked (Creswell and Poth, 2018).

3.2 Research Questions

Three research questions were used for the research study. These questions framed the study and act as a guide as we investigated the personal histories and experiences of the study's eight participants. Examining these questions helped the researcher to understand the reasons post-traditional males return to college. In addition, we looked to see what supports they consider important and what they feel is needed to be successful.

RQ1 What was your motivation for post-traditional male students (at the case-study community college) to return to college level studies? What are the factors that encouraged their return?

RQ2 How do participants perceive their decision to return college as being supported by the university (case study community college)?

RQ3 What barriers do post-traditional male students at the community college in this case study identify as hindering their achievement of academic? Describe the journey and your ability to persist regardless of the barriers.

These open-ended questions offered insight into the experience in higher education of the post-traditional male participants by creating a narrative dialog between the researcher and each participant.

3.3 Participants

The students who participated in the study met the criteria of the post-traditional male student, which is beneficial for quality assurance (Creswell & Poth, 2018). In addition to address the diversity of student populations on the campus the researcher applied maximum variation sampling method (Creswell & Poth, 2018). Maximum variation sampling occurs when the sample participants are taken from a large diverse body of possible participants. An intentional effort was made to select the participants from a diverse group of students. We used male gender, age, minimum of 12 credits completed, race and ethnicity as parameters when selecting participants. The researcher made an intentional effort to ensure the sample accurately reflected the diversity of the campus involved in the study. Maxwell (2013) suggests defining the dimension of the variation of the population which is most relevant to the study and selecting individuals that represent the most important and relevant variations. This method allows for the differentiation of the participants, as each person is an individual and may come from a completely different geographic area and socioeconomic background (Creswell & Poth, 2018). The cohort of students interviewed was a remarkably diverse group, which accurately reflects the surrounding community. In total there were 8 participants- 3 Caucasian, 2 Black/African American, 2 Hispanic/Latinx, 1 Asian/Pacific Islander.

Table 1. Participant Demographics

Demographic Information				
Name	Age	Race	Gender	Ethnicity
Andy	49	White/Hispanic	Male	Hispanic
Chuck	56	White	Male	Caucasian
Jose	42	Hispanic	Male	Hispanic
Nicki	31	Black	Male	African American
Santa	30	Black	Male	African American
Sky	48	White	Male	Caucasian
Steve	38	White	Male	Caucasian

Table 2. Demographics at Case Study Community College.

Student Body	
All College	Approximately 21,000 students
Gender	Female: 56%; male: 44%
Age	18-24: 80%; 25 and over: 20%
Ethnicity	White 51.3%
	Black/African American: 8.1%
	Hispanic: 29.3%
	Asian/Pacific Islander: 4.6%
	International: 0.4%
	American Indian/Alaskan Native: 0.3%
	Two or more: 2.0%
	Native Hawaiian: 0.1%
Other/Unknown: 3.9%	

The case study community college is located in a suburban north eastern area of the United States within a richly diverse community. Data from the college's website indicate twenty percent of the entire student body are age 25 and above.

Through interactive interviews we examined the self-reported experiences of 8 post traditional male students enrolled full time at the case-study community college. The individual interviews allowed for open communication in which the participants felt comfortable sharing their personal story. The community college involved is a large tri-campus institution. The participants involved in the research were all registered as fulltime students on one single campus. The campus used in the study is in a densely populated suburban/urban setting. The surrounding area is ethnically diverse and primarily working class. The study included interviewing 8 individual students who met the required demographics. All students interviewed were self-identified males over the age of 24 and had completed a minimum of 12 credits prior to the fall 2022 semester. In addition, most of the students were working fulltime and had family obligations.

The interviews all took place in zoom, and most were in the early evenings to accommodate the participants' scheduling needs. Each interview took between 40 and 60 minutes. All interviewees filled out an informed consent prior to the meeting and agreed to the conditions.

The interviewees were primarily completed during and directly after the fall 2022 semester. Students interviewed were all in good standing academically.

4. Findings

The major areas of study of the participants varied from pre-Nursing, History, Business, Liberal Studies and HVAC. All students' interviews had very precise goals. They shared similar aspirations of self-improvement and enhanced career opportunities. Only one student interviewed was not interested in a career change or professional advancement. Most were motivated by financial empowerment and greater opportunities that a college degree would provide. A consensus among the group was the feeling of limited opportunities without a degree.

Another commonality was the "missed opportunity" in their younger years. The interviewees spoke of their recognition of the need for good time management skills. Many spoke of their lack of this time management skill in their youth but have learned to adapt now as they attend college as adults. "I didn't have the time management skills I needed in my younger days". At this point in their lives when they have so many things to manage, collectively they appear to have realized the importance or prioritizing and managing their time wisely.

"Really my biggest issue is time,"

In addition, financial resources and the need to increase their earning power was a common thread. It is important to note the need to increase earnings to match their personal needs as well as their family's needs was also a significant factor triggering the student's return to college. Three students mentioned the feeling of plateauing in their industry and not being able to advance in way that would adequately support the needs of the family. "I was applying for promotion and my boss told not to think of it because of my lack of a degree." One student was going through a divorce and wanted to ensure a better life for his child.

Time management and the lack of availability of college resources was a major finding regardless of the degree path or goal of the students interviewed. In addition, all students were looking to enhance their sense of self-fulfillment. Six of the eight were genuinely concerned with their financial security. Most students interviewed felt supported by the college to some extent, but noted the lack of evening, weekend or online support.

5. Conclusion

This narrative case study research project offered insight into the experiences of the eight students who participated. The knowledge gained is not generalizable due to the small sample size and the singular campus, however it is meaningful to gain a greater understanding of the

needs of the post-traditional male student. This type of research can assist college administrators as they look to recruit more post-traditional males and support their retention.

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EPIC in action, measuring entrepreneurial competencies in higher education

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Abstract

Increasingly university programmes are introducing a range of experiential learning based programmes to support students to develop their entrepreneurial competencies during their time at university.

This paper describes how the University of Galway is utilising the Entrepreneurial Potential and Innovation Competences Tool (EPIC) to track the changes in student self-reported competencies having participated in one of its flagship student entrepreneurial programmes. Based in Ideaslab, the university's Human Centre Design Studio, the approach used is experiential, design centric and informed by D.School, Stanford.

Initial findings from the EPIC surveys completed by 23 students are reported. These data are part of a university wide initiative and further data will be collected over the next three semesters. In so doing, we hope to add to the body of knowledge concerning the utility of this approach to measuring the changes in entrepreneurial competencies following participating in a university based entrepreneurial learning activity.

Keywords: *Entrepreneurial competency; undergraduate student; measurement; experiential learning, design centric approaches.*

1. Introduction

Jamieson's (1984) framework for entrepreneurship education distinguished between education about enterprise, education for enterprise and education in enterprise. The core educational approach taken by the Human Centred Design studio in this case study is located within both the "education for" and "education in" approaches. In particular, the team utilise "Design Thinking" as a methodology across their programmes. They focus on fostering design thinking as a basis for practical engagement in developing innovative solutions to real world problems (Brown, 2008). Using the Stanford d.school¹ approach, students in Ideaslab learn to apply active problem solving as they work on real life challenges. Working within this methodology, IdeasLab are part of an international movement to use design thinking approaches to enhance the provision of entrepreneurial education (Linton & Klinton, 2019; Mueller & Thoring, 2012; Saroghi et al., 2019).

Within the University of Galway, the programmes offered by Ideaslab are currently being enhanced and developed as part of the Designing Futures Initiative, a suite of complementary and connected initiatives and modules, focused on developing the attributes, dispositions and skills required of graduates, to best support them in the challenges they face in the world of today. This overarching project is being tracked using a formative evaluation approach (Patton, 2010). Specifically, the evaluation team decided to deploy the EPIC tool (<https://www.heinnovate.com>) to explore whether participation in IdeasLab fosters the development of the entrepreneurial competencies of the students who take part.

The Entrecomp framework was developed by the Joint Research Centre (JRC) of the European Commission with the aim of building "a bridge between the worlds of education and work, by contributing to a better understanding and promotion of entrepreneurship competence in Europe" (Bacigalupo et. al. 2016, p.7). The framework consists of 15 competencies and detailed learning outcomes across three thematic areas, Ideas and Opportunities, Resources and Into Action. In 2018, the European Commission established the EEEPHEIC project (Evaluation of Entrepreneurship Education Program in Higher Education Institutions and Centres) to facilitate the development of common evaluation and measurement frameworks for entrepreneurial education (Baggen & Kaffta, 2022). One specific outcome was the publication of the EPIC tool (Entrepreneurial Potential and Innovative Competences), based on the Entrecomp framework. It is a course assessment tool that can be used by education providers to assess the effectiveness of the training provided. A series of thematic statements are provided across five domains of entrepreneurial competencies, entrepreneurial intentions and attitudes, enterprising behaviours, entrepreneurial strategies and education effects. The EPIC tool is freely available on the

¹ For further information see <https://dschool.stanford.edu/>

HEInnovate website. It is a design that it can be used flexibly and modified according to the cohort of students or learning situation. In this instance, the evaluation developed an online survey to be circulated to students participating in two Ideaslab programmes across one semester. This paper describes the programmes provided, the survey tool deployed and some initial findings from the data collection.

2. Methods

2.1. Programme Description

Two types of programmes were included in this case study. Firstly, 38 students participated in an enterprise challenge that was delivered through a combination of class room activity, team based work in students own time and mentoring sessions with external enterprise partners. Table 1 below provides an overview of the classroom content delivered to challenge participants.

Table 1: Enterprise Challenge Classroom Content.

Workshop	Content
Team building	Team warm up activity Introduction and Completion of Team Canvas
Introduction to Design Thinking	Designing Thinking Method Stakeholder Mapping Interviewing
Problem Definition	Focus on “How Might We” Practice review and developing HMW statements
Brainstorming & Ideation	Affinity Diagrams How Now Wow approach for Idea selection
Prototyping & Lean Canvas	How to create a value proposition Essentials of a Lean Canvas
Story Telling	Essentials of Storytelling How to develop a pitch Opportunity to draft out approach

At the outset of the programme, each student was assigned to one of eight separate teams. These teams are multidisciplinary and span students from first year undergraduate to PhD level. The challenges consisted of four personas detailing a real life situation for the enterprise partners. Each partners provided 4 sessions of mentoring to individual teams over the course of the challenge. These were to guide and support the students in their problem solving and idea development. Ideaslab staff facilitated the teams to make contact with their mentors at the arranged times and issued reminders about mentoring sessions at the weekly content workshops. In addition, the enterprise partners gave their time and expertise to attend the final team pitches and the selection of the winning ideas. These pitch sessions lasted approximately 2 hours, with four teams presenting to each of the two partners at two separate sessions. The challenge ended in week 8 of the semester with the selection of a winning pitch based on the effectiveness of the proposed solution in meeting the challenge set out by each of the enterprise partners.

The second activity in this case study is the Ideaslab internship programme is a paid placement for University of Galway students to work on projects with the Ideaslab team over 10 weeks in semester. Students are encouraged to work up to 4 hours per week on assigned tasks and are supported by a developmental scholarship for their participation. Students were recruited through an open call through Ideaslab and the college social media channels early in the semester. They applied to Ideaslab using a CV and a personal statement. A number were then selected for interview and 11 students were successful in becoming an Ideaslab intern. The internship programme offered a range of opportunities for students to get involved in Ideaslab projects over the course of the semester. At the outset, students were asked to write a short biography and publish it to the Intern team SharePoint site as an aid to building a community across the team. They were asked to update their LinkedIn profile and engage with the Ideaslab social media channels. Students were also asked to begin and maintain a reflective practice log. In this log, they were asked to identify their goals for the placement, to make weekly updates on their progress and complete a short reflection of their experience at the end of the internship. Interns were also able to attend sessions in Ideaslab on Design Thinking during the placement as well as engage with the Student Success Coaching² service.

2.2. Survey Tool

The evaluation team reviewed the online EPIC tool and identified a sub set of 20 statements across three of the five domains that best matched the course content. A number of demographic items and open ended items were included. The survey was circulated to all

² Student Success Coaching at the University of Galway is also part of the Designing Futures Initiative, further information is available at <https://www.universityofgalway.ie/designingfutures/>

participants at the end of each of the programmes using Qualtrics. Ethical approval for the research was secured from the university's research ethics committee.

2.3. Programme Participation

Across both programmes, a total of 49 students participated. The profile of this group of participants indicate a high level of representation of both international students (55.1%) and postgraduate students (53.1%). The Ideaslab team reported that this semester's participants was an outlier in terms of international and post graduate students and plan to track participation levels to monitor this issue next term to establish if this is a recurring trend.

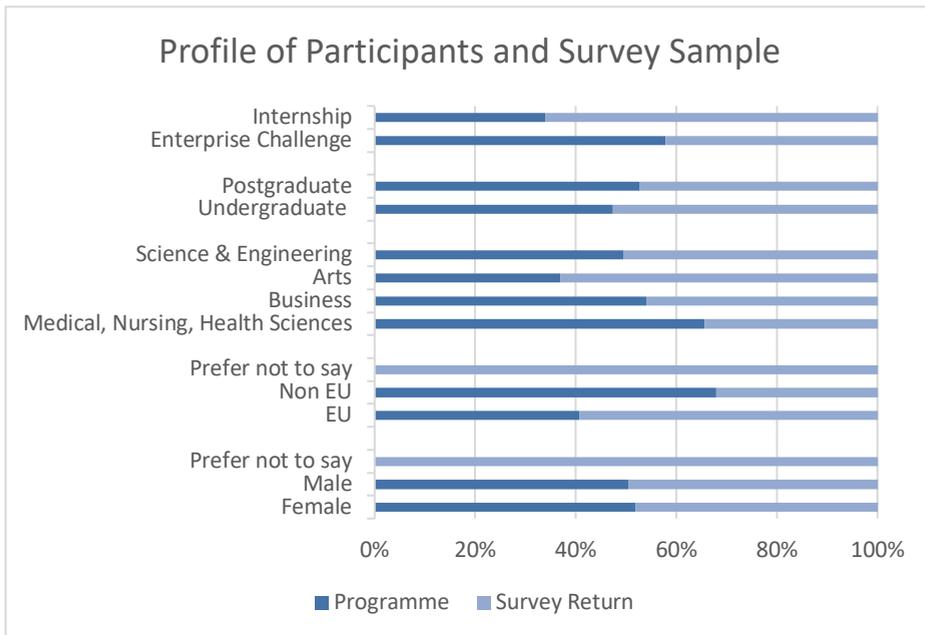


Figure 1. Profile of Participants & Survey Respondents.

3. Results

The survey was completed by a total of 23 students across both programmes, a return rate of 46.9%. Figure 1 compares the profile of survey returns to the overall profile of programme participants, illustrating a representative sample. Table 2 below provides a breakdown of the EPIC scores, illustrating the initial mean score across the group, the final mean score and provides the calculated difference. Notwithstanding the small sample size, a number of initial points can be made. Firstly, the area with the most overall increase in scores is in the “Ideas and Opportunities” area. This finding makes intuitive sense given the design centric focus of the programme. It is likely that this trend is reflected in the gains in the sub items on

“looking for new opportunities” and “want to solve problems in new ways”. Secondly, there is also a positive trend in a number of the items dealing with team engagement and working with others, “convince others to engage” “actively participate in teamwork”. Although as will be noted below the feedback on team engagement was developed further by considering comments made in the open-ended items included in the survey. Finally, the least development in scores occurred in the item dealing with “estimated budgets”. This finding does reflect less engagement on this topic during this iteration of the programme.

Table 2: EPIC Scores.

Section	Item	Pre Mean	Post Mean	Difference
Ideas and Opportunities	Finding new ways of solving problems	6.27	8.00	1.73
Ideas and Opportunities	Anticipate how to reach goals	5.96	7.78	1.83
Ideas and Opportunities	Assess ways to develop ideas	5.77	8.04	2.27
Ideas and Opportunities	Come up with innovative ideas	6.48	8.35	1.87
Ideas and Opportunities	Come up with new solutions	6.04	8.26	2.22
Ideas and Opportunities	Overall	6.10	8.09	1.99
Resources	Continue despite setbacks	6.17	7.7	1.53
Resources	Convey ideas enthusiastically	6.57	8	1.43
Resources	Convince others to engage	5.61	7.65	2.04
Resources	Estimate budgets	6.45	7.14	0.69
Resources	Find the right people	5.78	7.74	1.96
Resources	Perform unfamiliar tasks	6.09	7.82	1.73
Resources	Overall	6.11	7.67	1.56
Into action	Learn from challenging tasks	6.70	8.30	1.61
Into action	Look for new opportunities	6.41	8.45	2.05
Into action	Organise and structure tasks	6.35	8.04	1.70
Into action	Activity participate in teamwork	6.70	8.74	2.04
Into action	Overall	6.54	8.39	1.85
Mindset	Inventing new solutions	6.35	7.52	1.17
Mindset	Want to solve problems in new ways	6.91	9.04	2.13
Mindset	Want to work on my own ideas	6.57	8.43	1.87
Mindset	Want to define my own tasks	6.70	8.35	1.65
Mindset	Scanning the environment for opportunities	6.30	7.96	1.65
Mindset	Overall	6.57	8.26	1.69

4. Discussion

The EPIC tool did indicate positive impacts of participation on self-reported scores. However, as noted earlier, this particular sample was quite small (n=23). It will be possible to collate EPIC scores into SPSS for each of the next three semesters to track score changes across a larger sample, checking to see if there are different scoring patterns according to number of events attended or demographics etc.

The tool currently uses a device to allow participants to complete the survey at the end of the programme with a sliding scale to score each competency at their level both when they started and also at the end of the programme. A number of students in this cohort reported that it was difficult to be consistent using this approach and to estimate their level at the start of the event. As a result, the research team have modified the approach so that next semester students will rate their competencies on two different surveys, one at the start and one at the end of the programme.

While the items on the EPIC tool did indicate positive impacts on team engagement, a number of students indicated tensions with managing the time commitment, maintaining contact across the team and promoting team engagement in the open-ended survey items. Based on this feedback, the Ideaslab team have decided to provide an increase focus on team building on the start of the programmes to promote the positive development of team cohesion. In addition, as the semester progresses, they will regularly remind participants to link back for support and advice if challenges with team engagement persist.

There was also interest in including an item in the survey to get feedback from participants on how they would share a “bonus” with team members as a proxy measure of team effectiveness. The evaluator will source some options on this issue for the team to consider and include in the next semester’s data collection.

5. Conclusion

Baggan and Kaffka (2022) recommended that “the capability of European citizens to engage with the unknown and deal with uncertainty should be developed from childhood. Experiential or challenge-based learning programmes address this need and its offer should be ensured via progression lines from primary education to higher education and beyond, in the form of lifelong learning (both formal and informal) of adults” (p.10). This paper has described the deployment of the EPIC tool to measure the effectiveness of participation in two experiential learning opportunities aimed at increasing entrepreneurial competencies in a Higher Education setting. The initial data from this first cohort indicates that this measure has potential to track these changes in students’ self-reports. In particular, the tool seems to be sensitive to changes in those specific areas of design and ideation focus central to these

particular initiatives. Some amendments have been suggested to the deployment of the tool in the next round of data collection in this project. Further analysis will be carried out to consider the suitability of the tool with the total cohort of students over the course of the project.

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The MEM project: 5 years of experiences, challenges, and outcomes of an international double master-level degree

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Abstract

In the 2016-2017 academic year, a novel Double Degree educational project named MEM (Master in Engineering Management) between the University of Parma and New Jersey Institute of Technology (NJIT) had begun. Since then, three (3) double degree master's programmes have been developed, starting with the Engineering Management course. To date, 113 students have attended the MEM programme.

This paper aims to assess the impact of the MEM double degree programme. To this end, a questionnaire was developed and submitted to the students who completed the project and entered the workforce (66 students). An analysis of the survey results was then conducted to determine the impact, if any, of the MEM programme on the students' academic careers and/or their entry into the workforce. The results were compared across two (2) sets of students: those who participated in the programme and the students that graduated from the standard degree course.

Keywords: *Double degree, internationalization, engineering management education.*

1. Introduction

The world today is experiencing major challenges that require multicultural professionals to help in addressing them. It is no secret that the nature of the present supply chains is very complex, as they transcend political, cultural, technological, and geographical barriers. In essence, one of the main fulcrums that the resilience of these supply chains depends on is humans that have the capabilities to provide the needed nuances for their maintenance. Higher education is a major supplier of graduates that possess these traits.

As reported in the literature, the past decade has witnessed the development of many joint international programmes where students receive dual, double, and joint degrees, as well as several exchange programmes. Among these programmes is MEM. In HEAd 2018 (Montanari et al., 2018), we presented our experience at that time. In this paper, we share the recent developments, data, and extensions since then.

2. Literature analysis

In recent years global initiatives in higher education have received growing attention. This growth has resulted in a plethora of publications and conference presentations. This section reviews some of the pertinent ones.

Tran et al. (2023) have presented an in-depth analysis covering a study of 227 English-written articles that examine the transition of higher education, with a focus on internationalization. They report that, while the transition from domestic to international frameworks can be rewarding, it requires appropriate planning and support. Hynek (2021) has instead focused on how to achieve effective internationalization. He states that it is essential to build strong international partnerships by establishing joint degree or double degree programmes that integrate international students.

Maldonado (2022) describes in his paper the requirements, procedures, benefits, and results in the development of a dual programme in Mechanical Engineering between two universities in Mexico and Japan. For the past 15 years, the programme has graduated students who master three languages (English, Spanish, and Japanese), in addition to international experiences that have transformed their lives. Similarly, Stegall et al. (2021) have explored the benefits of integrating two international programmes for undergraduate business students. They demonstrated how these programmes enrich the students' experiences and provide employers with candidates that enjoy global exposure.

Knight (2012) has introduced a framework to improve the mobility of both students and scholars. The author has pointed out the risks and benefits of internationalization. He also provides a conceptual structure to analyze the meaning, trends, and opportunities of international dual, joint, and double degrees. Asgary and Robbert (2010) have presented a

cost-benefit analysis of dual international degrees. They also point out the risks and rewards of such programmes.

In his paper, Oliveira (2011) has illustrated how today's global markets require engineers with value-added experiences, particularly in humanities. In this work, the author reports on the opportunities resulting from the development of a consortium of three (3) universities in the US and Brazil. An interesting approach to internationalization was proposed in Gulick et al. (2006), where the authors introduce international co-op/internship programmes that allow expanded technical knowledge.

For additional insights, the interested reader is referred to (Aasmundtveit et al., 2018), (Cheng, 2021), (Corno et al., 2016), (Ivanova et al., 2020), (Ober et al., 2021), (Curtis and Ledgerwood, 2018), (Reardon et al., 2022), and (Wei et al., 2020).

As can be seen from the foregoing, the interest of the community towards the innovation, experiences, and opportunities that international dual, double, and joint degree programmes offer is very high. In the following introduction section, we present our own experience and results of double degrees developed between the University of Parma and the New Jersey Institute of Technology (NJIT) showing the progress achieved since our earlier paper presented in HEAd 2018 (Montanari et al., 2018).

3. The MEM Project

The MEM project (Montanari et al., 2018) provides students with an opportunity to receive two master's degrees from the University of Parma (UNIPR) and the New Jersey Institute of Technology (NJIT). The participating institutions collaborate on a non-exclusive basis on the development of master-level degrees in Engineering, where the Master of Engineering Management (MEM) dual degree programme (MoU, 2015) being the first one. Since then, two (2) further Master's degree programmes were added, one in Mechanical Engineering (MoU, 2016) and the second one in Engineering for the Food Industry (MoU, 2019.)

As stated before, MEM aims to advance academic exchange and cooperation in the fields of engineering in order to increase the transnational expertise of European and American students, enhance job opportunities, competitiveness, cultural exposure, and language skills (Malek et al., 2014). Students participating in the programme must pass core and elective courses in both institutions. The host University identifies the set of courses that should be taken by the participating students, according to each student's specific programme requirements. The approach allows more flexibility to meet the student's needs while fulfilling the graduation requirements of both universities. In designing the study plan for each student, it is essential, however, to develop the academic paths by appropriately balancing the length and the workload of the courses offered by the two universities. The

equivalence and the validity of the study plans and academic paths are verified by administrative advisors in each institution.

4. Methodology

4.1. Aims

The study aims to assess the impact of MEM from different perspectives, related to (i) the students' academic careers; (ii) the universities involved; (iii) the MEM project; and (iv) entry into the workforce. To perform this analysis, the phases before, during, and after the mobility were analyzed. First, the study seeks to identify any correlations between the academic careers of “standard students” (i.e., attending the standard master’s degree programme at the University of Parma) and “MEM students” (i.e., attending the double master’s degree). For instance, it aims to evaluate the “good grade point average” (GPA) of MEM students before their mobility period and at the end of their academic career, comparing it to the GPA of standard students. With reference to the University of Parma, the analysis aims to assess whether MEM contributes to enhancing the attractiveness of academic degrees, thus increasing the number of students coming from other universities and other regions of Italy. As far as the MEM project itself is concerned, the study seeks to quantify the satisfaction of the MEM students in terms of the academic curricula and the usefulness of the skills obtained for their job. Finally, regarding job placement, the study aims to define the impact, if any, of the MEM programme on the salary and the time elapsing between graduation and the first day of work, as well as the positive impacts of attending the project on the placement phase.

4.2. Source of data

Since the academic year 2016-2017, 113 students have been involved in the MEM programme. 81 of these students have completed their international mobility period, and 66 of them are already working. Based on the data gathered during these years of activity, a database was built to derive important insights into the project. To conduct the analysis, different statistical samples were defined based on the project phase investigated (before, during and after the mobility) (Figure 1). It is important to point out that all data were processed anonymously, to respect the privacy of the students. Additionally, several data sources were designed, starting with the UNIPR and NJIT databases. Another data source considered was the AlmaLaurea survey (AlmaLaurea Interuniversity Consortium and AlmaLaurea srl). The consortium involves 80 Italian universities and, since 1999, it has been carrying out annual surveys on the graduates’ profiles, providing a wide-ranging portrait of their characteristics, university achievements, and employment status. Specifically, the ranking focuses on the positioning of the graduates on the job market, the characteristics of the job, the salary, and the usefulness of the skills acquired within the degree courses. In this

study, an analysis of the past four years (2019-2022) was conducted, evaluating the responses for the Engineering Management degree class (LM-31, 34/S) both on the national level (about 2300 students per year) and with respect to the University of Parma (about 90 students considered per year). Finally, to determine the impact of MEM, a survey was conducted through a questionnaire submitted to 66 students who have completed their academic careers and are currently working. A response rate of 83% was achieved.

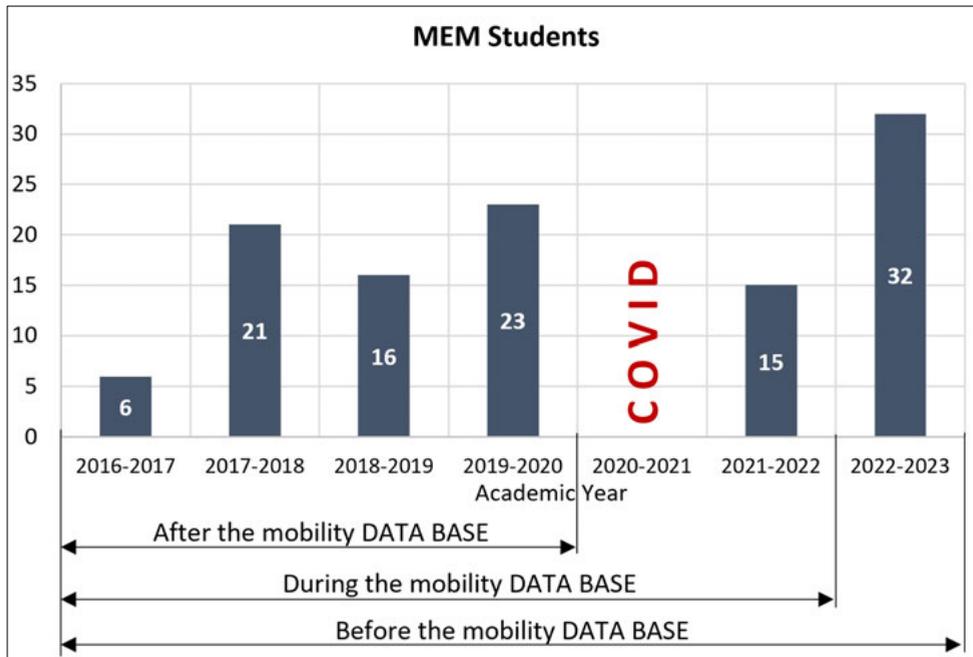


Figure 1. Number of MEM students over the years

5. Results

5.1. Academic Career

Based on the UNIPR data (Table 1), except for the COVID period, the number of MEM students has increased over the years, with 32 students participating in the project during the academic year 2022-2023. During the COVID period, there were no students enrolled in the double degree program as none were interested in acquiring the degree through remote mode, despite being given the opportunity to do so.

Table 1. MEM's impact on Academic career

	Standard Students	MEM Students
Bachelor's degree grade	101.1/110	97.8/110
Master's degree grade	103.2/110	106.8/110
Master's degree age	26.50 years old	25.11 years old
% of students graduated on time	81.25%	80.50%

5.2. Parma University

Thanks to MEM, the University of Parma has increased its visibility and attractiveness. In the first years of MEM only 12.12% of the master's students came from a different university, whereas in the last two academic years, the MEM students who did not get their bachelor's degree from the University of Parma were 27.7%. This value is higher than the percentage of standard students coming from other universities (22.1%, 15.4% on a national basis). Not only the double degree programme has increased its visibility and attractiveness over time, but now it appears to be more attractive than the standard master's degree course.

5.3. MEM Project

Based on the survey conducted among the MEM students, the following feedback (Table 2) was collected, with the ratings on a scale from 1 (completely disagree) to 5 (completely agree)

Table 2. Feedback provided by MEM students

	MEM Students
I would do the double degree experience again	4.64/5
I would recommend the MEM project to other students enrolled in the master's degree course	4.62/5
The double degree enhances the development of soft skills such as adaptation, flexibility, problem-solving, teamwork, curiosity, empathy, and organization	4.30/5
The skills acquired thanks to the double degree project are adequate for my job	4.29/5
Acquiring double degree is worthwhile, even if not specifically required for employment	4.54/5

5.4. Job placement

The impacts of MEM on job placement are the following:

Table 3. MEM's impact on Job placement

	Parma Standard Students	National Average	MEM Students
Working students after one year	83.0%	85.0%	90.7%
Months to entrance into the job market	3.1	2.8	2.4
% stable contracts after one year	33.5%	37.3%	80.0%
% graduates working abroad	2.2%	2.8%	9.3%
Salary after one year	1541.00€/m	1505.75€/m	1567.71€/m
Salary after two years	1605.00€/m	1590.00€/m	1636.25€/m

6. Conclusion

This article represents an important milestone in the field of double-degree programmes as there are very few cases in the literature where quantitative data are available to measure the impact of these projects. It is, indeed, extremely difficult to numerically quantify their impact. Moreover, an apparent peculiarity has been found regarding the salary. Clearly, it is the job market that determines its value, and not much can be said about it. However, it is evident that if, on one hand, students view the project positively despite receiving the same salary as those who did not undertake the double degree program, it means that, fortunately, "money" is not their priority. In other words, it is very reductionist to associate one's work with the salary earned: other values count in a career, such as the role, training, job quality, and the ability to work abroad, all of which can be achieved through a project of this kind. In addition, the University of Parma has increased its attractiveness and visibility. Most importantly, MEM students believe that the MEM project is an extremely positive value in job placement.

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Multiple-value governance in (German) higher education: a new paradigm?

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Abstract

Shifts in governance frameworks of higher education systems as well as scholarly debate indicate that New Public Management (NPM) – this long-standing hegemonial reform framework for the public sector in general and for higher education (HE) in particular – has passed its peak. This paper will explain and justify this claim for the case of German HE. It argues in favour of the assumption that a new governance paradigm – called multiple-value governance - is on the horizon. This new governance regime partly overthrows, partly modifies and partly succeeds NPM. In order to corroborate this claim, a reflection about the organizational consequences of introducing sustainability as one of many values into the German higher education sector is outlined at the end of the paper. The latter's intention is to lay a conceptual foundation for a research agenda that addresses the hypothesized changes in HE governance empirically and offers perspectives for further research.

Keywords: *Higher education governance; multiple-value governance; new public management; expansion of higher education; Germany.*

1. Introduction

Shifts in governance frameworks of higher education systems as well as scholarly debate indicate that New Public Management (NPM) – this long-standing hegemonial reform framework for the public sector in general and for higher education (HE) in particular – has passed its peak. This paper will explain and justify this claim for the case of German HE. It argues in favour of the assumption that a new governance paradigm – called *multiple-value governance* - is on the horizon. This new governance regime partly overthrows, partly modifies and partly succeeds NPM. In order to support this claim, the idea of a future investigation of the organizational consequences of introducing sustainability as one of many values into the German higher education sector is outlined. The overall ambition of the paper is to lay a conceptual foundation for a research agenda that addresses the hypothesized changes in HE governance empirically and offers perspectives for further research.

2. The Trajectory of NPM

New Public Management (NPM) has been the cause of an avalanche of reforms affecting the higher education sector in Germany from the late 1990s onwards. NPM's powerful promotion of values like efficiency, effectiveness, and subsidiarity has guided change in teaching, research and university administration, with varying consequences (cf. Wissenschaftsrat, 2018). Moreover, in the wake of NPM's focus on strengthening governance mechanisms like competition, external guidance and managerial hierarchy (de Boer et al., 2007), universities have advanced to become strategic actors (Krücken & Meier, 2006). The gain in autonomy and agency has affected both the university's goals as well as its internal decision-making and support processes. Additionally, the NPM-driven reshaping of HE organisations has spurred an increasing vertical and horizontal differentiation of higher education organisations (Banscherus et al., 2015; Scott, 2015). However, the state in Germany still occupies a dominant, although more distant position in governing the HE sector (de Boer & Huisman, 2020).

Today NPM seemingly has lost momentum. This is partly due to the failure of overly lofty expectations, partly to the successful implementation of NPM steering instruments (which are now taken-for-granted) and partly to the massive expansion of HE in Germany (Scott, 2015; Wolter, 2014) which is manifested in a growing number of HE organisations in general (with 426 extant universities today), of private HE institutions, students, graduates, staff, annual state funding, and publications (Dohmen and Krempkow, 2014; Dusdal et al., 2020; Wohlrabe, Gralka, and Bornmann, 2019). At the same time, the expansion is closely linked to a broad dynamics of differentiation which resonates with the multiplying of societal expectations toward HE. Universities face a vast range of already established or new societal demands (Schimank, 2001; Henke et al., 2017), including gender equality, health promotion,

open access, internationalization, accountability and others. These expectations circulate in different value-centred discourses within and outside HE and science. While NPM has opened the doors for them, they now tend to form a new governance regime in German HE that is about to replace NPM.

3. Multiple-Value Governance: the Emergence of a New Governance Regime

While NPM seems to have passed its zenith as a reform framework, the contours of a novel governance regime – even if still somewhat blurred (Klenk and Reiter, 2019) - have begun to take shape (Jungbauer-Gans, Gottburgsen & Kleimann, 2023). My claim is that the emergence of this new governance regime is fuelled by the value-related expansion of HE in the last decade and the ensuing dynamics of differentiation in HE. The new regime's core feature of a value-driven governance of HE institutions is fed by several discourses – like those on the pluralisation of higher education tasks, on accountability and auditing, on a third academic mission (Henke et al., 2017; Rubens et al., 2017), or on the concept of "public value" as a substitute for the efficiency-oriented NPM ideal (Broucker, de Wit, and Verhoeven, 2017). Empirically, it seems undeniable that HE organisations are confronted with a fast growing number of heterogeneous value expectations (with values as highly abstract, unquestioned aspects of preferability; Luhmann, 1985). Partly, these value-oriented expectations are rooted in long-standing societal debates (e.g. on gender equality or scientific excellence), partly they are embedded in rather recent discussions (about, for instance, open access). However, each of the discourses can be described as being related to a specific value proposition whose origins lie in different societal sectors and milieus. Some examples of these values are: gender equality, equal distribution of educational chances, diversity, health promotion, citizen science, knowledge transfer, research and teaching excellence, academic freedom, open science and open access, social responsibility of research and education, solutions for climate change, the fostering of democratic attitudes and participation, the inclusion of refugees or non-traditional students, lifelong learning, digitalization, internationalisation, the inclusion of disabled students, or the implementation of sustainability in academia.

As many of these aspects are not new, one may ask what is new about the presumably novel HE governance regime? The answer is: In contrast to NPM, the new regime is characterized by two specific features:

- 1) The regime is based on the widespread assumption that the HE system is able to and should provide the knowledge that is indispensable for society's coping with the great political, social, economic, ecological or health-related and even scientific challenges. While the political sector is expected to deliver binding decisions on all these matters, the HE system is expected to deliver (incorporated) knowledge that informs these decisions. As the

discourses on the challenges to which HE shall make its contribution are centered around abstract values, the new governance regime may be called “multiple-value governance”.

2) The new regime is composed of established as well as new actor constellations and characterized by a new balance of governance mechanisms. While some of these mechanisms – like status competition in HE (Krücken, 2019; Brunsson and Wedlin 2021) – have been strengthened before by NPM (de Boer et al., 2017; Hüther and Krücken, 2018), others are reinforced by the new regime – like novel professional networks, value-oriented cooperation with new partners outside academia, competition between universities in favor of societal values, or the establishment of new value-oriented self-governance committees or hierarchical bodies with representatives of different societal fields.

The resulting mixture and weighting of governance mechanisms enables actors from various societal areas to play a role in HE governance and to bring forward their interests concerning academic knowledge production and distribution. Accordingly, a key element of the research agenda this paper proposes should be the development of an adapted “governance equalizer” (deBoer et al., 2007) that accounts for this new configuration of HE governance mechanisms.

In this regard it is important to mention that the multiple-value regime is certainly not a completely new framework. It partly abolishes, partly continues, and partly reinterprets the former „pure“ NPM regime, thus constituting a bricolage of, on the one hand, NPM features with its typical values (efficiency, effectiveness, subsidiarity) and governance mechanisms (like competition for scientific excellence) and, on the other, of a multitude of both new and established values and recalibrated governance mechanisms. While the ideal type of NPM has underscored the *instrumental* dimension of HE governance, the multiple-value regime accentuates the *value*-relatedness of HE by linking the latter closely to the aforementioned substantial, often overlapping or even contradicting value propositions.

To implement these values, the new regime adopts the NPM governance toolbox, for instance using the competition mechanism to promote gender equality or sustainability development. At the same time, multiple-value governance enriches this „toolbox“ by employing alternative forms of governance like, as stated above, novel networks, collaboration patterns (Olechnicka et al., 2019), additional negotiation systems, or new forms of professional or collegial self-regulation (for instance through new career paths in academia).

4. Towards a Research Agenda

Against this background, the paper intends to corroborate its claim by focusing on some structural consequences in German HE organisations that are brought about by the new HE governance regime. While the effects of NPM on the organizational structures of German universities have been analysed quite thoroughly (Sağırlı, 2015; Bogumil, 2013), the impact

of the novel regime on university structures is much less investigated. In order to shed some light on the possible structural consequences, the paper concentrates on a prominent and promising example in this regard: the role of *sustainability* as a complex value proposition.

Sustainability is particularly suitable as a case for value-related changes in HE governance because, on the one hand, it clearly constitutes a value sphere: sustainability includes a broad spectrum of ecological as well as economic and social values which have been specified by the United Nations' 17 sustainable development goals. On the other hand, it is well known that the sustainability discourse has had an enormous impact on HE internationally as well as in Germany (Leal Filho et al., 2021, Leal Filho, 2016 and 2018). Hence, an analysis of how the sustainability discourse has been adopted through changes in organizational structures of German universities and through shifts of the latter's relationships to their environment seems to be a promising possibility to investigate structural effects of the assumed multiple-value governance.

To this end, the paper draws on the organization approach of sociological systems theory as an analytical lens (Luhmann, 2018; Köhl, 2021; Kleimann, 2018). According to this theory, the main organizational structures of HE institutions are goal programmes (i.e. teaching, research, third mission), conditional programmes (like administrative rules or formal career paths), communication channels (primarily represented by the hierarchical structure of universities), personnel, and organisational culture. It is in recourse to these conceptual distinctions that the paper asks whether and – if yes – in which way the demand for sustainable development has been adopted by German HE organisations through changes in their organizational structures. These structures include

- novel forms of organizational self-display,
- novel study programmes as products in teaching,
- novel goal programmes in research and third mission,
- novel conditional programmes (i.e. administrative rules),
- novel communication channels, and
- novel demands on academic and administrative personnel.

As several empirical observations of German universities show, one can conclude that sustainability has affected *all* structural dimensions of HE organisations in Germany (Leal Filho et al., 2021; Levesque and Wake, 2021). A preliminary analysis of these structural changes offers several interesting insights. For instance, it is the characteristic of universities as multidisciplinary and still rather loosely-coupled systems (Weick, 1976) that allows them to take up value expectations that actually conflict or contradict each other in social practice. Furthermore, the velocity and extent with which HE organisations were able to address sustainability issues indicates that they, due to their particular organisational structures, represent a type of organization which is highly responsive to heterogeneous societal value

expectations. This is why universities have been called “institutions of society” (Stichweh, 2009). Moreover, universities are not only addressees of the sustainability discourse, but actively contribute to it by shaping the ideas around sustainability through the elucidation of its meanings, the empirical analysis of its implications in different scientific fields and through the communication and distribution of sustainability-related findings via teaching, research, and third mission. In doing so, universities act as institutional entrepreneurs (DiMaggio, 1988) which actively shape their institutional environment.

