

Empowering Students Through Design Thinking: A Strategic Approach to Developing 21st-Century Skills in Higher Education

Franka Marie Herfurth^{}, Matthias Söll^{}, Sarah-Kim Gerber^{}, Andreas Diettrich

Chair of Economics, Business and Entrepreneurship Education, University Rostock, Germany.

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Abstract

In alignment with the European Education Area's objectives, higher education must prepare students to navigate the complexities of a rapidly evolving, interconnected world. To develop these 21st-Century Skills, Design Thinking has emerged as a strategic approach to fostering sustainable and innovative solutions in higher education. An academic course in the summer semester of 2024 positioned Design Thinking at its core, equipping students with the tools to critically analyse dynamics while fostering their ability to design impactful, solution-oriented innovations in vocational education and training. The article answers the question of how the use of the Design Thinking approach supports students developing crucial competences of the 21st century.

Keywords: Higher education; innovation; design thinking; human-centred design; digital learning environments.

1. Introduction

According to the *European Education Area* higher education institutions must “educate students to be successful in a complex and interconnected world that faces rapid technological, cultural, economic and demographic change” (European Education Area, 2025). This context is strongly connected to the framework of the 21st-Century Skills which include foundational literacies, competences and character qualities (World Economic Forum, 2024). Following the discussion of the World Economic Forum, the four different competences, critical thinking/problem-solving, creativity, communication and collaboration, express how students should approach complex challenges (World Economic Forum, 2024).

The design, development and support of innovation processes, as an answer to complex challenges, is a diverse field of vocational education and training activities, which is a focus area of the Business Education study programme discussed in this paper. The course *Innovation in Vocational Education and Training* in Business Education at the University of Rostock aims

to equip students with comprehensive competences in the development and design of innovations across various levels of the education system.

The realisation of the course in the past has shown that being spontaneously innovative is often a significant challenge for students, as academic curricula rarely require them to independently initiate, critically evaluate, and innovate within their projects. While the academic course aims to foster the development of these competences, such skills are typically underdeveloped at the outset. This initial lack of proficiency often heightens uncertainty and can, in some cases, result in reduced motivation (Chandraja et al., 2024).

One possible method in higher education to strategically tackle complex challenges and create sustainable and innovative solutions is to use the Design Thinking (DT) methodology. “Design Thinking encourages students to examine alternative perspectives, challenge presumptions, and develop original solutions to problems that they encounter in the real world by focusing on empathy, teamwork, and iterative ideation” (Alhafis et al. 2024). This constitutes the point of departure for the design-based research study outlined in this paper, which will be elaborated upon in the following sections.

2. Implementing a new didactical approach within Design-Based Research

The further development of the course adheres to the methodological principles of Educational Design-Based Research (DBR) and is systematically evaluated and continuously refined through an iterative design and research framework (Anderson & Shattuck, 2012; Euler, 2024). The study follows the generic model according to McKenney and Reeves and maps the core processes of analysis and exploration, design and construction (development) as well as evaluation and reflection. Parallel to these phases is the implementation and dissemination of the so-called interventions (Reimann, 2017). The research and development process was collaboratively designed by business education lecturers and a DT expert, aiming to foster sustainable change through the involvement of broadly qualified educators. In addition to its practical focus, the project sought to generate theoretical insights regarding the implementation and further development of teaching units. The didactic design was based on the assumption that learning the DT process, which is seen as an ‘intervention’ according to the DBR approach, enhances innovation capabilities related to 21st-Century Skills and promotes their long-term integration. The empirical findings were then to be related to the theoretical correlations already presented and thus contribute to an expansion of the theory.

This paper presents a micro-cycle of the DBR, which includes the evaluation of the intervention carried out based on a document analysis (McKenney & Reeves, 2012). As part of the evaluation framework of the DBR study, the students’ written reflections are used as a data collection method to further specify the core challenge for which a solution is being sought (Euler, 2024; McKenney & Reeves, 2012). Based on the reflections of the students, the

intervention team is able to draw conclusions regarding the effectiveness of the DT process. The course has been iteratively refined through several evaluation rounds conducted by the development team and will be implemented again, incorporating these revisions, in the next summer semester.