One dissemination mechanism for insights on sustainability are university networks. They are used by universities, for instance, to provide learning opportunities for sustainable management in areas where such solutions do not exist so far. Thus, the informative ‘strength of weak ties’ in these networks allows to get to know successful role models and to tap into bodies of knowledge for sustainable solutions.

Summing up, one can conclude that focusing on sustainability in German universities provides exemplary evidence of how the assumed multiple-value governance is implemented. Universities adopt to a varying degree value expectations in their self-descriptions, in research, teaching, organizational design, decision-making structures, administrative rules, and personnel. This observation should encourage further research on the structural implementation of sustainability and of other value propositions in HE organisations and is supposed to inspire further studies on the features and the international distribution of the emerging multiple-value governance regime.

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Development of the “Complex Project” course in the transport engineering education

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Abstract

In the paper we discuss the course history, the basic goals and principles defined at the beginning, and we talk about its methodology. For the “Complex project” course the main parts of the lecturer’s job are the detailed preparation of the project tender, the operative support of the students’ work, and they also have to perform the mid-semester and end-of-semester evaluations. Continuous progress is controlled by milestones laid out throughout the program. The effectiveness of the “Complex project” can be determined based on the previous years, and the future possibilities will also be examined. Besides elevating the level of education from the students’ perspective, at the same time it also improves the lecturers’ competences.

Keywords: *Practical course; integrated specific professional knowledge; project tender; teamwork; presentation and Final report; complex evaluation system.*

1. Introduction

The “Complex Project” course is part of the syllabus for the bachelor program for transport engineering. This course can be taken after completing the general studies, the basic and specialized professional courses. This methodological course integrates the theoretical knowledge gathered in the previous courses and focuses on solving complex transport engineering problems.

This course has been around for 15 years. Since its introduction it has evolved and has gone through experiments and changes. However, its upward trajectory is constant and its usefulness is apparent on higher levels as well.

This paper examines the fine tuning of these educational methodologies from the beginning stages to the present. It mentions the definitive changes of educational structure, and it introduces future developmental plans.

2. The general introduction of the “Complex Project” course

In this section we discuss the course history, the basic goals and principles defined at the beginning, and we talk about its methodology in general.

2.1. Historical overview

Until the 2000s there was no practical course that integrated the specific professional knowledge in transport engineering training. Design and operational control tasks only occurred as side projects in profession-specific courses, without any correlation. These include track design, schedule design, vehicle scheduling, software, etc.

During the curriculum developments of the new millennium, an idea came about to create a course that integrates the profession-specific knowledge. For its design we took inspiration from national and international examples. One of these was the project-based program of the university in Duisburg where the courses were built on solving a tasks set out at the beginning of the program. Due to the wider spectrum of transport engineering, the time constraints made this deep level of integration impossible, but we collected ideas from these principles. On a national level we found examples in the transport design programs where students worked on real-life design projects. We were not expecting these types of projects at the outset, but the ideas gave us a good starting point.

Similarly to the educational system in its entirety, the online learning that came about during the pandemic required significant methodological developments. Despite the technical challenges, positive changes happened, e.g in the methodology of task allocation that will be explained later.

2.2. The goal and general methodology of the course

As we outlined above, the goal of this course is:

- To develop the ability to use the theoretical knowledge in practice
- To recognize the interference of design processes and methods in complex tasks
- To be able to follow and carry out entire design processes
- To highlight the importance of teamwork and performance-based benefits
- To prepare for the autonomous planning of the thesis by going through the research methodology together, and to also prepare for the thesis debate by practicing presentation techniques.

Generally design tasks are created to be worked on by student groups for an entire semester. Groups are made up of 3-4 students. In our experience teamwork is not realized in groups with less than 3 people, and groups with over 4 people leave little room for each individual student which gives way for potential passivity.

The topics of the tasks are based on the two main areas of transport, road (local public transport) and rail, and students can choose based on their interest. Each topic has a responsible lecturer as a team lead who coordinates the groups' work. The in-person "contact lessons" are designed to be 4 hours/week, so 56 hours over the 14 weeks of the semester. For the successful completion of the project, students also need to work on the project individually which makes up about 50% of the overall effort.

The syllabus for the semester consists of consultations, project work outside of the classroom, and presentations.

3. Details of the teaching method

For the "Complex project" course the main parts of the lecturer's job are the detailed preparation of the project tender, the operative support of the students' work, and they also have to perform the mid-semester and end-of-semester evaluations.

3.1. The structure of project tenders

Over the years we worked on various project topics, but the structure of the project tenders was standardized in the early years. It's important that the design process should focus on the complex effects of problem-solving, meaning that beside traffic design, the projects involve technical, legal, economic, environmental and sociological aspects.

At the beginning we were selecting from projects completed by the department and we updated or recreated them. Later, we assigned tasks recommended by fellow lecturers that focused on solving traffic-related problems. Sometimes even students recommended project

topics. These resulted in a wide variety of papers but it also meant that different groups had different levels of difficulty, so the comparisons and evaluations were not fair. To solve this issue we decided to assign the same tasks to multiple groups which resulted in a healthy competitive environment but also had the drawback of groups being able to copy sections from each other. The pandemic brought about a solution for this matter. Due to the restrictions, in-person planning meetings had to be minimized. We designed a framework task for both road and rail and put students in groups based on their hometowns, so they could work on them using their regional data. This meant the solutions were comparable due to sub-tasks being the same, but the locations examined were different. This proved to be a great solution so we kept it after COVID.

Upon the allocation of project tasks we provided detailed descriptions to students that gave clear boundaries for the research. The main elements of the tenders:

- Type of transport (road/rail)
- Project title (recently it’s been a general title, later specified by the location)
- Precedents (motivation)
- Project goal
- Main points of development
- Mandatory pieces of content
- Recommended analytical methodology
- Main evaluation criteria.

These provide a good support and basis for the project development process for the semester.

3.2. Operative project lead

Each group has a lecturer as the project lead. They do not take part in the project development, but they keep a close eye on their groups and provide occasional guidance.

Project leads take part in the introduction lesson where the tasks are explained, and they help with orientation and group dynamics by providing detailed information when needed.

Project leads help their group understand the task and draw up a plan for the entire semester. Based on the members’ competencies they discuss the strong points of each person and select which part of the task they would be responsible for. They divide tasks both horizontally (can be completed in parallel) and vertically (interlinked and cannot be completed in parallel). They list the required resources such as data compilations, maps, national and international literature, published plans and papers, etc as well as the contacts of institutions, associations and scholars they need to involve. They also take stock of the required technical assets such as surveys, traffic countings, recordings, interviews, IT requirements, modelling and

simulation software. Considering the succession of sub-tasks, they create schedule with a Gantt diagram as the basis of project management.

The students start their work based on the project plan which usually begins with location visits and bibliography research.

The usual structure of the design process consists of:

- Understanding the background
- Uncovering the problem
- Examining the reasons
- Exploring the possible solutions (analyzing existing designs, looking for example, etc.)
- Examining their applicability
- Developing individual solutions
- Rating versions
- Performing ROI and impact assessment.

During consultations students report on the completed tasks, rate their usefulness with the lecturer's help, and determine the next steps.

Project leads invite competent external consultants beforehand to gain access to corporate information that could help students with the project.

The project lead also provides assistance with the oral presentations. With those, it is important that:

- All students participate in the preparations
- They keep to the time limitations (but also use up the available time)
- They use the correct terminology
- They have an awareness about their gestures
- They pay attention to grammar and clarity.

Main points of the supporting Power Point presentations:

- Their layout design should be suitable for the topic
- The number of slides should be appropriate for the time limitations
- Visible fonts and figures
- Contrasting elements
- Animations (but not unnecessary 'fireworks')
- Practicing pointing techniques (with pointer, cursor).

The spoken and written content has to harmonize with one another (the presenter has to talk about what's on the figures and the written text has to support the spoken content). The project lead assists with the preparation of the written project paper. The paper has a set

length limitation and mandatory content elements. Its format is identical to the regular thesis format so that students can learn the formatting expectations early. The general matrix of the semester schedule is shown on Figure 1.

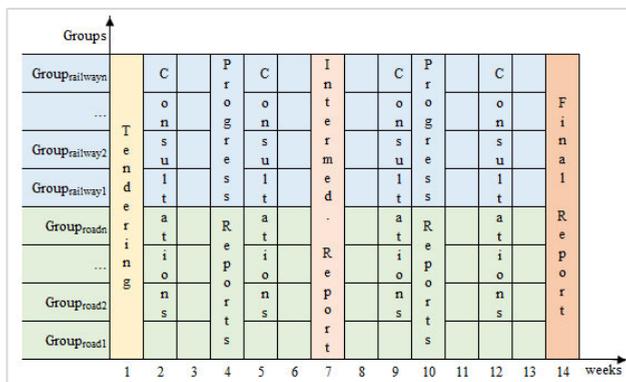


Figure 1. Semester matrix.

3.3. The evaluation process

Continous progress is controlled by milestones laid out throughout the program. The so-called progress reports (separate for road and rail) presented by the groups at $\frac{1}{4}$ and $\frac{3}{4}$ of the semester provide an update on the progress of the project. These are evaluated by all project leads. At the halfway point, all groups present a so-called Intermediate report in front of everybody. Groups present their current results with a Power Point presentation that serves as a rehearsal for the semester-closing presentation. Along with the project leads, students from other groups can also give constructive feedback. Besides points set forth in 3.2, professional opinions and individual requests can be added.

The course requirement is divided into 2 parts:

- Preparation and hand-in of the project paper by the required due date
- Presentation of the results at the Final report, and persuading the client.

The final evaluation will be determined by a ratio of 60% paper and 40% presentation. Both have a complex evaluation system with points given for certain sections. The format of the papers is checked by the course lead, 10 points can be given. The project lead evaluates the content and can give 50 points. The Final report is evaluated by all present project leads. They can give up to 40 points, and the average of all points given will be taken into account.

The sum of the above give the base of the point for each group, so maximum $10+50+40=100$ points. This is multiplied by the number of students in the group (3 or 4), and that is number that will be divided among the student. The points give to each person will be determined by the group. When they hand in the paper, each member also hands in a evaluation sheet where

they rate their team member’s work throughout the semester by dividing 100% among them. For each individual the average of the received % will be considered (to avoid cliques the project lead can overrule ratios). The points given to each student will be determined by distributing the total score of the group by the % received. These pre-determined criteria will give the final mark to the students.

If a group hands in their papers after the deadline, a “penalty” is taken by deducting x% of the points.

4. Evaluating the course

The effectiveness of the “Complex project” can be determined based on the previous years, and the future possibilities can also be examined.

4.1. Statistics

During the 15 years between 2008 and 2022, 562 students worked on 148 projects in 148 groups. The evolution of participants and topics by year can be seen on Figure 2.

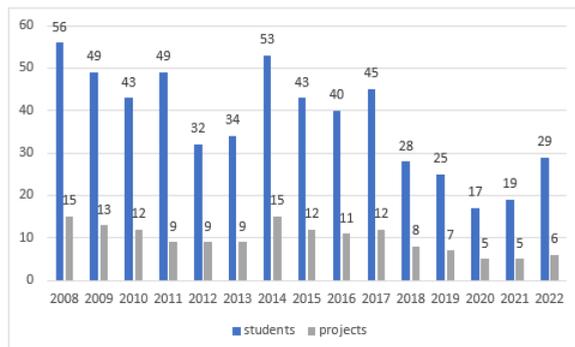


Figure 2. Number of students and projects 2008-2022.

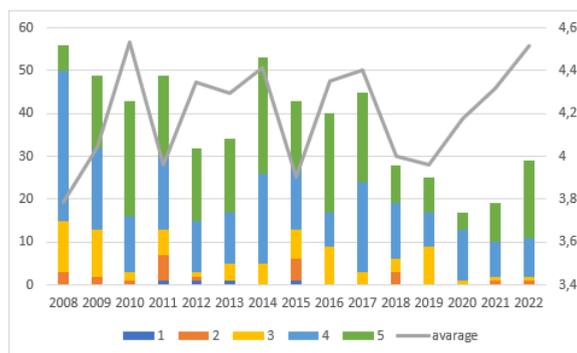


Figure 3. Grades and course averages 2008-2022.

Due to the practical nature of the course, the final grades and group averages are higher than for theoretical courses. In fact, the only ones who failed the class were the no-shows. The distribution timeline is shown on Figure 3. Over the course of 15 years the course average has been 4,20 (on a scale of 1 to 5) which show that the student were well prepared and enthusiastic.

4.2. Developments moving forward

It is apparent that the methodology is continuously improving. As a next step, along with tasks offered by our department, transport corporations will send us project plans. Students can apply for these and they will be available for 2-3 groups. We will provide a high level of guidance from the project leads and the groups will compete with each other to come up with alternative solutions. Lecturers will give presentations on the procedures that are deemed highly useful for the potential solutions. Students will separately present their progress every 3 weeks. The client company will take part in the semester-ending evaluation, and the group they find the best will receive a prize.

We have developed a continuation for this bachelor’s course for the master’s program. Students will already be familiar with the process of project development, so they will learn how to lead and coordinate projects.

5. Conclusion

This course is significantly facilitates the transition between theoretical education and practical application.

It provides a tool for acquiring the methodology that is required for understanding, creating and debating the thesis for each individual person.

Compared the results of the students at the final exam and thesis, we found that the marks are significantly better than before the introduction of the subject “Complex project”.

It lays a foundation for the master’s program and improves the professional recognition on the program.

Besides elevating the level of education from the students’ perspective, at the same time it also improves the lecturers’ competences.

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Digital identity and body identity: the mutation of the university environment in pandemic times

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Abstract

The pandemic period led universities to face new needs and to reinvent and readapt their educational activities in online mode to make them available and continuous. The consideration is about the effects produced in university students by the pandemic conditions and the exclusion of bodily experience in the real world. A study was led on a group of 405 subjects in order to evaluate their emotional, conflictual and social state and the possible emergence of obstructive behaviour in relation to themselves and others. Thanks to this study, it's clear that the bodily experience remains irreplaceable, and in a moment in which we have been deprived of the body and its resources, we need to reconsider the relationship between person and his body, re-evaluating it as a real value and relational foundation, of its innate potential as a means of learning.

Keywords: *Covid-19; corporeality; higher education; idea inventory; body identity; digital identity.*

1. Introduction

In the last three years, the global pandemic situation required the academic sphere to radically and immediately reconsider innovative teaching approaches and tools, in order to ensure the normal continuation of educational activities.

In the academic field, as in schools, there were radical changes and there was a shift from face-to-face teaching to distance teaching. In this period out of the ordinary, there has been a lack of social experiential teaching opportunities, which are fundamental for professional training, as well as experiences of a motor, playful, sporting and emotional nature, which are also to be considered as activities at the basis of personal growth.

In the academic environment, the appreciation of diversity and an inclusive spirit create opportunities for community and cooperation. In pandemic times the bodily identity was put aside (Francesconi, 2015), to leave room for digital identity, which was necessary to take part in a didactic relationship, but the concept of corporeity is not secondary, nor is the promotion of health in universities, which in addition to promoting higher education, should guarantee quality and well-being in relations with teachers and among students. Therefore, a detailed examination of the state of predisposition of students to progressively re-appropriate the potential of the body (Palumbo, 2013), which has been marginalized, is needed. If the educational relationship can be safeguarded through mediatization, it is worth trying to explore the abilities of the body and especially the corporeity, understood as a hub of multiple knowledge (Gamelli, 2011). Consequently, it is the case to introduce a pedagogy of corporeity, which can transfer in the various educational fields those basic principles an education to the motor movement in its different forms, which lead to a body culture conceived as bodily awareness.

It is therefore necessary to reflect on how the university environment has been invested in a pandemic period of change, in which the student has been forced in the confined space of his home and his room to face a new concept of self-perception (Gibson, 1979) and self-efficacy, on how each individual student had to try on his own to take the bodily self, gradually replaced by a digital self (Lo Piccolo, 2019). As a result of this pandemic period, the inevitable repercussions on the increased burden of both emotional and physical stress due to the continuous restrictions caused by the lockdown periods, cannot be ignored. It is therefore increasingly common to experience stress disorders, and university institutions cannot fail to take charge of this, because, from an inclusive perspective it is the task of university institutions to ensure a learning environment that meets both the needs and expectations of each and every individual.

2. Research

2.1. Objective

The study aims to promote mental health and psychophysical well-being in the academic environment by assessing perceived self-efficacy in managing internal and external conflicts, as well as an interpersonal and intrapersonal analysis on a group of subjects attending the University of Salerno.

2.2. Sample

The subjects observed within the framework of the research are students at the University of Salerno, (Southern Italy) who were identified in a convenience sample of 405 students (M=124; F=281) aged between 20 and 25.

2.3. Instrument

The Idea inventory questionnaire by Kassinove et al. (1977) was used as a tool for the evaluation of cognitive and motor dysfunctional aspects. The test consists of 19 items (reduced version), on a Likert scale, with scores from 1 to 4. The student is asked to answer and provide his or her degree of agreement or disagreement with the items indicated.

2.4. Data analysis and results

The Idea Inventory, in this survey, is intended to detect the level of changes implemented at the mental level in response to an adaptation or non-adaptation in one's context, in this specific case the academic context. The data were pre-screened to determine the accuracy of data entry. Valid data were classified into a descriptive statistic (SPSS software) and a frequency calculation was performed. The significant data are shown in the table (fig 1.) Thus, the analysis showed that: in Item 22, 45.7% of the students answered that they are totally agree. This result manifests a lack of resilience to the ability to try again after a failed attempt (Vaccarelli, 2016), and to not finding comfort in the other as well as having to adapt quickly to new situations and put oneself in a position to actively react to the changes; in Item 4, 33.3% of the students answered that they totally agree. For almost two years we have been experiencing a different reality, the result of significant changes that cannot be ignored, of new pedagogical realities that can be tangible and valuable, and think about themes such as intercorporeality (Rinaldi, 2003), taking into account the teacher/learner relationship; this relationship is based on wide aspects concerning eye contact, but also gestures, mindfulness, synchrony, what goes beyond eye contact, voice, gestures, rhythm, aspects that are imperceptible in distance mode; in item 8, 45.9% of the students answered that they totally agree. In this case, the students accumulated more anxiety and less problem solving skills with regard to their lives, all caused by an inability to relate and open up to the world; in item 9, we note the 29.1% of studens are totally agree. This result can be traced back to the lack

of comparison with the other, and the uninterrupted and limiting interface with the only display of the mobile phone and computer; in Item 10, 48.6% of the students answered that they are totally agree; the ability to manage difficulties represents an inherent human skill, but if not properly exercised, it can lose its effectiveness and cause frustration and discomfort. In Item 12, 38.5% of the students answered they totally agree, this result shows the educational emergency that we are going through. Teachers, researchers and the students themselves have a duty to commit themselves to a renewal of teaching actions and to provide tools that guarantee the possibility of a constant relationship between bodies to arrive at a new physical presence as a "still" point in teaching. That is, the presence of a pedagogy that gives space to new, rather than new, rediscovered epistemological tools: corporeity and intercorporeity.

ITEM 1 – It is essential to obtain the esteem and affection of the people who are important to me

	F	%
Totally agree	215	53,1
Quite agree	121	29,9
Quite disagree	26	6,4
completely disagree	43	10,6
Total	405	100,0

ITEM 2 – It's terrible when things don't go as they should.

	F	%
Totally agree	185	45,7
Quite agree	106	26,2
Quite disagree	73	18,0
completely disagree	41	10,1
Total	405	100,0

ITEM 3 - It is easier to avoid responsibilities and commitments than to face them

	F	%
Totally agree	85	21,0
Quite agree	46	11,4
Quite disagree	148	36,5
completely disagree	126	31,1
Total	405	100,0

ITEM 4 - When I'm in a difficult situation, I easily give up if there is no one to help me out

	F	%
Totally agree	135	33,3
Quite agree	51	12,6
Quite disagree	148	36,5
completely disagree	71	17,5
Total	405	100,0

ITEM 5 - I'm afraid I don't know how to deal with people in authority in the best way

	F	%
Totally agree	55	13,6
Quite agree	130	32,1
Quite disagree	148	36,5
completely disagree	72	17,8
Total	405	100,0

ITEM 6 - I take it out if others don't like my appearance or the way I dress

	F	%
Totally agree	42	10,4
Quite agree	77	19,0
Quite disagree	123	30,4
completely disagree	163	40,2
Total	405	100,0

ITEM 7 - A person of value must always be competent and comfortable, whatever he does

	F	%
Totally agree	75	18,5
Quite agree	122	30,1
Quite disagree	143	35,3
completely disagree	65	16,0
Total	405	100,0

ITEM 8 - I get angry if I don't achieve my goals

	F	%
Totally agree	186	45,9
Quite agree	113	27,9
Quite disagree	70	17,3
completely disagree	36	8,9
Total	405	100,0

ITEM 9 - My unhappiness is mainly caused by the events or people I deal with and have no chance to control it

	F	%
Totally agree	118	29,1
Quite agree	42	10,4
Quite disagree	166	41,0
completely disagree	79	19,5
Total	405	100,0

ITEM 10 - We always need to lean on someone stronger than us

	F	%
Totally agree	35	8,6
Quite agree	105	25,9
Quite disagree	164	40,5
completely disagree	101	24,9
Total	405	100,0

ITEM 11 - It is a terrible thing not to be able to find the perfect solution to our problems			ITEM 12 - When I arrive at a party I feel very bad if no one comes to greet me		
	F	%		F	%
Totally agree	197	48,6	Totally agree	50	12,3
Quite agree	69	17,0	Quite agree	119	29,4
Quite disagree	105	25,9	Quite disagree	149	36,8
completely disagree	34	8,4	completely disagree	87	21,5
Total	405	100,0	Total	405	100,0

ITEM 13 - I feel like a worthless person when I do not succeed well in my work or study			ITEM 14 - I get angry if my opinions are not accepted		
	F	%		F	%
Totally agree	156	38,5	Totally agree	37	9,1
Quite agree	91	22,5	Quite agree	123	30,4
Quite disagree	103	25,4	Quite disagree	164	40,5
completely disagree	55	13,6	completely disagree	81	20,0
Total	405	100,0	Total	405	100,0

ITEM 15 - I feel sad and rejected when others neglect me			ITEM 16 - I avoid situations where I have to make choices because it makes me nervous		
	F	%		F	%
Totally agree	75	18,5	Totally agree	68	16,8
Quite agree	163	40,2	Quite agree	44	10,9
Quite disagree	124	30,6	Quite disagree	181	44,7
completely disagree	43	10,6	completely disagree	112	27,7
Total	405	100,0	Total	405	100,0

ITEM 17 - I get nervous and need to be helped when I face difficult commitments and responsibilities			ITEM 18 - It's the past that influences my life and I can't do anything to change it		
	F	%		F	%
Totally agree	38	9,4	Totally agree	38	9,4
Quite agree	83	20,5	Quite agree	75	18,5
Quite disagree	206	50,9	Quite disagree	145	35,8
completely disagree	78	19,3	completely disagree	147	36,3
Total	405	100,0	Total	405	100,0

ITEM 19 - I worry a lot if I can't find the right solution for my commitments		
	F	%
Totally agree	82	20,2
Quite agree	207	51,1
Quite disagree	85	21,0
completely disagree	31	7,7
Total	405	100,0

Figure 1. Results of Idea Inventory Test.

3. Discussion and conclusions

This study aims to understand how the possible onset of dysfunctional attitudes can influence the effective and complete absence of bodily communication. Therefore, it is necessary to invest in the teacher, so that he or she can grow with and through the body, with the implementation of transformative and innovative teaching practices as an opportunity for improvement. Within the university contexts, there is a plurality of epistemologies, and to be able to imagine a confluent path between these systematically means rethinking not didactics itself, but the ways in which the university system considers didactics to be central, and how didactics, as a science of interaction, can be a 'significant opportunity for students. In the light of the latest studies and directions, it is essential to rethink corporeity not as a dissociating, secondary element, separated from the rest of education. On the contrary, the *Pedagogy of the Body* arises, revisiting the current educational contexts, in which corporeity is scarcely involved, and proposes instead a greater interconnection and scientific reflection on the formative and educational value of the body intended as a mediator capable of giving meaning to the educational experience (Sibilio, 2011). The pedagogy of the body is an educational and training approach that aims to enhance and strengthen the role of corporeity in learning contexts. In this perspective, it is necessary to consider a more corporeal scenario, in which posture, eye contact and the correct use of verbal and non-verbal language are used. The body can and must be recognised as the primary articulation of all learning, and to do so it is appropriate to look at corporeity with construction, in order to create a new operational dimension, aimed at reaching significant dimensions involving the emotional and affective life, and to be able to explore the body's potential in training processes. Indeed, it can be stated that «the body plays a crucial role in the development of cognitive abilities» (Kyselo & Di Paolo, 2015 p.520). The profound crisis experienced during the pandemic period seems to have affected the self-perception and selfefficacy sphere (Bandura,1997), leading to continual reflections on the future and eliciting continual questions on how to make up for lacks and absences caused by virtual teaching. The solution might be to be able to conceive of the body in a vision of centrality and not as an orthosis of the mind, so as to be able to understand the real peculiarities of corporeity as a unity and crossroads of multiple learning. Reflecting on the statement *I am my body* (Marcel, 1951), then in a future perspective, teaching strategies should focus on corporeity by moving towards the valorization of educational practices that offer the possibility of discovering the body's potential by means of its expressive resources (Berthoz, 2011). The body has for too long been conceptually kept at the margins of learning processes, and thus needs continuous redemption as part of an entity. Our body, therefore, is much more than a window on the world, it is a reality, a field for receiving data of all kinds that noisily pours in, but it is certain that every single piece of information, therefore, afference will not be lost but somehow somatically incorporated and reused to face new educational and... life challenges.

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Reflective practice to bridge the theory-gap practice in Human-Computer interaction classes

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Abstract

There is a need to incorporate reflective practice in students' studies at higher education institutions to bridge the perceived theory-practice gap in Human-Computer Interaction classes. Reflective practice as an approach is employed for students to make connections between theory and practice. Reflective practice allows students to evaluate what they have learned through practice. The action research methodology was used to facilitate the research. All students who completed the assignment were invited to participate in the study, and since it was voluntary, 24 students took part. Using reflective sheets, the students were able to evaluate their current actions to improve in the future. Data were analyzed using conventional content analysis to interpret the data. The results indicated that the students were able to reflect on their work and new ideas they can incorporate into their future work. The relevance of reflective practice to bridge the theory-practice gap is highlighted.

Keywords: *Reflective practice; theory-practice gap; higher education; Human-Computer interaction.*

1. Introduction

There is a common belief that there is a gap between the Human-Computer Interaction (HCI) theory and its application. The perceived theory-practice gap is also visible in HCI classes. Students are faced with the problem of a lack of time allocated for practical work to bridge the perceived theory-practice gap (Pittarello & Pellegrini, 2017). In HCI education, the usability and user experience of interactive systems and products are explored, understood, and improved (Abdelnour-Nocera, Michaelides, Austin, & Modi, 2012). Case studies are commonly used to teach students how to apply the theory they've learned (Collazos & Merchan, 2015). RP was identified as the best theory to guide the intervention needed to assist students to bridge the perceived theory-gap practice. In order to effectively assess what students have learned from practice, reflective practice is an essential component of reflective learning (Chaffey, de Leeuw, & Finnigan, 2012). The reflective practice process allows students to apply theory to practice (Colomer, Serra, Cañabate, & Bubnys, 2020).

Action research has been chosen as the suitable methodology to facilitate the process of RP. The purpose of AR is to improve the performance of lecturers and the learning experience of their students (Efron & Ravid, 2019). In order to improve current practices, AR process participants need to engage in self-reflection and question some interventions.

The aim of the present study was carried out to bridge the theory-practice gap by using RP in HCI classes. Data collected revealed that the use of RP is relevant for bridging the theory-gap practice.

2. Methodology

Students enrolled in the second year of an IT program who have registered for the graphical user interface design module that focuses on Human-Computer Interaction participated in this study. They were given an assignment as part of the formative assessment. All students who completed the assignment were invited to participate in the study, but because participation was voluntary, only 24 students out of 183 participated. Participants completed a reflective sheet to reflect on their process during the completion of the assignment.

Action research (AR) is an orientation to knowledge creation that arises in the context of practice and requires researchers to work with practitioners (Huang, 2010). In its initial formulation, 'action research' was defined as a method that enabled theories produced by the social sciences to be applied in practice and tested based on their practical effectiveness (Carr, 2006). In this research context, students will be involved in projects that will enable them to learn by practising, in other words, they will be active participants who are going to apply theory in their practice. The five iterative phases of action research as illustrated in Figure 1

(Baskerville, 1999) are diagnosing, action planning, action taking, evaluating, and specifying learning.

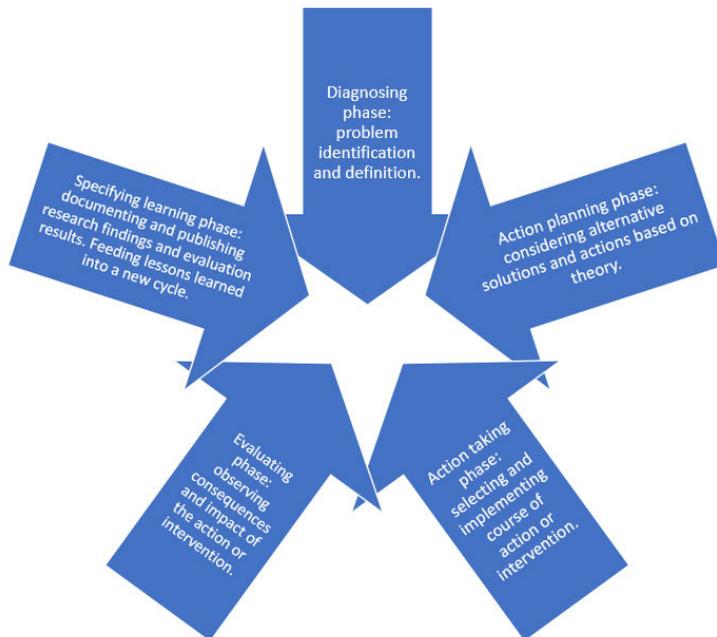


Figure 1: Action research process adapted from Baskerville (1999).

2.1. Diagnosis phase

During the diagnosis phase, the lecturer/ researcher discovered that the students were making little use of theory when completing the practical work. The problem identified created some barriers for students to learn the design principles in order to apply them during their practical assignments. This also revealed that the students are unable to link the theory learned and the practical. The performance of the students on theory assessments was better as compared to the practical assessments. The students studied theory to pass the main assessments and practical assessments were only formative and no summative assessments were done. The problem identified from this stage will be used to plan the action that will be undertaken for the cycle.

2.2. Action planning phase

In order to conduct an effective intervention, it was necessary to first identify and evaluate the problem. The intervention consists of a plan of action aimed to improve a participant's attitude toward improving their skills. The possible actions to assist with the problem identified in the diagnosis phase from the literature are presented in Table 1.

Table 1: Possible interventions.

Recommendations from literature	Possible intervention
Students complete a new task through hands-on experience (Konak, Clark, & Nasereddin, 2014).	Students will have to complete hands-on work as part of their assignment. Students will be required to do practical work as part of the assignment
Describe what went well and the problems they encountered, as well as where they will need to improve (Schultz, McEwen, & Griffiths, 2016).	The reflective sheet will incorporate the questions: During the course of completing the assignment, ask the students what challenges they encountered, Ask students how they solved the problems encountered, Obtain their feedback on how they would improve their work if they had more time.
Assignment grading standards are developed properly (Roldan et al., 2020).	Students work will be evaluated based on the use of a rubric throughout grading. The work should be communicated before it is submitted.
The reflection process follows after students completed their work (Konak et al., 2014).	Students are invited to reflect on the completed work Participants will be asked to reflect after completing the work. Each participant will be given a reflective sheet to complete.
The students attend the theory classes and practical classes thereafter. Using the diagnosis results, an action plan will be developed to alleviate the identified problem in order to develop students' skills.	

2.3. Action taking phase

During the action taking phase, the next step was to give students a practical assignment to complete as part of reflective practice. The summary of the actions taken based on the planning phase is presented in Table 2.

Table 2: Interventions implemented.

Recommendations from Literature	Interventions
Students complete a new task through hands-on experience (Konak et al., 2014).	<ul style="list-style-type: none"> • Students completed hands-on work as part of their assignment. • Students were required to do practical work as part of the assignment
Describe what went well and the problems they encountered, as well as where they will need to improve (Schultz et al., 2016).	<p>The reflective sheet incorporated the following questions:</p> <ul style="list-style-type: none"> • During the course of completing the assignment, the students were asked what challenges they encountered, • students were asked how they solved the problems encountered, • Feedback was obtained on how they would improve their work if they had more time.
Assignment grading standards are developed properly (Roldan et al., 2020).	<ul style="list-style-type: none"> • Students' work was evaluated based on the use of a rubric throughout grading. • The work was communicated in class before it was submitted to clarify misunderstandings.
The reflection process follows after students completed their work (Konak et al., 2014).	<ul style="list-style-type: none"> • Students were invited to reflect on the completed work • Participants were asked to reflect after completing the work. • Each participant was given a reflective sheet to complete.

2.4. Evaluation phase

The data were analyzed using conventional content analysis. Table 3 gives the summary of the process undertaken to analyze the data.

Table 3: Content analysis process adapted from Zhang and Wildemuth (2009)

Process	Application in this study
1. Preparing the data	The collected data was available in written form for use in Atlas.ti.
2. Defining the unit of analysis	Conventional content analysis was used.
3. Developing categories	Codes that contribute to the same meaning or context are categorized.
4. Testing the coding scheme on a sample	Data from four participants were coded.
5. Coding all the text	Coding each text entailed assigning a code to it.
6. Assessing consistency	Errors were thoroughly checked, and updates were made as needed by going over the coding twice.
7. Drawing conclusions from the data	The key categories have been identified and discussed.

2.5. Specify learning phase

Two categories derived from the data collected for this study will be discussed in this paper. The *challenging parts category* and *problem-solving category* are discussed:

Challenging parts category

In accordance with the challenges encountered, participants highlighted the difficult aspects of the assignment that they encountered while completing it. The question was designed to determine whether or not the participants could analyze their progress and identify where they went wrong. The difficulties that the participants encountered were nearly identical because they involved understanding the assignment's requirements. Among the challenges listed were the following:

- problem with understanding the requirements;
- challenge with knowing what the banner is;
- difficulty with knowing where to start; and
- experiencing the work for the first time.

One of the most difficult aspects of reflective practice was revealing how participants acted when they first encountered the assignment. In this case, reflective practice aided in

determining those other students may be unprepared to complete an assignment. The results revealed that, in order to engage in reflective practice effectively, you must first thoroughly understand the assignment's requirements.

Problem-solving category

The problem-solving question sought to ascertain what the participants did to overcome the difficulties they encountered throughout the difficult sections of the assignment. The participants reflected on their actions as well as their coping strategies. These included asking questions, seeking additional assistance, and conducting Internet research. The following is a summary of actions taken:

- Using the internet and YouTube;
- Contacting the lecturer for clarification;
- Studying theory to understand;
- Finding answers in their study materials; and
- Carefully reading instructions.

Current and prospective students will be encouraged to learn the various strategies that will help them complete an assignment successfully. Students nowadays face information overload due to the abundance of information available on the internet, making it difficult for them to choose appropriate content for their assignments.

3. Discussion

Participants were asked to identify the challenging parts they encountered while they were completing the assignment. The purpose of this question was to determine whether the work presented a challenge to the students. The findings indicate that when participants were completing the assignment, they encountered problems related to the processes and methods involved. Understanding what is required is crucial since it allows students to focus on the correct strategy when answering the questions. This statement is supported by Cerdán, Pérez, Vidal-Abarca, and Rouet (2019) who assert that students need to understand what they have been asked.

The goal of the problem-solving question was to find out how the participants overcame the challenges they mentioned. Participants were asked what steps they took to solve the problem. This allowed participants to reflect on the steps they took to overcome the problems they encountered. The participants stated that they solved the problems using the theory work. If students are unable to contact the lecturer, they should read the instructions several times to ensure that they understand the question.

4. Conclusion

Students will be asked to watch the videos provided again before submitting their work to ensure that they understand the examples of work relevant to what they are required to complete in the future. In order to effectively complete their assignments, students will be encouraged to master a variety of strategies. This paper has revealed that it is possible to bridge the theory-practice gap in HCI classes by increasing student engagement and providing activities that encourage hands-on exploration and experimentation. It is essential to incorporate more interactive activities and discussions into classes so that students are able to gain a deeper understanding of the material as well as apply it to real-life situations. Furthermore, instructors should provide resources and activities that cater to the different learning styles of students. It is through these strategies that the students will be able to gain a deeper understanding of HCI theory and practice, resulting in a more successful academic experience. This paper has detailed how to bridge the theory-practice gap in HCI classes.

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The use of TAM in evaluating the effectiveness of network simulation tools in internet technologies subject

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Abstract

Technology has immensely influenced the educational space around the globe by using educational tools to assist students with practical work. This became evident when higher learning institutions reached a standstill due to the COVID-19 pandemic. However, the effectiveness of these educational tools in teaching and learning remains unknown. This research aims to use the technology acceptance model to guide the analysis of the effectiveness of a network simulator called a packet tracer. This study was conducted in November 2022 with 82 Internet technology students. A quantitative method was used in this study. Data were collected through observations and survey questionnaires. Cross-tabulation was used to analyze the data. The results revealed that Packet Tracer, as a virtual learning tool, has proven to be an effective software for supporting the teaching and learning of Internet technology students. This contributes to the body of knowledge and technology in the education discipline.

Keywords: *Education; evaluation; Packet Tracer; TAM; virtual learning; technology.*

1. Introduction

The shift in technology has impacted the socioeconomic world; this simply means that Higher Learning Institutions (HLIs) have also been impacted (Štrbo,2021). Higher learning Institutions face various challenges during the teaching and learning of computer-related subjects (Ambiyar, Yondri, Irfan, Putri, Zaus, & Islami, 2019; Sudarsana, Armaeni, Sudrajat, Abdullah, Satria, Saddhono & Ekalestari, 2019), causing both students and teachers to participate and interact less in the learning process. This was specifically observed in Internet Technologies (a computer networking subject). Some of the impediments encountered in the subject include (1) the limitations of network devices, so students have to take turns in a group practice, causing some students not to participate; (2) the high price of network devices needed for practice; and (3) the practice process should take considerable time, because students must physically configure the network, in addition to the minimal amount of practice equipment.

Teachers can now use virtual learning technology (V-learning) to overcome problems experienced by students. As a result, V-learning can strengthen HLIs to become more competent and prepare students for the global market (Janal, Jalil, & Ahmad, 2020).

Visual learning technology uses visual aids such as videos to deliver educational content more effectively (Du, Dai, Tang, Hung, Li, & Zheng, 2022). In the same line of argument, Abdrabou and Shakhathreh (2021) emphasized that V-learning greatly benefits and enhances the learning process, as interactive effects are used to reinforce the material being studied. It is therefore considered a great way of learning as it aids in increasing a learner's interest in a certain subject, which makes the learning process more enjoyable and keeps the student's interest for longer periods.

Packet Tracer (PT) software is a visual tool utilized around the globe. Packet Tracer is a comprehensive learning software application for teaching skills and concepts related to computer networks (Muniasamy, Ejlani, & Anadhavalli, 2019). The software can perform computer network simulations or is often called a computer network. As mentioned by Abdrabou and Shakhathreh (2021), the software makes learning more comfortable by providing a realistic network simulation and visualization of the environment. In addition, this packet tracer software can simulate ongoing real-time updates that highlight the logic and network activities.

In this study, the researcher used Technology Acceptance Model (TAM) to guide the analysis of the effectiveness of PT. The technology Acceptance Model is a theoretical framework used to explain how people accept and use technology. It was developed by researchers at the University of Massachusetts in the late 1980s and is based on prior work by researchers in the fields of organizational behavior, cognitive psychology, and information systems (Isaac et al, 2018)

The rest of the paper is organized as follows: Section 2 provides work related to this research. Section 3 discusses the methodology of this study. Section 4 highlights the theory underpinning this study. The results are presented in Section 5. The last section provides the conclusions of the study and recommendations for future research.

2. Related work

Packet Tracer software has been used around the globe to enhance students learning. Especially during the COVID-19 pandemic (Allison, 2022). A recent review of the literature found that, since the outbreak of the pandemic, more and more institutions have adopted PT as a teaching tool to foster remote learning. The review also highlights the importance of providing adequate training for teachers on how to effectively use the tool to facilitate learning. Other studies have examined how the use of PT can help to improve student engagement and performance, as well as its potential to provide hands-on experience to students who are unable to access physical networking equipment. Finally, there is also research into the challenges faced by educational institutions when using PT, including the need for better student support services and more resources to enable effective teaching.

For instance, Ojugo and Eboka (2021) used PT to improve service delivery and performance dependability by conducting standardized tests, such as throughput tests, application response-time tests, and availability tests on a campus network in Nigeria.

Another scholar used PT as an effective pedagogy in computer networking courses in Malaysia. Their study revealed that PT successfully helped their students to understand several key concepts of computer networking and, at the same time, quash some abstractions they faced in the course (Noor, Yayao, & Sulaiman, 2018).

A study conducted in Malaysia by Allison (2022) developed a Survey on the Challenges Faced by the Lecturers in Using PT in Computer Networking Courses. Their idea was to identify the problems faced by teachers throughout the teaching and learning process, even with the help of instructional simulations. In their conclusion, the authors proposed that laboratory work activities need to be improved by employing an engagement taxonomy as its preparatory guidelines.

Thus, an environment in which any technology or educational tool is adopted or used provides different results depending on how it is used, who uses it, and their location. Therefore, it is important to evaluate the usefulness and ease of use of PT software to evaluate its effectiveness in the context of Internet technology students.

3. Underpinning theory

This study applied TAM as the underpinning theory. TAM is a useful theoretical model for predicting how technology or a system is used and its effectiveness (Isaac et al, 2018). According to Allison (2022), TAM is a widely accepted concept that explains the relationships between users and technology. It is based on the notion that users' attitudes towards technology are based on their beliefs regarding the utility and convenience of the technology. According to the TAM, user opinions of usefulness and ease of use are the major factors in determining if a user will adopt and use a system. The TAM has been used to understand and anticipate the behavior of users in a range of scenarios, such as technology acceptance, software engineering, and e-commerce (Isaac et al, 2018).

The technology Acceptance Model assisted the author by guiding the evaluation of the significant effects of student perceptions, student motivation, perceived ease of use, and perceived usefulness of the adopted virtual technology in enhancing the accuracy of students' performance and learning.

It is worth noting that the author only used two constructs from the TAM model. These two constructs—perceived ease of use and perceived usefulness—allowed the researcher to evaluate the effectiveness of PT.

4. Methodology

This quantitative research was conducted at a public university in South Africa (SA), where 82 respondents were asked to complete a questionnaire survey. Questionnaires were prepared using Likert scales with five options from Strongly Agree to Disagree Strongly. Aspects evaluated include aspects of Internet Technologies, learning, and communication. The questionnaire before being used for data collection is validated by an expert (expert judgment). Four experts validate the questionnaire. After the expert validated the questionnaire, a tryout was conducted.

The researcher also used observations to collect data. The author observed students during lab sessions and noted their level of engagement with the network simulation tools. 2. students were asked to complete a questionnaire to assess their level of satisfaction with the PT. 3. The author monitored the students' interaction with PT and took notes of their performance. 4. students were asked to provide feedback on their experience with PT. 5. The amount of time students spent on the PT was measured. 6. The quantity and quality of the student's work completed with PT was assessed. 7. The author monitored the student's progress in using the network simulation tools by tracking the grades they receive.

The collected data were from October 2022, as Internet Technologies (INT) is a second-semester subject. The response rate of the study was 100%, which is good compared to other studies found in the literature.

A Technology Acceptance Model (TAM) was used to guide the data analysis. The following two TAM constructs were validated: 1. perceived ease of use of PT and 2. Perceived usefulness of PT.

4.1. Perceived ease of use of Packet Tracer

Perceived ease of use refers to how easy it is for users to learn and use Packet Tracer (Vinay & Rassak, 2015). It is an important factor in determining user adoption, as users are more likely to use a technology if they find it easy to use. Packet Tracer is a powerful network simulation tool that can be used to design, configure, and troubleshoot networks (Janal et al, 2020). Users have reported that the software is intuitive and easy to use, making it a good choice for those new to network simulation (Isaac et al, 2018).

4.2. Perceived usefulness of Packet Tracer

Perceived usefulness is the extent to which a user believes that using Packet Tracer will enhance their job performance (Sudarsana et al, 2019). It is based on the belief that Packet Tracer will help the user become more efficient, accurate, and productive in their work. Additionally, perceived usefulness may also be based on the user's belief that Packet Tracer will improve their understanding of networking concepts, as well as increase their overall knowledge of networking (Isaac et al, 2018).

5. Results

To efficiently evaluate the effectiveness of PT for INT students, it was necessary to determine whether the V-learning tool was useful. The analysis of PT's perceived ease of use is shown in Table 1, using the following determinants: installation, connection, addressing, configuration, and simulation. Based on each determinant, participants were asked questions, and a yes or no answer was expected.

Numerous studies have demonstrated that perceived ease of use is crucial in the context of information systems (IS). According to Isaac et al (2018), the definition of perceived ease of use refers to how much a person believes using a given system or technological equipment will need little to no effort. Students' experience of installing PT was 89%, which means that most of the students were able to install the tool, and 84% of the students were able to connect the devices. What was interesting about perceived ease of use was the addressing determinant. The questionnaire revealed that only 67% were able to address the topology and 33% could not. This means that addressing is an element that requires students' attention.

The configurations and simulations were 74% and 77%, respectively. This implies that for PT to be more effective, these elements need to be considered so that they can be improved.

Table 1: Perceived Ease of Use of Packet Tracer.

Determinants	Question	Yes	%	No	%
Installation	Was installation easy?	73	89%	9	11%
Connection	Did you manage to connect your devices?	69	84%	13	16%
Addressing	Were you able to address your topology?	55	67%	27	33%
Configuration	Were you able to do the configurations?	61	74%	21	26%
Simulation	Was simulation understandable?	63	77%	5	23%

Furthermore, Table 2 shows the perceived usefulness of the packet tracers. There is a claim made in the literature that perceived usefulness improves with perceived ease of use. The allegation appeared to be true based on the results of this study. Abdrabou and Shakhathreh (2021) stated that perceived usefulness is the extent to which a person thinks that employing a specific system or piece of technology will improve their performance.

According to the results presented in Table 2, all students obtained a new skill, and their knowledge was improved by using PT for teaching and learning. Although 5% of the students felt that PT did not save time, they all agreed that it was cost-effective, with a percentage of 100. Additionally, 91% felt that the information provided about PT was complete and adequate, while 9% believed that the information was incomplete. Thus, efforts should be made to enhance the information provided.

Table 2: Perceived usefulness of Packet Tracer.

Determinants	Questions	Yes	%	No	%
Skill acquired	Did you obtain any new skills?	82	100%	0	%
Knowledge improvement	Did your practical knowledge improve?	82	100%	0	0%
Save time	Does using a packet tracer save time	78	95%	4	5%
Cost-effective	Is it cost-effective to use a packet tracer?	82	100%	0	0%
Information completeness	Do you think you have all the information you require about the packet tracer?	75	91%	7	9%

6. Conclusion and recommendations

Using V-learning tools like Packet Tracer as an instructional aid in computer network courses is beneficial. Packet Tracer is an advanced teaching platform that provides an interactive and fun environment for both students and teachers. The findings of the study suggest that most students believe that using this type of tool can facilitate a better understanding of computer networking concepts, make studying technical concepts simpler, and enhance their networking abilities. Furthermore, the ability of Packet Tracer to demonstrate network algorithms proves its worth as a resource to learn networking principles, concepts, and routing protocols, which are known to be the most difficult and important topic in this subject.

TAM has been proven to be an effective method of assessing the efficacy of network simulation tools in Internet Technologies courses. The research indicates that these tools have been successful in helping students comprehend and apply network theories, as well as giving them practical experience in designing and testing networks. The results also point to the

benefits of the tools in terms of developing problem-solving skills and improving general analytical thinking. TAM has also been beneficial in providing feedback on the satisfaction and engagement levels of students in terms of the tools' effectiveness. Ultimately, TAM has provided an overall measure of the impact of the tools on student learning and performance. In conclusion, PT is an effective tool for studying computer network topics, such as technical and routing protocol principles, and students' exam results can be used to measure the effectiveness of the Packet Tracer for future use.

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Symbiosis between Learning Analytics and digital transformation

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Abstract

Higher Education Institutes (HEIs) are undergoing a profound and widespread digital transformation with the introduction of digital technologies in education. The introduction of digitised educational environments produced huge data repositories that could serve learning analytics, for the purposes of understanding and optimising learning and the environments in which it occurs. Where the digital transformation of education made learning analytics better and more qualitative, learning analytics leverages the digital transformation of HEIs by taking better informed actions.

This paper elaborates on the process of developing a conceptual learning analytics platform at KU Leuven (Belgium). Where the project started off as a pure data project, gradually several preconditions emerged, which caused a lot of side-tracking. The introduction of learning analytics needs a digital transformation of education. At the same time the digital transformation of education needs qualitative and quantitative learning analytics to take it to the next level. As if Learning Analytics and digital transformation live in symbiosis with each other.

Keywords: *Digital transformation; higher education; Learning Analytics; Data platform.*

1. Introduction

Due to the impact of digital technologies, society is undergoing a profound and widespread digital transformation. This causes disruptive innovation in many different sectors, including higher education. No Higher Education Institute (HEI) will be able to afford ignoring the evidence from the data, without losing competitiveness in the future (Hidalgo, 2018). Hereby, the digital transformation of HEIs is not a goal as such but must serve a purpose. However, most HEIs are focused more on digitisation and digitalisation than actual digital transformation, triggered by the introduction of Learning Management Systems (LMS). To mature towards a complete digital transformation a coordinated pedagogical and technological shift is needed (Brooks & McCormack, 2020). Yet, the biggest challenge in this change process is not the technology as this is merely related to budgets and resources, allocating these in the most optimal way. The pedagogical shift is much harder since it involves people and the culture of the HEI. Even the Covid-19 pandemic, regularly referred to as the so-called burning platform that compelled HEIs to use technology and quickly ramp up their capacity for online teaching and learning, was not enough to induce a full digital transformation (Pelletier, 2021). Many lecturers that had a bad experience with the forced crisis-change, revert to the known recipe of traditional classroom education and assessment, complicating digital transformation. Nevertheless, the changing role of universities stimulates the urge to change anyway (Barnett, 2010).

Learning analytics plays an important role in this necessary transformation of HEIs and can be defined as “the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it occurs” (SoLAR, 2022). The creation of huge data repositories by the introduction of digitised educational environments such as LMS, MOOCs or other virtual environments indeed leads to new areas of research and techniques.

The goal is to optimise the learning process (Khalil & Martin, 2016) but at the same time these new kinds of analytics ask us to reflect deeply on what kinds of learning we value. Learning analytics do not passively describe sociotechnical reality, they begin to shape it. (Buckingham Shum, 2014). Using ‘The learning analytics cycle’ (Clow, 2012) Buckingham Shum (2014) describes how the implementation of Learning Analytics triggers very fundamental questions. By answering these questions, the university takes decisions on what kind of education they want to offer, how they want to measure this and what actions they want to take to improve learning.

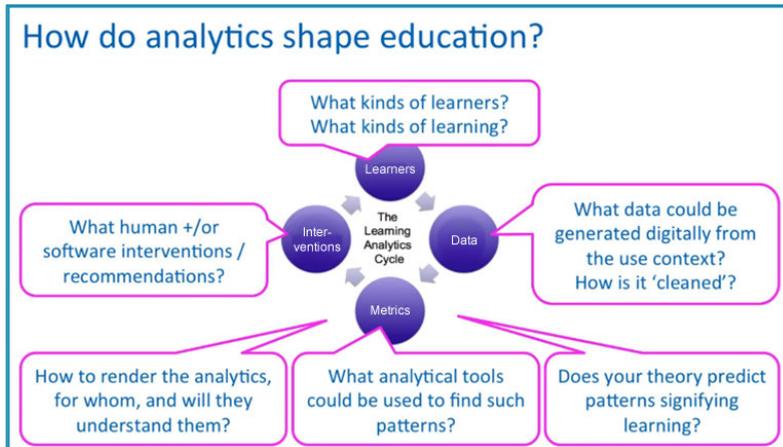


Figure 1 "How Learning Analytics shapes education" (Buckingham Shum, 2014) based on 'The learning analytics cycle' (Clow, 2012).

Already in 2012, Greller & Drachsler proposed a generic design framework that can act as a useful guide for setting up Learning Analytics services in support of educational practice and learner guidance, in quality assurance, curriculum development, and in improving teacher effectiveness and efficiency (Greller & Drachsler, 2012).

While interest in learning analytics has grown rapidly among HEIs, the maturity levels of HEIs in terms of being 'student data informed' are only at early stages. The SHEILA (Supporting Higher Education to Integrate Learning Analytics) project aimed to build a policy development framework that supports systematic, sustainable and responsible adoption of LA at an institutional level (Tsai et al., 2018). Both frameworks underline the importance of the involvement of all stakeholders in a LA project, with a special emphasis on their privacy.

This inspired the Science, Engineering and Technology Group (SET Group) of KU Leuven to initiate the project '*Learning Analytics & Dashboards: in function of the efficiency and effectiveness of blended learning*' to investigate how existing data on students' digital study behaviour can be used to give motivating and action-oriented feedback to didactic teams. During this project it became clear that Learning Analytics was more than just unlocking some data and producing fancy dashboards. Although many specific issues that arose during the project were already described in detail in other documents, the project did not move forward by just pasting together the proposed partial solutions.

This paper elaborates on typical pitfalls and matching insights on the symbiosis between Learning Analytics and the Digital Transformation. The authors hope to inspire Higher Education Institutes (HEIs) to implement Learning Analytics and use it as a tool to leverage the digital transformation in their HEI.

2. Methodology

The project 'Learning Analytics & Dashboards' was set up in an agile way, with 'planning periods' of about 10 weeks and associated sub-goals. At the end of each planning period, a steering committee discusses the results and defines sub-goals for the next iteration. Based on the SHEILA framework we worked with colleagues collectively to determine the priorities for the project. With standard data modelling techniques, we've created a dimensional data model that would cover the needs for those learning processes needing learning analytics the most.

2.1. From conceptual learning analytics platform to Proof of Concept by involving stakeholders.

During the project specific feedback sessions were organised with stakeholders whose opinions were important for the further progress. Depending on the subgoal, participants were selected from a very broad range of roles and functions within the university. These sessions allowed qualitative analysis of problem statements, alignment with the needs of the stakeholders and thus their support of the proposed solutions. They also generated input from involved lecturers, so that several demo-dashboards could be built, and a conceptual learning analytics platform was developed.

By involving the different institutional stakeholders in the development, testing, deployment, and assessment phase of learning analytics tools, most of the resistance to change might already be mitigated in an early stage of the project. It will be of critical importance for its acceptance that the development of learning analytics takes a bottom-up approach focused on the interests of the learners as the main driving force. (Greller & Drachslar, 2012)

However, to scale-up these solutions, and generate proof for the concept, a more structured and targeted approach is required to get a clear view of the present operational needs that exist in terms of study data and learning analytics. Through semi-structured 1-on-1 interviews with innovators and early adopters in Learning Analytics the conceptual learning analytics platform is surveyed.

2.2. Finding unity and scalability towards a Minimum Viable Product

Where a bottom-up approach helps to increase the support of the stakeholders, there is a risk that proposed solutions diverge from each other giving a scattered landscape of tools and dashboards for learning analytics. To create a uniform learning analytics platform, there is a need for organizational information governance encompassing the processes, standards, rules, and practices an organization follows. The findings of the project contributed considerably to the recently initiated KU Leuven working group 'learning data policy

framework' to set out the boundaries and conditions for a centralised learning analytics data platform.

Simultaneously, the side-project E-COOL (Effective and Consistently Organized Online Learning environment) sought guidelines to bring systematics in terms of structure, layout, and communication on the LMS, considering the differences in didactic work forms and learning objectives. A systematisation in the structure of a course is crucial to create unambiguous and useful learning analytics. Interpreting digital traces requires knowledge of course structure and how learning materials are integrated into the learning approach. Even more importantly when dashboard present cross-curricular data where the information user can not have a detailed insight in how each course is structured.

3. Results and discussion

Where the learning analytics project started off as a pure data project, the present scope is much wider. Gradually, several preconditions emerged, which caused a lot of side-tracking: privacy, data quality, course & curriculum design, structuring the LMS, external tools & LTI couplings, ... In addition, the context in which the project was set up turned out to be very complex: the momentum of the pandemic, discrepancy between learning objectives and learning content assessment, the rollout of formative testing & blended learning, migration to a new LMS, ...

Nevertheless, a conceptual learning analytics platform and proof of concept could be developed based on the feedback sessions and interviews. This allowed the generation of concept dashboards, which fed the feedback sessions and interviews (Figure 2).

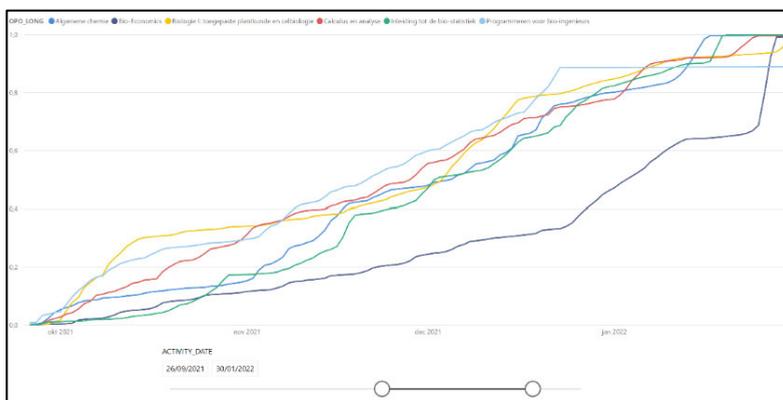


Figure 2 Concept learning analytics dashboard.

At the same time, many didactic teams appeared to question the usefulness of Learning Analytics. A huge gap in engagement for learning analytics between the Innovators & Early

Adopters on the one side and the Early Majority on the other side became very clear. To tackle this growing resistance to change the focus on the support of the stakeholders became even more important, together with scalability and sustainability of the proposed solutions. Where the Early Adopter can still live with teething problems, bugs and beta models, the Early majority are pragmatists who only use things that are 'Complete' and somehow solve their problems (Peeters, Grommen & Tubbax 2023). To gain wider support for learning analytics to justify the deployment of a full learning analytics platform at the university, the gap between the Early Adopters and Early Majority of learning analytics needs to be bridged.

Additionally, when inventorying other ongoing Learning Analytics investigations at KU Leuven, typically executed by innovators at a small scale, we noticed that most projects had a double complexity. Not only were they investigating new technologies or applications to capture, process and/or visualise study data. They were also looking at innovating the educational processes that were more suited for blended education. Because innovators do not always have scalability in mind, but rather seek an ad hoc solution to their own specific problem, most of these projects were not viable. Even more reason to find a solution and build a centralised learning analytics data platform that still satisfies them, but which is scalable.

Building a centralised learning analytics data platform is an essential step towards scalable analytical capabilities. This requires good information management capabilities to integrate, extract, transform, and access transactional data (Davenport & Harris, 2007). Whether we are speaking about the Knowledge Discovery in Databases (KDD) process in datamining (Fayyad et al., 1996) (Figure 3) or of the extract, transform and load (ETL) process in Business Intelligence & Analytics (Vassiliadis, 2009), the base of qualitative analytics is materialised by the analytical database on which visualisations, reports, Machine Learning Training, etc. for the data consumers can be built.

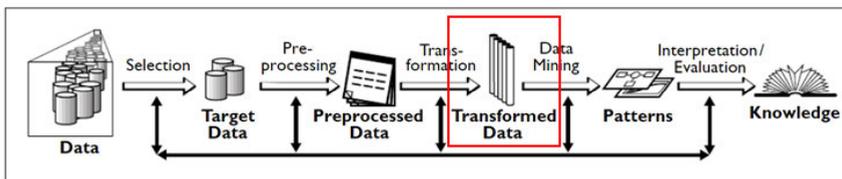


Figure 3 Overview of the steps constituting the KDD process (Fayyad, Piatetsky-Shapiro et al. 1996).

The building of such an analytical database can only be achieved when the processes that would fill the source databases are digitalized sufficiently, so that the database is rich enough to draw well-founded conclusions and to take data-driven action. This is why the working group 'learning data policy framework' has put effort in defining a typology and inventory of which study data should be integrated in learning analytics. Furthermore, through the SHEILA framework priorities on learning analytics policy were agreed on.

The results of this seed project will be used as a blueprint for a scale-up project in which the learning analytics strategy and system are implemented and deployed. The partnership in the current project with people of the Educational Policy Units and ICTS is crucial for the continuation toward the scale-up project.

4. Conclusions

Building a learning analytics strategy for HEIs is so much more than merely aggregating some data and building generic dashboards. The maturing of the learning analytics and the evolution from digitisation towards digital transformation clearly go hand in hand. As HEIs are maturing in their digital transformation, more qualitative learning information is generated, and more accurate learning analytics become feasible. By providing more and better information about the study progress of a student, the HEI can improve their digital transformation in education, on every level.

This sounds like a positive spiral every HEI would want to enter. However, there are some conditions and pitfalls. For instance, the streamlining of these processes and standardising the information in a central learning data store, is essential to transform the institution's operations, strategic directions, and value proposition. To develop this centralised learning analytics platform, involvement of all stakeholders seemed necessary, in an iterative process.

Moreover, the implementation of learning analytics and the digital transformation of the HEI must be managed in sync with each other so that both exist in symbiosis. Otherwise, the positive spiral turns in to a negative vicious circle, with one change running ahead from the other, bringing unused solutions. A challenging mission in a challenging world that keeps HEIs competitive for the future.

Acknowledgements

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Six colours for inclusion: results of an explorative activity in a simplicity approach

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Abstract

Schools and teachers are called upon, in the age of complexity, to control a plurality of problems related to the numerous stimuli arising from the personal and environmental influences of students. This implies a new way of working in the direction of creativity, which therefore becomes a teaching tool as well as a human process. This paper presents the results of an exploratory activity, conducted on 657 teachers, as part of the training activities for teaching support to pupils with special educational needs at the University of Salerno. The aim was to investigate whether teachers in training can develop lateral thinking, based on suggestions derived from de Bono's (2015) studies and, specifically, his "Six Hats for Thinking" theory, highlighting points of agreement with the simplicity theory proposed by Berthoz (2011). This represents a different way of using colour to think, act and include.

Keywords: *Inclusion; lateral thinking; divergent thinking; simplicity; creativity.*

1. Introduction

The school, in the age of *complexity*, due to the presence of a plurality of stimuli, of innovations. In this context the teacher must support the students to *decipher* of all the stimuli and problems, as well as search for strategies to deal with them (Sibilio, 2020), trying to find innovative and *non-linear* strategies (Sibilio, 2012; Sibilio & Zollo, 2016), which are on the great line of *creativity* (de Bono, 2015a). In this sense the logic of creative thinking, if declined in educational experiences included in the construction of the teacher's competences, could prove to be an interesting strategy for the resolution of problematic situations.

In this regard, it is possible to find elements of commonality with the scientific reflections of Alain Berthoz, a physiologist of perception and action who, in his theory of simplicity (Berthoz, 2011), hypothesises that the solutions devised by living organisms to decipher and deal with complexity can be considered valid and applicable to the entire class of *adaptive complex systems*. One of the principles of simplicity described by Berthoz is *deviation*, i.e. a rule that attempts to solve the problem, but in an original way, and by using, and experimenting with, a plurality of trajectories, perhaps even unknown ones, to arrive at the resolution of the problem itself. The prerequisite for the use of deviation in education can be identified in the subject's ability to deal with the complexity of problematic situations through the use of *creativity* (Goleman et al., 2017), *divergent thinking* (Guilford, 1950) and *lateral thinking* (de Bono 2015; 2015a), which have shown interesting educational implications and are corroborated by a rich scientific literature. In the present study, we will show precisely the results of an exploratory survey conducted on a sample of 657 students, attending the training courses for the support qualification for Secondary School at the University of Salerno, in order to identify whether in the course of their action they are able to exercise lateral thinking, thus maturing transversally innovative competences for problem solving and for the development of inclusive operational trajectories, using de Bono's (2015) "*Six Hats for Thinking*" as a tool for action, according with Berthoz's (2011) *simplicity detour*.

2. Colours, divergence and inclusion

The first theory on the concept of divergent thinking dates back to the American psychologist Guilford, who open to new solutions and capable of giving rise to a new associative mode of elements to achieve objectives, placing it alongside the convergent thinking that had characterised scientific research up to that time. According to the scholar's perspective, therefore, *convergent thinking* operates within established schemes, tackles the problem with a given method and, through the latter, finds the only possible solution; *divergent thinking*, on the other hand, acting outside the established schemes, allows one to approach the problem with a new approach, arriving at original *solutions* and identifying the creative process with

the typical dynamics of problem solving (Zollo, Kourkoutas & Sibilio, 2015). Creativity is an exclusive characteristic of a few exceptional minds and becomes the hallmark of human thought, the natural expression of the individual's inner self. A further theorist, who made creativity the cornerstone of human action, was de Bono (2015). The Maltese psychologist and physician, in fact, applying creativity to the world of business and linking it to corporate competitiveness, defines it as "*the ability to think and act differently that can be developed in a systematic and deliberate way by anyone willing to put the principles of lateral thinking into practice*" (de Bono, 2015a, p. 28). An application of creativity for the development of problem solving skills. A scholar, through the metaphor of hats, learns how to approach problems by assuming different points of view and proposes six different perspectives from which an idea can be generated. This premise is useful to understand how through the creative and divergent process one can also produce results in the recognition of the other from oneself, in the awareness that the hat worn by the other from oneself represents his personal mode of expression, his value to be recognised, accepted and supported, in a suitably inclusive vision.

Edward de Bono's reflection starts from the way we approach problematic situations, considering in many cases only one point of view and thus reducing the possible solutions. According to the scholar, each way of solving a problematic situation can be compared to a hat that not only defines a certain type of thinking, but also has its own colour (de Bono, 2015); therefore, instead of trying to cover all aspects with thinking, it is possible to separate the various types of thinking and carry them out distinctly. The colour that distinguishes hats (white, black, green, red, blue, yellow) represents a much broader mode of expression; it takes on a symbolic significance. It becomes, in fact, a means of guiding the individual to activate mechanisms of *perception of diversity*, of different ways of facing reality, using colour as an interpretative key, as a tool for accepting the different way of looking at the world, as a different method of valuing diversity, adapting to a thought that is not lateral, but inclusive, respectful of *all* and *each one*. Von Goethe (1970) himself considered colour as the actions of light capable of *expressing passions and actions*. Colour, therefore, is a representation of oneself that only finds meaning in the relationship with the other, in the awareness that with the other the total process of recognition of belonging to a nature is realised. Colour, therefore, expresses the sensitivity of the individual, strong feelings, both positive and negative, capable of providing insight into us and others (Carluccio, 2008). Kandinsky himself in "*The Spiritual of Art*" (1989) explains the semanticity of colour, according to which black is synonymous with despair, meaning and the end, from which other colours unravel, a symbol of *re-birth* and continuation, the beginning of new worlds to explore. Colour, consequently, is an expression of conditions, of experiences, of personal and shared experiences, a means of *re-encountering* and integrating different colours which, in union, in each case give rise to chromatic balance. Declined in the educational field, the exercise of lateral thinking theorised by de Bono would require experiential itineraries for

the construction of the teacher's professional skills, to be carried out through activities that introduce the subject's ability to exercise flexibility and detour in didactic transposition. This finds points of contact with Berthoz's theory of simplicity (2011).

3. Creativity in a simplicity perspective

From the descriptions conducted so far on the concepts of creativity, divergent thinking and lateral thinking, interesting points of reflection emerge on possible didactic declinations of these theories in the perspective of a simplicity didactic, i.e., a teaching method capable of *deciphering* and *coping* with the complexity of training processes and educational contexts. Simplicity starts from the assumption that human organisms can flexibly adapt to problematic situations, using operational *patterns* and *rules* of use. If we want to connect simplicity with lateral thinking and, consequently, creativity, it is possible to identify significant analogies (Guilford, 1967; Goleman et al., 2017). Among the distinctive traits of creative, divergent, lateral thinking as analysed are *flexibility*, *reliability*, and *detour*, identified by Berthoz as properties and rules of simplicity, i.e., simplicity tools and rules that enable deciphering and coping with complexity, including *educational complexity*. *Flexibility* and *reliability* to change are, in fact, configured as simplicity properties of the didactic system and of didactic and inclusive action, which must "*be capable of perceiving, capturing, deciding or acting in many ways (vicariousness) depending on the context, compensating for deficits, coping with new situations*" (Berthoz, 2011, p. 9). These are, therefore, tools that allow one to disentangle oneself from the protean difficulties of the learning experience, seizing precisely from the problematic situation the opportunity to broaden knowledge through action. In a similar vein, de Bono (2016) proposes using thought not to solve individual problems, but to grasp new interpretations of reality.

The search for different adaptive solutions and alternatives to usual situations constitutes, in this sense, the expression of a freedom of choice in the broad repertoire of possible solutions to avoid getting lost in complexity. Berthoz precisely sees this as the rule of simplicity, grafted onto the search for exactly this plurality of original solutions to problems (Zollo, Kourkoutas & Sibilio, 2015). In this sense, further simplicity rules such as *inhibition*, the rule of refusal and the principle of detour appear useful to bring out the potential of creative thinking, which precisely requires the ability to inhibit and reject automatic and immediate solutions, identifying flexible operational strategies that, through ancillary complexity, bring out new modes of didactic action capable of favouring the learning process. Such didactic actions are also suitable for favouring inclusive pathways (Sibilio, 2013; 2015). In the light of these reflections and considering the systemic perspective outlined, the acquisition of *creative thinking skills*, consistently with a simple vision of didactics, could be a valid strategy to promote training interventions aimed at deciphering complexity, favouring effective and inclusive courses of action.

4. Description of an exploratory survey: methodology

4.1. Research question and objective

On the basis of the theoretical premises presented, a research investigation was carried out, initiated on the basis of the question: *Is the teacher, both in training and working at school, able to exercise lateral thinking, which is also important for the maturation of creative thinking and useful for applying it during the teaching phases in order to guide the pupil to the development of problem solving?* The question was therefore posed as an objective to investigate whether teachers in training, in the process of obtaining the qualification to teach support aimed at the Secondary School, are able to recognise creative thinking in themselves, understood as *"the set of attitudes, expressions and techniques that allows one to transversally cut through the schemes of an asymmetrical self-organised system to generate new conceptions and perceptions"* (de Bono, 2015a, p. 201) and are predisposed to use it.

4.2. Participants and instrument

The research, eminently exploratory in nature, was conducted with a sample of 657 students, without a purposive selection, who from September 2022 to July 2023 are following as part of the Enabling Pathways on support for Secondary School at the University of Salerno, characterised by both a general and special pedagogical-methodological-didactic framework (General Didactics, Special Didactics, Special Pedagogy, Methodology and Educational Design). For data collection, a Google form has been prepared, structured in two parts. The first part surveyed the age of the participants and their gender, in order to identify the gender variable with respect to the answers provided. A second section of the questionnaire asked, instead, to self-attribute one of the six hats described by De Bono, on the basis of the characteristics of the hat that seemed more representative.

4.3. Research phases

The activity proposed to the teachers in the four training groups was divided into three phases. In the initial phase of the course, were explained the main studies on creativity and divergent thinking, focusing in detail on Edward de Bono's theories of lateral thinking and presenting the 'Six Hats for Thinking' method as a tool for exercising creative thinking. Subsequently, was illustrated Alain Berthoz's theory of simplicity. The first phase, characterised above all by theoretical reflections on the subject, was followed by a practical-operational moment: the teachers, in fact, already previously involved in group activities of various types, were proposed an exercise aimed at exercising *lateral thinking* and, therefore, *creative thinking*, centred on the declination of the properties and rules of simplicity in general didactics, in disciplinary didactics and in special didactics. In the third phase, after providing the theoretical foundations with regard to creativity, were carried out a series of group training experiences that, through discussion, highlighted the importance of awareness of *diversity*

and perceptual plurality in teaching. Subsequently, teachers were asked, based on Edward de Bono's (2015) "*Six Hats for Thinking*" method, to indicate on a pre-filled table using the integrated *Google Forms* function, the colour of the hat that best described their personal characteristics in the problem-solving phase, specifying, through the indication of the colour, the approach considered prevalent with respect to the others.

5. Data analysis

The analysis of the data, conducted using the method of descriptive statistics, made it possible, first, to detect how the teachers in training within the framework of the Enabling Pathways on support for Secondary School have different perceptions of their own approach to solving problematic situations. Being an experience aimed at understanding the teachers' tendency to use creativity for a lateral approach to *metacognitive* and *inclusive* didactics, to overcome the rigidity of logical models linked to vertical thinking very often used, specific attention was paid to the colour of the hats that fully represent the two types of thinking: *white* (vertical thinking) and *green* (lateral thinking).

6. Results and discussion

Regarding the data about the age of participants, it should be stressed that the 76% of total participants of four groups has an age between 31 and 50 years, versus 24% that has an age between 25 and 30 years. In addition, the data about the gender of participants shows that 82% of participants was female, versus 18% of male gender.

About the data from the first group, it should be noted that the highest prevalence was attributed to the red hat (29%), and the yellow hat (21%). The blue hat also found a good percentage of attribution (18%). The last two hats identified as their own were green (13%) and white (13%). As far as the second group is concerned, a prevalence of the red hat (29%), followed by the blue hat (23%) should also be noted. An almost equal percentage emerges between the yellow (15%) and black (14%) hats. Here too, the white hat (10%) and the green hat (9%) are in the minority in terms of self-attribution compared to the others. As far as the results of the third group are concerned, there was again a prevalence of the red hat (25%), followed by an equal percentage of 17% of yellow and white hats. This was followed by a 17% attribution of blue hats. The lower attribution of the black (14%) and green (12%) hats, representative of lateral thinking, should be highlighted. As far as the last group is concerned, it should be noted that the red hat (31%) is the predominant one, followed by the blue hat (25%). Then comes the white hat (16%), followed in the last positions by the green hat (13%), yellow (10%) and black (5%).

From the analysis of the data, it emerges that the way of acting, reflecting, of the teachers is aimed at a prevalence of *emotions*, the red hat being the prevalent one in all four groups. It also emerges that the vertical thinking hat, i.e. white, does not turn out to be one of those most attributed, a sign that the teachers are attempting a change of course in the way of acting and operating, attempting to overcome a vertical tendency in the way of approaching the problem, highlighting an initial form of *non-linearity* (Sibilio, 2012; Sibilio & Zollo, 2016) through recourse to emotions, to positivity, also experimenting with a possible interconnection of the six hats through organisation, highlighted with the choice of the blue hat. However, the road to be taken so that the green hat, i.e., that of *lateral thinking*, is preponderant, is still uphill, as the teachers do not show, for all four groups, a general tendency to wear such a hat, which is useful for exercising creativity, while also respecting the *detour* from operational standardisation.

It is also to be hoped that black can increase its percentage. The hypothesis of the rejection of the black hat is its association with negativity. In truth, the black hat requires that a person, in each problematic situation, is also able to foresee weaknesses in order to construct suitable paths to intervene and avoid them, even then by resorting to creativity. This kind of aspect is necessary for those who, working in the world of Special Educational Needs, can identify the elements of weakness in the pupil, highlighting their strengths as a tool for building a good inclusive curriculum. In relation to sociodemographic analysis emerged that in the first group it was also highlighted that the female participants had a convergence towards the choice of hats associated with creativity (60%), with a positive outlook on life, while the male participants attributed to themselves hats relating to the sphere of rationality and order (40%). A similar process also occurred in the other groups, where it emerged that 70% of the participants converged towards the red hat, an indication of how the participants see themselves as inclined towards emotion compared to the male participants. The results that emerged for the other two groups were not very dissimilar. From this we denote that there is still a perspective according to which girls are generally associated with emotion, with creative action, while men instead with a more rational and linear action.

7. Conclusions

In the situation of complexity, dynamism and plurality that characterises today's educational contexts, the exercise of *creative thinking* could represent a valid *problem-solving strategy*. The production of new and alternative ideas, the ability to approach problems in an innovative way, *flexibility*, *adaptation to change* and *detour* are not only the peculiar characteristics of *creativity*, but also fit coherently into the perspective of inclusion and in the perspective of a simplified didactics. The results of the training activity carried out with the teachers within the framework of the Enabling Pathways have, however, highlighted, through the research carried out, which was exploratory in nature, a low predisposition on the part of

the teachers to exercise creative thinking and to use *flexibility, adaptation to change and detour* in the teaching field. In the light of this scenario, starting from the awareness of the importance, in teacher training, of *creative thinking*, which, as emerges also from the *Profile of Inclusive Teachers* (2012), allows for the development of effective and flexible strategies, and due to the various cognitive styles of learners, it would be appropriate to work more on creativity (Zollo, Kourkoutas & Sibilio, 2015).

In conclusion, the results presented if, on the one hand, they solicit further and broader studies, on the other hand, they encourage, on the basis of the critical issues that emerged, scientific reflection on the necessary and possible planning of specific training itineraries aimed at the acquisition, by teachers, of didactic detour skills and the identification of flexible and alternative strategies that can be capitalised on in the activity of coping with the educational complexity in the educational environment.

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Cybersecurity education in European higher education institutions

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Abstract

This research paper presents some of the findings of an ongoing Cyber Citizen Initiative project (2022–24), which benchmarked civic cybersecurity education and training in all European Union (EU) member states. The research paper focuses on cybersecurity education in higher education. The study concluded that cybersecurity education varies across the EU. Whereas some countries have dozens of higher education institutes providing education in cybersecurity, some others have only a few institutions and educational programmes for the topic. In general, the educational programmes tend to be specific and focus on technical skills. A wider understanding of cybersecurity as a societal concern, civic cybersecurity skills, and discipline geared cybersecurity competence building may be lacking from the curricula.

Keywords: *Cybersecurity competence; cybersecurity skills; cybersecurity education; higher education; European Union.*

1. Introduction

The overarching digitalization of societies has made the strengthening of cybersecurity competence at all levels of society and across its sectors a priority in many countries. For a longer period, this has meant the build-up of cybersecurity focused educational programmes and curricula in universities and universities of applied sciences, as well as the integration of cybersecurity awareness and skills into basic and secondary education. More recently, the need of teaching civic cybersecurity skills to everyone in society has become emphasized.

This research paper presents some of the findings of an ongoing Cyber Security Initiative project lead by Aalto University, Finland. In its first phase (in 2022), the project benchmarked the 27 European Union (EU) member states regarding the teaching of civic cybersecurity skills. Civic cybersecurity competence is understood as “[t]he knowledge, skills and abilities required to operate in a cyber environment” (Limnell et al., 2023, 2, 142). Everyone living in a digitalised society needs such competence. Data collection was implemented by extensive online research supplemented with interviews, conference and seminar attendance, and a scoping literature review.

This research paper focuses on findings regarding the teaching of cybersecurity skills in formal, higher education in selected member states. The countries in the sample provide a view to cybersecurity education across the union: Finland, Estonia, Germany, France, Romania, Spain, and Greece. Alongside providing geographical coverage, the selected countries rank relatively high in cybersecurity indices and/or host pivotal EU cybersecurity institutions. The research paper asks: How is cybersecurity competence currently built at universities and universities of applied sciences in the selected countries? The study includes both educational programmes in cybersecurity and civic cybersecurity training provided to all students in higher education.

2. Cybersecurity training in higher education in selected EU member states

There is no universally agreed practice of benchmarking (Chen et al., 2020). It can be understood as a process of improvement through adaptation and substitution of a process by another recognized as better (Maire et al., 2008, 765). In the Cyber Citizen Initiative project, benchmarking meant establishing the state of civic cybersecurity education across the EU to find out adoptable practices. This research paper focuses on higher education institutions providing cybersecurity education, the content of educational programmes, and the ways in which national cybersecurity strategies strive to improve cybersecurity education.

2.1. Finland

Finland's goal is to be a country of excellence in cybersecurity. One of its main strategic policies is the “[d]evelopment of cyber security competence – everyday skills and top skills

as cyber security safeguards" (The Security Committee, 2019, 8). National measures to enhance cybersecurity competence include, inter alia, the strengthening of cybersecurity and information security related education at all educational levels (The Security Committee, 2019, 4, 9). Higher education degrees focusing on cybersecurity are offered by both universities and universities of applied sciences. However, topics related to cybersecurity are part of several other higher education degree programmes as well (Limn ell et al., 2023).

Universities of applied sciences provide technical cybersecurity education. In terms of content, this education (eight bachelor's and four master's programmes, as well as specialisation, supplementary, and conversion training) is comprehensive and serves the needs of the industry. (Lehto, 2022, 9, 61-62.) There are three university degree programmes focused on cybersecurity, all master's programmes (provided by the universities of Jyv skyl  and Turku and Aalto University) (Limn ell et al., 2023). In addition, cybersecurity is included in the structure of many degree programmes as optional or compulsory studies and many IT programs offer a possibility to study broader cybersecurity studies. Several free cybersecurity courses are also offered to everyone by the Finnish Institute of Technology (FITech), which is a network university. Its founding members include seven universities and technology industry associations. (Lehto, 2022, 10, 72, 76, 85, 92.)

2.2. Estonia

The promotion of a cyber-literate society is one of the goals in Estonia's cybersecurity strategy. To achieve this goal, the academia must be involved in cooperation with the public sector and companies. Cybersecurity is taught at all educational levels as part of the development of digital skills. Lack of cybersecurity specialists and a small number of new talents in the field are recognised as challenges which must be solved, for example, by including cybersecurity in intensified IT studies. (Republic of Estonia, 2019, 7-8, 15, 17.)

Studying cybersecurity in higher education is possible in two master's programmes. Tallinn University of Technology (Tallinna Tehnik likool, TalTech) runs a master's programme "Cybersecurity" in cooperation with the University of Tartu (Tartu  likool). The students study under high-level cybersecurity practitioners from universities, industry, law enforcement, CERT, and the NATO Cooperative Cyber Defence Centre of Excellence (Taltech, 2023). The international master's programme "Cyberus Erasmus Mundus Master in Cybersecurity" is administered by the University of South Brittany in France (Universit  Bretagne Sud) and TalTech is responsible for a part of the training. Students can specialise either in software cybersecurity or IoT cybersecurity. (Universit  Bretagne Sud, 2023.)