A total of 20 students participated in the course, organised into teams consisting of a minimum of two and a maximum of four members. The dataset for this micro-cycle is derived from written reflections submitted by the students as part of their final reports. These reports, completed at the conclusion of the course, provide a robust foundation for the qualitative analysis of individual and team learning processes, as well as subjective experiences. The reflections were conducted collaboratively within each team and were structured to address two distinct aspects: the innovation process based on the DT approach and the dynamics of teamwork.

The qualitative analysis of the data was carried out using Mayring's approach to qualitative content analysis (Mayring 2022). In the content approach, deductive categories were developed for coding in relation to the four critical future skills critical thinking/problem-solving, creativity, communication and collaboration (World Economic Forum 2024). Intercode reliability was ensured by communicative validation, as the two lecturers both examined the material and discussed different interpretations.

3. The intervention: Design Thinking Coaching

Based on the DBR approach the starting point is a practically relevant educational problem for which a new solution has yet to be developed: in this case, a teaching-learning concept to foster students' innovation skills for the future. As an empirical approach, it is not about testing theory, but rather about applying and developing theory (Reimann, 2017). The main aim of the intervention in the course was to develop conceptually complex teaching units for the effective and structured promotion of innovation skills, and at the same time to reflect on the possibilities and limitations of their implementation in the DT process in an explorative and research-based way (Delius, 2022).

DT was chosen for this study due to its strong emphasis on user-centered innovation, iterative prototyping, and interdisciplinary collaboration. Unlike other active learning methods, DT actively promotes divergent thinking and early experimentation to foster novel solutions. Furthermore, DT's strong integration in both educational and professional innovation contexts ensures a high degree of applicability and relevance to real-world innovation processes.

The new key element, the intervention in the context of DBR, was the coaching on DT designed to foster "outside the box" thinking and provide a robust theoretical foundation for systematically approaching innovation within professional learning contexts. Firstly, the course introduced students to DT methodology as a human-centred approach to problem-solving in

line with the Massachusetts Institute of Technology (Massachusetts Institute of Technology, 2025). Through a combination of theory, case studies, and hands-on projects, introduced by a DT expert in the field of instructional design, the students developed a high-level understanding of the DT process and how to apply it to real-world challenges. The secondary aim of the programme was to highlight the importance of collaboration (including collaboration with tech) and introduce students to emerging technologies that are impacting education.

4. Results & Discussion

The developed project ideas, which have been evaluated within one micro-cycle within the BDR study, illustrate digital teaching-learning arrangements that the student groups have developed. The final reports show that the previously trained DT methodology was applied and reflected upon differently. The students' reflections on both the application of DT and the team reflection were analysed in the context of the four 21st-Century Skills critical thinking/problem-solving, creativity, communication and collaboration.

4.1. Critical thinking/problem-solving

This competence is reflected in the students' reflection reports on multiple levels. Firstly, it is evident in the critical analysis of the innovation's content and its practical implications. The students systematically examine communication barriers, the limited acceptance of the proposed innovation, and the challenges faced by small and medium-sized enterprises due to resource constraints. Additionally, they address the broader issue of the theory-practice gap, which poses fundamental challenges to the successful implementation of innovative concepts. Furthermore, their reflections extend to the use of digital tools in teaching and learning environments, critically evaluating their functional scope and potential licensing constraints.

- “SMEs in particular could also find it difficult to incorporate their specific needs and content due to resource bottlenecks, which could lead to their trainees being disadvantaged.” (P 01)

Secondly, the students engage in a critical examination of the DT process itself. While they acknowledge the value of an iterative approach, they emphasise, based on their own experiences, the necessity of continuous adaptation to enhance the developed solutions. Key aspects identified include the importance of feedback mechanisms, the role of prototyping, and the integration of external perspectives to refine ideas. The student groups used these aspects to varying degrees. Moreover, they highlight flexibility as a fundamental prerequisite for ensuring the effectiveness of the overall process.