2.3. Germany

According to the German cybersecurity strategy, responsible behaviour in cyberspace and the opportunities and risks brought by internet are an essential part of digital citizenship

skills. Therefore, digital education must be integrated into the country's entire education system. (BMI, 2016, 10.) The organization of and decision-making in the school system are delegated to the education ministries of the 16 states. Thus, each state has different regulations regarding the curriculum, the provision of study subjects and degrees, and the transition between school forms. The federal government's goal is that by graduation young people have sufficient knowledge and skills related to IT security. The aim is to increase and to expand course offerings in IT by establishing more study places at universities and supporting leading institutions, especially in computer science (BMI, 2016, 10).

IT studies are offered in almost all universities, which also include comprehensive information and cybersecurity study units. For example, University of Saarland provides a master's degree in cybersecurity, which offers students an opportunity to deepen their cybersecurity knowledge comprehensively and choose a specialization in the areas of cryptography, privacy, software security, systems and networks, formal methods, or legal aspects of cybersecurity (Universität Des Saarlandes, n/d). The Cybersecurity Higher Education Database (CyberHEAD) by the European Union Agency for Cybersecurity (ENISA) lists altogether five bachelor's and master's degrees related to cybersecurity.

2.4. France

The French white paper on defence and national security (2013) already highlighted the influence of increasing the number of trained information and cybersecurity experts on national security. In addition, it was to be ensured that information and cybersecurity were integrated into higher education in computer science, with the aim of preventing vulnerabilities in information systems and promoting vigilance and response against cyber threats (Poupard, 2016). To achieve these goals, The Agence nationale de la sécurité des systèmes d'information (ANSSI) created the CyberEdu programme, which purpose is to provide resources for cybersecurity training. This activity led to the creation of the CyberEdu association to develop and maintain the original programme and to grant approval to courses. In autumn 2019, CyberEdu published 78 certified training courses (Poupard, 2016).

The national cybersecurity strategy (2015) also highlights the importance of digital security as part of higher education. Higher education institutions should have a training unit dedicated to digital security. Contemporarily, French universities offer several programmes focused on digital and cybersecurity, such as MSc in Cybersecurity (CySec), MSc in Computer Science in Computer Security, and Master in Data & Security Science. According the CyberHEAD database (2023), France is offering 11 different master's degrees and postgraduate courses related to cybersecurity.

2.5. Romania

The Romanian cybersecurity strategy (2021) defines goals and identifies components that are relevant for the functionality of digital services and their safe utilization. The aim is to create a necessary framework for the future development of state administration, the business environment, the national economy, and the education and research sector. The government is investing in the development of education technology as part of the implementation of the Digital Education Action Plan of the European Commission for 2021–27. It has allocated resources for the improvement of digital pedagogical skills, educational resources, and physical and other resources. (Directoratul National de Securitate Cibernetica, n/d.)

In an EU funded Cyber_Education project, Romania's nine largest universities were invited to create common and modern curricula for cybersecurity and educational laboratories. The project was launched by the Bucharest University of Economics, which specialises in training cybersecurity experts. There are 54 public and 35 private universities. Universities specialising in cybersecurity education are Technical University of Cluj-Napoca (n/d) teaching Information and Computing System Security and University Politehnica of Bukharest (n/d) teaching Coding and Storage Theory of Information Master.

2.6. Spain

Spain emphasizes the importance of national cybersecurity culture, which is one of the five main goals and materialized in two of the seven lines of action in Spain's National Cybersecurity Strategy (2019). Cooperation between public and private organizations and the media should be encouraged and strengthen human and technological skills promoting appropriate professional skills. Line of action 5 boosts research, development, and innovation support in digital and cybersecurity programmes, including universities and research centres. It also identifies needs for professional skills in cybersecurity and fostering collaboration between educational and training institutions by enhancing such elements as continuous training and university education. It also pays attention to identifying, encouraging, and retaining cybersecurity talents. Line of action 7 develops cybersecurity culture, such as digital literacy and quality and truthfulness of information. In schools, raising awareness and cybersecurity training are adapted to all levels, fields, and subjects. (Gobierno de España, 2019, 38, 52-53, 56-57).

According to ENISA's CyberHEAD database (2023), cybersecurity is taught in 23 different higher education programmes (one bachelor's programme, while the rest are master's programmes). Spanish National Cybersecurity Institute INCIBE (2021) has listed 168 institutions that provide training in cybersecurity of which 49 are universities. As examples, Barcelona's Ramon Llull University's (2023) Master in Cybersecurity on-site study syllabus includes subjects such as ethical hacking, security analysis, and cyber intelligence. Mondragon University provides a master's degree in data analysis, cybersecurity, and cloud

computing. The studies include ethical hacking, internships in companies, and cybersecurity management. (Mondragon Unibertsitatea, 2018.)

2.7. Greece

Of the five strategic goals in Greece's cybersecurity strategy two (goals 4 and 5) address the ambitions for higher education. For instance, the state will offer support to research and development at the academic level. Such supportive actions include, for example, the reform of curricula to cover more cybersecurity issues and enhanced collaboration between academic and research institutions. One of the main flagship activities is the development of an Education and Awareness Action Plan, which will include an analysis of the current situation and an outline of targeted actions and activities for academic institutions. In relation to academic education, emphasis is given on the preparation of future cybersecurity executives. Suitable undergraduate and postgraduate study programmes are developed, and student attendance is incentivised. (National Cybersecurity Authority, 2020, 63-69.)

Several state universities and private colleges offer studies in cybersecurity. There are 24 universities which are all accredited by the state. Only education given at universities is considered higher education. (Study in Greece, 2023.) The CyberHEAD database lists four universities and five master's programmes (ENISA, 2023). For example, the International Hellenic University offers a master's degree in Cybersecurity, which main topics are digital forensics, intrusion detection and network security, and security audit and compliance (International Hellenic University, n/d). The University of the Aegean has a master's programme in Information and Communication Systems Security. Courses include network security, database security, cryptography, privacy, cybersecurity, and forensics. (University of the Aegean, 2022.)

3. Concluding remarks

Cybersecurity education varies significantly between the EU member states (for the full qualitative and quantitative benchmarking, see Limnéll et al., 2023). Whereas countries like Spain have dozens of higher education institutes teaching cybersecurity, others like Estonia have only a few institutions and educational programmes for the topic. The numbers ought to be contextualised, for example, with the size of the population and hence the estimated national need for expertise. In general, the educational programmes tend to be specific and focus on technical skills. A wider understanding of cybersecurity as a societal concern, civic cybersecurity skills, and discipline geared cybersecurity competence building may be lacking, even if some countries have also integrated these perspectives into curricula. Thus, the educational breadth and depth are to be considered as well. For strengthening civic cybersecurity competence, however, higher education is only a part of the puzzle. Alongside experts, a skilled general population is needed to support secured digitalisation of society.

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The impact of digital platforms enhancement on global virtual teams' engagement across selected business schools

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Abstract

This research explores the effect of the utilization and improvement of digital platforms in teaching and learning, through a global virtual project that involves business schools from five nations. The study concentrates on how technology used in the education process at various business schools has impacted the engagement of undergraduate and graduate students in global virtual team work during the post-COVID period. Additionally, the paper examines how the formations of global virtual teams of students has increased significantly their motivation in the subjects such as international business, strategic management and cross-cultural management. The study is based on a blended learning international collaboration project involving 114 students participating in global virtual collaboration through various digital platforms in International Management and International Business classes. The results demonstrate that through computer-supported collaborative learning, students from all participating business schools were highly committed and motivated in carrying out their assignments. The paper demonstrates that the integration and use of digital platforms in both face-to-face and online classes in International Business and International Management within this virtual collaboration has offered students new knowledge and sustained their motivation throughout the project.

Keywords: *Global virtual teams; business schools; engagement.*

1. Introduction

The ongoing global pandemic has brought about numerous changes in education, particularly in higher education, where the integration of latest technologies has accelerated. At the same time, students have altered their expectations of colleges and universities as new global and regional trends have become the norm (Arora et al., 2020). Experiential learning has become prevalent in business schools, with classes in international business and international management being enhanced through global virtual teams, allowing students and instructors to collaborate with counterparts globally, regardless of geographical barriers (Fayed et al., 2021). The prevalence of digital platforms has also emerged thanks to exponential advancements and the COVID era, significantly altering classrooms globally by incorporating the latest technologies to manage this digital transformation (Velez-Calle et al., 2020).

The main objective of this paper is to highlight the rapidly growing impact of digital platforms on students' commitment in international business and international management courses. The research covers five countries and five different business schools, including both undergraduate and graduate students who collaborated virtually. The paper focuses on determining the factors that motivate these five international business school students to engage in virtual cooperation in the fields of international management, strategic management, and cross-cultural management.

The experiential learning referred to in the paper involves two main projects: X-Culture and BLIC (Blended Learning International Cooperation). The BLIC project was established in 2014 by the Baden-Wuerttemberg Cooperative State University (Duelle Hochschule) in Germany. The aim of the BLIC project is to engage undergraduate and graduate students in developing a business strategy to internationalize German companies by entering emerging and advanced foreign markets. The BLIC concept aligns with a program established by the German Ministry of Foreign Affairs to promote competitiveness, digitalization, and internationalization of small and medium-sized German companies. Thus, Duelle Hochschule Baden-Wuerttemberg (DHBW) established BLIC as an international project, intensifying its international cooperation with international partner business schools through a program promoting global virtual collaboration, taught at both the undergraduate and graduate levels.

The BLIC program, has expanded to six countries across three continents, attracting students from the US, South Africa, Iceland, the UK, the Czech Republic, and Estonia. The program focuses on global virtual collaboration, where students act as managers and management consultants and conduct cross-cultural studies and business strategy analyses for German small- and medium-sized enterprises (SMEs). The program is an innovative teaching method in international business classes, as it provides students with opportunities to improve their

intercultural, language, technical, management and working skills. Business schools globally are incorporating new approaches in their curriculum, such as virtual projects with partner universities, to provide better preparation for their students and to foster international experience. The paper's research questions focus on the impact of experiential learning and the introduction of digital technologies on the motivation of bachelor and master students to participate in virtual global teams from different business schools. The use of digital learning platforms allows scholars to receive constant feedback from students and gather detailed data on their engagement in global virtual collaboration.

2. Literature Review

2.1. Digital Platforms impact on Global Virtual Teams

In recent years, the use of digital platforms in teaching international business courses has become increasingly popular. Adopting supportive technologies to facilitate learning has become a widespread practice in higher education. The integration of online and blended learning platforms into international business courses has greatly impacted and improved education systems (Erpenbeck et al., 2015; Northey et al., 2015; Nortvig et al., 2018; K. Smith & Hill, 2018). The use of innovative technology in higher education creates a future-focused teaching and learning environment across business schools (Becker et al., 2018). According to a meta-analysis by Chen et al. (2018), computer-supported collaborative learning (CSCL) has resulted in a positive impact on knowledge acquisition, skill development, and student perception (as shown in Table 1). During the pandemic crisis, the rapid development of technology-assisted learning and teaching accelerated as education providers sought to maintain their programs (MMB Institut, 2021; Wipper & Schulz, 2021). The pandemic served as a catalyst in transforming traditional, factory-model education into a student-centered approach that prioritizes individualized lifelong learning. In this context, professionalizing learning involves leveraging technology to enhance it (Hattula et al., 2021; Horn & Staker, 2017).

Nortvig et al. (2018) conducted a review of literature on e-learning and blended learning and found that a common approach is to define online learning as the opposite of face-to-face learning (Ryan et al. 2016). Online learning is described as being flexible in terms of time, place, and pace, and is facilitated by web-based technologies that replace traditional brick-and-mortar classrooms (Bernard et al., 2014; Chigeza & Halbert, 2014; Israel, 2015; Northey et al., 2015; Potter, 2015). Pellas and Kazanidis (2015) highlight the use of learning management systems (LMS) and virtual learning environments in online learning environments. Virtual learning environment is characterized by involving the students in face-to-face, blended learning modules or courses by using various digital platforms such as MS Teams, Moodle, Canvas and others. The online learning environment consists of entirely

online mode teaching and learning, which prevailed during global pandemic across the business schools.

A technology-rich learning environment supports the underlying pedagogical approach. In online learning settings, instructors have the opportunity to provide feedback and guidance to facilitate learning outside the classroom. By combining traditional teaching methods with technology-assisted methods, the learning environment can be enriched and both approaches can benefit from each other. Under certain conditions, blended learning can be more effective than online or face-to-face learning alone (Pellas and Kazanidis, 2015; González-Gómez et al., 2016). In the BLIC program, students collaborate in virtual global teams and experience realistic scenarios such as client-consultant relationships. This student-centered approach prepares them for the global workplace and a blended learning approach was deemed the most appropriate teaching method (Velinov, Bleicher, & Forrester, 2021). In the student-centered approach, the focus is on the students, as they are working as managers or consultants and they have to perform their tasks either in teams or individually. Thus, it requires from them to learn constantly and to communicate explicitly and clearly with their counterparts globally.

Despite the growing interest in blended learning, research in this area is still in its early stages (Smith, 2018). Smith (2018) describes blended learning research as practical, specific, and focused on outcomes. Despite the widespread dissemination of blended learning concepts in recent decades, it is still considered a specialized rather than a general phenomenon. According to Smith and Hill (2018), there is no standard understanding of blended learning, and a joint conceptual framework is needed. However, they highlight meaningful commonalities in definitions that emphasize the combination of online and face-to-face learning (Graham, 2006; Garrison and Kanuka, 2004; Allen and Seaman, 2014). Different definitions highlight different distributions of online and face-to-face teaching, but all acknowledge the integration of virtual, technology-enabled communication with the interventions of humans (Eaton, 2020; Graham, 2009; Le Rossignol, 2009; Nortvig et al., 2018).

3. Methodology

This study collected data from 114 students from five business schools in Germany, UK, US, Iceland, the Czech Republic, and Estonia who were enrolled in business and management programs. The data was collected through an online questionnaire by applying Likert scale and they were distributed via Google Forms and analyzed to determine the impact of digital platforms and teaching innovations on student engagement in GVTs. The study also compares the students' perceptions of the effectiveness of digital platforms and teaching approaches before and during the pandemic period (2017 and 2022).

The paper evaluates the effect of utilizing modern digital platforms in teaching and learning in a select group of business schools on student engagement in Global Virtual Teams (GVTs) as part of the BLIC and X-Culture programs. These programs take place each semester in the same five business schools and offer students an opportunity to participate in experiential learning cycles. These experiential learning cycles represent learning cohorts, which is either module or entire course on international business, strategic management or cross-cultural management stretched out from one month to four months. The BLIC program is smaller in scale, with a focus on global virtual teams made up of bachelor and master male and female students in the age of 18-25 years old who serve as managers and consultants, conducting cross-cultural and market analyses. On the other hand, the X-Culture program is larger and includes a wider range of project activities.

In the field of business education, courses in International Management and International Business are widely taught at universities and business schools worldwide. These courses are taught not just in English but also in local languages. Students in these courses are given a variety of tasks, such as individual assignments, group presentations, written assignments, peer reviews, critical thinking essays, and other deliverables, which help them develop their analytical and team-working skills, as well as their entrepreneurial skills. The universities are putting significant effort into internationalizing their curricula, which is a trend that is seen across business schools and universities worldwide. Students connect with their foreign counterparts mainly through virtual means, such as Skype, Facetime, WhatsApp, Viber, and WeChat, in their Global Virtual Teams and group assignments. The majority of students involved in the BLIC project rely on digital platforms for communication and also use WhatsApp group chats and search engines such as Google for information (see Table 1 and 2).

The paper uses previous research by Chen et al. (2018) on the effects of computer-supported collaborative learning (CSCL) on students' perceptions as its methodology. However, this study stands out as it focuses on the impact of the global pandemic on the implementation of global virtual teams (GVTs) where students from universities worldwide collaborate remotely. Three key aspects are emphasized in the definition of blended learning: the students have a degree of flexibility in terms of time, place, path and pace; this flexibility is combined with the need for in-person learning under supervision; and finally, the authors highlight the importance of a cohesive learning experience. The design of a blended learning course in International Business must be such that content is taught both online and in person and that the teaching methods complement each other seamlessly.

4. Results

Tables 1 and 2 below explain what is the students' perception on BLIC and X-Culture projects and different factors have been evaluated by using the Likert scale. These factors include utilization and intensity of using digital platforms by students for conducting their tasks in GVTs. Also, it is evaluated students' perception on their communication with other students and teachers by the usage of wide varieties of digital platforms and communication channels. Both tables represent consolidated data from all business schools within the field research. The research findings indicate that students have a positive view of their experiences in the BLIC and X-Culture projects. During the nationwide shutdowns in 2022, the students were required to stay at home, but the adoption and use of digital platforms and online learning were critical for them to stay connected with their team members and complete their assignments. The students reported satisfaction with their team's performance and the support they received from lecturers and team coaches through the search engines such as Google, Bing and others reaching at the value of 6,289 out of 7 (see Table 1). The lecturers were also evaluated highly by the participants, and the communication via community or conference technologies was ranked high, indicating a strong level of interaction between students and lecturers reaching at the value of 4,596 out of 7 (see Table 2).

Student interest in the X-Culture and BLIC projects was fluctuating throughout the academic year, due to their busy schedules with jobs and multiple group assignments in each subject. The students also expressed fear about working virtually with peers from other countries, as it required them to do extra work, such as reading online information and maintaining virtual contacts. However, students' motivation to work in GVTs remained high, as they value the communication with the teachers and students counterparts abroad by using available icloud digital platforms, which enable the students to perform their tasks and assignments efficiently (see the value of 4,026 on the cloud-based groupware for collaborative work).

5. Discussion

The paper describes how GVTs are a recent trend in International Management and International Management courses at business schools and these courses are appealing to students. The universities have been participating in the BLIC program since 2017 and all students in the study sample worked virtually with their peers from bachelor and master programs. The majority of Czech students had good English language skills, allowing them to communicate and collaborate effectively with their international counterparts. Around 15-20% of the 40 students per semester were international, with the majority being Russian-speaking students who had proficiency in both English and Czech.

When it comes to students' reluctance to work in GVTs, the main causes are fear of communicating outside of their comfort zone, low knowledge of foreign cultures and work habits, limited time to dedicate to GVT work, and most commonly, discomfort speaking in English. Many of the students who participated in GVTs also had student jobs alongside their studies and found it challenging to balance both. The students felt that the GVTs took up too much of their time, and often asked their international management instructors if the X-Culture or BLIC projects were mandatory or optional. The Czech students in particular had low self-esteem when it came to GVT tasks and assignments and were not eager to collaborate with non-Czech students.

Table 1. Usage of digital media and technologies by the students within BLIC and X-Culture Programs.

	N	Min	Max	Means	Std.Dev.
Utilization intensity of technologies and tools: 1. Online libraries from the university	114	1.000	7.000	3.149	1.915
Utilization intensity of technologies and tools: 2. Internet search engines (e.g. Google, Bing)	114	2.000	7.000	6.289	1.239
Utilization intensity of technologies and tools: 3. Social media portals (e.g. Facebook)	114	1.000	7.000	3.096	1.914
Utilization intensity of technologies and tools: 4. Video channels (e.g. YouTube videos from experts)	114	1.000	7.000	3.763	1.859
Utilization intensity of technologies and tools: 5 Community/ Conference technologies (e.g. Zoom, MS Teams, Skype, WebEx, etc.)	114	1.000	7.000	5.035	1.982
Utilization intensity of technologies and tools: 6. Cloud-based services (e.g. Google Drive, DropBox, OneDrive)	114	1.000	7.000	4.026	2.216
Utilization intensity of technologies and tools: 7. WeChat, Whats App, Viber App, etc.	114	1.000	7.000	5.272	1.859
Utilization intensity of technologies and tools: 8. Learning portals from the university (e.g. Moodle, Canvas, Blackboard)	114	1.000	7.000	3.430	2.069

Source: Own elaboration *1=Not at all or very low utilization intensity, 7=Very high utilization intensity.

Table 2. Digital tools for communication and interaction between students and teachers within BLIC and X-Culture projects.

	N	Min	Max	Means	Std.Dev.
Utilization intensity of technologies and tools: 1. Online libraries from the university	114	1.000	7.000	4.105	2.212
Utilization intensity of technologies and tools: 2. Internet search engines (e.g.Google, Bing)	114	1.000	7.000	4.596	1.999
Utilization intensity of technologies and tools: 3.Social media portals (e.g.Facebook)	114	1.000	7.000	2.026	1.747
Utilization intensity of technologies and tools: 4.Video channels (e.g.YouTube videos from experts)	114	1.000	7.000	2.772	1.896
Utilization intensity of technologies and tools: 5 Community/ Conference technologies (e.g.Zoom,MS Teams,Skype,WebEx,etc.)	114	1.000	7.000	4.982	1.886
Utilization intensity of technologies and tools: 6.Cloud-based services (e.g.GoogleDrive,DropBox,OneDrive)	114	1.000	7.000	3.018	2.428
Utilization intensity of technologies and tools: 7.WeChat,Whats App, Viber App,etc.	114	1.000	7.000	4.877	2.108
Utilization intensity of technologies and tools: 8.Learning portals from the university (e.g.Moodle,Canvas,Blackboard)	114	1.000	7.000	1.772	1.482

Source: Own elaboration *1=Not at all or very low utilization intensity, 7=Very high utilization intensity.

International Management and International Business courses, particularly when it comes to Global Virtual Teams, can be demanding for students. They need to adjust to a large amount of instructions, establish contact with their team members from around the world, and maintain virtual cooperation for at least one semester. The challenges faced by global virtual teams extend beyond pedagogical practices and require lecturers and tutors to understand the broader context of students' readiness to cooperate and how it is influenced by online communication (Johnson, 2013). Furthermore, the implications of cultural values and

practices on student aversion to cross-cultural teamwork, as well as the role of trust-building in virtual teams, need to be analyzed in order to help students achieve a committed performance in virtual teams and networks (Hakanen, M., Kossou, L., & Takala, T., 2016).

6. Conclusion

The focus of this article is the impact of experiential learning in global virtual teams (GVTs) on student motivation, as seen through the lens of the BLIC project. The authors believe that incorporating international business education into hands-on, adjustable, and experimental learning will bring more value to universities. Despite its small size and focus on partnership and agile testing, the BLIC project has been successful in motivating students by providing opportunities to develop business skills, strategic thinking, and communication abilities in hybrid learning environments. Both the BLIC and X-Culture projects have positively impacted student motivation by providing hands-on experience and international business knowledge.

This paper has both academic and theoretical implications. From an academic perspective, the authors found that experiential learning through GVTs has increased motivation among students at the selected business schools, largely due to the use of various digital platforms. The theoretical aspect of the paper highlights the role of digital platforms and virtual interaction in GVTs and experiential learning. The findings suggest that virtual collaboration enhances learners' mindset, digital inclusion, and motivation. To maximize the benefits of virtual collaboration, students were encouraged to document their learnings through a structured reflective report. The future development of GVTs is crucial in shaping high-quality international business courses and keeping students motivated to participate and contribute in class.

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Evaluating the impact of strategies on students' perceptions of digital transformation – a case study of a Swedish higher education institution

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Abstract

Digital transformation (DT) in Higher Education Institutions (HEIs) affects the learning environment with digitally-enhanced teaching methods, student assistance, and administration processes. HEIs develop strategies to exploit the chances offered by DT. Our study investigates the connection between the strategic work of HEIs on DT and how students perceive the results of this work in their daily studies. We applied a case study design on a Swedish HEI to gather our results. Results show that students are somewhat positive about the strategic work but still perceive digitalization as a barrier to collaborating with peers and lecturers. Our research contributes to knowing if the time and effort spent on an HEI's DT impact the student stakeholder group. By bringing forth ways of improvement, we generate new knowledge about DT processes in HEIs. Thus, we inspire educators and administrators in this industry by putting forward lessons learned and improvements.

Keywords: Higher education; digital transformation; strategy; students' perception; case study.

1. Introduction

In Higher Education Institutions (HEIs), digital transformation (DT) affects the learning environment with digitally-enhanced teaching methods, student assistance, and administration processes (Reid, 2014). DT relates to integrating technology in all areas within an organization, thereby transforming its operations to deliver better service (Weerawardane, 2021). To succeed on a journey to a digitally mature organization, a roadmap pushed by a digital strategy is needed (Gobble, 2018). HEIs have specific strategies, resources, and support mechanisms related to their DT. Students are an essential stakeholder group directly affected by strategies and resources. It is of utmost importance for HEIs to know how their students perceive the progress of their DT journey. Thus, our research questions are: To what extent are strategic documents and students' perceptions regarding DT related to each other? What should HEIs focus on to improve students' perception of DT?

We choose a case study approach to investigate how Malmö University (MaU) in Sweden works with its DT and how its students perceive it. In terms of the number of students, MaU is among the ten largest universities in Sweden. MaU is actively working towards developing digital competencies in staff, as well as promoting flexible learning environments for students through blended learning (Malmö universitet, 2022). Especially the faculties of Teaching and Technology drive research on digital learning. These factors contributed to the choice of Malmö University as an adequate case.

The following presents a background section on DT in higher education (HE). After, we inform about the case study design. The result section presents aspects of policy documents combined with findings from survey data. Within the discussion, we will enhance results with the current literature and suggest areas of improvement before concluding our paper.

2. Theoretical background

Besides learning and teaching, several other dimensions need to be considered in DT, such as administrative tasks, human resourcing, marketing, and DT governance (Benavides, Tamayo Arias, Arango Serna, Branch Bedoya, & Burgos, 2020). DT is a highly complex process. Hence, it is essential to look at the process holistically and place the different stakeholders at the center of it (Benavides et al., 2020). Many different elements depend on each other, e.g., managers, government, faculty, digital platforms, information systems, teacher training units, teachers, and students (Benavides et al., 2020). DT might shift the roles of teachers and students, as pedagogical concepts such as flipped classrooms are easier to pursue with digital technologies. DT enables autonomous, flexible learning concepts and enhances collaboration (Benavides et al., 2020). The DT affects all the different procedures and services. Hence, HEIs require a complete institutional strategy (Gobble, 2018).

Leaders of HEIs have identified four superior goals connected to DT: (1) improving students' learning environment, (2) increasing operational efficiency, (3) stimulating innovation in education, and (4) increasing computing power for cutting-edge research (Alenezi, 2021). These goals imply the importance of integrating digital tools into existing systems to rethink the concept of HEIs. However, DT has mostly been seen as a support for the existing learning and teaching environment instead of contributing to a greater disruptive change (Alenezi, 2021). Similarly, some scholars suggest that students' digital competence should be promoted by using digital tools early in all courses (Gulliksen, 2017). In doing so, HEIs help meet future societal demands for advanced digital skills in the population (Gulliksen, 2017).

The Swedish Higher Education Authority suggested the creation of a national strategy for digitalization in HE (Universitetskanslersämbetet, 2022). While today there is no nationally DT strategy for HEIs, local alternatives can be found in universities' guiding documents. Regularly, these documents focus on digital and/or blended learning. Other aspects of DT were seemingly not included (Ljungqvist, 2018). Goals in the documents do not always coincide with teachers' experiences. A comparison of Swedish university teachers' experiences with universities' documents regarding digital teaching identified discrepancies. Often, the documents anticipate digital teaching to be efficient and time-saving. Instead, the teachers' experiences indicate an increased workload (Ljungqvist, 2018). Teachers' and students' experiences of digitalization at Gothenburg University show that the Covid-19 pandemic boosted the use of digital teaching tools. Even if digital teaching existed, it was seldom used before (Wackenhut & Gillette, 2022). The pandemic has removed many constraints. The future will show how future guiding documents will be influenced by the learnings of enforced digitalization during the pandemic. A DT strategy cannot encompass wordings in a document. Organizations must perform strategically by strategizing, having a strategy, and being strategic (Gulbrandsen & Just, 2020). Words, resources, and stakeholders are essential to consider when an organization's strategic efforts are to be reviewed.

3. Method

We investigated MaU's DT process in 2021 by using a case study design. According to Yin (2013), case studies are performed in five distinguished steps: (1) *Plan* by identifying why a case study is preferable; (2) *Design* by defining the units to study; (3) *Prepare* by screening potential cases, (4) *Collect* evidence through data sources; and (5) *Analyze* by identifying patterns and developing an analytical framework. As our topic is complex and needs a holistic observation by understanding a real-world case in an authentic context, we deem a case study to be an appropriate approach (step 1). The units being studied (step 2) are MaU's policies - as an expression of its strategic DT work - and the perceptions of MaU's students regarding its DT. This study can be seen as a single case study preparing for further research (step 3) and informed suggestions for MaU. For a case study, it is expected that different materials,

such as documents and interviews, must be collected (Creswell & Poth, 2017). We collected several documents (step 4) containing Malmö University's DT strategies and resources, such as the official document "Strategy 2022" (Malmö University Board of Governors, 2017), which contains the university's goals and visions between 2018 and 2022. Additionally, we examined strategy documents before 2018 to follow up on its transformation (Lindquist, 2017). We inspected its organizational structures. Regarding the student's perceptions of the university's DT, we have used data collected from a survey conducted in 2021 with participants of semesters two and five from Malmö University within the study program Bachelor in Media Technology (Packmohr & Brink, 2022). In total, 156 students participated. Participants had to rate 30 DT-related items on a five-point Likert scale (Vogelsang, Brink, & Packmohr, 2020). From the survey items, we have selected 13 as they reflect on the strategy documents. We analyzed different materials (step 5) to learn how the documents influence the university's operations and affect the students' perceptions. We use analytical generalization to reject, modify, corroborate, or advance existing theories (Yin, 2013).

4. Results

MaU's strategy document from 2018 to 2022 (Malmö University Board of Governors, 2017) stated that the primary stakeholders were staff and students. Relations to digitalization are found in the focus areas of *identity and role in society* and the *university environment*. Within these areas, the strategy states specific goals such as *digital competence and offers*. MaU wants to generate quality in education and research by making the best of digital improvements. Further goals regarding *developing the digital work and learning environment to meet present and future requirements for digital skills* can be found. The document states that the university will *use the potential of digital technologies*. MaU possesses several *Advisory Boards* besides its faculties. One of them is the *Advisory Board for Digitalisation*. Its mission is to manage the work of digitalization and point out directions to achieve the vision of being at the forefront of digital technology in education, research, and operational support (Malmö Universitet, 2023). The *Board for Digitalisation* advises the vice-chancellor and the University Board. The chairman of the advisory board is the dean of the Faculty of Technology. Representatives from different departments are part of the board. The Advisory Board of Digitalisation interprets digitalization as more than mere integration of different tools. Instead, digitalization is a cultural change. The application of digital technologies facilitates work and enables new initiatives in the academic environment (Malmö Universitet, 2023). Other contributions have been made, such as appointing a university-wide digitalization officer or other activities organized by the Center for Teaching and Learning, such as workshops, implementation of digital exams, or courses such as *Collaborative learning in digital learning environments*. In September 2020, the university launched the so-called Digihub, where students and staff members can borrow digital equipment. Students

can connect to other students as digital mentors to get help with online studies, mainly regarding tools such as dlp and collaborative tools, and content production. Digihub is gathering different resources and offers in the same place, such as media production, IT support, mentors, and pedagogical support. Since 2018, MaU has used Canvas as its digital learning platform, which provides a rather open structure. There are many possibilities for designing a course in terms of using dlp tools and layouts. MaU offers courses on using Canvas for staff and students via the platform itself (Malmö Universitet, 2023).

Table 1. Survey results.

(#) Item in keywords	Agree	Rather agree	Neither nor	Rather disagree	Disagree
(1) necessary technical means to use digital course offerings	64,7%	21,2%	9,0%	4,5%	0,6%
(2) university moving forward in terms of DT	24,4%	42,3%	23,7%	9,0%	0,6%
(3) sufficiently trained in the use of the dlp	9,6%	20,5%	24,4%	26,9%	18,6%
(4) digital teaching has negative effects on collaboration with peers	34,6%	30,8%	11,5%	16,7%	6,4%
(5) difficulties in motivating to participate in digital courses	20,5%	26,9%	10,3%	22,4%	19,9%
(6) not enough resources for digital teaching	9,6%	19,9%	32,1%	23,7%	14,7%
(7) lecturers have IT skills to handle dlp	14,7%	24,4%	24,4%	26,9%	9,6%
(8) university offers digital services, which support my studies	25,6%	41,0%	21,2%	9,6%	2,6%
(9) digital teaching worsens exchange with lectures	35,3%	32,1%	15,4%	12,8%	3,8%
(10) University has clear vision/DT strategy	5,8%	24,4%	45,5%	17,9%	5,8%
(11) University management supports DT	19,2%	35,9%	39,7%	3,2%	0,6%
(12) learning culture at university has not changed due to DT	7,7%	21,2%	32,1%	26,3%	12,2%
(13) university strives to constantly improve to transform digitally.	10,9%	40,4%	34,6%	12,2%	1,3%

From a larger survey (Packmohr & Brink, 2022), we selected 13 items related to MaU's DT work. For an exploration of the data, table 1 represents the frequencies of the possible degrees of agreement/disagreement. Students are confident that they possess the necessary technical means (1). On the contrary, students perceive rather insufficient training on the dlp (3).

Collaboration through digital channels with fellow students (4) and lecturers (9) is perceived as negative. In comparison, perceptions of problems in motivation (5) are fairly evenly distributed. Regarding resources (6), students tend to have a slightly positive perception. A balanced perception is visible regarding lecturers' skills (7). With MaU's strategy (10), there is a tendency toward the middle. Additionally, the engagement of the top management (11) is perceived as positive. Regarding the learning culture (12), there is a tendency toward the middle. On a positive note, students perceive MaU as open to improvements within DT (13).

5. Discussion

Considering the wording regarding DT within MaU's strategic documents, there is a high overlap with definitions from the field (Reid, 2014). MaU wants to use DT to affect the university's culture, which students do not entirely perceive as changed yet. One part of a changed learning culture is a digital-nomad pattern (Nurhas, Aditya, Jacob, & Pawlowski, 2022), which offers students the opportunity to study and gain other experiences simultaneously. MaU might more explicitly communicate such opportunities to students. MaU's Advisory Board of Digitalisation comprises representatives from several departments, which ensures a broad administrative perspective. However, neither students nor teachers are included. Scholars highlight the importance of having all stakeholders involved (Benavides et al., 2020). Monitoring of the two stakeholder groups within the core operations seems to be imperative. Students find digital courses challenging regarding collaborations with peers and motivating themselves, despite MAU offering the course *Collaborative learning in digital learning environments* for teachers. A solution is to enable more interpersonal exchange and counseling (Draxler-Weber, Packmohr, & Brink, 2022). Instead of setting up a top-down solution, co-design methods with the intended users as an active part of the design process (Sanders & Stappers, 2008) could be a way to address these challenges. The students perceive MaU as at the forefront of its digitalization. It seems MaU's efforts on DT are paying off. Most students judge MaU's digital services to support students during their studies as positive. This might be connected to the visibility of DigiHub, which is available for guidance. Looking at DigiHub, a recommendation could be an even stronger connection to the universities core operations. Practically, DigiHub's personnel could become part of courses. The students give scattered answers regarding teachers' knowledge of working with the digital platform. One reason might be that Canvas' open structure enables a great degree of freedom in how courses can be designed and executed. This might lead to the widespread perception of teachers' competencies but might also relate to the dilemma between standardization and adaptation (Aili & Bjarnason, 2020). Another problem is the time lecturers need to adapt to digital teaching (Universitetskanslersämbetet, 2022). Even if courses and guides are available, developing competencies takes time, especially in faculties that are less prone to technical and/or pedagogical education. The dilemma of standardization

and adaptation might also reflect on the answers regarding sufficient training. As there is no objective standard on the dlp, students need to be trained for adaptability. It seems the university is giving the students the impression that it continuously improves on its digitalization. Still, the Covid-19 pandemic might have triggered many changes, which students perceive as an effort of the university (Boström, Collén, Damber, & Gidlund, 2021).

6. Limitations and Conclusions

To analyze efforts on a strategic level, our study connected a university's strategy documents to its students' perceptions. In general, the perception of students is positive. Regarding collaborations and motivation, we found more negative perceptions. Thus, recommendations are to include stakeholders more in the DT process. Even if a single case is examined, a case study should draw general conclusions (Yin, 2013). Most universities need help with their DT. MaU is a common example of an HEI that is pursuing its DT, leading to the fact that our recommendations could be applicable in diverse settings. A specific advantage could be the Swedish government's digitalization vision for the whole state. As this is a single-case study, further research could include a multiple case study design (Yin, 2013) or collect additional data, e.g., instructors' perceptions. In addition, more in-depth statistical analyses could provide further insights. Our quantitative data was collected during the Covid-19 pandemic. Students might be positively biased toward MaU's digitalization work.

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My first six months (MF6M): industrial design students perceptions of their first semester experience of learner-centred design studios

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Abstract

This paper reports on a learning and teaching project investigating the experience of Industrial Design students in their first semester of study in three courses that were reimaged to increase students' agency in shaping their learning. In this five year project, My First Six Months (MF6M), teachers aimed to create a learner-centred environment by using facilitative, rather than directive, teaching strategies in a studio-based context. Focus groups with students explored their experience of the courses and unearthed valuable insight into students' expectations about learning at university and the design discipline. Students were overwhelmingly positive about collaborating in their projects, while diverse expectations about learning and teaching roles and bemusement about the different emphasis on assessment featured prominently in students' reflections. Recommendations arising from their perceptions include providing an ongoing narrative about independent learning throughout each course and ensuring support and expectations for independent learning are more explicitly designed into the course delivery.

Keywords: *Industrial design pedagogy; progressive education; learner-centred.*

1. Introduction

My First Six Months (MF6M) is a five-year learning and teaching initiative that commenced in 2018. The initiative involved reimagining three first-year studio courses with learner-centered pedagogies in an undergraduate Industrial Design degree at an Australian metropolitan university.

The objective of the foundation year courses was to introduce students to learner-centered learning and teaching methods during their first semester, with the aim of establishing their independence as learners in these courses and their future studies. The initiative sought to depart from the traditional tertiary education model, which relied on an assumed or unconscious enculturation of students in design practice (Webster, 2007).

A purposeful shift in classroom power dynamics from the teacher to the learner (Goodyear & Dimitriadis, 2013) promoted personal and social construction of knowledge (Bandura, 1997). The 'students as partners' (Matthews, 2017) approach was employed from their first steps, to engage their independence as lifelong learners into these courses (McLean & Varadarajan, 2020) and its objective was to cultivate students' independence and self-regulation as learners (Bandura, 1997), fostering their individual development and confidence (Boud, 2000).

The MF6M courses were deliberately designed to challenge the roles of both learners and teachers. The students received less direction from tutors in leading and evaluating learning than it was assumed they would be familiar with, as first-year university students. Tutors were instructed not to "talk at students" by way of lectures or seminars but to embody partnering dispositions and work alongside learners to support and prompt but not lead learning. Despite diverse modes and contexts of practice over the life of the initiative, the approach to learning and teaching remained consistent.

This paper addresses a period in the course where classes in each course were combined as a weekly three-hour studio workshop for approximately 60 students enrolled. The teaching team (three tutors) physically located themselves to be among students in the workshop space to facilitate and guide the weekly activities where students needed to be highly active and participatory in exploring, experimenting, researching and constructing design solutions collaboratively.

Each course provided an extensive set of digital resources for students to explore according to their own interests and needs for researching, prototyping and making design solutions. Site visits to professional studios and industry locations along with evening talks with professionals were also offered as additional learning opportunities.

2. Realistic

A key feature across the MF6M approach involved students working in small groups to develop responses to design briefs, setting their own solutions and standards according to their combined skills and knowledge. Classes were free from the direction and external influence of an expert or ‘master’ and students were provided with a range of digital resources, site visits and expert talks that were not prescribed throughout each course but offered for students to curate and engage with for their own needs and interests. Using inherent design processes of pinup, peer review and self-assessment, there was an underlying objective for students to also begin developing their own understanding and language of design concepts and standards nurtured through emerging and ongoing dialogues about quality and standards of their work (Boud, 2000; Sambell, McDowell, & Montgomery, 2012). At heart, these methods sought to seed students’ independence and to avert a ‘master’ and ‘apprentice’ model of learning that may become construed through power relations often established in assessment practices like the studio review or presentation (Webster, 2007). At the outset of MF6M it was assumed that the introduction of learner-centred methods would stimulate shifts in students’ expectations about roles and responsibilities in learning and teaching.

3. Methodology

A research proposal was designed to investigate and evaluate the student experience of MF6M. It acquired University Ethics approval and was led by an academic developer who was external to the School that the project was based in.

Focus groups were used to acquire students’ perceptions of their experience in these courses and students were invited, rather than selected, to participate. The focus groups were promoted by posters and in-class visits by the academic developer, as well as prompts from teaching staff to students. Of the approximately 60 students enrolled across the three courses, five students from those courses responded and opted in. The diverse student sample of five was randomly assembled into two groups, of whom four were school leavers - three females (one who had previously engaged in Industrial Design study in Semester 2, 2017) and two males (one who was mature-aged in his mid-twenties), all were domestic students.

The participants signed consent forms and were advised they could cease involvement in the study at any stage and that their participation was anonymous, their contribution would be de-identified and what they disclosed would have no impact on their assessment results for this and other courses in their studies.

Each of the interviewed students had experienced at least one of the courses in the MF6M project, though did not need to have had previous experience of the program to share

perceptions about the MF6M course they were enrolled in. Questions based on the following topics: *Structure of the Course*, *Learning Activities* and *Learners and Teachers Roles*, were issued before the focus group, for participants to consider.

Transcripts of the focus groups were commercially transcribed, analyzed using NVivo for themes, and shared with participants for member-checking. None of the participants had any objection or comments about the veracity of the transcribing or that the content of the interviews should be changed or removed. To further correlate the focus group responses, Course Evaluation Survey (CES) qualitative comments were also thematically analyzed. An inductive approach was used to allow unanticipated responses and insights to emerge, in addition to the deductive process for identifying initial perceptions.