4.2. Creativity

The clear structure of the DT process and creativity methods to think outside the box proved to be particularly helpful, as it guided the creative thought processes and provided targeted impetus for new ideas.

Developing their ideas for potential innovations, the students used digital platforms such as *Gather.town* and *Minecraft*, which provide interactive and collaborative environments. In addition, AI-supported tools and communication applications were used to organise teamwork efficiently. It is worth noting that some of these digital tools were deliberately used in a playful or misappropriated way to generate unconventional ideas.

- “We came up against limits during this phase, but we quickly recognised our focus and our scope for action in this respect.” (P 02)

Various established methods of idea generation were used to support creative development. These included brainstorming, conducting surveys, creating sketches and creative walks. These methods helped to gather innovative impulses, deepen the problem analysis and visualise initial conceptual drafts.

A key factor for creative collaboration within the teams was promoting open communication, transparency and empathy.

4.3. Collaboration

The team reflection analyses highlighted various opportunities for both personal and collective growth through collaboration. This process not only fostered innovation but also supported the professional and personal development of the participants. A central challenge for the students was coordinating teamwork and managing time, which they addressed through strategies such as scheduled meetings, spontaneous online discussions, and the use of communication tools. Flexibility, mutual understanding, and adaptability to changing schedules emerged as key competencies supporting effective collaboration. Role allocation significantly influenced team dynamics, with some groups assigning roles explicitly and others allowing them to evolve naturally. In both cases, role differentiation was seen as enhancing efficiency by utilising individual strengths, while maintaining a flexible and democratic structure that supported shared decision-making and active participation.

- “As the project progressed, we decided to focus on specific roles in order to accelerate progress and increase the effectiveness of our work.” (P 03)

Feedback was essential for refining ideas and navigating uncertainties, with teams using structured feedback loops to validate and adjust their approaches. This iterative culture not only improved the quality of solutions but also promoted continuous learning and self-development.

4.4. Communication

Communication and collaboration are closely interconnected, as effective teamwork relies on openness and transparency. A structured approach, including regular in-person and online meetings and asynchronous communication via messengers, ensured synchronised progress and efficient coordination. Transparent communication was essential to maintaining fairness in decision-making and preventing negative impacts on individual team members. Additionally, flexibility and democratic task distribution were identified as key success factors, fostering adaptability and efficiency. Finally, the integration of feedback and continuous reflection played a crucial role in improving work quality and optimising processes, enabling iterative refinement and collective progress.

- “In conclusion, we have learnt that the integration of feedback and continuous reflection on the work process is essential to ensure the quality of the work and identify opportunities for improvement.” (P 03)

5. Conclusions

The evaluation of the micro-cycle of the data analysis of the written student reports proved that the application of the DT process in an academic course contributed to foster 21st-Century Skills such as critical thinking/problem-solving, creativity, collaboration, and communication. The present analysis highlights the multidimensional nature of teamwork in innovation projects and demonstrates how students overcame challenges through independent problem-solving, structured role allocation, and the integration of feedback. Despite being assigned the same task, the results exhibit significant variation, indicating that the process of innovation design is highly individualised. Key success factors for teams composed of independent actors working towards a common goal in a non-standardised, uncertainty-driven process include flexibility, adaptability, communication, and cooperation - an observation supported by the analysed data. Accordingly, DT appears to be a suitable methodological framework for equipping students with essential future skills.

As students often find it challenging to engage spontaneously in innovative and conceptual work, despite these being fundamental competencies of the 21st-Century Skillset and essential for the demands of new work environments, the integration of the DT approach can serve as an effective pedagogical entry point. It promotes problem orientation, provides a structured pathway toward innovation development, and simultaneously, enhances and organises collaborative teamwork. For this reason, the success of implementing DT in educational contexts should not be evaluated solely through traditional criteria such as user satisfaction or the adoption and implementation of specific solutions. Rather, its value lies in fostering

students' competence development, with particular emphasis on cross-disciplinary collaboration and the generation of innovative outcomes.