4. Findings

Following is an analysis of the students' perceptions that emerged from the above-mentioned topics of the focus group questions.

4.1. Structure of the Course

Students indicated that they liked the course structure, which consisted of an initial three-week 'intensive', a seven-week project development phase, and a two-week portfolio preparation period. Weekly classes had an open approach with collaborative group activities instead of lectures and seminars, which students enjoyed for the sociability, interaction, and diversity of feedback from the tutors, particularly around assessment tasks and outcomes. Although some students were still uncertain about expectations, they generally enjoyed the class structure as it encouraged active discussion and sharing of work and feedback. Engaging with their peers' work inspired and motivated those students, allowing for the construction of shared standards and expectations, rather than relying on external frameworks. This often served to inspire or motivate students through a sense of competition or awareness of new possibilities for their own work.

However, the ambiguous nature of the project thematic still left some wanting clearer briefs and more formative feedback from the teaching team to establish confidence in requirements and assessment tasks. Overall, students voiced that the design studio activities such as presentations and pin-ups were useful for facilitating learning and keeping on projects track.

4.2. Learning Activities

The students referred to learning activities that are inherent to design practice (pinups, presentations, site visits, peer feedback and review), and other activities that were designed to develop their independence as learners and emerging professionals (group work, self-assessment, industry and site visits).

Design Practice: Students in the course found the pinup and work presentation practices to be positive and motivating experiences that allowed them to interact and engage with their peers and the teaching team. Despite some initial uncertainty about the requirements, students soon recognized the value of these activities in providing formative feedback for improving their work and progressing ideas.

While students appreciated the peer feedback and review process, they also felt that it could be constraining. Some students found it challenging to provide constructive feedback, as P4 noted that some students tended to focus too narrowly on one aspect of the work. Similarly, P3 found that the feedback they received could be obvious at times. All students acknowledged that giving and receiving feedback was a valuable skill that they needed to develop further.

Activities for Learning for Independence: Students were overwhelmingly positive about working in groups and found it to be a valuable learning experience. They appreciated the opportunity to collaborate and recognized that working with others had multiple benefits for developing their design skills and socialization. Though, student P3 was also aware of the challenges of shared work, with some students feeling uncertain about what they could claim for their individual assessment.

While students were positive about peer feedback and review activities, they also wanted more ‘expert’ critical feedback from tutors to scaffold their understanding of standards in the discipline. Students P2 and P4 also expressed bemusement at the social dynamics and competitiveness that sometimes emerged in the peer review process, such as when peers would not accept constructive feedback.

Self-assessment was seen as a valuable tool for developing self-regulation skills and reflecting on learning, but student P1 and P3 were not as enthusiastic about it or fully confident in the veracity of the process. There was a sense of uncertainty about the standards they were assessing to and how to judge their own work. Despite this, students generally found the MF6M course structure to be engaging and collaborative, although students P4 suggested that clearer briefs and more formative feedback from the teaching team would have been helpful to contextualize the outcomes of self-assessment.

4.3. Learner and Teacher Roles

Facilitating rather than Directing: First-year students had mixed responses to tutors not taking the lead in directing their learning. Some enjoyed the freedom to follow their own interests and adapt briefs to their skills, while others expected more specific guidance, particularly for managing their time and maximizing their efficiency in the learning process.

In addition to guidance, students also expected tutors to help them understand difficult concepts and theoretical constructs. They liked hearing tutors give their opinions to challenge

them. For example, student P4 found a class particularly memorable when the course coordinator gave a provocation about design and waste. Student P4 also mentioned, although it annoyed some, they thought it was a useful wake-up call.

Guidance and Clarity: While students were trusting to engage in introductory activities that inducted them to the design discipline and the program, they wanted more clarity about the specific requirements and standards for learning activities and tasks that were oriented to assessment. They also expected specific guidance for managing their first encounters with design education protocols and practices like the pinup and presentation.

Evaluating Learning: During the focus group, students expressed confusion about the self-assessment process and its relationship to their final grade. Student P1 was unclear about their role in the process and how it related to the criteria for assessment. There was also uncertainty about the moderating process and its purpose. Student P3 recounted how a tutor explained that if a self-assessment was an outlier to the trend, that it would be brought back in line. Regardless, some students remained unsure about the inconsistencies they observed in how peers were assessing their work. For those who wanted to participate thoughtfully, they were uncertain about the standards expected and how to assess their work. Students P1 and P4 concurred that although they successfully constructed an understanding of a benchmark, that there was still a lack of definitive measure.

5. Discussion

Students highly valued the social opportunities in their courses and were overwhelmingly positive about group work. As first year students, they demonstrated a maturity in managing social and group dynamics under pressure while working collaboratively in groups. It was perceived as an inherent aspect of design practice. Leveraging each other's skills, learning's and talents through the constant public presentation and discussion of projects, it seemed they were able to garner more appropriate, implicit and direct feedback, which produced a higher quality of work outcomes. These identified benefits clearly resonate with the qualities that Ashford-Rowe, Herrington, and Brown (2014) associate with authentic assessment.

The most significant and underlying issue to emerge from the interviews was that a number of students were still unsure about the intended purpose of the self-assessment process. Their perceptions revolved around inconsistencies and uncertainties running through the process, such as: lack of awareness of moderation, students ignoring peer feedback and grading themselves high, or others taking the process seriously and genuinely reflecting on their learning but getting little confirmation of standards. As first year students who mostly had not experienced self-assessment previously, these doubts about the process are understandable and the issues they describe have been acknowledged by others, including Sambell et al. (2012).

The dominance of grades in shaping students' attitudes towards learning is notable, as reflected in their inclination to equate the process of self-assessment with the final grade (Biggs & Tang, 2011; Sambell et al., 2012). This focus on grades detracted from the cognitive process of reflecting on their own work. Additionally, students were influenced by social dynamics and competition, through seeming arrogance or ignorance, 'appeared' to result in some awarding inflated grades, thereby raising concerns about the fairness of the moderation process, even though they knew that extreme grading would be moderated by the teaching team. It may be that at the time of the focus groups, students hadn't received their final grades for the course and thus had not been able to 'close the loop' or examine the gap between their own estimations and the moderation process, and thus be confident in the integrity of it.

The language used by students throughout the interviews suggests that most were not immediately ready to be independent 'partners of learning', a key intention of the MF6M initiative. Although comfortable to be creative in exploring ideas, problem solving and prototyping for learning activities, they tended to convey notions of dependency on tutors, often expressing need for 'clarity', 'guidelines', 'consistency', 'standards', 'benchmarks', particularly around assessment tasks, or 'explain a little bit more', 'more feedback', 'I didn't really know where I was at' for learning activities. However, the language they use to describe the deficiencies that they perceived also points clearly to needs that are relational and dialogic, resonating with strategies that Matthews (2017) proposes as essential for a successful 'students as partners' model. Additionally, as first year students in semester one, they did display strong abilities to set goals, problem solve and complete work, suggesting that with some clearer guidance in the set up and defining of expectations, independence and partnering as learners is a clearly achievable goal for the next stages of the program.

6. Recommendations

The following key points emerged from the student experience and suggestions for addressing them:

1. Establish clear context and ongoing narrative to reorient students towards increased independence and self-responsibility as learners and partners in learning.
2. Provide a clearer definition of responsibilities for teachers and students to align expectations.
3. Offer guidance and assistance for students to navigate and engage with the extensive range of resources available.
4. Provide explicit guidance, feedback, and benchmarks early on to manage anxiety, support awareness of standards and expectations, and gauge student development.
5. Socialize assessment as a learning process to embed a changed mindset and understanding of lifelong assessment literacy.

6. Ensure integrity of self-assessment results through moderation and reflection on the process of self-assessment and responding to feedback, potentially ‘unhooking’ grades from the assessed product.
7. Reflect and share experiences of ‘partnering’ at the end of the course to confirm milestones and expectations around independence and self-regulation development.
8. Establish a contract of expectations and responsibilities to support busy students in planning their engagement with the course's rich experiences and resources.

7. Conclusion

In summary, the students who participated in the focus groups had positive perceptions of the three courses within MF6M, recognising the courses' purpose of preparing them for the complexities of the world. They valued the emphasis on group work and its relevance in both their design education and personal development. Some students even acknowledged the courses' aim to promote innovative thinking and social responsibility within the design field.

However, the students also shared aspects of their experience that did not meet their expectations, including uncertainty, feeling overwhelmed, and discrepancies between their assumptions and the course expectations. As this project aimed to introduce new social norms and responsibilities for learning, it is crucial for students and teaching staff to establish and maintain a culture of effective communication and mutual support throughout the program. Doing so will ensure that students remain confident and committed to their learning not only during their time at university but throughout their future lives.

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Student perceptions of a remotely operated motor-driven generator in engineering education

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Abstract

Smart technologies in engineering education provide students with relevant real-world experience and safeguard the quality of instruction during emergency remote teaching. This paper aims to have students complete a motor-driven generator practical via a RemoteLab and measure their perceptions of the experience. A survey was conducted with five-point Likert scale questions asking students to indicate their satisfaction with the useability and effectiveness of the RemoteLab, then given a list of action verbs from Gloria Willcox's feeling wheel to select what best described their emotions during the exercise, and finally open-ended questions to expand on their experience. Results showed students found the system easy to use and effective and most felt joyful and powerful emotions during the exercise. There was some indication that they still preferred contact sessions on campus which shows that a RemoteLab may be best used as an intervention when the contact mode of delivery is suddenly disrupted.

Keywords: *Engineering education; RemoteLab; online learning; Gloria Willcox feeling wheel; (4IR) Fourth Industrial Revolution.*

1. Introduction

Engaging students hungry for new experiences have become a challenge in an online teaching and learning environment, especially in subject fields where practical experience is dependent on working with expensive, or hard-to-come-by, tools and machinery. Practical experience is crucial for deeper learning and building student confidence (Bradberry & De Maio, 2019). Engineering students studying renewable energies need to experience the relationship between their theoretical lectures and practical laboratory exercises to fully assimilate the new skills. Renewable energies have large variants in test conditions, thus field tests on systems are often analysed under real-world conditions in research and training.

Distance laboratories as teaching tools were becoming more widely used for imparting practical skills to students in online teaching and learning delivery but saw an enormous boost in the field of e-learning in education during the COVID-19 pandemic when universities and other institutions of learning, were forced to shift their delivery to online environments (Gamage, et al., 2020). Creating a laboratory that allows students to practice their newly acquired theoretical knowledge in real-world conditions requires smart technology that enables a user to remotely control the machinery in the laboratory from any location over a network. The fourth industrial revolution uses modern smart technology in the automation of traditional and modern manufacturing including the Internet of Things (IoT). IoT is a new technology paradigm thought of as a global network of machines and devices that can interact with each other, bridging the gap between the world of the Internet and our physical plane (Kumar, Tiwari, & Zymbler, 2019). The development of IoT protocols can be used in the construction and implementation of a RemoteLab.

For this paper, the two universities – the Technical University of Ulm (THU), Germany and the Central University of Technology (CUT), South Africa – collaborated on developing a didactic concept RemoteLab that allows students access to the prototype motor-driven generator from any location via the Internet. Students from both universities used the RemoteLab and were subsequently asked to complete a questionnaire gathering their perceptions of the experience. The students' perceptions of the useability of the system will assist the lecturers in shaping and improving the RemoteLab. Gathering perceptions as qualitative data will help the researchers answer their research question on how students feel about using a motor-driven generator in the RemoteLab and more richly describe the human experience (Paradis, O'Brien, Nimmon, Bandiera, & Martimianakis, 2016).

This paper will first review relevant literature on practical experience in an online environment, the RemoteLab, and describe participant attitudes. Then the method underpinning the research is discussed after which the paper is closed with the results of the survey and the conclusions drawn from the data.

2. Literature Review

Online practicals can be performed either by virtual or remote laboratories. In the case of virtual the exercise is simulated via a computer whereas, in a remote laboratory, the physical operation runs in real-time and only the control thereof is facilitated by a computer which can be in a different geographic location connected to a network accessed by the user (Mohammed, El Zoghby, & Elmesalawy, 2020). For the engineering lecturer, a remote laboratory is preferable as the student experiences the operation actively and is not only an observer as the simulation runs through the operation. Practicing with the physical machine/tool, albeit from different a location, allows the student to problem-solve and troubleshoot on the spot which enriches the learning experience. It allows students the opportunity to work with machines/tools that they may otherwise not have access to, like the motor-driven generator used in this paper.

It can be difficult for students to describe how they are feeling about classwork as emotions can be deemed as separate from a “work” state of mind. As the engineering field often attracts people with a more analytical mindset this is especially true for engineering students. The Gloria Willcox feeling wheel, was inspired by Joseph Zinker's and Robert Plutchik's comparison of emotions to colors but adjusted to action verbs, can be used to frame questions with the correct vocabulary so that participants can identify their feelings regarding the specific experience (Willcox, 1982). Gloria Wilcox developed action words linked to feelings in a wheel diagram using the four basic emotions: scared, sad, mad and glad but with glad expanded into joyful, powerful, and peaceful (Zinker, 1978) (Plutchik, 1982). These action words can be used to frame survey questions and so assist the participant with putting a name to the emotion they experienced.

3. Methodology

The development and implementation of RemoteLab motor-driven generator using Google cloud can be seen below:

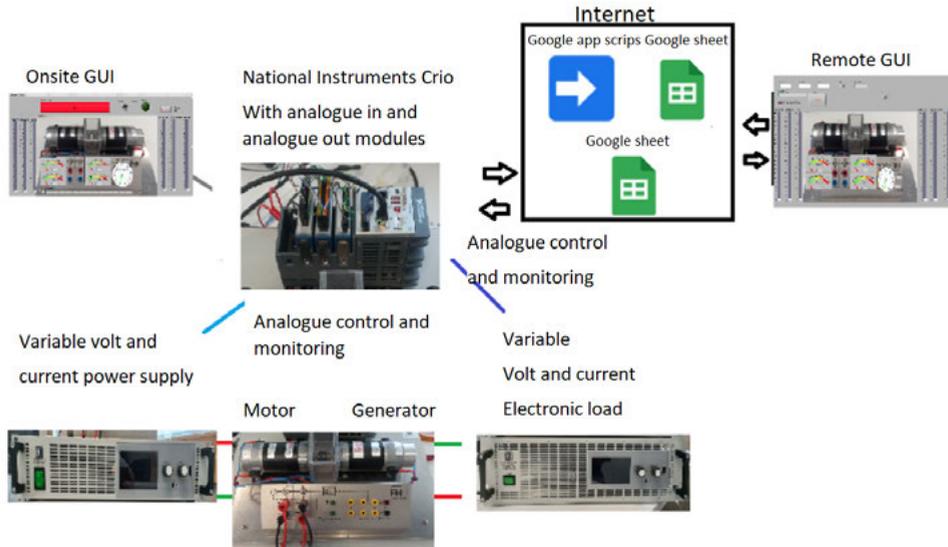


Figure 1. The final prototype RemoteLab

The prototype RemoteLab is built on a typical motor-driven generator lab experiment. The user would adjust the variable power supply and variable load as indicated in the experimentation documentation. In the prototype RemoteLab this was replaced by controlling the inputs via a LabVIEW CRIO and the electronic control inputs of the supply and load via new custom software. The new Human-Machine Interface (HMI) can be controlled onsite and a second digital twin HMI with the same look and feel was programmed that can be controlled online. The Google cloud space is the backbone or in-between to the remote twins and the main controller. Of these servers, Google sheets and Google scripts were used.

An exploratory study is employed along with descriptive statistics involving quantitative analysis of the collected data. Data was collected with surveys using five-point Likert scale questions measuring students' perceptions of the RemoteLab experience, from being "Not satisfied at all" to being "Extremely satisfied". The Likert scale, developed in 1932, is still widely used today to measure participant attitudes. From the five- or seven-point scale the participant can select their strength of feeling, for example whether they agree or disagree with the statement (Joshi, Kale, Chandel, & Pal, 2015).

Student perceptions of the learning environment can be predictive of learning and indicative of motivation to learn (Wallace, Kelcey, & Ruzek, 2016). Participants were then given the opportunity to select multiple feeling wheel action verbs in response to the question: "Which of the following emotions would you say you felt while working on your generator remotely?" to gauge their emotional mindset during the exercise.

As stated, the RemoteLab prototype was built by converting a typical motor-driven, generator lab experiment to an online RemoteLab prototype with local and online HMI's. The prototype was evaluated by a sample group of 10 students, selected by asking for volunteers from both the German and South African cohorts. They were asked to do the typical experiment using the online prototype RemoteLab. The hardware is stationed in the German ULM campus and German and South African students were accessing it from their homes and/or a computer facility on the respective campuses. After the experiment was completed, the sample was asked to do a perception survey via Google Forms. Ethical clearance was obtained for the survey.

4. Results

Out of the 10 participants, 8 were from the CUT, and 2 were from ULM. Of these, 40% were between the ages of 26 and 30, and 60% were between 18 and 25. Being all under the age of 30 one would expect a certain amount of tech-savvy, but 80% indicated that they have never worked in a RemoteLab before.

Results indicated that the RemoteLab useability (labeled as very easy, easy, normal, hard, very hard) bell-curved with 10% saying it was very easy and 40% indicating it was easy to use, with the other 50% stating normal, no hard or very hard.

Perceptions delivery mode 60% of students preferred to have hands-on classes with both the lecturer and peers in the same location. So even though they found the RemoteLab easy to use, they still preferred the traditional contact sessions.

The satisfaction pole on the ability to still test their theoretical knowledge in a practical exercise even when remote, (labeled as extremely satisfied, satisfied, neutral, dissatisfied, not satisfied at all) the majority responded to being satisfied with the bell curved from normal to extremely satisfied.

Perceptions, from the sample, on working with the physical equipment remotely indicated a bell curve toward more satisfied. Working with the actual hardware is a positive experience as renewable energy experimentation, in its nature, has large variants in test conditions that are not always possible with simulation or purely theoretical calculations. This tends to aid in learning if students see the external and environmental factors producing a deviation in theory calculations.

As stated in the normal operation of the experiment students would have had to manually change the variable power supply and variable load. For it to be a RemoteLab, this system needed to be automated first, with a new window HMI. Perceptions from the sample on the new graphic interface saw the curve leaning to satisfied and extremely satisfied but with some neutral and even one dissatisfied indicated, which needs to be investigated.

The following questions and results were designed using the feeling wheel.

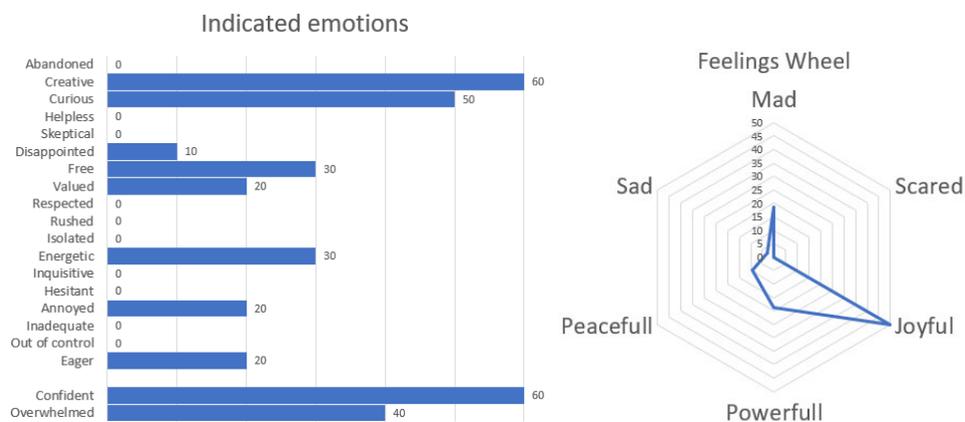


Figure 2. Recorded emotions from participants and interpreted to the feelings wheel

Most of the area occupies the ‘joyful’ to ‘powerful’ section, with a smaller area covered in the ‘scared’ and ‘mad’ sections. The negative emotions could be ascribed to this, being most of the participants’ first attempt at a practical exercise in a RemoteLab, which may have caused frustration while learning to navigate the new environment. Note that mostly positive feelings were recorded, thus the minority indicated frustration should cause too much of a concern, but a solution could be that more technical training on the use of the remote system is perhaps needed before the exercise is undertaken in the future.

The survey was concluded with some open-ended questions to allow participants space to expand on their experience. To see if learning took place the question: “Do you think it’s important to test your theory on real world physical equipment? Motivate.” was asked. The sample mostly replied yes with some indicating the following: “Yes, for us to have more accuracy and have proof of what is calculated theoretically can also be achieved remotely”, “Yes, it helps to put theory into practice while in turn gauge one’s understanding of the work.”, “Definitely, because everything you’ve learned you need to practice it in the real world”

The question: “How do you see the difference between a software simulator and a remote physical system for experimentation?” was asked to see if the sample could distinguish between a simulator and a remote laboratory, and most were able to as seen in the following excerpts: “Remote physical systems give you the real-life experience or expectation”, “With the remote physical system we can see the actual machinery and hear a sound in the background unlike on the simulator”, “Physical systems will be more accurate, since it allows for the practical variable”. Some apprehension was also recorded with one participant

stating that: *“The only difference is that with a remote physical system one is more cautious as one wrong move could blow the machine”*. This answer shows a need for instructing the students on possible issues and troubleshooting to instill confidence. One participant preferred the simulation stating: *“It is interesting that there is a real object running at the other end but if the simulation would run with fewer lags, I would prefer the simulation”* which suggests further investigation into the use of simulators may yield valuable insight.

Participants also showed a sense of the exercise’s value, when asked for “Any comments?”, one stated gratefully: *“Thank you for organizing the remote Lab experience it was a great exposure to see how remote-control machinery can be done as we are in the 4IR era.”* And another wrote: *“This opens a door for a lot of possibilities, to a place that has limited resources for students to learn and expand their understanding of theory content.”*

5. Conclusion

The purpose of this paper was to gauge engineering students’ perceptions of using a RemoteLab to operate a motor-driven generator. Perceptions were gathered with a survey conducted after the experience. The survey used five-point Likert scale questions to determine the students’ satisfaction with the useability and effectiveness of the RemoteLab. Then the students’ emotional mindset during the exercise was determined by asking them to select feeling wheel action verbs from a list that most described their emotions. Finally, they were given the opportunity to expand on their experience with open-ended questions.

The Likert scale questions indicated a high level of satisfaction with the system and that students found it easy to use and effective. However, when asked about their preference between the RemoteLab and the traditional contact sessions, the majority were inclined toward a physical class in the same location as the lecturer and their peers. Most students selected joyful and powerful from the feelings list, indicating a positive mindset overall, with some mentioning feeling scared and mad, most likely due to it being their first RemoteLab experience. During the open-ended questions, most responses were positive and showed that students were ready to use the RemoteLab when necessary. The following quote from one participant represents the general feeling best: *“The experience was amazing, and I hope to do it again”*.

This paper showed that RemoteLabs, like other 4IR technologies, can be useful in engineering education when circumstances force remote learning, but that students would still prefer the on-campus contact sessions with the lecturer and peers. The use of the feeling wheel to gauge emotional state during the exercise gives valuable insight into the mindset of the students during this new experience and along with the data from the Likert and open-ended questions will help the lecturer improve their teaching and learning practice and better prepare the curriculum for possible future disruptions, like the past COVID-19 pandemic.

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Ideas on digitally supported individualization of teaching and learning for evolving competency requirements

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Abstract

The world is changing rapidly, mainly due to the digitalization of all areas of living. A huge amount of information is accessible via the Internet, and since it is no longer possible for individual humans to keep track of it, artificial intelligence (AI) is analyzing this data. In this rapidly changing world, students have to be educated for a successful career during their whole working life. These boundary conditions lead to completely new challenges for the education of students that are unprecedented in this form. Digitalization in education can help to cope with these challenges but can only be a means, not a goal. Personal interaction with students remains the most important task in education to address individual weaknesses and further develop strengths and talents. With the increasing amount of openly available information and the consequently increasing diversity of experiences within the group of students, differentiation is advancing to become the key to successful education. Digitization can help with this challenging task and support communication between students and their experienced instructors. But computers cannot replace human interaction and attempts to improve teaching efficiency by replacing this communication with electronic means endangers the learning success for complex concepts. This article analyzes education demands and possibilities for digitally supported teaching and learning.

Keywords: *Digitalization; higher education; student competencies; differentiation.*

1. Introduction and Motivation

More and more information is being generated and is accumulating as common accessible and searchable knowledge. In all fields of professional working life, topics are becoming more and more complex. Experts are concentrated on smaller and smaller fields of knowledge. This exponential growth of information and the apparent availability of nearly all information on the Internet leads to a completely new scope of teaching and learning.

The idea and motivation for this article arose during personal discussions about the demands for teaching and learning in this fast-changing world with an exponentially increasing amount of information. This article postulates the need for a fundamental change in higher education as the consequence of the described change in information availability. The authors postulate:

Theorem 1 *There is enough information on any subject available: A plethora of books, internet pages, online videos, scientific papers, blogs and podcasts are out there for any teaching topic – easily accessible and not too difficult to find.*

The conclusion is that the traditional role of a lecturer has no benefit for future learning:

Corollary 1 *The benefit of lecturers in the modern learning process is not to provide additional material or repeat facts.*

The goal of this article is to think about new teaching scenarios with benefits for learners and new roles for lecturers. The next Section 2 explains how the modern information society changed the diversity of students. Section 3 describes expected shifts in graduates' competencies that are necessary for their later working life and Section 4 explains the resulting changes in study goals for students. Section 5 describes the impacts of digitalization on students' education and Section 6 shows a way toward a digitally supported individual teaching and learning. The last Section 7 gives a summary and a conclusion.

2. Change in Diversity of Students

The diversity discussion is focusing on differences in talent, social background, and personal living situation. Due to the information society, the diversity discussion needs to enter a new scale: In former times a few books and school education were the main sources of information for students. There was a mainstream of competencies induced by the standardized teaching at school. Pupils received the same information, had the same learning goals and passed the same tests. Some, from today's point of view, small differences between students originating from diverse social backgrounds have been discussed (Ahmadaliev et al., 2022; Ugras, 2018). However, in the modern information society, things are changing fundamentally. The school has lost its effect of standardizing the competencies. The contribution of schools to the information supply has become less and less important, as even very young children can learn

from the internet. Every individual has consumed a different set of information, developed different competencies and built a different world model. In consequence, students are not only having social diversity, but they have developed an individually unique set of knowledge, competencies and an individual way of thinking. This is the main source of diversity and makes conventional teaching approaches less effective.

Theorem 2 *The main source of future student diversity will result from information diversity.*

3. Shift of Graduates' Competencies in Working Life

The working environment of professional life is changing rapidly. Berger and Frey (2015) write that “Jobs that are not at risk of computerization have something in common: they require an understanding of human heuristics or involve the creation of novel ideas - that is, they require social or creative skills.” and “Over the next decade, the computerization of middle-income jobs will shift to mainly substituting for low-income workers, while the demand for problem-solving, creative and social skills is likely to increase further.”

Dondi et al. (2021) write that citizens benefit from a set of fundamental skills:

- add value beyond what can be done by automated systems and intelligent machines
- operate in a digital environment
- continually adapt to new ways of working and new occupations

They state that the two major factors of proficiency with a higher likelihood of employment are “Adaptability” and “Coping with uncertainty”.

ChatGPT was asked “Which competencies are needed for future work?” with the answer:

“There are several competencies that are likely to be important for future work, including:

1. Technical skills, such as programming and data analysis.
2. Interpersonal and communication skills, such as the ability to work effectively in teams and to communicate complex information clearly.
3. Problem-solving and critical thinking skills.
4. Creativity and the ability to adapt to change.
5. Emotional intelligence, including the ability to manage stress and navigate emotional dynamics in the workplace.
6. Digital literacy, including proficiency with technology and understanding of how it is used in various industries.
7. Cultural competency, including the ability to work effectively with people from diverse backgrounds and cultures.
8. Continuous learning, the ability to learn new skills and technologies quickly and adapt to new situations.”

This answer by ChatGPT is not generated by its own research and ChatGPT doesn't understand the real meaning of this question; this answer is produced by using a huge data set implemented inside an artificial neural network. ChatGPT can't generate new knowledge, but it helps to extract and summarize existing knowledge.

Theorem 3 *As AI programs gain more and more skills for finding, summarizing and analyzing knowledge and competencies of graduates for a successful career will change fundamentally.*

Where AI can achieve acceptable and reliable results, it will do so faster and cheaper than humans. Remaining tasks for humans will be those where AIs can't deliver sufficient quality.

4. Resulting Changes in Study Goals

4.1. Information Selection and Evaluation, not Information Gathering

The amount of information is increasing exponentially and the Internet gives access to a large part of mankind's knowledge. Search machines show all available information on the internet on request and ChatGPT from OpenAI (2023) is the next level. This reverses the teaching paradigm of the past where a lecturer had to generate new content with information specifically prepared and arranged for the students. The capacity that was used to achieve this is now free for other activities in teaching that have gained importance: Focusing on topics that are essential in a digital world with overwhelming information flows.

Theorem 4 *The job of lecturers will be to teach students how to gather valuable information, how to evaluate and connect these to find solutions. Lecturers need to assist in building up mental working models by setting up connections between gathered pieces of information for gaining competencies.*

Guiding students will consist of enabling them to find the required facts for a given challenge, evaluate the correctness of the information, and discard misinformation. From this information, a creative process of problem-solving should be started.

4.2. Information Selection and Evaluation, not Information Gathering

It is expected that most routine work of academic professionals can be done by AI. Real social interaction, self-reflected and critical thinking, and creativity can not be performed by today's AI. They are trained on a data-set and can manipulate the output according to trained rules and user interaction. But they can not reflect on their work based on a world model and so the systems are limited in their ability to create novel ideas (Boden, 1998). Mazzone and Elgammal (2019) write that "clearly, machine learning and AI cannot replicate the lived experience of a human being; therefore, AI is not able to create art in the same way that human artists do." This says that AI and humans act principally different.

Shneiderman (2020) “endorses a Human-Centered AI approach for designing and developing systems that support human self-efficacy, encourage creativity, clarify responsibility, and facilitate social participation.” Real social interactions, critical thinking, and creativity as well as responsibility are not possible with current AI approaches. But AI programs can help humans to do a better job when human-AI cooperation is done in an appropriate way.

Theorem 5 *Social interaction, critical thinking, and true creativity will be future key competencies and gain in importance. These will be complemented by the competencies to work in the digital domain and to interact with AI computer programs.*

Humans will be needed in these important areas and consequently there will be an increased need to develop the competencies required to perform such tasks during their education.

5. Impacts of Digitalization on Education

5.1. Increase of Efficiency

Routine jobs in teaching can be performed well by AI and thus the efficiency of knowledge transfer can be increased. Barbosa et al. (2022) predict in the future working trends for 2050 that it will be possible to train a large number of students using MOOCs. These teaching programs that mainly focus on knowledge can be automated. Examples are trainings for jobs where special knowledge is important and learners have acquired the competencies for self-organized learning as well as the domain-specific thinking models before. Asimov (1957) described in his science fiction novel “Profession” that knowledge is easy to transfer to humans but to learn how to gain competencies is a long and individual process.

Theorem 6 *Many approaches introducing digital elements into teaching and learning focus on increasing ‘efficiency’, i.e. educating more students with the same amount of resources and in consequence reducing the direct contact between lecturers and students. This can be only done when teaching knowledge, not competencies.*

5.2. Shift of Focus in Education

As the transfer of knowledge will become an increasingly self-driven, and media and tool-supported process, there will be a shift of focus for the human-driven teaching towards skills and competencies like critical and creative thinking as well as social interaction. This part of teaching can not be handed over to AI and builds up indispensable competencies to further develop the state of the art of any discipline. One important factor driving human activity is to ‘do things in the right way’. The definition of ‘right’ however, is based on a complex rule set based on the observation of nature and social interaction.

Theorem 7 *The teaching of knowledge can probably be automated by AI, but the teaching of skills and the development of personality i.e. individual thinking models require interaction with the complex world models of experienced humans to be efficient.*

Claxton (2023): “As for ChatGPT, we quickly learned that its greatest skill is lying.” Maybe lying is not the correct wording, as there is no real understanding of the content by the AI model but it selects and synthesizes information from the internet according to algorithms. The AI has no idea if any information is true or not, not speaking of seriously complex concepts. There is also no conscience of the AI; ethical limits are implemented by algorithms and result in mere censorship but there is no understanding of ethics itself. AI systems are largely unable to foresee the consequences of their actions, which leads to overoptimism and as many reports show, blunt lying in case of a lack of information. With this, the AIs will probably increase the amount of misleading information being available on the Internet and thus increasing the risk of misleading other AIs.

Theorem 8 *The teaching of the future will mainly promote social interaction, critical and creative thinking, reflection about their own work and prediction of consequences.*

5.3. Personalization of Learning

With AI software that helps lecturers with routine work for a high number of students, there will be more time for the personalization of teaching and learning. Barbosa et al. (2022) predict in the future working trends for 2050 that learning will be more personalized with tailored learning plans. This new freedom should be used by lecturers to shape a new era of learning. Lecturers and students can be assisted by AI software, other media, or can do teaching and learning using pure human interaction. The prerequisite for this new era of teaching is a new set of competencies and a new mindset for lecturers and students. The future of competency-oriented learning will require redefining the role of lecturers:

Theorem 9 *The work where lecturers can't be replaced by AI is the ability to identify individual ways of thinking and to provide specifically adapted guidance towards more competency. This can be done with the assistance of AI software.*

This implies that experienced lecturers must get into an intense academic discussion with the learning individuals to be able to observe their specific thinking models and draw the right conclusions, how to support them:

Corollary 2 *The job of lecturers will be to guide students to compensate for existing deficits, develop individual strengths, and their personality.*

This makes it clear that while increasing the efficiency of teaching by possibilities of digitalization is very useful, it is extremely important to take care not to reduce the contact between students and lecturers. This would endanger the effectiveness of the unique

competency of human instructors to individually guide students and thus reduce the effect of the teaching work: The construction of a physical and ethical world model to validate the own activities happens in observation of the physical reality and direct social interactions. Also, the systems are largely unable to foresee the consequences of their actions, which leads to over-optimism and as many reports show, blunt lying in case of a lack of information. This will increase the need for humans to be able to verify the validity of the information.

Corollary 3 *To be didactically useful, digital elements need to be integrated in such a way as to increase and intensify the intellectual contact between lecturers and students.*

Tools that lecturers can use to improve their impact on the learning process are very valuable.

Corollary 4 *Digitalization in education is an important supporting tool for an effective educational approach but it is not a goal of teaching to integrate as many digital elements as possible.*

The introduction of digital elements might lead to a distraction from the actual teaching goals, or to an increased separation of lecturers and students playing with computers instead of interacting in discussions. Careful didactic design of a learning environment fitting to the intended learning outcomes will therefore become an even more challenging task.

Theorem 10 *Digitalization should never be the main goal of teaching, but a supporting tool to achieve maximal competencies of students.*

6. Digitally Supported Individualization of Teaching and Learning

Digitalization will give a valuable contribution to education. It releases from routine work and gives more time and freedom for individual coaching of students. Higher education has already undergone an evolution during the last decades as many teaching techniques have been developed and applied that allow for more individualized instruction like project-based learning, or activating concepts as inverted classroom schemes. AI will lead to the next big step in teaching and learning. With the integration of AI software into the learning process, both the efficiency and effectiveness of teaching and learning can be drastically improved. This evolution has to be developed further and their application has to be extended to achieve the goal to intensify the contact of thinking models of lecturers and students to support young people in developing their world models. The authors think that:

1. Gathering knowledge using digital tools with the aid of AI computer programs. This can be highly automated without the individual support of an instructor.
2. Developing students' competencies is an individual process under the guidance of an instructor. This process can't be automated by using digital means.

7. Summary and Conclusion

The authors see fundamental changes in the way how students will learn in the future as required learning outcomes and available methodologies are changing completely. Digitalization will force a change in the mindset of lecturers and learners for education to remain effective. Competencies in working life that have been essential in the past will be obsolete. Many tasks will be performed much better and cheaper by AI in the future. Other competencies that correspond to the nature of human beings will become increasingly important. Consequently, successful education will need to undergo fundamental changes. Education of human nature will be much more important than it was in the past. Integration of human interaction and AI computer programs into courses will be a key development for future learning programs to increase the efficiency and effectiveness of teaching and learning.

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Using technology innovation and blended delivery for student-centred learning in large undergraduate classes

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Abstract

Delivery methods of Higher Education classes have been scrutinised globally during the COVID-19 pandemic as academics and students were forced to shift rapidly to online delivery modes. In a post-COVID-19 scenario innovative teaching and learning approaches are required to rethink how large student cohorts can be educated online and on campus in a meaningful way, thereby reenvisioning the traditional lecture and its wider class context. This paper reports on the approach taken by the authors who restructured and redesigned an existing second-year undergraduate subject in an Australian architecture faculty. They collaborated with specialist learning designers to develop a blended mode of large-class delivery that simultaneously addresses their students' desire to engage with subject content flexibly and asynchronously, whilst benefitting from in-person interaction in the classroom. The new subject was subsequently delivered for the first time at the point of writing this paper.

Keywords: *Blended teaching; innovation; pedagogy; polling; student-centred; post COVID-19.*

1. Introduction

The delivery of classes in tertiary education has long been ripe for a major overhaul. Since the start of the millennium, education designers have been proposing new modes of teaching that take into consideration the needs of current students while making better use of new communication methods facilitated via high-end technology. Universities around the world investigated novel subject-delivery methods and implemented online classes, yet most of their efforts can best be described as half-hearted and cautious, given the existing proliferation of face-to-face learning as the predominant model of student engagement.

The cautious attitude towards online teaching changed dramatically with the sudden arrival of the COVID-19 pandemic in early 2020. The transformative character this presented to the tertiary education sector globally is well documented elsewhere (Ewing, 2021; Neuwirth et al., 2021; Singh et al., 2021 & 2022); it has had a major impact on the acceptance and quality of online, hybrid, and blended teaching approaches. As universities around the world are entering the post-pandemic era, many lessons learned emerge that point towards the need to reflect on what worked, what didn't, and what needs to be approached differently. Tertiary Education institutions are having a watershed moment when weighting off between the benefits of an on-campus experience and the flexibility inherent to flipping their classrooms.

As society changed irreversibly due to COVID-19, what is the best model for delivering content in higher education? Have University campuses lost ground as places for encounter, knowledge creation and dissemination? How does one counter isolation of students, instead focusing on the campus experience? Are there still benefits for students to attend classes in person? The research presented in this paper considers many of the above questions, as part of the author's redevelopment a large-cohort second-year undergraduate subject that interlocks as design-enabling subject with design studios taught in an architecture faculty.

2. Methodology

In the absence of existing frameworks that guide large-class subject development in higher education within the Post-COVID 19 context, the authors conducted an in-depth literature review to assess innovative learning approaches pre, during, and post COVID 19. The literature review focused on structural issues associated with designing a learner-centred subject design, as well as analysing the role of technology in facilitating blended learning modes and cognitive flexibility among students.

In order to complement the learnings from others with the lived experience and challenges faced in their home institution, the authors carried out an in-house review of the subject they took over, thereby consulting with former tutors and students on what worked well, and what needed to change. This review focused on leaving the assessment aspect of the subject

unchanged, yet focused on the opportunities of delivering the class as via a flipped-classroom model. The subject counts as a ‘design-enabling’ subject, meaning that its purpose is to teach students skills that can be applied on other subjects, notably by intersecting with their design studio activities. For that reason, the authors conducted a series of workshops with relevant studio coordinators (among others) to fine-tune the curriculum towards their specific needs.

Due to the focused effort required to reinvent the content of the subject in a short matter of time, the authors sought and gained research funding from their home institution. It allowed them to run a series of workshops with learning-design experts, who advised on optimal pathways to introduce blended and other learning techniques, and to employ research assistants to work on the curriculum over a 3-month period. As proven elsewhere to support architectural education (Brandao et. al, 2021), the authors used the tool ‘Miro’ for interactive whiteboarding, brainstorming, and diagramming to advance the development of the subject.

3. Background

Researchers seem to agree that the disruptiveness of COVID-19 on the way universities deliver their teaching content is simultaneously an opportunity for a major rethink of how classes get taught in higher education. At the outset of the pandemic, Pellegrini, Uskov, and Casalino (2020, p.222) called for a radical transformation of learning approaches to make room for new skills, cultures and reference models. They predicted that young people would be unwilling to go back to their usual way of working, once they experienced the advantages of studying at home; they warned that invaluable insights offered by onsite lessons would get lost without asynchronous and carefully prepared support (p.240). The validity of the traditional lecture as the predominant instrument of knowledge transfer for large classes had previously been challenged by Garrison and Kanuka (2004), who questioned the willingness of students to commute to campus to receive a one-directional presentation that does not require them to engage with the subject content in a stimulating and challenging way. In the context of knowledge transfer, a distinction between learning from lecture material as a way for gaining knowledge, and interaction with subject matter experts who actively challenge students’ thinking needs to be made. Whereas the former assists learners in building up explicit knowledge, the latter emphasizes on implicit understanding applied by learners in changing contexts. Halpern and Hakel (2003) refer to the sharing of implicit knowledge as an essential task of higher education to allow students to implement solutions independently.

The validity of retaining the in-person lecture format in post COVID-19 times remains in question. Ewing (2021, p.42) discusses concerns voiced by Asia-Pacific education leaders who propose moving away from the lecture/tutorial format all together. Yet she sees prerecording a lecture and putting the video online not seen as a solution either: *We will have to do much better than simply providing an online recording... academics will need to spend*

time developing more engaging online programs with the assistance of learning designers. Singh et al. (2022) add that: The reason for being on-campus and face-to-face should outweigh the perceived convenience of participating remotely (p.310). Questions surrounding the future of the lecture and other on-campus learning hence point towards the level of bi (or multi) directional interaction and stimulation students experience during the lecture. Singh et al. (2021) add: Students must feel compelled to participate in-person because the learning is incredibly dynamic, interactive, or uses equipment or immersive experiences that cannot be accessed remotely (ibid).

Based on existing literature, learning designers will find it hard to identify a clear pathway forward in their configuration of student-centred learning approaches that best fit their subject. On one hand, research seems to suggest that knowledge-retention rates are higher when individually placed learners draw on online resources (Li & Lalani, 2020). Yet other research points towards the benefits of an on-campus experience that fosters students' sense of belonging (Neuwirth et. al, 2021, Singh et. al. 2021), that provides opportunities for peerto-peer instruction (Carmichael & MacEachen, 2017), better interaction between faculty and students (Alshahrani & Ally, 2016), and the establishment of 'cognitive presence' where meaning is constructed through sustained discourse (Garrison et al., 1999).

4. Case Study: Large-cohort design-enabling subject (LCDES)

The impetus for the authors' research emerged from recent staff changes within their home institution that required a redesign and reconfiguration of a second-year large-cohort subject that plays a strategic role within their faculty bachelor's degree. The subject is embedded within a suite of correlated subjects, and its function is to teach foundational skills that feed into a range of other subjects and design studios within the degree. Enrolment numbers for this subject range between 300 and 350 students per semester, and changes to the curriculum required a complete redesign of the subject contents.

The redesign was required for two main reasons. Firstly, a perceived mismatch between the learning outcomes of the subject, which focuses on training students to better perform in a design studio setting, and the needs of correlated subjects. Secondly, based on the desire of the authors to re-evaluate the lecture and tutorial format (and associated learning material) that had been developed during the COVID-19 pandemic, where the subjects was delivered online only. Coordinators of the correlated design studios highlighted the need for change, as the LCDES did not fulfill its design-enabling function, instead running as a design studio that competed with their class. This sentiment was shared by students who lamented the extensive workload associated to overlapping submission deadlines between these subjects.

In recognition of lessons learned during COVID-19 (and beyond) the authors aimed to develop a new delivery mode for the LSDES to address the above issues. They were awarded

internal funding from within their home institution to allow for a consolidated 3-month period for the subject redesign. Supported by a group of teaching-design specialists within their home institution and drawing on available literature, the authors conceived a guidance strategy to address several aspects of the subject redevelopment:

- A flexible, learner-centred teaching setup using a semi-flipped classroom.
- A combination of weekly asynchronous and synchronous student activities.
- A dynamic delivery mode that combines individual and asynchronous pre-class learning material (covering knowledge accumulation: what is...?), large-class interactive lectures (explaining the purpose of this learning activity: why are you studying...?), and small-group tutorial classes (coaching and directing students at applying knowledge for the development of assignments: how do I ...?).
- A fundamental rethink of the traditional lecture format into a highly interactive and engaging event that includes in-class polls, group discussions, and co-teaching.
- Targeted use of information and communication technology (Learning Management System/videos/in-class polling/etc.) to support the above learning activities.

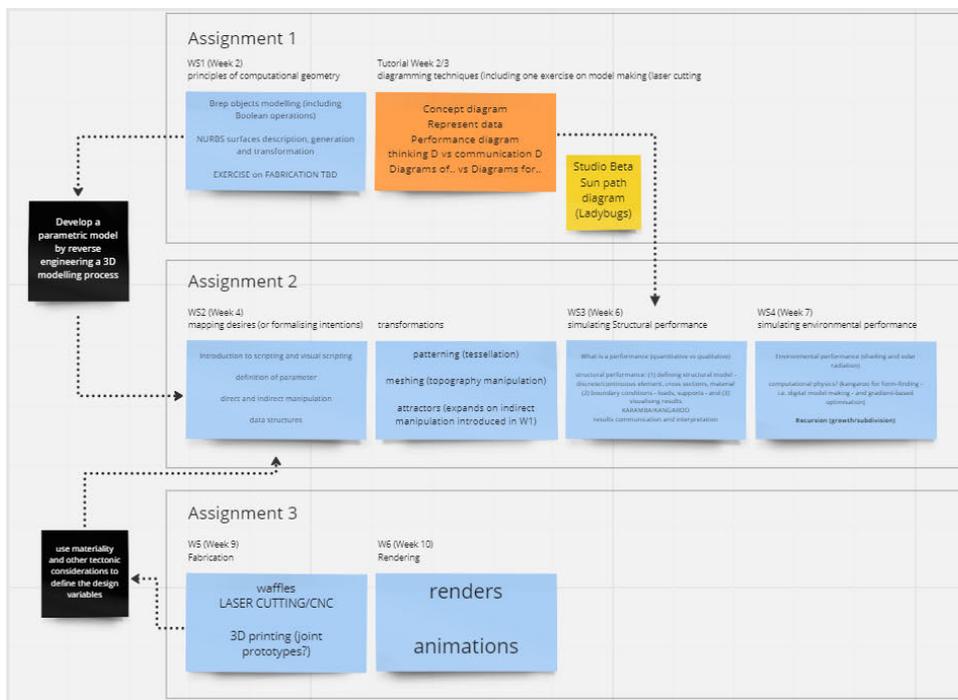


Figure 1: Diagram illustrating the interaction between lecture, tutorial and workshop activities.

The starting point for advancing the strategy in greater detail was developing new learning outcomes and associated, assessment tasks. Four learning outcomes were defined, with three key tasks aligned to them (see Figure 1).



Figure 2: Miro board developed to structure lecture, tutorial and workshop activities, in association with assignment guidelines and deliverables.

The authors subsequently mapped out all inherent learning requirements for the twelve-week teaching period (see Figure 2). These were divided into *what* students need to learn, *why* it is relevant to learn such material, and *how* they can achieved certain tasks via dedicated processes and techniques. These three foci break down as follows: *What* is captured as a set of four weekly ten-minute presentations that are pre-recorded. The associated videos are placed on the LMS and students are asked to engage with the material before each class as the semester progresses. Each video contains a question/provocation that serves as starting point for further conversation during the weekly Monday morning lecture. There, the subject matter experts curate a highly dynamic discussion to contextualise the *why* behind the learning material. The lecturer facilitates discourse, invites opinions from students in the room and responds to ad-hoc feedback from the large cohort. In order to make this work, real-time polling (via Poll Everywhere) is used to gather input from the students and foster deep understanding among learners (Stover et al., 2015). Benefits of on-campus interaction are tapped into by grouping students in pairs and asking them to discuss their views before responding to the real-time poll. The weekly Monday lecture is followed by a two-hour tutorial class later that day and a second tutorial class on Thursday. Drawing on the pre-lecture content and the in-lecture experience (and associated polling output), tutors work with groups of up to sixteen students to explain in greater detail *how* they can engage with the processes and techniques in preparation for their assignment. Groups of four students are formed and the tutor will engage with one group at any point in time whilst other groups discuss their progress with their peers.

5. Discussion

Preliminary observations from the setup of the LCDES highlight that the bespoke nature of the subject to be developed required a unique response to design a matching pedagogy that includes different modes of content delivery. Neither the pre-2020 face-to-face delivery, nor the online delivery approach taken during COVID-19 offered a feasible pathway in setting up the learning environment for students. The decisive ‘back to campus’ move by the author’s home institution required an immediate response to develop the differentiated and student-centred learning blended teaching approach.

The authors were fortunate to receive support and in-house funding by the University of Melbourne *FlexAP Academic support team* to redesign the subject from scratch between the 3-month semester break. Mapping out all individual learning outcomes and associated subject content and subdividing it into designated sets of information communicated via different media, represents a highly labour-intensive effort. The authors redeveloped all three assignments from scratch, which translated in detailed mapping of before class and in-class activities by educators and students. When configuring those, a previous student (who had since become a tutor in the subject) proved to be pivotal as a sounding board to weave-in a student’s perspective, thereby fostering the student-centric teaching approach desired by the authors. The redesign for the LCDES had additional consequences outside the pedagogy and modes of delivery: Class tutors needed to be given an opportunity to become familiar with the (discussion and polling) outcomes emerging from the lecture to prepare for their tutorials later that week. At the start of semester tutors needed to get introduced to the logic behind the blended learning strategy and learn how to adjust their pedagogy accordingly.

Due to the complexity of class setup, a focus on timetabling tutorials and associated classroom spaces proved to be essential. Learning designers needed to consider the often predefined and restricted staff and room availability and work within those constraints.

6. Conclusions

This paper proposes a way to develop an interface and interlock (pre-)lecture, tutorial, and workshop activities in a large-cohort undergraduate architecture subject by means of blended delivery modes and technology tested and used before and during COVID-19. The subject restructuring specifically addresses the risk of a lack of student engagement with traditional lectures, in particular if there is a disconnect with assignment preparation and activities during tutorials and workshops. The availability of technology, including applications that strengthen learning both online, as well as in-class plays an essential part in designing the best possible environment in higher education classes.

Moving forward, the authors aim to include future feedback from students to support the developed interactive lecture format (with pre-recorded material and in-class polling) to gauge the feasibility of transforming traditional lectures within undergraduate subjects. Learner-centric blended delivery of classes and supporting material seems to be a useful approach to develop a more dynamic and engaging academic environment for students.

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Postgraduate degree program in social business as a new knowledge tool in entrepreneurship and social impact

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Abstract

Inside the new theories and learning models, we can identify social business as a valuable tool to develop entrepreneurial skills focused on solving social problems effectively and profitably, and also create innovative solutions that generate a positive impact on community.

A social business arises with the purpose of solving a social problem using the market system; It is created on a non-profit basis. Even so, the business model is sustainable, guaranteeing its operability. Social businesses combine social and economic objectives, seeking to generate a positive impact on society and the environment. They emerge as an alternative to the traditional way of doing business.

The following paper aims to explore the concept of social business, its importance and how a postgraduate degree in social business can be useful for those entrepreneurs looking to develop skills and knowledge within this innovative area.

Keywords: *Social business; entrepreneurship; teaching.*

1. Introduction

This new innovative approach has come to change the way in which businesses are conceived and the role they can develop in society, since companies no longer focus only on maximizing profits and recovering their investment, but from the beginning they are born with a different conception: a positive social impact. Among the motivations for the creation of this type of business is to contribute to solving challenges such as poverty, inequality, environmental, among others.

At a time where traditional economic theories and structures have not been sufficient to generate satisfactory answers to today's social problems, it is necessary to rethink from the academic field, the assumptions, objectives, scope, and tools to address these challenges. Therefore, it is pertinent that the Autonomous University of Baja California (UABC) offers highly specialized programs that address these issues, such as a Master's and Doctorate program in Social Business (MDNS). This project contributes to the efforts of the university to offer programs immersed in the local, national, and international avant-garde.

The academic background of the MDNS program has its origin in the performance of social linkage and innovation that the UABC has carried out through the Faculty of Economics and International Relations (FEyRI) since 1999 with the emergence of the Program of Research, Assistance and Teaching of Micro and Small Enterprises (PIADMyPE), followed by the Center for Research, Assistance and Teaching of Micro and Small Enterprises (CIADMyPE) and now with the UABC-Yunus Center for Social Business and Wellbeing project, an organization dependent on the FEyRI.

These microenterprise training programs are developed as a collaborative public policy between the local government and the university to promote formal entrepreneurship, help microentrepreneurs in vulnerable contexts and thus improve the country's welfare prospects. It is recognized as an innovative model of assistance to provide non-financial services to microentrepreneurs where university professors and trainees collaborate (Mungaray Lagarda, Osorio Novela, & Ramirez Angulo, 2021)

This institutional effort becomes increasingly relevant and necessary as we look at the increase in the population living in poverty, either measured by income or by access to basic goods such as food, education, health and infrastructure, by which is an issue of concern for various actors in society, both globally and at national, regional or local level (Chavez Nungaray & Hernandez Gomez, 2015).

2. Social business as a new model of entrepreneurship with social impact

Neoclassical firm theory focuses on the concept that firms have a primary goal, which is to maximize their profits which leads to the long-term largest market share. There is an

emphasized responsibility towards shareholders, considering that innovation is a key factor within the process. And it is under these conditions, through which it is established that the only rational objective pursued by the firm is to maximize its profits (Morales Sánchez, 2009). Unlike traditional firms, which focus on maximizing their profits and long-term growth, social businesses consider social objective as a fundamental aspect of their business model.

This innovative approach has led to a new way of understanding the role of firms in society and has prompted the creation of a new theoretical model that focuses on sustainability, innovation, and social responsibility. This theoretical model recognizes that firms can and should be agents of positive change in society and that economic sustainability and positive social impact are not mutually exclusive.

International evidence shows that the motivations of firms, individuals and entrepreneurship are more complex, diverse, and transcendental than what dominant theories propose. Firms can allocate part of their resources for philanthropic actions, community improvements or finance foundations that do not pursue any profit. On the other hand, there are social activists, community leaders, politicians or academics who put the common interest before individual interest (Yunus, 2013).

Muhammad Yunus, an economist and university professor, founded Grameen Bank in Bangladesh. The Grameen Bank, also known as the "bank of the poor" is a pioneering microfinance institution in the field of social entrepreneurship that aims to reduce poverty in Bangladesh (De Diego Rábago, 2018). Since the structure of the financial system was designed to extend credit only to people with purchasing power, this limited the options of vulnerable people to start a business that would help their livelihood. In 2006, Muhammad Yunus was awarded the Nobel Peace Prize for this project.

Within Yunus' philosophy a social business can be Type I or Type II. Type I refers to a business where investors reinvest their profits to try to solve a social problem; while Type II are businesses that arise from need, also known as subsistence enterprises (microenterprises), businesses that have the purpose of providing income to people who are in a situation of poverty. In this sense, in the first case, it is the nature of the products, services, or operating systems of the business that creates social benefit. This kind of social business might provide food, housing, health care, education, or other worthwhile goods to help the poor. With the second type of social business, goods or service produced might or might not create a social benefit. The social benefit created by this kind of company comes from its ownership. Because the ownership of shares of the business belongs to the poor or disadvantaged, any financial benefit generated by the company's operations will go to help those in need (Yunus, 2013).

Social business are managed under seven principles: try to improve society as the main objective and not to generate profits, be financially profitable, respect the environment, investors recover their investment and the surplus is used to finance innovation and business development, employees receive competitive salaries and share the spirit of goodwill (Yunus, 2010).

In Mexico, social businesses have gained ground in recent years to address social and environmental challenges in the country; on issues such as access to education, rural development, employment, and environmental sustainability (Rubalcava de León & Zerón Félix, 2020).

Both social and traditional businesses have their strengths and weaknesses, however, social businesses offer unique advantages compared to traditional businesses, such as its focus on sustainability, social problem solving, its fusion with the community and social and environmental responsibility. These models can be an effective way to achieve long-term change.

Importantly, social businesses also face unique challenges, such as balancing their social and economic goals and the need for financing. That is why it becomes a topic of interest that social entrepreneurs receive training and formal instruction that allow them to further raise their chances of success.

3. Master and PhD in Social Business

The Master's and Doctorate program in Social Business is proposed as a space to link the concepts of financial and economic sustainability used by traditional businesses, but now applied to self-sustainable businesses and projects, which do not pursue monetary benefits, but to solve some social problem.

The professionalizing nature of the MDNS program allows to identify, disseminate, and replicate the best practices, local, national, and international, of the actors that already implement actions and have experience, from the private or public sector, such as activists, community or social leaders, non-governmental organizations and public agencies of all levels focused on social and economic development. At the same time, it provides its students with the technical and theoretical tools for the identification, diagnosis, design, implementation, and evaluation of a social business, while incorporating strategic concepts into decision-making.

The objective of the programs is to train professionals of the highest level who are interested in detecting, analyzing and developing projects associated with social businesses, which contribute to mitigate problems of education, food, health and well-being of society, through

entrepreneurial and solidarity activities, contributing to the improvement of the quality of people and the community.

Therefore, the profile of the student who is sought to enter the program must have as main characteristics a sensitivity to social problems and an interest in contributing to the formation of knowledge, which allows him from this motivation to design, manage and develop innovative strategies applied to the operation of a social business.

The Master's and Doctorate program is designed with a duration of two years and three years respectively. The evaluation system is based on objectives and contribution to the graduation profile; therefore, the evidence of a result is required to infer that the student has achieved the objectives that have been established in the syllabus proposed in the program. Within this syllabus are the compulsory and optional subjects, presentation of progress of the social business project, stays and intervention, as well as any other academic activity endorsed by the holder of the subject or the Social Business Project Committee.

It is expected that the stays and professional intervention will preferably be in local areas of Baja California and contribute on the student's work in the area they define together with their terminal project tutor. Those who receive them within the different sectors in these stays and professional interventions are called operational collaborators, who work through systemic frameworks the active participation of the learning topics seen in class.

MDNS program will be characterized by strengthening in the students the professionalizing tasks applied in the framework of the two and four seminars that contemplate the curriculum of the master's and doctorate, respectively, which give rise to the realization of a semester colloquium of advances of terminal works, where the students are evaluated by committees of experts.

The curriculum of the master's degree privileges the practical and operational approach, while the doctorate emphasizes, in addition to the previous ones, the analytical-comparative sense; both totally aimed at solving social problems. A substantive difference with respect to other programs is that it offers a balance in topics and contents both in theory and in tools for measuring and evaluating impact.

Studying a postgraduate degree in social business can be useful for those looking to develop specific skills and knowledge in this field. Develop training in issues of social responsibility, sustainability and social innovation that allow students to have a broader perspective on the role of companies in society; without neglecting the business tools needed to create and manage successful social businesses.

The curriculum of the master's degree includes one year of subjects and one year of stays and professional intervention. The subjects that students take are development problems,

quantitative methods, methods of social intervention, resource management, solidarity economy, social cost-benefit analysis and leadership and management.

In the case of the doctorate, the first year is of subjects and the next two correspond to stays and professional intervention. The subjects they take are studies of development problems, quantitative and qualitative methods, social business project seminars.

4. Social projects as a result of postgraduate degree in Social Business

Within the MDNS program, there has been the opportunity to train professionals who can create innovative business solutions that address social and environmental problems of utmost importance, as well as a management and development.

- **Hopetruck: cooking up new stories:** This social business project aims to reintegrate young people who have been in conflict with the law or who are at risk, through a business model that consists of a training process in the gastronomic area, when they conclude they can practice for a period of three months in a Food Truck to later be placed in different allied companies after an evaluation, thus achieving their social and labor reintegration.
- **CUALLI: Solutions for the financial sustainability of Healthcare Centers in Baja California:** The aim of this social business is to provide biodegradable cleaning products to social care centers in marginalized regions to facilitate their access to essential hygiene products. At the same time, landfill centers are installed, which do not generate waste where these centers will receive the necessary inputs and tools through cross-subsidy consignment.
- **Moon Jams: A Business Model for Sustainable Community Development:** Business model focused on the integral recovery of artisanal food processing to promote sustainable community development in the High Mountains Region of Veracruz. This project seeks to identify artisanal food processing owned by the community to which value can be added and are potentially marketable. It also seeks to link with community agents who have resources to develop processes efficiently.
- **Route 2:** Civil Association that supports, empowers, and encourages young women in their personal development through workshops focused on mental health along with an art therapy methodology, in turn, the importance of the subject is promoted in schools. The objective is to promote in the community the importance of taking care of their mental health, their personal and professional development in young people, creating a link with specialized people.

5. Conclusions

The opening of a professionalizing graduate program provides the opportunity to acquire knowledge within a real context, to study the phenomena within their conjuncture. Likewise, it is a reality that there are no postgraduate programs in social business in the region, so presenting an offer in this regard would contribute to the development of local, regional, national, and international research, which allow the creation of strategies and consequently improve the quality of life of vulnerable sectors.

The creation of this program provides useful information and research and serve as a means of linking projects for priority sectors to be supported by the university. In this way, research would be provided in favor of the neediest social sectors, focused on increasing the quality of life of the population in poverty.

In this way, the MDNS program represents for the state of Baja California and the region an important project in terms of linkage, research, application, and professionalization, by generating highly trained human resources that can respond to the most preponderant social problems of the region. As an academic project, it has the task of continuing to bear fruit in applied science of high impact in the field of economic and regional development, specialized in social business, through the collection and analysis of data and information collected from primary sources, to produce quality and innovative specialized academic materials.

By continuing to support and foster the growth of social businesses, we can contribute to a fairer and more sustainable future for all. The opening of a postgraduate course with these characteristics would bring several benefits to the university, including the competitive advantage over other universities, since no other offers it, which would strengthen the leadership of the UABC nationally and internationally, and would pay for the sense of solidarity and social responsibility that has always characterized our excellent university.

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Embeddedness of students with special educational needs in higher education

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Abstract

Previous research has examined the institutional and extra-institutional embedding and network of students, however, we still know little about the network of students with special educational needs. What makes this research unique is that it compares the characteristics of SEN-A and SEN-B students. Therefore, the embeddedness of students with special educational needs within the institution is investigated using quantitative research method. The research sought an answer to the question of what characteristics can be used to describe the network of students with special educational needs, and whether there is a difference between SEN-A and SEN-B students. Based on the results, there are significant differences in the case of students with special educational needs, whether they are embedded more strongly in the environment inside or outside the institution.

Keywords: *Special educational needs; higher education; social capital.*

1. Introduction

The correlation of the student networks with academic performance indicators has already been investigated by many researchers (Bourdieu 1988, Coleman 1988, Pusztai 2011). They show that students perform significantly better when they are in harmony with their environment (Astin 1993). Several studies have proven that the social capital created by student networks promotes a successful school career and admission to higher education. The academic embeddedness also promotes this during studies, especially the relationship with the other students (Pusztai 2011). In the case of students with special educational needs, it has also been proven that the positive attitude of the students - in addition to the attitude of the teachers - is important and is also a condition for successful integration (Petó and Ceglédi 2012). In terms of relationships outside institutions, the most important are the contemporary circle of friends, the family, and voluntary and religious communities. (Utasi 2002, Albert and Dávid 2007). In the case of pupils and students with disabilities, we do not have information on friendships outside the institution, but there are already researches on contemporary friendships that also include the institutional environment. Hrabéczy (2020) in his research examining families with special educational needs in the fourth grade found, among other things, that children with special educational needs spend less time with their peers outside of school compared to the average. In our research, in connection with Coleman's social capital theory, we examine the inter- and intragenerational network of relationships of students with special educational needs inside and outside the institution, so in the following, we will review the relationships within the institution between peers, between students and teachers and with other institutional administrative staff we present the results concerning relationships outside the institution, and the results concerning peers and the family.

1.1. Definition of the target group

According to the OECD, there are three main groups of special educational needs, SEN-A (disabilities), SEN-B (difficulties), and SEN-C (disadvantages). The types of disabilities classified as students with disabilities in the Hungarian Higher Education Act can be placed in two groups in the OECD category system, the SEN-A and SEN-B categories. The division based on this is illustrated in Table 1. In the course of the research, we will later compare students with special educational needs belonging to the SEN-A and SEN-B categories.

Table 1: Hungarian students with special educational needs in the OECD SEN category system.

SEN-A	SEN-B
Motor, sensory (vision, hearing), speech disability	Other psychological developmental disorders (learning, attention or behavior control disorder), autism spectrum disorder

Source: own editing based on OECD (2004) and Nftv 2011.

2. Methodology

2.1. Hypotheses

In addition to the family, other intergenerational and intragenerational relationships of individuals also have a major impact on academic progress and higher education integration, which has been supported by numerous researches. These factors also prove to be decisive for students with special educational needs (Pusztai 2011, Pusztai and Szabó 2014, Hrabéczy 2019). However, integration into different communities can be of varying degrees and difficulties due to stereotypes and prejudices, depending on the type of specific educational need (Séllei 2015, 2018). Knowing these, we assume the following:

- a) SEN-A students have a stronger intergenerational relationship system than SEN-B students, but SEN-B students have a stronger intragenerational relationship system.
- b) In the case of students with special educational needs, the relational capital within the family will be decisive from the point of view of higher education embeddedness.

2.2. Methods

To investigate this, we implemented a large sample questionnaire data collection using the snowball method (N=331). The database from this data collection is referred to as the IncludED2020 database, referring to the possibility of participation in inclusive education and the year of data collection.

There is no database available to researchers that can be used as a sampling frame for such research and would provide access to students due to the GDPR. Based on the anonymized statistical data, approximately 2,000 people in Hungary belong to this category, of which we tried to reach 10%. Since probability sampling was not possible in the absence of a sampling frame, we resorted to snowball sampling. Keeping in mind, first of all, that the different types of special needs appear among the respondents in accordance with the real proportions, therefore our sample represents the reality in terms of SEN types. However, we were not able to achieve representativeness in terms of training areas. In spite of these limitations, the data collection proves to be an investigation with an exceptionally large number of elements both at the Hungarian and international level. The indicator of this is that we cannot find any research in the literature that would have carried out a large number of questionnaire data collection by interviewing students with disabilities, we can only find analysis of national statistics and interview research with a smaller sample. The choice of method is also justified by the fact that there are many students with disabilities in higher education who do not register their disability either at the time of admission to higher education or during their studies in the administrative systems of higher education, thus these students would remain hidden from the researcher's eyes by the approach through higher education institutions.

However, we also consider it important to include these people in the research, since we have very little information about their presence and the reasons for not registering their disability, but by asking them, another aspect of the studies of these students can be investigated.

3. Results

To test our hypotheses, we performed a cluster analysis. The cluster centers are illustrated in Table 2. The analysis was carried out along two dimensions, with the previously discussed inter- and intragenerational, as well as intra- and extra-institutional relations items. After that, the variables were standardized and then included in the analysis.

Based on Table 2, it can be seen that, with the help of the included variables, four embedding types emerged in the case of students with special educational needs. The following distribution can be seen in relation to embeddedness along the clusters (Table 3).

Based on Table 3, it can be seen that there is a significant difference in embeddedness among students with special educational needs. SEN-A students are overrepresented among those with institutional intergenerational embeddedness, and among them the lowest proportion are those characterized by a lack of social capital. On the other hand, the opposite can be observed in the case of SEN-B students. They are overrepresented among those with a lack of social capital, while among them the proportion of students with institutional intergenerational embeddedness is the lowest. It coincides with our assumption that the intergenerational embeddedness of SEN-A students and the intragenerational embeddedness of SEN-B students will be stronger, however, the high proportion of SEN-B students with a lack of capital is an unexpected result. According to Coleman (1988), the lack of social capital is an important risk factor of dropping out. Our result in the light of Coleman's results shows us, that SEN-B students can be a more disadvantaged situation during their studies, caused by the fewer supporting opportunities and a weaker social network.

A comparison was made along these clusters along the lines of socio-economic background, achievement before higher education and the characteristics of the course and institution visited by the student. Due to space limitations, the tables representing these results are not published in the study, but our results are discussed in the conclusions.

Table 2: Cluster centers (N=343).

	Institutional inter- generational	Intra- generational	Family inter- generational	Lack of social capital
parent: Financial support	0,011	-0,696	0,082	-1,054
parent: Meet with friends	0,209	-0,113	0,395	-0,816
parent: Knowing how the children spending their free time	-0,016	-0,455	0,124	-1,061
parent: Encouraging to study	0,082	-0,654	0,357	-1,071
parent: Conversation about culture	0,591	-0,172	0,150	-0,752
parent: Cultural programs together	0,425	-0,293	0,353	-0,685
parent: Conversation about books	0,483	-0,176	0,316	-0,917
parent: Relationship with instructors	0,509	-0,050	-0,149	-0,302
parent: Conversation about future career	0,339	-0,311	0,491	-0,834
parent: Cooking for the student	0,259	-0,394	0,418	-0,414
parent: Interested in their child's studies	0,021	-0,776	0,327	-1,361
parent: Drives their children to classes	0,598	-0,219	-0,037	-0,309
parent: Involve student in housekeeping	-0,077	0,056	0,387	-0,741
instructor: Helps to cooperate with other students	0,904	-0,129	-0,464	-0,078
instructor: Helps with studies	0,593	0,087	-0,362	-0,274
instructor: Helps with career choice	1,099	-0,339	-0,417	-0,070
instructor: Conversation about student's personal problems	0,624	-0,082	-0,280	-0,156
instructor: Encouraging to study	1,094	-0,204	-0,483	-0,176
instructor: Takes abilities into account	0,720	0,095	-0,392	-0,403
students: Talking about problems related to studies	-0,074	0,134	0,007	-1,811
students: Spending free time regularly	-0,004	0,294	-0,321	-1,017
students: Conversation about student's personal problems	0,093	0,238	-0,193	-0,911
students: Lend books and notes	-0,175	0,234	-0,312	-0,584
students: Talking about future career	0,329	0,309	0,107	-1,087
students: Inquires in case of absence	0,388	0,444	0,030	-0,689
students: Studying together	0,124	0,323	-0,160	-0,763

friends: Talking about problems related to studies	-0,549	0,369	0,179	-0,682
friends: Spending free time regularly	-0,375	0,253	0,107	-0,167
friends: Conversation about student's personal problems	-0,448	0,284	0,285	-0,389
friends: Lend books and notes	-0,236	0,287	-0,096	-0,345
friends: Talking about future career	-0,297	0,224	0,226	-0,514
friends: Studying together	-0,232	0,317	-0,011	-0,264

Forrás: IncludED2020

Table 3: Distribution of embeddidness clusters in the comparison of students with special educational needs (Chi-square test, $p < 0.05$), (%), (N=331).

	SEN-A	SEN-B
Institutional intergenerational	<u>30,5%</u>	15,8%
Intragenerational	28,4%	32,1%
Family intergenerational	29,8%	32,1%
Lack of social capital	11,3%	<u>20,0%</u>
N	141	190

Source: IncludeED2020. Note: For underlined values, the value of adjusted residuals is greater than 2.

4. Conclusions

In this research, we explored the components and characteristics of the higher education embeddedness of students with special educational needs, as well as the relationship between higher education and pre-higher education networks with certain factors of admission to higher education. In the course of the analysis, we were able to separate four types of embeddedness based on the strength of relationships within and outside the institution, as well as inter- and intra-generational characteristics.

The largest proportion of SEN students with institutional intergenerational embeddedness are men, but among the SEN-B students belonging to this cluster there are still more women. In terms of socioeconomic background, the members of this cluster typically came from big cities and were mostly the children of parents with higher education, who have a better than average subjective financial situation. This cluster is characterized by the fact that among them we most likely come from single-parent families. They demand extra points mainly in the form of preferential treatment and additional performance.

Embedded in the environment inside and outside the institution is typical for students with special educational needs embedded in the intragenerational environment. There is a higher proportion of women within this cluster, and the proportion of SEN-B students from mosaic families is also significant. They are overrepresented from villages and towns, and although

they are not in this cluster in the highest proportion, they are mainly children of parents with secondary education. They are mostly characterized by a good financial situation, however, students with a poor financial situation are overrepresented among SEN-B students within this cluster.

Intergenerational embeddedness within the family is more typical of female students, and students with special educational needs coming from whole families are included in this cluster in the largest proportion. Among them, we can most likely find students coming from smaller towns, who are the children of parents with secondary education, and who are characterized by a good subjective financial situation.

The fourth cluster includes those students with special educational needs who lack social capital and are characterized by a lack of interactions with their environment in all examined respects. It is more common for male students with special educational needs, including mainly SEN-B students. Among them, we find the largest proportion of students with special educational needs who were not raised by their parents, and mainly the children of parents living in smaller or larger cities, but with primary education, who are characterized by a poor subjective financial situation.

By capturing the characteristics of these clusters and mapping the dimensions of their entry into higher education, we obtained a more accurate picture of the relationship between the networks of students with special educational needs and their entry into higher education.

In this connection, we assumed that SEN-A students have a more extensive intergenerational relationship system, and SEN-B students are more characterized by intragenerational embeddedness. This assumption was partially confirmed, as our results confirm that SEN-A students have a stable institutional intergenerational relationship system, who, recalling their secondary school studies, report less negative teacher behavior towards them, and it is more typical for them that their interactions with instructors are also positive and more frequent. Also, SEN-A students are the least characterized by the lack of capital. On the other hand, in the case of SEN-B students, we did not clearly demonstrate a greater degree of intragenerational embeddedness. Although the level of intergenerational embeddedness will be higher in their circles, those struggling with a lack of capital are still overrepresented among them.

We also assumed that the social capital within the family plays a decisive role in the case of embeddedness in higher education. However, we assumed that the existence of relationships within the family will be a more significant resource for SEN-A students than for SEN-B students. However, in the case of the effect on embeddedness in higher education, it became visible that family relationships in themselves result in few differences between the two investigated groups, and we did not experience the supporter's effect on embeddedness in the entire sample either. In the case of socio-economic background factors, however, the impact

on higher education embeddedness emerged. However, among the examined students, the quality and quantity of the institutional relationships established before higher education, i.e. the connection with high school teachers and high school classmates, proved to be more important. However, it has been proven that in the case of SEN-A students, parental involvement has a stronger effect on admission to higher education than in the case of SEN-B students. The social capital between SEN-A and SEN-B students within the family may be the one that can compensate for the disadvantage arising from the disability during the preliminary selection process.

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Black digital humanities in interdisciplinary undergraduate teaching on diversity, gender, and sexuality

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Abstract

Two undergraduate courses (2020-23) introduce students interested in the humanities and computing to the life, works, and intellectual and material legacy of the world-famous African American writer and activist James Baldwin (1924-1987). Cross-listed with the Afroamerican and African Studies, American Culture, Digital Studies, and English Departments, these courses utilize an open-access digital collection documenting Baldwin's life and his selected works. Through innovative and experiential application of literary history in conversation with the emerging fields of Black Digital Studies and Black Digital Humanities, students develop projects that build (and build on) a growing, open-access archive. Published on the ArcGIS StoryMaps platform, these projects achieve two important higher-education goals: (1) They produce student-driven knowledge on an internationally renowned Black figure accessible to non-academic users; and (2) they confirm the importance of humanities and diversity literacy as invaluable skillsets in the modern workplace.

Keywords: *James Baldwin; literature; black digital humanities; interdisciplinary; undergraduate.*

1. Introduction

This paper explores innovative teaching and learning in two undergraduate courses cross-listed between the Departments of Afroamerican and African Studies, American Culture, Digital Studies, and English at the University of Michigan-Ann Arbor in the United States. The courses introduce undergraduate students interested in the humanities and computing to the life, works, and rich intellectual and material legacy of the African American writer and activist James Baldwin (1924-1987). Limited access to Baldwin's papers and no writer's museum in the United States make this key twentieth-century American author hard to teach outside of his published works. The courses intervene in this situation by combining innovative interdisciplinary learning and production of new knowledge on this writer in the form of an open-access digital archive.

Teaching methods harness students' considerable digital skills to make engagement with themes in the humanities, especially from antiracist and antiheteronormative perspectives, a creative and collective endeavor. The authors believe that college instructors can significantly advance inclusivity in the classroom, as well as foster humanities literacy and civic engagement, by taking full advantage of students' familiarity with a range of digital media and tools. In that sense, learning and teaching also become a cross-generational dialogue.

The courses are: "Preserving James Baldwin's Legacy through Black Digital Studies" (AAS 498-in action seminar) and "What's Love (Sex+Race) Got to Do with It: Reading James Baldwin's Fiction in the Twenty-First Century" (AAS 498-in action seminar). Designed by Prof. Zaborowska, a literary and cultural studies scholar with over three decades of scholarly and teaching experience in interdisciplinary humanities and cultural studies, these courses reflect an innovative and experiential focus on the ways in which African American literary history can and should be taught, i.e., in a rich conversation with the emerging fields of Black Digital Studies and Black Digital Humanities.

The courses utilize and expand through students' projects the rich archive amassed for over two decades by Prof. Zaborowska. Alongside more traditional materials like published texts, the courses draw on an open-access digital collection mounted on the website of U-M Library, as well as the resources of the National Museum of African American History and Culture/Smithsonian/NMAAHC in Washington D.C. They are supported by IT and instructional staff, thus making sure that students also acquire new computing skills as they develop their projects.



Pictured: Homepage of Chez Baldwin Writer's House Digital Collection on U-M Library's website.

The authors have collaborated on teaching techniques that combine interactive lectures, discussion, multimedia material and writing, and public-speaking assignments that will be described in this presentation. The courses also include guest speakers, and culminate in university-wide symposia open to the public in which students present their work. The long-term goal for the various iterations of these two courses is to create a virtual writer's house-museum for Baldwin that, instead of bricks and mortar, will be constructed from student projects showcased on an open-access website. The work of the course will be available to all, and especially to local K-12 communities in Ann Arbor, Ypsilanti, and Detroit. Our James Baldwin's Virtual Writer's House-Museum will in time become an anti-racist teaching tool and legacy all its own.

2. Teaching Archive

Inspired by Prof. Zaborowska's recent monograph, *Me and My House: James Baldwin's Last Decade in France* (Duke UP, 2018), the archive for both courses combines several types of resources for students' projects, with the goal of combining instructional goals with public humanities ones. The materials included in the digital collection, for example, consist of thousands of high-definition digital photographs taken between 2000 and 2014-18 on research trips to St. Paul-de-Vence, France, where Baldwin's house was located, and where he spent his last prolific sixteen years. As Prof. Zaborowska argues in the aforementioned book and in an essay in the *American Quarterly*, these images of Baldwin's house, known locally as "Chez Baldwin," and of its contents are key to the preservation efforts of this writer's material legacy in the United States and beyond. Taken weeks before that building was lost to developers and demolished in 2014, the images of the structure preserve its quality

and processes of deterioration over time. The objects from the house that were meant to be discarded, were instead salvaged by a friend of Baldwin's who allowed them to be documented via digital photography. PhD candidate Rodríguez Barrera was team leader in the processing of metadata for the collection and oversaw undergraduate research assistants as they went about categorizing and ensuring the high quality of the various digital materials. The resulting archive includes documentation of the building, an extensive collection of vinyl records, jewelry, reference books, artwork, even furniture, as well as the contents of a private library, phone logs, bills, receipts, and other ephemera.

Documentation of research trips to the site of the house, interviews with subjects who knew the writer, and documents gathered at research trips to the Schomburg Center for Research in Black Culture in NYC, where the James Baldwin Papers are located, complement the resources for both courses, alongside the writer's published works and diverse artwork created to commemorate Baldwin by male and female artists.

The ever-expanding virtual Baldwin's "writer's house-museum" resulting from the student course work published via StoryMaps will become a hub for teaching this writer, offering a student-centered alternative to a brick-and-mortar structure. The students' creative productions—e.g., collaboratively produced podcasts and social media posts, written explorations, recorded interviews, video, or virtual-reality implementations of Baldwin's household archive, etc.—will make the surviving Baldwin's life matter a foundation for new knowledges and interpretations of his ideas on equality, inclusion, tolerance, and humanitarianism.

3. Course Descriptions

In addition to offering the public a glimpse into Baldwin's everyday writing life, student projects from both courses encode and interpret the objects with which the author surrounded himself, as well as the books that he read and collected in his library. Serving as one of the founding blocks in the learning process, the collection organizes the students' final projects into a website of resources that will grow with each iteration of the courses. This lasting archive of knowledge on Baldwin is rooted in the present historical, cultural, and political moment, reflecting both courses' different approaches to Baldwin.

In both courses, students work with the ArcGIS StoryMaps platform to create original, individually designed final research projects. All students, all levels of experience, and all fields of study are included in the course, including architecture, literature, general humanities, social sciences, and STEM fields. Student final projects showcased at university-wide symposia (held on Zoom as of this writing) include guest speakers who comment on students' work.

3.1. AAS 498: “Reconstructing James Baldwin’s Legacy in the Digital Now”

“Reconstructing” taps into the recent resurgence of this important national and international figure as the subject of new scholarship and as an African American popular culture icon (Black Twitter, Black Lives Matter). Students work with a Canvas course site that includes media and other learning tools and resources (e.g., the films *I Am Not Your Negro*, *If Beale Street Could Talk*, *James Baldwin: The Price of the Ticket*, *I Heard It through the Grapevine*, *James Baldwin: From Another Place*, etc.), including online collections and other African American Studies-related digital projects. We also host 3-4 guest speakers via Zoom, and students have a chance to introduce the speakers.

The students work individually and in groups to explore some of the following larger themes in literary and cultural studies: (1) recasting national identity through intersectional approaches; (2) the centrality of domestic settings to African American authorial creativity; (3) the importance of Black women writers to Baldwin’s later works; (4) Baldwin’s relevance to the articulation of androgynous and trans identities today; (5) Baldwin’s theorizations of popular media such as cinema, photography, and TV; and (6) Baldwin in fashion and style and as a creative inspiration.

3.2. AAS 498: “What’s Love (Sex+Race) Got To Do with It: Reading James Baldwin’s Fiction in the 21st Century”

“What’s Love” explores Baldwin’s philosophy of identity, love, and creativity that has inspired trans people and academics, musicians and painters, dancers and theater actors, and film directors and documentarians. This course approaches Baldwin’s ideas through a Black queer lens—Black Queer Humanism (BQH)—while beholding the many musical, literary, and visual inspirations that came to Baldwin from such eminent artists as Bessie Smith, Aretha Franklin, Nina Simone, Alice Walker, Maya Angelou, Toni Morrison, Audre Lorde, Josephine Baker, Beauford Delaney, Vincent Van Gogh, Vertamae Smart-Grosvenor, Glenn Ligon, Janet Mock, Billy Porter, BLM, among others.