Ultimately, the findings presented here must be interpreted within the limitations of qualitative research. It becomes evident that the reflection process led some students to produce standardised responses to provide an anticipated "desired" answer. While this phenomenon cannot be thoroughly examined within the framework of content analysis, it suggests, upon deeper interpretation, not necessarily the development of innovation competencies, but rather a strategic orientation toward achieving a favourable course grade. Furthermore, retrospective reflection by students may have led to cognitive distortions, and the time pressure under which the final reports were written could have further influenced the accuracy of their self-assessments. This also indicates that the implementation of the DT method within this intervention did have limitations in prioritising the quality of the innovative solution over formal assessment. Consequently, this may inhibit the development of innovation-related competencies. This is also why the outcomes of the student projects, the innovative concepts in vocational education and training, are evaluated by the intervention team, consisting of lecturers and DT experts, according to predefined criteria. This evaluation is conducted independently of the students' written reflections and is systematically compared with the results from the previous and subsequent cohorts. This process constitutes an additional micro-cycle within the broader research framework.

This paper presents the DBR-based development of a debate on Empowering Students Through Design Thinking: A Strategic Approach to Developing 21st-Century Skills in Higher Education within the field of business education. In addition to the course's design principles, structure, and procedure, the results of a content analysis were outlined and evaluated. Critical thinking/problem-solving, creativity, collaboration, and communication were identified as essential components in the design of innovative educational spaces within the context of business education. The course prototype was piloted for the first time in the summer semester of 2024 and will be offered again in the summer semester of 2025 with targeted adjustments. In the next step, the students' reflections will be analysed again and placed in the context of the teaching-learning experiences of the intervention team. Against the backdrop of this development process, the following questions arise:

- Do students perceive the course as an opportunity to develop 21st-Century Skills?
- Does the course change students' imagination of how to conceptualise, implement, and evaluate innovations in a dynamic work and life environment?

In this context, further research will explore how 21st-Century Skills can be systematically developed through the use of Design Thinking in academic teaching.

References

- Anderson, T., & Shattuck, J. (2012). Design-Based Research. *Educational Researcher*, 41(1), 16–25. <https://doi.org/10.3102/0013189X11428813>
- Chandraja, C. V., Ajayan, T., & Ruskin, Shabi, George, Mathew (2024). Innovative pedagogies: Adapting teaching strategies for modern learning environments. *21st Century Teaching and Learning in Classrooms*, 63–74.
- Delius, K. (2022). Wie Wissenschaft und Praxis Fachunterricht gemeinsam weiterentwickeln können: Eine Design-Based Research-Studie zur Förderung der Sprechkompetenz im Englischunterricht. *EDeR. Educational Design Research*, 6(3). <https://doi.org/10.15460/eder.6.3.1704>
- Euler, D. (2024). Design-Research – a paradigm under development. In D. Euler & P. F. Sloane (Eds.), *Design-Based Research* (pp. 15–44). Franz Steiner Verlag.
- European Education Area. (2025). Innovation in education. <https://education.ec.europa.eu/education-levels/higher-education/innovation-in-education>
- Massachusetts Institute of Technology. (2025). Unit 2 Assignment: Design Thinking with Students. <https://openlearninglibrary.mit.edu/courses/course-v1:MITx+11.155x+1T2019/course/>
- McKenney, S. E., & Reeves, T. C. (2012). Conducting educational design research. Routledge.
- Reimann, G. (2017). Design-Based Research. In D. Schemme & H. Novak (Eds.), *Berichte zur beruflichen Bildung. Gestaltungsorientierte Forschung - Basis für soziale Innovationen: Erprobte Ansätze im Zusammenwirken von Wissenschaft und Praxis* (49-61). *Bundesinstitut für Berufsbildung BIBB*.
- World Economic Forum. (2024). The skills needed in the 21st century. <https://weforum.org/nve-2015/chapter1.html>