Students read Baldwin’s novels written between 1953 and 1979, his selected short stories (“Sonny’s Blues,” “Going to Meet the Man”), and several key essays. Baldwin’s fiction, which has been often misunderstood and dismissed by critics, in fact examines and anticipates the complex ways in which we approach racialized gender, sexuality, and erotic attraction in our own historical moment. Like “Reconstructing” (see section 3.1), “What’s Love” invites students to develop final projects that engage broader themes in literary and cultural studies, such as the centrality of domesticity to African American artistic production and Baldwin’s theorizations of popular culture.

4. Conclusion

These courses offer invaluable tools to today's young people to enter a diverse and complex world with strong humanities and digital-literacy skillsets. Students get to explore a major international Black queer activist, intellectual, and literary figure, all while honing their reading, writing, and public-speaking skills. Their final projects get published on StoryMaps, thereby offering them an accomplishment to include on their resumes. Students explore intersectional identity in ways that few other courses offer. For example, by exploring Baldwin's daring plots involving interracial couples and queer and other non-normative sexual attachments, students wrestle with his careful dissections of class, religiosity, colorism, and family violence—all of which a politics of respectability often kept hidden and unspoken as much within intimate and local communities as on the national scene at his time, and even in ours. With wars raging in Europe and Africa, and police brutality and gun violence escalating in the United States, our students need humanities skills and new and exciting learning tools more than ever.

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Digital Resources

_ Chez Baldwin: <https://quod.lib.umich.edu/b/baldwin1ic?page=index>

_ StoryMaps basics: <https://doc.arcgis.com/en/arcgis-storymaps/gallery/?resource=https%3A%2F%2Fwww.esri.com%2Fen-us%2Farcgis%2Fproducts%2Farcgis-storymaps%2Fstories>

_ Selected student projects:

<https://storymaps.arcgis.com/stories/43f933f23153477885ab114bf7ff7b08>

<https://storymaps.arcgis.com/stories/b47cba93c8444183997a915e3670b652>

<https://storymaps.arcgis.com/stories/09cf1dfb9e38447a9b3aacc89b3cc1a4>

Audiovisual and accessible translation from a transdisciplinary insight: curriculum design and professional practice for intercultural communication

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Abstract

Audiovisual translation and Media Accessibility are fields of Translation Studies where academic research and professional practice directly influence the translator's training.

In this paper, we address the curriculum design of two modules on Audiovisual Translation and Media Accessibility in an undergraduate level in terms of concepts, modalities, text types, methodology, learning outcomes and software. The main goal is to analyze to what extent professional practice conditions training for intercultural communication.

We find out that there are labor multidisciplinary activities that demand new functions from the audiovisual translator and we conclude with a reflection on the transdisciplinary insight that training necessarily acquires in these fields.

Keywords: *Audiovisual translation; media accessibility; translator's training; employability; intercultural communication.*

1. Audiovisual Translation and Media Accessibility in Translation Studies

Audiovisual Translation (AVT) is the denomination of a translation modality that can be also named in many different ways: dubbing and subtitling, film or cinematographic translation, multimedia translation, subordinate translation, translation for television, translation for the screen... Principally due to its wide scope, the most internationally agreed term is AVT, used as an umbrella term (Díaz-Cintas & Remael, 2021).

This terminological acknowledgement determines the definition of the concept, that needs to be broad enough to cover a wide spectrum of texts and broadcast channels but limited enough to not overlap other misleading modalities of translation that could be integrated under the same umbrella, like webpages localization. In this sense, AVT can be defined as a translation modality whose texts are characterized for offering information through the simultaneous combination of two different channels, the auditory canal and the visual channel, and for being multimodal texts in which at least two codes converge, the linguistic and the visual, sometimes also integrating the musical code (Chaume, 2012).

Media Accessibility (MA), on the other hand, refers to those practices that allow users with sensory impairments (visual and hearing) to enjoy “full access, without obstacles or barriers, to information, entertainment and training offered not only by audiovisual media (film, video and DVD, television, and the internet), but also by other communicative situations such as theatre, opera, conferences, museum exhibitions, etc.” (Díaz-Cintas, 2010, p. 158; our translation). From a more universalist account, MA embraces a “broader conception of accessibility as an instrument for the human rights of all”, and it is not confined to “any specific group of people or barriers” (Greco & Jankowska, 2020, p. 62).

AVT and MA, therefore, have a plural nature prone to approaches from different perspectives that converge in the three valuable poles of all translational and translation activities: academic research, professional practice and training.

The academic grounds are settled within Translation Studies, a discipline that is characterized by its interdisciplinarity, understood as the tendency to establish links with other academic disciplines with which it cooperates in approaches and methods in order to progress in scientific knowledge.

In the specific fields of AVT and MA, this disciplinary convergence reveals itself (i) in the current research trends highlighted in international academic conferences, highly permeable to the inclusion of research perspectives from other academic fields (e.g. Linguistics, Semiotics, Sociology, Film Studies or Reception Studies); (ii) by integrating research methodologies derived from disciplines such as Statistics or Sociology; (iii) through the most cutting-edge research instruments like the ones used for eye-tracking experiments (generally targeted towards marketing studies, professional training, sociological studies or neurological

studies); (iv) in order to implement their results in everyday realities, such as in the form of subtitling for the D/deaf and the hard-of-hearing (SDH), audio description for the B/blind (AD), surtitling for the opera or theatre plays or respeaking for live broadcasting; (v) making its first attempts in immersive SDH and AD environments, mainly intended for the theatre and implying virtual reality technology; (vi) or comprising diversified recipients (e.g. children, languages learners, the elderly, audience with mental impairments, etc.).

2. Translator's training in Audiovisual Translation and Media Accessibility

2.1. Transdisciplinarity

When it comes to the training in AVT and MA, they become a transdiscipline in their own right as they traverse disciplinary boundaries to combine those pedagogical approaches that best suit them according to real professional demands, being the most significant ones:

- i. The approach by learning objectives and tasks (Delisle, 1993), which brings together the intention pursued in the translation process and finally achieved in the translation product by means of various pedagogical activities. That is the case of the following learning outcomes intended for undergraduate translation trainees in the modules subject to revision: "Trainees will be able to translate various types of audiovisual texts to different extents, identify different types of documents and the translation challenges that may be posed by a certain project, analyze their ability to translate each translation assignment and produce a translation of an acceptable quality in a reasonable period of time".
- ii. The functionalist approach (Nord, 2005), which understands translation as an act of intercultural communication, and in doing so the translation trainee should develop a general competence of "Acquisition of knowledge of other cultures and development of linguistic and cultural interaction and mediation skills", as it is stated in the modules.
- iii. The constructivist and social approach (Kiraly, 1995 and 2000), whose axis is the collaboration between trainers and trainees alike, that is, the collaborative learning; in this case, trainees are fostered to engage themselves in developing a transversal competence, namely, the "Ability to work in a team and to relate to other people from the same or from a different professional field".

Nowadays many public institutions, private agents and professional associations, both at national or international levels, offer specialized training in AVT and MA that favors the very much needed emergence of the transdisciplinary audiovisual translator. In an undergraduate level, Spanish universities currently offer modules in AVT, with or without MA in their study programs, as part of the curricula of the degrees in Translation and Interpreting.

2.2. Curriculum Design

Precisely, we contextualize this study within two modules of AVT that are offered in year 3 and year 4 of the Degree in Translation and Interpreting at the University of Malaga (Spain). Being the first module compulsory and the second module optional, the total trainees' workload is 150 hours per module, out of which 45 hours are devoted to classroom training.

The main objective of these modules is to awaken and deepen the inter and intralingual translation competence in AVT and MA from English into Spanish, in the case of AVT and MA, or from Spanish into Spanish, solely for MA. To do so, three specific objectives are followed:

- i. To apply theoretical, terminological and instrumental bases (documentation and computer tools) in the translation of audiovisual texts.
- ii. To understand the translation of audiovisual texts as a professional activity.
- iii. To reflect on the translation process from a linguistic and a pragmatic perspective.

Together with the learning outcomes and competences formulated above, these objectives lead to the design of a very specific curriculum, where transdisciplinarity inevitably rules.

The coordination between the two modules is mandatory so that there is a direct relationship between the time and resources that are invested in the training process and the intended learning outcomes.

For this reason, the following table sums up this effort in terms of concepts, modalities, text types, methodology, learning outcomes and software that are actually used in both year 3 of the Degree (first year of AVT) and year 4 of the Degree (second year of AVT and first year of MA).

Table 1. Audiovisual Translation and Media Accessibility Curriculum Design.

Year 1	Year 2
	Concepts
AVT theory	AVT professional environment:
AVT modalities	○ Global panorama and job prospects
Analysis of the audiovisual text	• Profession
AVT professional environment:	- Project management
○ Self-employment	• Associations
○ Estimates	• Training
○ Invoices	• Challenges
	Modalities
Subtitling:	Subtitling for VOD platforms
○ Machine translation subtitling and postediting	Dubbing for VOD platforms
Dubbing:	Multimedia translation:
○ Voice over/narration	○ Localization and translation of video games
	Media accessibility:
	○ Subtitling for the D/deaf and the hard-of-hearing
	○ Audio description for the B/blind
	Text types
Subtitling:	Subtitling and dubbing for VOD platforms:
○ Movies	○ Movies
○ Trailers	○ TV series
Dubbing:	Multimedia translation:
○ TV series	○ Localization and translation of video games
○ Advertising spots	• Video games
○ Corporate videos	Media accessibility:
○ Voice over/narration	○ Subtitling for the D/deaf and the hard-of-hearing
○ Interviews	• Documentaries
○ Reality shows	• Tutorials
○ Instruction manuals	○ Audio description for the B/blind
	• Animation (short or feature films)
	• Informercials
	Methodology
○ Direct translation EN>ES with/without transcripts	○ Direct translation EN>ES with/without transcripts
○ British EN + American EN + other varieties	○ Intralingual Translation ES>ES (SPS and AD) with/without transcripts
○ Clips 1:30-3:00 minutes long	○ British EN + American EN + other varieties
○ Difficulties: repetitions, hesitations, overlapping voices, speed, humour, puns, foul language, terminology, calques, songs	○ Clips 3:00-4:00 minutes long
○ Assignments: same text types with added difficulties	○ Difficulties: style, register, dialects, sociolects, idiolects, multilingual texts, neutral Spanish, cultural references, sound effects (SPS)
○ Estimates and invoices	○ Assignments: same text types with added difficulties
	○ Estimates and invoices

Learning outcomes

Subtitling:

- Subtitling according to an academic style guide (e. g. Díaz-Cintas and Remael, 2021):
- Spotting (with/without transcripts)
- Formal and textual features
- Translation techniques
- Spatial and temporal features
- Proficiency in subtitling software (with subtitles embedding)

Dubbing (voice over/narration):

- Dubbing according to an academic style guide (e. g. Chaume, 2012):
- Dubbing (with/without transcripts)
- Translation techniques
- Synchronization and adaptation
- Text segmenting
- Dubbing symbols
- Proficiency in dubbing and video editing software (with recording)

Subtitling for VOD platforms:

- Subtitling according to professional style guides (e. g. Netflix or BBC)
 - Review of previous competences and introduction to new ones
 - Subtitling without spotting lists (with/without transcripts)
 - Proficiency in subtitling software (with subtitles embedding)
 - Proficiency in project management
- #### Subtitling for the D/deaf and the hard-of-hearing

- Subtitling according to UNE 153010 and comparison with professional style guides
- Subtitling without spotting lists (with/without transcripts)
- Proficiency in subtitling software (with subtitles embedding)

Dubbing for VOD platforms:

- Dubbing according to professional style guides (e. g. Netflix or Deluxe)
- Review of previous competences and introduction to new ones
- Proficiency in dubbing and video editing software (with recording)

Audio description for the B/blind:

- Audio description according to UNE 153020 and comparison with professional style guides
- Audio description with/without dubbing (with/without transcripts)
- Proficiency in dubbing and video editing software (with recording)
- Proficiency in project management

Localization and video game translation:

- Multimedia translation: subtitling, dubbing, voice over/narration, localization...
- Proficiency in Excel and subtitling, dubbing and video editing software (with subtitles embedding)

Software

Subtitling: Subtitle Workshop

Machine translation subtitling and postediting: DeepL, Google Traductor, YouTube

Subtitles embedding: Handbrake

Dubbing: Audacity + Avidemux /OpenShot

Subtitling for VOD platforms: Aegisub

Subtitling for the D/deaf and the hard-of-hearing: Aegisub

Subtitles embedding: Handbrake

Dubbing for VOD platforms: Audacity + Shotcut

Voice over/narration: Audacity + **Audio description for the B/blind:** Audacity + Shotcut

Project management: Airtable, Google

General software: Any Video Converter/Freemake Video Converter/Handbrake, VLC

2.3. Professional Practice

The curriculum design table is reviewed and updated every year based on the needs of AVT and MA as a professional practice, on the actual university budget and the trainees' information technology (IT) possibilities. The latter explain the choice of free and open source software compatible with Mac and Windows from the myriad of tools available. The former delves into the current demands of the labor market, that require from the audiovisual translator to have professional skills in order to carry out multidisciplinary activities linked, above all, to the handling of new technologies. It is the case of computer-assisted translation tools, machine translation tools, the translation and localization of video games and subtitle post-editing.

In addition, specifically designed AVT tools are a must in the professional skills that any audiovisual translator should master regarding IT. That is the case of specific subtitling software or video editing software useful for dubbing.

Regarding the concepts, modalities, text types and methodology implemented in both years, apart from channeling them towards the professional environment, all are sequenced from the general to the particular, they are graded in progressive levels of accomplishment and they do not overlap, trying to cover the widest spectrum of learning outcomes.

These multidisciplinary activities demand new functions from the audiovisual translator, whose professional practice may appear camouflaged in different terminology. As a matter of fact, if we search under "translation" in the Netflix Jobs webpage, we will find different positions with no trace of "translation" in their denominations, but they would certainly benefit from the translators' professional skills; not to mention that the very same positions are also found under other searching terms, more AVT-related, like "subtitling" or "dubbing": Content Localization Project Manager, Localization Director, Localization Producer – Games, Localization Project Manager, Localization Project Manager – Studio and Marketing, Manager, Film & Series Marketing, Product Manager, Localization, or Senior Animator & Rigger – Games Studio. Being most of these positions related to projects, diverse work teams are highlighted in the lateral menu, some of them belonging to adjacent fields, not specifically to AVT itself, like marketing and advertising, economic sciences, data engineering or even research. This is the case of Consumer Insights, Creative Content, Creative Marketing Production, Creative Production, Data Science and Engineering, Netflix Games Studio, Partner Marketing, Partnership, Product Management, or Strategy and Analysis.

3. Final remarks: An Intercultural Communication Crossroads

AVT and MA can be understood as an intercultural communication crossroads where the academic interdisciplinarity is understood as a flow of parallel knowledge that is integrated into AVT and MA; the professional multidisciplinary refers to the versatility of the audiovisual translator's professional skills, and the training transdisciplinarity relates to the figure of the audiovisual translator as a whole different from the sum of the parts that compose them.

This configuration poses further challenges to the AVT and MA trainer, who must always make an effort to update their curriculum design in relation to the work demands of the prospective audiovisual translator while not neglecting the academic reflection on the translation processes.

As for the latter, envisaging the turn towards Accessibility Studies as a different field from Translation Studies (Greco & Jankowska, 2020) would allow more academic deepening in both fields separately and in cooperation; as for the former, encouraging the collaboration of educational institutions with AVT and MA companies in the form of, for instance, employability and entrepreneurship actions (Enríquez-Aranda & García Luque, 2023) or professional training for trainers (Bolaños-García-Escribano, Díaz-Cintas & Massidda, 2021) would bring training closer to the professional context. The route ahead offers large possibilities starting as it does from an intercultural communication crossroads.

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Setting learners up for success: a universal design for learning approach to industry placement assessment

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Abstract

The diversity of learners has never been more pronounced with the accessibility to learning through remote means. Universal Design for Learning (UDL) endeavours to address some of the challenges posed by their diverse needs. This research aims to explore the perceptions of learners and their academic supervisor on the use of UDL principles as part of the assessment strategy of an Industry Placement module undertaken in a higher education institution. The learner participants were offered assessment feedback in a number of different formats by the supervisor participant; namely typed and video. The results of the research indicate a very positive response from both stakeholders. Multiple means of representation and action/expression were found to help break down barriers for diverse learners and to set them up for success. Scaffolding and content creation methods that are comparable in terms of workload need to be provided to increase adoption by both stakeholders.

Keywords: *Universal design for learning; multiple means of representation; multiple means of action & expression; assessment strategy; industry placement.*

1. Introduction

Offering learners equal opportunities when it comes to their educational journey seems like something that should be the norm rather than an exception. However, in reality, this is not always the case. Novak (2022, pg. 2) reports that learners often experience “academic, behavioural, social-emotional, cultural, and linguistic barriers” to learning. These diverse needs of learners require a customised approach to learning goals, course content, delivery methods, and assessment. The Universal Design for Learning (UDL) framework developed by Meyer and Rose in the 1990s aims to cater to the diverse needs of learners (Meyer, Rose, and Gordon, 2014). Novak (2022, pg. 19) defines the Center for Applied Special Technology (CAST) UDL framework as “an expression of a belief that all students are capable of learning and that instruction, when crafted and implemented with this belief in mind, can help all students succeed in inclusive and equitable learning environments”. The UDL framework applies a three-pronged approach of multiple means of engagement, multiple means of representation, and multiple means of action/representation (CAST, 2023). Multiple means of engagement enable learners with different motivations to become interested and to successfully complete their programme of learning. Sensory disabilities, learning disabilities, language, and culture all influence how learners understand and comprehend content presented to them. Multiple means of representation set out guidelines to support educators in offering choices to learners. Lastly, the provision of multiple means of action and expression empowers learners to choose the means of communicating their learning in a way that matches their strengths. The importance of choice is reinforced by Merrill and Gonser (2021) when they state, “By centering choice, educators signal openness to negotiating the middle ground and offer students scaffolded opportunities to practice decision making, explore their academic identity, and connect their learning to interests and passions”.

The challenges of remote learning have also become more prominent in recent years and are of interest to this study. While remote delivery has made learning more accessible it has also brought many challenges. There is no in-person contact, and therefore fewer opportunities for informal communications, for clarification and feedback purposes, to take place between learners and lecturers. Both parties need to proactively arrange formal online meetings and/or send emails. This lack of engagement choice is a challenge for diverse learners and a barrier to success. On the other hand in on-campus settings, informal communications happen organically - learners approach lecturers at the end of lectures, chance meetings in the corridors, and/or dropping into a lecturer’s office. These and other informal communication methods provide the on-campus learners with multiple means of communication with their lecturer. Peer-to-peer exchanges are also more prevalent in on-campus learning. The lack of effective interaction in an online environment is confirmed by Tarhini et al (2013). For remote delivery, information representation often defaults to a typed format – such as email/learning platform notifications, assessment briefs, and feedback. While a typed format

is also used as part of face-to-face delivery it is supplemented by other diverse means of communication not feasible and/or applied in remote delivery. This combination of reduced means of communication and reduced means of information representation poses a challenge for remote learners with the diversity of remote learners and their needs far more pronounced when compared with face-to-face learning. UDL literature highlights the value of supporting learners “It’s about eliminating barriers so every student can succeed” (Novak, 2022, pg. 33).

The overall aim of this research was to explore the perceptions of learners and academic supervisors on the implementation of UDL principles as part of the assessment strategy of an *Industry Placement* module undertaken in a higher education institution. This included exploring learners’ views on the possibility of being offered alternative means of expression when submitting assessments in the future and the experience of an academic supervisor using multiple means of representation when providing assessment feedback. The research was developed to address the needs of diverse learners who are engaged in remote learning, specifically on professional placement, who have been found to be under-represented in higher education in Ireland (Waters & Rath, 2022). The stakeholder’s viewpoint will help to understand how the current assessment strategy is meeting the needs of the learners and academic supervisors and what impact UDL principles can have. It is hoped learners’ engagement and success can be improved.

2. Methodology

A case study approach was employed for this research. This involved exploring the participants’ experiences of assessment when UDL principles were applied to a module they were engaged with. Yin (2018, p.15) defines “a case study is an empirical method that investigates a contemporary phenomenon (the ‘case’) in depth and within its real-world context”. A stage 3 *Industry Placement* module was selected as the case study for this research. Learners undertake the *Industry Placement* module – worth 40 out of 60 credits - from September to May. They are required to attend the industry placement company four days a week and online lectures one day a week. An academic supervisor is assigned to the learner to guide and assess their learning and engagement whilst on industry placement. The learners typically have no face-to-face contact with their academic supervisor except for one meeting during the academic year that takes place in their placement company. Communication is via email and MS Teams meetings. Assessment of the module includes learners submitting weekly placement reflective journals, to a personal learning software called PebblePad, detailing their learning experiences. The academic supervisor provides feedback on a weekly basis which the learners must respond to in subsequent journal submissions. The current assessment strategy stipulates the learners submit a typed reflective journal with up to 8 supporting images on PebblePad by 9pm at the latest each Sunday and the academic supervisor provides feedback via a text box and the option to add an attachment

in PebblePad by 6pm at the latest each Friday. Learners are not offered alternative means of expression when submitting their reflective journals and multiple means of representation are not being utilised by the academic supervisors when providing feedback to the learners.

In semester 1 of the 2022-2023 academic year an approach was made to one of the researchers by a learner on the *Industry Placement* module who reported they were struggling to comprehend and respond to typed feedback from the researcher who was their academic supervisor. Specifically, interpreting passages of text was identified by the learner as being an issue. This was causing the learner a significant amount of anxiety and stress. The learner also disclosed they had several learning difficulties the academic supervisor was unaware of. The means of representation were not effective for this learner's needs. In response, UDL principles were piloted to alter how feedback was provided to this learner by the academic supervisor and later rolled out to a number of other learners. This included focusing on providing clear and structured feedback, adding numbering to separate out points of information and where a response was required, recording feedback using MS Teams video, providing the video link, attaching a copy of the video and the transcript of the video to the feedback form in PebblePad, and encouraging the learners to engage with learning support where appropriate. The application of UDL principles to this module set out to address the shortcomings identified and reduce barriers for diverse learners to succeed in the module.

Purposeful sampling was used for this research, with the academic supervisor participant the researcher, and the three learner participants being supervised by the academic supervisor participant. This was conducted as a pre-pilot study with a view to conducting a full pilot in the 2023-2024 academic year with a full cohort of learners (n=36 and academic supervisors n=7). Hence the small sample size in this case.

Data was gathered from the learners in the form of an interview conducted by the researcher who was also the academic supervisor. The learner participants were asked about their views on the current assessment strategy and the initial UDL principles tested including 1) their experiences of the UDL principle employed in the assessment of the *Industry Placement* module, 2) their perceptions of the barriers and support for student success for diverse students undertaking remote learning using UDL principles. A semi-structured interview was used with a combination of open and closed questions. The duration of the online interviews was 10 minutes. An online interview using MS Teams facilitated learner participants placed in companies in different geographical locations to complete the interview. The academic supervisor participant engaged in personal reflection on the experience from their perspective documented through a video and engaged in dialogical reflection with the learner participants.

Ethical issues of the research pertained to the risks of 1) actual and perceived student coercion due to the power balance of the researcher as the academic supervisor of the learner

participants, and 2) disclosing confidential information provided by the participants (including personal and/or sensitive data). These risks were mitigated by taking appropriate measures in the research method including obtaining ethical approval from the institutions' ethics approval committee, informing the learner participants that participation in the study would confer no academic advantage or disadvantage for them, providing information sheets and an opportunity to ask questions, voluntary signed consent, the right to withdraw up until the interview transcripts were collated and data anonymized, and the anonymising of all personal/organisation names provided in the interviews.

3. Findings & Discussion

The findings of this research will be discussed from the perspective of the learners first, followed by the perspective of the academic supervisor.

3.1. Learner Findings

Of the three learner participants, all three submitted their reflective journals in a typed format as stipulated by the assessment strategy. When asked if they ever asked to submit using a different means of expression Respondent 1 (R1), Respondent 2 (R2) and Respondent 3 (R3) said no. R1 commented, "They've asked me to do this in writing, so I'll just do it in writing. Keep my head down and get it done". All three respondents expressed an interest in submitting using different means of expression. R2 is cited as saying "I haven't thought about it for other[s] kinds of assessment" and "maybe I would consider something more creative, like a presentation or [or] even a video". A similar response from R1 states "maybe a video a week would be useful, ... and kind of it would be a bit...less stressful". R1 ranked their preference of reflective journal submission formats as follows: "Audio or video, probably first and then face to face, then writing... probably last". There was some caution expressed by R2 "I've been most confident in the writing just because that's what we do all day, every day and even at work now, writing emails every day". R3 was "definitely [be] open, open to doing a different method" but reported being worried about the quality of the submission using different formats citing "my grades might take a hit for a little bit" but "I would eventually get better at it and it would probably even exceed my typing potential". On the other hand, R1 spoke about hoping it improved the standard of their submissions when they said "Maybe I'd feel more connected to it, so maybe I'll put... more of an effort ... Yeah, it would make it more colorful and more kind of interesting". The issue of support to create reflective journals using formats other than typed was then discussed. While R1 felt confident they did not need support creating videos as "it's not something I'm entirely unfamiliar with" and "it's quite an easy kind of an easy medium to...to take on board", the other two respondents felt support was needed. R2 cited needing technical support while R1 said "I would like to experience all methods to see what I am best with". Specifically getting to

experiment with the methods and become competent without the pressure of being assessed was suggested.

The participants were asked for their perceptions of the change from typed to video feedback from the academic supervisor. All were very positive with R3 making comments such as it “just help[ed] me keep up with it”, “it was definitely a massive improvement”, “that was a massive weight on my shoulder” and “the spoken word was easier to consume”. It’s noteworthy that this respondent has learning difficulties and found typed feedback difficult to comprehend. R2 said they did not need to receive video feedback but “it feels more personal” and “It’s just friendly through the video”. Likewise, R1 reported that they found both typed and video feedback were equally effective but feedback via video was “nice because I can tell tones” and “I can tell if there’s something umm you want to tell me that I might miss in the writing... which is interesting”. R1 also cited in reference to video feedback “I really liked it because I found it easier to remember...I’d be working in the workshop...remember something you said”. Both R1 and R2 confirmed they do not have any learning difficulties. So, while R1 and R2 said they did not need video feedback if they had a choice they would choose receiving video feedback.

3.2. Academic Supervisor Reflections

In terms of the means of representation utilised by *Industry Placement* module learners, the academic supervisor participant had no preference as to the means of expression they would receive for review and assessment. As per the assessment rubric for the reflective journals, the academic supervisor participant encouraged and found it beneficial when R1, R2, and R3 used supporting images, along with the typed feedback to assist the understanding of the subject matter being discussed in the journal. Their reflection on providing multiple means of representation for the reflective journal was a positive one with the option of the learning being able to choose to be promoted. The academic supervisor comments “help the student to find what they’re best at and how they can maximize their grades”.

The academic supervisor had never provided video feedback to learners of any module previously. Instead, typed feedback was used as was common practice among the participant and their academic peers in higher education. While there was no question that the academic supervisor would not apply their knowledge of UDL principles to change the feedback format in the hope the difficulties R3 was experiencing could be resolved. However, there was a preconception on their part that it may take longer than typed feedback and there may be a drop in the quality of the feedback. The experience of the academic supervisor participant of creating video feedback was that it did involve a learning curve and initially, it took longer than typed feedback. However, the academic supervisor reports they got faster at creating videos with practice. Secondly, with practice, the academic supervisor reflected their diction improved and delivery become more natural. Transcripts required post-video editing. Over

the course of the semester, as the academic supervisor became more proficient with creating and editing video feedback they reflected “it is marginally longer than with the written one...the transcript is probably the hardest bit... I go through it and I delete the time stamps”. Learner participants reported they watched the feedback video and read the accompanying transcript. For academic supervisors to engage with video feedback the academic supervisor participant asserts “a supervisor [needs to] be comfortable in whatever media they use for feedback... that you know it supports the student, but it's not onerous and it's not a stress for them either”. The academic supervisor has questioned whether both means of expression are equal in terms of quality “I could do a lot more editing and very carefully choose my words and language in a written one. That I couldn't do in the video unless it was going to be recorded 100 million times”. When questioned all three learner participants reported they did not notice a drop in content and quality when the means of representation changed from typed to a video format.

Like the learner participants, the academic supervisor participant did report they preferred video feedback “I enjoy it as well” and “I felt more connected with the students by me speaking to them”. Interestingly, when R1 and R2 were asked towards the end of the semester which means of representation they preferred R2 said “It was a nice change and I'd be happy to get the feedback in that format in the future - whatever is easiest for you”. Interestingly, the academic supervisor participant was now in the position where choice has been handed back to them by a number of the learner participants as to what means of representation they wished to use to provide feedback. On reflection, the academic supervisor participant decided “I could have given written feedback to a number of those students, [but] I opted not to because I actually enjoy doing the video feedback”.

4. Conclusions & Recommendations

Although only a small pre-pilot study the perceptions of the learners and academic supervisor stakeholders indicate the UDL interventions in the *Industry Placement* module assessment strategy were beneficial and supportive of the participating learners. These interventions included focusing on providing clear and structured feedback, adding numbering to separate out points of information and where a response was required, recording feedback using MS Teams video, providing the video link, attaching a copy of the video and the transcript of the video to the feedback form in PebblePad, and encouraging the learners to engage with learning support. In particular, it ensured that learners with learning difficulties could fully engage with the reflective journal assessment element of the module and it set them up for success. UDL choice empowered the learners to be resourceful, and knowledgeable and to take ownership of their learning for the *Industry Placement* module. Any changes to industry placement journal submissions and feedback should not take learners/academic supervisors longer than current means of expression and representation. Remote learning was found to

pose a challenge for students with diverse learning needs. It is more difficult to access multiple means of representation and expression, to link in with peer support, and to engage with institutional learning supports. The importance of face-to-face visits cannot be underestimated to ascertain UDL needs.

Five recommendations emerge from the research namely; 1) Ensure the *Industry Placement* assessment strategy provides learners with a choice when submitting their reflective journal submissions and update the personal learning software PebblePad to accept them, 2) Encourage both learners and academic supervisors to explore multiple means of expression and representation, 3) Provide scaffolding for learners and academic supervisors to ensure they are competent in alternative means of expression and representation, 4) Develop methods for creating content using multiple means of expression comparable in terms of workload, 5) Conduct a wider study with a full group of learners and academic supervisors in a future iteration of the *Industry Placement* module to ascertain the impact of UDL principles on the assessment strategy on learning success.

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The UNIVAC project: implementing the user journey approach in accessibility research at university

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Abstract

Work for inclusive, quality education and the reduction of inequalities is among the prioritised lines of action promoted by the Sustainable Development Goals of the United Nations (2015). In the context of higher education, persons with sensory disabilities who study and work at universities face daily accessibility challenges when interacting with their pervasive digital environments. The ongoing UNIVAC research project aims to qualitatively analyse the measures taken by Spanish universities to overcome such challenges, as well as to explore areas of improvement in accessibility at university. This paper presents the project's aim and scope, and proposes the adoption of the cross-disciplinary user journey approach as a form of methodological innovation in accessibility research in higher education.

Keywords: UNIVAC project; accessibility; user-centered research; user journey; persons with disabilities.

1. Introducing the UNIVAC project

Today, there is a growing interest in the international arena to work for inclusive, quality education. Work for inclusive education and the reduction of inequalities is consistent with the Sustainable Development Goals (SDGs) proposed by the United Nations (2015), which establish, among others, the following objectives:

By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university.

By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations.

Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, nonviolent, inclusive and effective learning environments for all.

In this context, the project *Sensory accessibility at the Spanish university: current needs and prospective solutions* (henceforth UNIVAC) aims to analyse the response given by Spanish universities to the needs of persons with sensory disabilities (PSDs). In a context of increasing digitisation, which has been exacerbated by the Covid pandemic, the project intends to offer a reliable diagnosis of the reality of our university system. Such a diagnosis is a necessary first step towards the implementation of measures to guarantee PSDs' equal opportunities and their right to quality education. UNIVAC proposes an empirical study based on a wide set of qualitative data aimed at revealing both the needs of PSDs and the actions currently taken to cater for them in the public universities of three autonomous communities in Spain, namely Andalusia, Catalonia, and the Basque Country.

The project focuses on the needs of PSDs belonging to the three main types of university user groups, namely, students, teaching and research staff, and administration staff. The object of study are not PSDs in themselves, but rather the *environments* in which they carry out their daily activities and, more specifically, the digital or digitised environments (the physical classroom in which digital material is used, the software used by university staff, the virtual classroom, registration management applications, and so on). This approach is aligned with the social and the human-rights conceptions of disability, in accordance with which disability is perceived as an experience of avoidable exclusion linked to the environment (Albert & Hurst, 2012; Huete, 2013). In the project's framework, the source of any access barriers is not an individual with disabilities, but rather an inaccessible society, which is not prepared for a digital transition that takes everyone into account. Thus, any interventions to improve accessibility need to take place on the environment. In this context, key digital accessibility services designed for PSDs come into play: the project will report on the degree of implementation of services such as captioning, subtitling, translation and interpretation in

sign languages, audio description, the audio induction loop, audio guides, alternative text, adaptation of texts to the Braille system, large print, or speech synthesis, among others.

Apart from aiming to respond to a social need—the current context of digitisation should not leave PSDs behind; in this case, by keeping them apart from the university system—, the project seeks to advance in both the theoretical and descriptive knowledge gathered in the field of inclusive higher education. Through reports published by entities that work for the inclusion of persons with disabilities in higher education in Spain, such as the Universia Foundation¹, we have access to statistical data that draw attention to the number of students who denounce situations of inaccessibility faced during their university studies. This kind of quantitative information does not by itself allow to map the types of accessibility challenges faced and propose solutions, as the data must be complemented with qualitative information. The innovative approach of the project is precisely the qualitative insight that is gathered from PSDs through focus groups, semi-structured interviews and student diaries, all applying the user journey approach. Ultimately, UNIVAC is expected to empirically contribute to policy-making. In this regard, the participation of inclusion staff in the project is another strong suit.

2. Aims and scope of the project

As has been mentioned, the project aims to offer a diagnosis of the current situation in regard to the challenges and measures taken to provide inclusion for PSDs studying and working at university. More specifically, the project has three main objectives: the first one is to describe the different types of needs described by users with different profiles (year of study, area of knowledge, work field, type of disability). This objective will allow us to interpret the quantitative data already available today in regard to disability and higher education, such as the dropout rates of students with disabilities, as well as the underrepresentation of PSDs in MA and PhD degrees (Fundación ONCE, 2022). In relation to the staff, the project will focus on identifying accessibility challenges and solutions in current workflows.

The second objective of the project is to explore the accessibility services available at this stage, and those on demand by users. Likewise, the project will describe the degree of satisfaction with the present services, both on the users' part and on the providers' (e.g. inclusion service units at the universities under study, teaching staff providing accessible materials to students with disabilities). Research actions connected to this objective will reveal whether access services are applied *ex ante*, i.e., in the design phase and in accordance with the principles of universal design, or *ex post*, after the user's demand, as an adaptation

¹ <<https://www.fundacionuniversia.net>>. [02.02.2023]

of a previously designed, inaccessible service or product (Greco, 2019; Arias-Badia *et al.*, 2022).

The third objective of the project is connected to its intensive dissemination—as has been argued in the specialised literature, in the case of projects aimed at improving the accessibility of environments or services, it is particularly important for the results to reach and be “understandable” by the main potential beneficiaries of the research conducted (Greco & Jankowska, 2019, p. 8)—in this case, PSDs, university students, and university staff. The right of all citizens to participate in scientific progress and to enjoy its benefits and applications is included in fundamental texts such as the Universal Declaration of Human Rights (art. 27) or the International Covenant on Economic, Social and Cultural Rights (art. 15b). Likewise, the project wants to go beyond raising awareness about the need to pay attention to accessibility and raise specific applicable proposals; the latter is in line with the appeal recently made in the European TRACTION project to European researchers working on accessibility (Orero, 2020).

3. Methodological approach

The study adopts a qualitative methodology. This section briefly reports on the types of data collected for the purposes of the project, as well as on the approach adopted in the research actions involving participants.

3.1. Data under analysis

Two types of data will be collected and analysed: data reported by informants and data derived from the analysis of digital materials. The data reported by informants will include the following:

- the recordings and transcripts of focus groups, with active students, with graduated students, and with staff;
- the recordings of the observation of the interaction with digital media by PSDs, to complement the self-reported challenges identified in the focus groups;
- questionnaires to representatives of the three stakeholders involved in the project;
- semi-structured interviews with representatives of non-profit organisations working for the rights of PSDs;
- semi-structured interviews with accessibility professionals who work with users of sensory accessibility services;
- diaries and longitudinal monitoring of a selection of users. A detailed follow-up will be carried out on the experiences related to sensory accessibility of two participants from each of these groups: students with disabilities, university staff

with disabilities and teaching staff (with or without disabilities) with experience in teaching PSDs.

The data derived from materials analysis will consist of the following elements:

- main website (homepage) of the universities of the participants in the focus group;
- website presenting the studies of the participants in the focus group;
- website presenting the inclusion service unit of the focus group participants' universities;
- registration application of the focus group participants' universities;
- main website of the virtual campus of the focus group participants' universities;
- accessibility guidelines and training material offered to university staff;
- selection of teaching materials used by the students participating in the focus group;
- selection of software and digital documentation frequently used by the staff with disabilities participating in the focus group.

The first data set (derived from social research instruments) will be analysed through thematic analysis (Braun & Clarke, 2012) using the computer-assisted qualitative analysis software ATLAS.ti. As explained in the following section, the qualitative data coding will incorporate the phases of the user journey approach as themes. A content analysis will be applied to assess the second data set (derived from the above-cited materials and documents: university websites, accessibility guidelines available to university staff, teaching materials, etc.). This analysis will also be conducted with the aid of ATLAS.ti.

3.2. The user journey approach

The term *user journey* is employed in the field of User Experience Design (UX) to describe the prototypical path followed by users to reach a goal when consulting a website (Endmann & Keßner, 2016). Similarly, the notion of the *customer journey*, from the field of Business research (Tueanrat et al., 2021), is used in state-of-the-art industry research conducted with accessibility users as informants to establish which processes call for the implementation or improvement of accessibility services.

UNIVAC will incorporate this cross-disciplinary notion in the design of all the research activities involving user participants, as well as in the description of the results of the project. The project is interested in mapping the phases of the *student/worker journey* through university in which inaccessibilities arise. Thus, the interviews, focus groups and questionnaires will contain blocks on the following aspects:

- discovery: this block will contain questions about situations of (in)accessibility related to the phase in which users realised their need or desire to study or work at university.
- information: this block will contain questions about situations of (in)accessibility related to the phase in which users tried to find out about possible studies / jobs.
- selection (“sale”): this block will contain questions about situations of (in)accessibility related to the phase in which users opted for studies/jobs.
- follow-up (“acquisition”): this block will contain questions about situations of (in)accessibility related to studies / job performance.

In sum, the UNIVAC project combines several qualitative methodologies to 1) describe the state of sensory accessibility measures in Spanish universities applying a user journey approach, 2) to cross-check university staff (both professors and inclusion staff) and students’ experiences with data derived from the analysis of digital materials, and, ultimately, 3) to encourage policy change regarding current shortcomings in (digital and in-person) accessibility services in higher education settings.

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About change: how institutionally aligning online pedagogy, design and technology impacts higher education teachers

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Abstract

Emerging empirical evidence in e-learning research is revealing the advantages of aligning learner-centred pedagogical practice with social learning-based instructional designs and appropriate interactive technologies to bring about systemic changes to learning online. This inquiry forms part of a larger qualitative action research study. Our aim was to determine the impact of such a cross institutional change initiative on a group of instructors, teaching in multi-disciplinarian fields in a higher education technical institute in Chile. Findings from questionnaires, field notes and in-depth faculty interviews revealed that evolution towards teachers' roles as mediators and identities as empowered facilitators and community builders occurring over the initial years of the initiative were accompanied by encouraging signs of the development of 21st century skills and identities on the part of students. In our post pandemic era, as online learning becomes more the norm, understanding such effective pathways to excellence in digital spaces is paramount.

Keywords: *Higher education; distance learning; online instructional design; 21st century pedagogy; social interactive technologies; identity.*

1. Introduction

In the ‘new reality’ of the post pandemic era, more institutions than ever are incorporating online learning as a permanent offering in their programming. How do they avoid the well-documented pitfalls that befell many online learning contexts in the pivot to distance learning, and indeed even before (Zhang et al., 2022)? In recent decades, promising theories have emerged that seek to provide solutions for guaranteeing effective learning in online spaces. An ongoing debate around ways of connecting these theories with ‘real’ practice has surfaced as a result (Pange et al., 2011). More recently, scholars have argued that advances in creating this connection can be achieved by aligning instructional designs (ID) and pedagogical practices with contemporary learning theory and with the use of social media technologies in online settings (Picciano, 2017; Margaryan et al., 2015). Teachers are vital in these change processes. Knowing the voices of teachers from an institution that has managed to implement such an aligned ID/pedagogical practice /technology model (Charbonneau-Gowdy et al., 2022) could add valuable insight into the challenges teachers face in such change processes and the kinds of viable support mechanisms that are required for the theory/practice connection to be realized and effective online learning to be assured. Indeed, scholars examining the various levels of teachers’ preparedness and abilities in online spaces and the impact on learners (Vlachopoulos & Makri, 2021) are pointing to a paucity of research in this area.

Our study was intended to respond to this call. From 2020 to 2022, the Chilean technical institution we report on in the study launched a collaborative macro/meso/micro initiative to address inconsistencies in the frameworks of their distance learning programs. Institutional policies professed that programs were preparing students for the highly social workworlds in which they were inhabiting – contexts that require networking, strong communication skills, critical and innovative thinking in technical areas. Yet, in reality its programming emphasized students working online in individual silos accumulating information and being evaluated on their abilities to absorb and retain this knowledge. The change initiative, with the internal support and drive of one of the researchers, herself a senior administrator, involved taking concrete steps across all program areas to align online instructional designs, pedagogical practices and uses of technology with current 21st century social-learning based theory (Charbonneau-Gowdy, 2022). At the same time, teachers were supported in a process to transform their practices from an emphasis on content and evaluation of information retained, to one in which promoting learner agency, social learning through community building and the engaged use of interactive technologies, were integral. The aim of this study was to understand the experiences of teachers in this newly installed institutional trajectory. We focused on academic staff employed in the institution (n=73 of 150) during the period from 2020 to 2023 and how they related to the changes both in teaching and student learning that

they were being called upon to implement and promote. The following questions guided the inquiry:

1. In what way did this group of teachers relate to the new direction in online learning practices being established in the institution?
2. In their view, what changes, if any, did they find themselves making in their roles as teachers over this period?
3. What changes, if any, did they witness in learners' identities and practices?

2. Theoretical Underpinnings

With the experience that many in education have had online during the recent COVID-19 pandemic, few would dispute that the use of technology leads unquestionably to effective learning. For the last two decades, e-learning scholars have extolled the advantages and virtues of technology-based learning (Castro et al., 2019). Yet, it became clear during the pandemic that these claims presupposed certain contextual conditions – pedagogical, design-based and technological. Gathering from reviews of scholarship documenting educational experiences lived online during the pandemic, these conditions were in too many cases absent (Vlachopoulos et al., 2022). As Adinda et al. (2020) have stressed, it is only in the epistemological conformity of these conditions with contemporary learning theory and 21st century goals that effective online learning can be achieved.

Essentially, these theories and goals a) place learners and their agency at the centre of learning processes; b) are predicated on the understanding that learning is a complex social interactive phenomenon; c) involve learners in community collaborating on co-constructing knowledge based on their individual social contexts and experiences; and d) have important implications for learners' competencies and identities in a highly dynamic, technology-driven society (Charbonneau-Gowdy et al., 2019). It is evident that the roles teachers play in ensuring these kinds of scenarios for learners in their classrooms deviate substantially from traditional ones. The challenge has been how to support teachers in making the transition to these new roles.

In the last two decades, theorists in e-learning have proposed models to support teachers, and other stakeholders, in recognizing the importance of such practices and conditions in digital spaces (see Picciano, 2017). While each distinct, these theories share a common focus relevant to our study – that is, to advance the concept of online learning environments as spaces where teachers share a role with students in deliberating ideas, where social presence is evidenced through teacher/student engagement in discussion boards, blogs, wikis, and videoconferencing, where a teacher's aim is to promote knowledge construction and the development of abilities, including metacognitive ones, rather than the dissemination/assimilation of information, where teachers foster the collaboration of learners

to solve problems through discourse, and where their role is to be active facilitators and an essential part of the learning community (Picciano, 2017).

Theories can propose frameworks for effective teaching and learning online, yet recent studies show it is through solid instructional designs that closely reflect these contemporary e-learning theories that ‘real’ pedagogical practice can be impacted. A case in point, Margaryan et al. (2015) assessed the instructional design quality of 76 distance learning programs, (MOOC’s). They found the majority “faired poorly” in aligning contemporary theory-based design to online practice. The framework and key questions used in their analysis (Table 1) allowed us to draw inferences about the roles and pedagogical practices of teachers in our study.

Table 1: Framework for evaluating instructional designs used online (Margaryan et al., 2015).

Guiding Principle	Description
Problem-centred	Learners learn skills in the context of real-world problems
Activation	Learners activate their existing knowledge and skills for developing new skills
Demonstrated	Learners learn when exposed to “real” examples of new skills to be learned rather than information
Application	Learners have opportunities to apply their new skills to solve problems
Integration	Learners have opportunities to reflect on, discuss and defend their new skills
Collective knowledge	Learners contribute to collective knowledge
Collaboration	Learners collaborate with others to build knowledge
Differentiation	Learners have options according to their individual needs
Authentic resources	Learners are put in real world situations
Feedback	Learners are given regular feedback

3. Methodology

A qualitative participatory action research (PAR) methodology was chosen for the study for several reasons: i) the underlying incentive involved this approach to respond to challenges and the “potential in the approach to create meaningful and authentic change for those involved” (Barcelona, 2020, p. 9); ii) the emphasis the approach places on drawing together the macro, meso and micro levels of the institution, a critical component of sustained change

initiatives in online teaching and learning (Charbonneau-Gowdy et al., 2019); iii) its suitability for investigating complex human activity and for uncovering participant voices (Denizen et al. 2005).

3.1. Research Design

Table 2 illustrates the various overlapping phases of the study and the tools used to collect the data in each phase. These research phases coincided with the 3-pronged program changes in Instructional Design, technology tools and pedagogical practices to which teachers were in parallel adapting and in which they were playing a key role. Essentially, the institutional changes included: a) adding synchronous videoconferencing sessions in all courses for building learning communities; b) providing increased opportunities and resources for student collaboration on both learning assignments/projects and assessment processes; c) using group project-generated media as course content ; d) incorporating forums, padlets and career-designated community sites into courses for students to exchange ideas and opinions; e) creating separate institution-wide faculty and student online community sites.

3.2. Context and Participants

The study took place in Chile, considered an economically stable country one of only 2 members of OECD in South America, yet with deep socio-economic divisions and where a majority of citizens have unequal access to quality education. Teachers in general are poorly paid and lack employment stability resulting in a recent concerning national drop in interest in the profession. The institution where the study took place employs on average 150-200 faculty members – 46% permanent 54% non permanent, the latter contractual many of whom must supplement their incomes by teaching elsewhere. Students are all working adults, the majority from vulnerable disadvantaged backgrounds, both educational and economic.

The privately-owned technical institute, founded in 1985, has offered 100% online programs since 2017, one of few prior to the pandemic to do so. Technical courses are offered in 15 career streams organized in 5 areas: administration, education, industrial, health and social. Seventy-five teachers from a cross-section of these areas responded to the survey during Phase 4 of the study, and 9 of this group opted to participate in the in-depth interviews. Teachers' voices (n=105) were also represented in the various field notes collected over the phases of the study (Table 2). Participants represent 3 groups of experience – those with experience before and during changes, those employed at the outset of the change and those who joined in the second year of the process.

Table 2: Four phases of the study.

Phase	Type of Data	Description
<i>Phase 1: Introducing ideas for change:</i> September & October 2020	Field notes: Minutes of meeting	Collaborative discussions with representative teachers, heads of department and management on improvements to virtual classroom resources (n= 20)
<i>Phase 2: Bringing awareness to social learning in the online modality:</i> November 2020 to August 2021	Field notes: Documents	Teacher awareness-raising actions with information delivery (articles, infographics, capsules)
<i>Phase 3: Institutional trainings in relation to social learning in online modality:</i> November 2020 to December 2022	Field notes (2020): Minutes of meetings Field notes (2021): Meeting notes Digital correspondence	Online collaborative capacity development sessions with teachers (n = 60) <ul style="list-style-type: none"> • Sessions to promote the development of collaborative capacities with teachers (n = 57) (2021). • Communication in digital environments (n=37) (2021). • Sessions to foster intentional feedback and interaction with students (n=59).
	Field notes (2022): Workshop observations	The Role of the Teacher as Coach: The Learning Revolution (n=75) – workshop sessions on teaching strategies to generate meaningful learning
<i>Phase 4: Follow-up and teacher support:</i> March 2021 to January 2023	Field notes: Documents Teacher surveys (January 2023) Teacher interviews (January 2023)	<ul style="list-style-type: none"> • Minutes of meetings by area January 2022 (5 areas). • Minutes of teacher feedback on individual support sessions <p>Teacher feedback surveys on ID-pedagogy-technology institutional changes (n=73)</p> <p>2 recorded ZOOM 60-minute feedback sessions - teachers reacting to their roles in the changed programs and their observations of students (n=9)</p>

3.3. Data Collection and Analysis

Data was collected using the various qualitative tools listed in Table 2. The data was analyzed using grounded qualitative coding methods involving a combined inductive-deductive process (Miles et al., 2014). After establishing a conceptual framework, a series of iterative steps were taken that included: i) inspecting the data sets for those data that could inform the research questions; ii) multiple readings and considerations of the data sets; iii) condensing and coding the data for key concepts and ideas that related to the theoretical framework and literature review; iv) identifying and refining salient or common themes from coded data; v) forming a conceptual framework that could be corroborated by findings.

4. Analysis and Discussion of Findings

Based on data from all data sets, the investment that the institution made not only in the alignment of design/pedagogy/technology but also in a systematic ongoing and regular support (Table 2) of faculty's efforts to apply appropriate changes in their teaching, reaped positive results - encouraging signs of development in teachers, and ultimately in their students. Two themes emerged from our analysis of the various data sets: 1) the evolving roles and identities of teachers and 2) the evolving roles and identities of students.

4.1. The evolving roles and identities of teachers

Change leaders in the institution were well aware that the sustained success of their 3-pronged initiative to ensure that their distance programming was aligned with current learning theory laid essentially in the hands of the faculty and their teaching practices. Evidence of a trajectory on the part of a majority of teachers (see Table 3) in terms of their roles was unpacked from the data analysis. Early data suggests that many saw their roles at the time as content developers and information distributors, responsible for motivating students to absorb knowledge and provide prescriptive answers to questioning. For the most part, faculty members in these early stages considered and fostered learning as an autonomous process and took little initiative to engage with students in virtual classes or online in forums. Over the course of the PAR project, the ongoing support and guidance teachers received led to considerable development of their teaching practices that reflected new strategies and roles as evidenced in: i) increased focussing on learner-generated content, ii) promoting of group work where students would co-construct new knowledge in their fields and think critically, innovatively, metacognitively and iii) exploiting interactive tools to engage with their students and to build enriched professional relationships and communities of practice. In tandem with these changed roles, teachers assumed more confident and engaged identities as online learning guides and facilitators. It is important to note that over the course of the 2 years, faculty's active engagement online went from 69% in 2021 after a year of support training to 90% in 2023.

Table 3: Evolving Teacher Roles.

Initial Teacher Roles	Evolving Teacher Roles	Representative Excerpt from Data
<ul style="list-style-type: none"> • Viewing one’s role as content expert not on teaching expertise • Focus on content development • Expository pedagogical strategies • Closed questioning in forums • Emphasis on teaching not on learners and learning • Fostering of individual student motivation and autonomous learning 	<ul style="list-style-type: none"> • Increased focus on promoting learner-generated content • Strategies that foster learners’ co-construction of knowledge and their learning • Intentional interactions to encourage critical thinking and debate • Role oriented to mediate learning through active methodologies • Increased understanding of learning as a collaborative constructive process • Recognition of virtual environments as spaces to promote engaged learning 	<p>“I feel that the accompaniment allows me to work with active methodologies so that my students can create, carry out and put into practice what they have learned" (Teacher interview January, 2023).</p> <p>“There is evidence of fewer expository classes and greater strategies for students to construct learning... For example, in the forums they went from closed questions to questions that favor interaction and debate" (Field notes, teaching managers, 2022).</p> <p>“Most of the teachers generate active participation, open questions in the forums, providing feedback and generating new challenges" (Area Head Meeting, Teaching Direction, October 2021).</p>

4.2. The evolving roles and identities of students

The teachers’ evolving roles and identities seemed to coincide with transformations they themselves witnessed in their students. An earlier report provides a full account of the change process and the resulting transformations in students (Charbonneau-Gowdy et al. 2022). One teacher sums up the early identities of many students in the following: "I have been able to see that many students who arrive, who are older people and after a long time they decide to study. So, they arrive first with that insecurity, low self-esteem and with the fear of failure... they get frustrated and want to drop out" (Teacher interview, January, 2023). Such observations of insecurity and low self-esteem among many incoming students were short

lived. Teachers' comments after a few months of observing students exposed to new teaching practices revealed more empowered, engaged individuals convinced of their role as key agents in their learning development and the value of social learning to that development - to being critical, analytical and innovative thinkers, strong communicators and self-directed learners. As one teacher observed: "At the beginning, very few students were connected, now there are more and more, and everyone participates. I think this helps them in the professional interactions they will have in their future, they are able to generate their own ideas and reflections" (Teacher feedback questionnaire, January, 2023). It is this and many similar observations from teachers that attest to the fact that the changes they made in their practices were instrumental in empowering and engaging learners in activities that had 21st century benefits for their skills in the immediate and long term.

5. Conclusion

It is not unusual for institutions to revamp their programs in an effort to improve both educational and financial results. Typically, curriculum reform initiatives begin as a macro-level priority with minimal input from meso or micro level stakeholders, except in the reform plan's operationalization agenda. Ultimately, the result is often what scholars call "the implantation gap." (OECD, 2020, p. 4). In the case of the institution in this study, the process was decidedly different. Besides initial and regular ongoing collaborative input from all levels - macro level leaders, meso level administrators and micro level teachers and students, a systematic and organized plan was installed to accompany and support teachers, and indeed students, over the two-year rollout period. Based on the strong evidence we uncovered, this long-term guided effort combined with the epistemological objective to align design, pedagogy and technology resulted in clear signs of a transformation in teachers' roles and identities – from detached deliverers of information to confident and engaged collaborators and guides in learning, and in students – from disadvantaged and impeded by low self-esteem to thinking and behaving as 21st century learners, engaged and confident in ways that reflected well for their futures. The significant drop in student attrition compared to pre-changes, from 40% to 24.2% based on latest institutional figures, is further evidence of the benefits of the approach. While we recognize the context specific nature of our study, we believe these results add to the call for similar initiatives in diverse levels and contexts to add to the empirical evidence for a way forward to educational changes in online learning.

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Psychometric properties of the Spanish-language version of the Agentic Engagement Scale (AES): a preliminary study

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Abstract

In 2011, Reeve and Tseng operationalized the measurement of the 'agentic engagement' construct in five statements. Later, the preliminary scale was empirically validated (Reeve, 2013) to assess the students' active contribution during the education process. This work presents a preliminary study of the psychometric properties of the Spanish version of the Agentic Engagement Scale (AES). Using a sample of 194 participants, we analyzed item responses distribution, factor structure, internal consistency, and evidence based on the relationship between the AES and other measures of engagement and personality traits. The results confirmed its one-factor structure and its reliability in terms of internal consistency. In conclusion, the Spanish version of the AES seems to be a promising scale to assess agentic engagement in Spanish-speaking students.

Keywords: *Agentic Engagement Scale; measurement; unidimensional; Spanish.*

1. Introduction

Academic engagement is a multidimensional construct formed by behavioral, emotional, cognitive, and agentic aspects (Reeve & Tseng, 2011; Morcillo-Martínez, Infantes-Paniagua, García-Notario, & Contreras-Jordán, 2021). Its importance in education has grown due to its potential to promote learning and prevent school failure and dropout (Rodríguez-Fernández, Ramos-Díaz, Madariaga, Arrivillaga, & Galende, 2016).

Reeve and Tseng (2011) defined the concept of *agentic engagement* as the edifying students' input to the process of receiving instructions. In this way, agentic engagement is a unique and proactive type of engagement that generates continuous dialectical transactions between teacher and student (Reeve, 2013). In other words, it involves “the most frequent ways students proactively and constructively engaged themselves in the flow of the day’s instruction” such as by asking questions, expressing preferences, and providing suggestions (Reeve & Tseng, 2011). In 2013, Reeve developed the Agentic Engagement Scale (AES) to measure these interactions through five items that showed a unifactorial structure ($\alpha = .84$).

Recent studies have already administered the AES in Spanish-speaking samples, but they were limited to sample populations of secondary (Cuevas, Sánchez-Oliva, & Fernández-Bustos, 2016) and primary school students (Morcillo-Martínez et al., 2021), which prevents generalizing the findings to university students. Our investigation fills this gap in the literature. Reeve and Tseng (2011) have found moderate correlations between the agentic engagement construct and other types of engagement (e.g., behavioral engagement, emotional engagement, and cognitive engagement). In addition, some personality traits such as extraversion, agreeableness, and conscientiousness have shown a positive correlation with general engagement (Qureshi, Wall, Humphries, & Bahrami, 2016). Finally, several researchers have focused on the contribution of engagement to student outcomes such as academic achievement (e.g., Kimbark, Peters, & Richardson, 2017; Lardy, Bressoux, & De Clercq, 2022). Notably, Reeve (2013) has found the potential of agentic engagement to explain independent variance in student achievement.

The aim of this study is to conduct a preliminary assessment of the psychometric properties of the Spanish version of the AES in a sample of university students. Specifically, we analyze item responses distribution, factor structure, internal consistency, and evidence based on the relationship between the AES and other measures of engagement and personality traits.

2. Method

2.1. Participants

The sample consisted of 194 students (154 women [79.4%], 38 men [19.6%], and 2 non-binaries [1.0%]). Their age ranged from 17 to 48 years ($M = 20.6$; $SD = 3.83$). At the time of

the study, 95.4% were enrolled in bachelor's degrees, 3.6% were postgraduate students (Master's degrees/Postgraduate courses), and 1.0% were enrolled in doctorate programs.

2.2. Measures

The original English-language version of the AES (Reeve, 2013) includes five items measuring students' dialectical and transactional participation in class (e.g., "During class, I express my preferences and opinions"). Item responses are presented on a 7-point Likert scale, ranging from 1 (*completely disagree*) to 7 (*completely agree*). Items were translated and adapted into Spanish by means of parallel translation and reconciliation procedures.

The Spanish version of the Utrecht Work Engagement Scale for Students (UWES-9S; Schaufeli & Bakker, 2004) was administered. This nine-item scale is the standard tool for assessing work engagement characterized by vigor, dedication, and absorption (e.g., "When I'm doing my work as a student, I feel bursting with energy"). Items are scored on a 7-point Likert-type scale, ranging from 0 (*never*) to 6 (*always*). The UWES-9S has been shown to be internally reliable ($\alpha = .84$) and have a three-factorial structure that seems invariant across gender and educational levels.

The Spanish version of the Mini International Personality Item Pool-Five-Factor Model-Positively Worded (Mini-IPIP-PW; Martínez-Molina & Arias, 2018; original version by Donnellan, Oswald, Baird, & Lucas, 2006) was applied. This instrument includes 20 items to measure the Big Five domains: extraversion (e.g., "I am the life of the party"), agreeableness (e.g., "I sympathize with others' feelings"), conscientiousness (e.g., "I get chores done right away."), emotional stability (e.g., "I am relaxed most of the time."), and openness to experience (e.g., "I have a vivid imagination"). Items are rated on a 5-point Likert scale, ranging from how well each statement described them from 1 (*not at all*) to 5 (*completely*) to evaluate each personality trait. There is sufficient support for the Spanish Mini-IPIP-PW's factorial validity and composite reliability ($\geq .90$). Its associations with engagement suggest convincing correlations (Qureshi et al., 2016).

A sociodemographic questionnaire was included to get participants' information about gender, age, current studies, and the admission grade point average (GPA). Even though average grades seem biased (De Clercq, Galand, Dupont, & Frenay, 2013), they are the most common institutional information about student academic performance (Lardy et al., 2022).

2.3. Procedure

The data were collected between October and November 2022 using a convenience sample. Undergraduate university students received the invitation to participate in the study on their virtual campus. They received a link to an online questionnaire (hosted on the Qualtrics software platform: <https://www.qualtrics.com>) that included the instruments listed above and were asked to share the link with others on their social media (e.g., Twitter, Instagram). The

inclusion criteria were (1) being a university student at the time of responding to the questionnaire, and (2) having a proficient level of Spanish. Before starting the questionnaire, all participants were informed about voluntary participation, anonymity, and confidentiality in the study, and gave online informed consent.

The study followed the Declaration of Helsinki (World Medical Association, 2001) and was approved by the bioethics commission of the University of Barcelona.

2.4. Analysis Strategy

The statistical data analysis programs Jamovi 2.3.21 and the lavaan package (Rosseel, 2012) were used to analyze the psychometric properties of the AES.

Descriptive statistics of the AES were obtained at the item level, including mean, standard deviation, and percentage of item endorsement, skewness, and kurtosis coefficients, as well as corrected item-total correlations. We assessed the dimensionality of the AES through confirmatory factor analysis (CFA). We used the weighted least squares means and variance adjusted (WLSMV), which is suitable for ordinal items. The goodness of fit was assessed by means of the Comparative Fit Index (CFI; $\geq .90/95$ reflecting acceptable-to-excellent model fit), and the Standardized Root Mean Square Residual (SRMR; $\leq .06$ suggesting good model fit) (Hu & Bentler, 1999).

We calculated the scale-level descriptive statistics (i.e., mean, standard deviation, skewness, and kurtosis values) for the EAS, the UWES-9S, and the Mini-IPIP-PW. Furthermore, the internal consistency of these scales was examined using Cronbach's alpha (α) and McDonald's omega (ω) coefficients.

Validity evidence based on relationships between the AES and other measures was calculated using Pearson correlations relating the AES total score with the UWES-S9, the admission GPA and the Mini-IPIP-PW trait scores.

3. Results

3.1. Item-level Descriptive Statistics

Table 1 informs about the distribution of the AES item scores. All the items spanned the entire range of the scale (i.e., 1-7), but participants less frequently responded to the "completely agree (7)" option. Skewness and kurtosis coefficients suggested non-significant departures from normality, even though items have a moderate positive asymmetry. All corrected item-total correlations were high.

Table 1. Item-Level Descriptive Statistics of the SP-AES.

Item	M	SD	PIE (%)							SK	K	r _{ix}
			1	2	3	4	5	6	7			
I1	2.97	1.76	23.7	29.4	11.9	10.3	12.4	10.3	2.1	0.60	-0.90	.70
I2	3.01	1.83	21.1	33.5	12.9	8.2	9.8	9.3	5.2	0.77	-0.62	.70
I3	3.29	1.84	22.2	20.6	13.9	10.8	17.5	11.9	3.1	0.29	-1.21	.57
I4	3.27	1.90	23.2	20.1	14.9	11.9	16.0	6.2	7.7	0.45	-0.95	.61
I5	2.77	1.72	29.4	28.4	10.3	10.3	12.9	6.7	2.1	0.72	-0.67	.67

Note. I = Item; M = Mean; SD = Standard deviation. PIE (%) = Percentage of Item Endorsement; each statement is rated on a 7-point Likert-type scale. SK = Skewness; K = Kurtosis. r_{ix} = Corrected item-total correlation.

3.2. Factor Structure

The one-factor model fits the data well (CFI = .972, SRMR = .048). Figure 1 shows the path diagram of the one-factor model of the AES. All factor loadings were high and statistically significant.

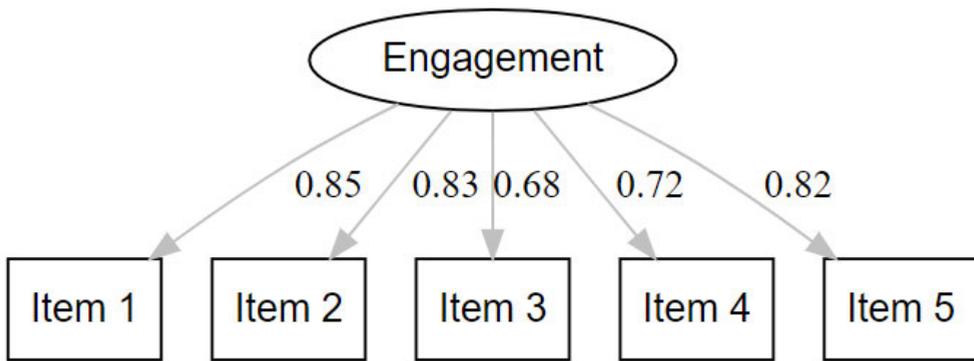


Figure 1. Path diagram of the one-factor model of the AES.

3.3. Scale-Level Descriptive Statistics and Internal Consistency

Table 2 shows the scale-level descriptive statistics (i.e., mean, standard deviation, skewness, and kurtosis values) and the internal consistency of the AES total score. The internal consistency was evaluated using Cronbach’s alpha (α) and McDonald’s omega (ω) coefficients, both suggesting that scores provided by the AES are reliable.

Table 2. Descriptive statistics, internal consistency coefficients, and correlations of the AES with engagement, academic achievement, and personality traits.

	M	SD	SK	K	α	ω	r
AES	15.3	7.11	0.51	-0.27	.84	.86	-
UWES-9S	31.7	10.8	-0.11	-0.64	.92	.92	.39**
Admission GPA	8.02	1.00	-0.23	0.16	-	-	.02
Mini-IPIP-PW							
Extraversion	10.3	3.63	0.21	-0.69	.76	.76	.22*
Agreeableness	15.8	3.15	-0.73	0.16	.83	.83	.11
Conscientiousness	12.5	3.62	-0.20	-0.53	.82	.83	.10
Emotional stability	9.65	3.42	0.26	-0.69	.74	.75	.12
Openness to experience	13.4	3.80	-0.21	-0.40	.83	.83	.25**

Note. M = Mean; SD = Standard Deviation; SK = Skewness; K = Kurtosis; α = Cronbach's Alpha; ω = McDonalds' Omega; r = Pearson Correlation. * $p < .01$; ** $p < .001$ (two-tailed).

3.4. Validity based on relations with other variables

Descriptive statistics and internal consistency coefficients of the other measures of engagement, academic achievement, and personality traits are shown in Table 2, also their bivariate correlations with the AES. The total score of the AES was moderately associated with students' work engagement ($r = .39$). Contrary to what we expected, the AES was not related to the admission GPA. According to the relation of AES with personality traits, the extraversion and openness to experience factors were significantly related to AES.

4. Discussion

This study shows the initial psychometric evidence of the AES in a Spanish university students sample. The item-level descriptive statistics scores of the Spanish version of the AES yielded similar distributional properties to those observed in the original scale (Reeve, 2013). Furthermore, the internal consistency in our results aligns with the original scale and the Spanish versions of the AES for secondary school students (Cuevas et al., 2016) and primary school students (Morcillo-Martínez et al., 2021).

Moreover, our investigation revealed that the one-factor structure of the AES (Reeve, 2013) showed a good model fit and high factor loadings of the five items. These results are similar

to other validity studies of the AES (Cuevas et al., 2016; Morcillo-Martínez et al., 2021) that reinforce our confidence in the future replication of this structure in larger sample sizes.

Our findings support the correlation between the AES and students' work engagement in line with the study of Reeve and Tseng (2011), which highlighted the correlation between the AES and other engagement types. On the other hand, we observe a positive relationship between AES and extraversion similar to Qureshi et al. (2016). However, we found low correlations between AES and agreeableness or conscientiousness. In the future, more research may be performed to identify early predisposition to engagement.

Finally, the absence of a correlation between the AES total score and academic achievement, as measured by admission GPA, may be attributed to the possibility of grade average bias, as suggested by De Clercq et al., (2013). Additionally, it is worth noting that the admission GPA represents past information, specifically the mark used for university admission, rather than current academic performance. As other authors have found (Lardy et al., 2022), it would be expected that the relationship between engagement and current academic achievement would be higher.

5. Conclusion

The Spanish version of the AES appears to be a promising instrument for measuring agentic engagement. It corroborates good psychometric properties: adequate factor structure, convincing internal consistency, and validity evidence based on relations with students' work engagement and extraversion personality traits. These findings have theoretical and applied implications in education to promote programs and interventions in this field.

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Education 4.0: MiReBooks - Development and Usage of Mixed Reality for Teaching Mining in Higher Education

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Abstract

In order to meet workplace demands in relation to Industry 4.0, the MiReBooks project was established in 2019. The main focus of this paper is to present the project's outcomes in the field of Education 4.0 whereby, Mixed Reality (MR) Mining Engineering educational material was developed for teachers, this in order to integrate MR in classroom instruction with the aim to enhance student understanding and application of knowledge to increase their competence in the specific field of the subject. An account of a MR application in a mining lecture is presented, together with student feedback, providing grounds to ascertain that the integration of such technology can improve student learning in the achievement of lesson/course Learning Outcomes.

Keywords: *Mixed Reality; Mining; Education 4.0; Teaching & Learning; Engineering.*

1. Introduction

The economic age of rapidly advancing technology, digital transformation and workforce demands, set exceptional challenges on educational systems to prepare graduates for their future careers (Teo et al. 2021). The advancement of Industry 4.0 requires educational institutes to transform teaching and learning approaches and to conceptualise new learning content to meet the demands of industry now and in the future. This approach further requires the training of transversal skills which permit learners to not only acquire technical knowledge but also with opportunities to train soft skills and promote an adaptive mindset and readiness to flexibly engage with new methods to deal with the intricacies of technological advancements and uncertainty (Ralph et al. 2022).

Ergo, Higher Education Institutes (HEIs) play a pivotal role in contributing to industry required competences by ensuring the workforce readiness of their graduates. Within the discipline of engineering education, with a particular focus in the field of mining, traditional based teaching and learning techniques prevail. Frontal based theory lectures are supplemented, when possible, with onsite mine visits, which limits the student's possibility to interact with the mining operations at a meaningful level.

In 2019, the 'Mixed Reality Handbooks for Mining Education' project was launched (MiReBooks). This being one year after the release of the Digital Education Action Plan 2018-2020, from the European Commission. This action plan laid the foundation for innovative education, setting out the skills, knowledge and attitudes citizens need for life, including digital competence (Eu Comm. 2018).

The MiReBooks was a successfully applied for project funded by the European Institute of Innovation & Technology (EIT), within their Raw Materials Knowledge Innovation Community. In 2019, the project commenced with the aim to create a new digital teaching and learning experience which would enhance and optimise traditional paper-based education by enriching it with virtual and augmented reality-based experience.

The MiReBooks project comprised a consortium of core HEIs, Industry entities and research institutes and was led by the Montanuniversität Leoben in Austria. The other core HEI partners were, Luleå University of Technology (LTU), Rheinisch-Westfaelische Technische Hochschule Aachen (RWTH) in Germany, Tallinn University of Technology in Estonia and the Technische Universität Bergakademie Freiberg (TUBAF) in Germany, Technische Universität Graz (TUGraz) in Austria, Università di Trento (University of Trento). Also, research institutes and companies comprised of core and associated partners connected to the project were, KGHM Cuprum sp. z o.o. Centrum Badawczo-Rozwojowe (KGHM Cuprum Ltd. Research & Development Centre) in Poland, Teknologian tutkimuskeskus VTT (Technical Research Centre of Finland Ltd. VTT) in Finland, Luossavaara-Kiirunavaara AB, LKAB in Sweden and Epiroc AB also in Sweden (MiReBooks 2019).

The main objectives of the MiReBooks project involved the following aspects:

- The development of an instructional ‘Didactical Handbook’ on using/integrating Mixed Reality in lectures
- The development of a Virtual Reality lecturing tool
- The development of Mixed Reality integrated Mining book series

This paper will serve to demonstrate the abovementioned outcomes of the MiReBooks project and provide insight into current/future activities. It will also present an account of the didactical usage of ‘Mixed Reality’ in a Mining lecture, as taught at the Montanuniversität Leoben, Austria within the academic year 2022.

2. Project Objective and Scope

The overall scope of the project was to develop a new digital learning experience that would innovate the teaching, learning and subsequently applying, of mining engineering education at a tertiary level. Combining state-of-the-art pedagogical methods with digitalisation of teaching materials, students are able to maximise and take advantage of new ways of classroom interaction that is more suitable for the needs of their generation as digital natives. The tools and material outcomes from the project are correspondingly designed in such a way that it is also attractive for professional industry application targeted at life-long learners to bring existing employee’s competences in line with the latest developments.

2.1. MiReBooks – Didactical Handbook

One of education’s most important tools is pedagogy and subsequently, the didactics applied for teaching/learning materials (OECD 2019/20). One of the pinnacle outcomes from the project was to develop a didactical handbook for educators to understand and aid them in the use of mixed reality (MR) in lessons. The book was developed and designed by pedagogues in the English language and split into 4 chapters.

Chapter one provides an introduction to the applications of Mixed Reality in connection with Raw Materials in lessons, Education 4.0. It provides deeper understanding and examples of what, and how, MR aspects can benefit teaching and learning. Chapter two provides input on Teaching 4.0. It specifically addresses didactics in education through the understanding and application of Bloom’s Taxonomy to derive appropriate Learning Outcomes for lessons integrating MR technology. It explains in detail Gamification and other methods for teaching and how MR technologies can be applied in Raw Materials related education. Chapter three provides a deeper account/understanding of teaching with Mixed Reality and the various means that can be applied e.g. VR headsets, handheld devices e.g. mobile phone and possible MR content. Finally, chapter four provides the reader with the practical set-up of integrating

MR elements in domain teaching. It offers the reader a MR decision matrix to help guide the lesson development to the appropriate MR tool for the purpose of instruction.

The MiReBooks Didactical Handbook is provided free of charge for all educators who would like to apply these technologies in their lessons with the goal to improve and aid the understanding and application of aspects in relation to e.g. mining engineering education.

2.2. MiReBooks – Virtual Reality Lecturing Tool

MiReBooks VR lecturing tool introduces the use of 3d models and 360° videos and images to the lectures in the classroom as well as online for remote teaching. The MR media contained in the book can be accessed for use in lectures and to enhance comprehension of complex topics. The tool takes over the role of electronic presentation software e.g. PowerPoint, including VR media, while allowing lecturer/student interaction. The VR lecturing tool requires the use of VR headsets, currently Oculus Quest 2 is being used for the students and a tablet, or laptop, for the lecturer to convey the lesson. The lecturer can play 360° videos and images and/or 3D models as part of the presentation. When in a new 360° exciting environment it is easy for the students to get distracted and lose focus on the teaching activity and miss the learning outcomes. To avoid focus diversion, the lecturer has some features available to keep the student's focus. These features allow real-time (RT) drawing on the 360° video/image or 3D model and field of view blocking. The lecturer has also an overview of the connected student's status, to detect any connection issues and even loss of focus from students. The students also have access to features, such as question placement and 3D model manipulation. All these features ensure enough control over the VR environment so that the learning goals can be achieved more efficiently than with traditional methods.

2.3. MiReBooks – Mixed Reality (MR) Integrated Mining Book Series

One other important outcome from the project is the development of a mining book series with integrated MR material. The development of this is a cross collaboration of several Universities in Europe. The overall focus is on sustainability in mining and a total of 7 books are in the series. These have been written by leading experts in the topic field from the Universities' and each book covers the following topics: 1. Sustainability and Mine Planning 2. Safety in Mining 3. Rock Fragmentation 4. Surface Mining 5. Underground Mining 6. Rocks Mechanics and lastly, 7. Mine Closure.

Each mining handbook includes QR codes (Links) which trigger extra learning content. This enhances comprehension of complex topics and provides more material to extend the competence of the students. The platform is based on a webpage. The content linked to the QR codes have different natures:

1. Study cases: are for the student to put into practice what they learn in the books. So, competence on the topic can be tested by solving problems of performing calculations.
2. AR 3D models: can be explored on the platform and also as AR with the help of a smartphone or tablet. The platform has an AR 3D model delivering system that bridges the need for an APP. From the platform, the camera from the student's smartphone is used to show the 3D models as AR. 3D visualization helps to understand the spatial distribution of operations and promotes self-exploration as well as technical discussions in the classroom.
3. 360° videos and photos: can be explored from the browser or with the help of smartphones/tablets and VR headsets (e.g. Oculus Quest 2). By using VR headsets, the student is immersed in a VR environment which helps with understanding the scale and distribution of operations.
4. Links to more content: VR and AR are not always the best tool to enhance comprehension of every topic. Conventional videos, as well as content on other web pages, are shared to promote the students further reading and researching.

While the platform is conceived as a tool to share multimedia content triggered by the books, users must find value in it even if they do not own any of the MiReBooks handbooks. All content shared on the platform will include enough explanation so that it can be understood and useful for all platform users.

3. Learning Pathway

The following section will provide insight into a university lecture, the use of virtual reality to support the understanding and application of knowledge in the classroom and the continuous feedback from students which allows insight for improving the user experience from both the teaching and technological sides.

3.1. Continuous Mining Methods – Surface Mining (held on November 29, 2022)

A total of 15 students studying mining engineering attended a two-hour lecture about surface mining. The didactical set-up was the integration of a MR environment whereby, each student was provided with a VR headset and given instructions on its functionality. This method is used specifically to aid the teaching and learning knowledge transfer. The learning outcomes for the lesson where: upon completion of the lecture the student will be able to 1. Understand the basics of continuous surface mining methods and 2. Explain the different surface mining operations. During the lesson the students used MiReBooks programmed VR headsets and were transported virtually onsite to two running open coal pit mines located in Germany (Hambach and Jänschwalde). This allows the student full access to all operational aspects of the mine that otherwise would not be accessible or difficult to arrange as a site visit. Ergo,

the knowledge transfer goes hand-in-hand with the practical insight into the material being taught and the lecturer is able to explain in detail what they are seeing, how it works and the different surface mining methods that are applied.

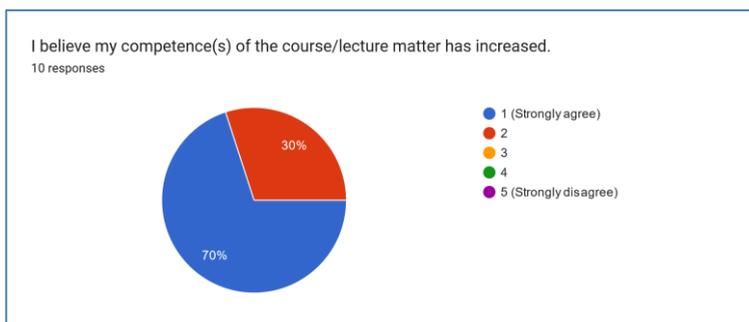
Directly after the lesson, both the students and the lecturer are provided with an extensive online feedback form which they immediately complete. The questions asked provide answers regarding the software usability and lecture didactics, which also includes an assessment of the learning outcomes. This feedback loop is indispensable in providing input to develop the software further and to create a better user experience. In each iteration of the software, bugs are corrected, and also, new features are built in to directly address the user's feedback.

3.2. Lesson Feedback, 'Continuous Mining Methods – Surface Mining'

A total of 15 students attended the lecture, whereby only 10 fully completed the feedback form and could therefore be used. The gender division of the students were 4 females and 6 males. The feedback form is divided into several sections: general information, user ability (VR), system usability, learning outcomes and lastly, open feedback questions to help improve the experience.

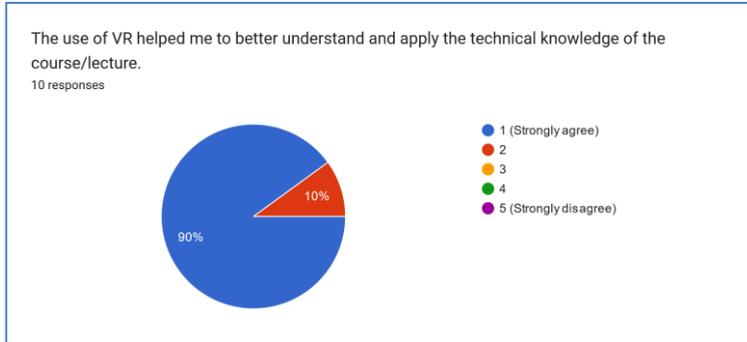
The feedback (self-assessment) provided by the students in direct relation to the Learning Outcomes of the lesson, was addressed by the following two questions and a 5-point Likert scale was used whereby, 1 is strongly agree and 5 is strongly disagree. A total of two questions in this section are provided to the students: 1. 'Post lesson, I believe my competence of the course/lecture subject matter has increased' and 2. 'The use of VR helped me to better understand and apply the technical knowledge of the course/lecture.'

The results of the 10 completed forms will now be presented in relation to the feedback form questions on the lesson LO's: LO 1. Upon completion of the lecture the student will be able to: Understand the basics of continuous surface mining methods. LO 2. Upon completion of the lecture the student will be able to: Explain the different surface mining operations.



Graph 1. Student Feedback Responses.

In relation to the question: 'Post lesson, I believe my competence of the course/lecture subject matter has increased', 70%, respectively 7 of the students indicated that they strongly agreed that their competence(s) of the lecture in relation to surface mining methods had increased, while 30%, respectively 3 agreed with the statement.



Graph 2. Student Feedback Responses.

In relation to the question: 'The use of VR helped me to better understand and apply the technical knowledge of the course/lecture', 90%, respectively 9 of the students indicated that they strongly agreed that the use of VR helped them to better understand and apply the technical knowledge of the lesson, while 10%, respectively 1 agreed with the statement.

The above results give reason to believe that integrating MR within domain curriculum can improve and enhance the students' ability to not only comprehend the lesson material but also in applying it. The Learning Outcomes are reached and tested immediately by the teacher who is not only relaying information but has the possibility to demonstrate the application of this within a classroom environment.

4. Conclusion/Outlook

Digitalisation in education must be part of the future learning pathway to ensure a competent workforce for the mining engineers of tomorrow in Europe. The MiReBooks project has changed the way traditional teaching and learning in mining education takes place. Through the continuous feedback loop the various applications of MR, the platform and the book series are constantly being improved. The feedback from students and teachers in direct relation to the course/lesson Learning Outcomes demonstrate the transfer of knowledge and competence of the participants can be enhanced. As Education 4.0 integrates technologies it also addresses not only the necessary hard skills taught as part of the lessons but also the soft skills needed within the field of digitalisation necessary for Industry 4.0.

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