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Introducing co-creation and generative coaching into learning environments: the effects on students' self-regulation skills, self-efficacy and academic efficacy

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Abstract

In this action research study, we investigate the impact of co-creation and generative coaching on students' self-regulation, self-efficacy and academic efficacy in the context of three course units in higher mathematics education at university. Using questionnaire data, we measure (1) to what extent students perceive a difference between the learning environments of the three experimental courses - with co-creation and generative coaching - and those of the three control courses - without co-creation and generative coaching - and (2) to what extent there is a difference in self-regulation, self-efficacy and academic efficacy in the experimental learning environments vs. in the control learning environments. Descriptive statistics and paired t-tests show statistically and practically significant impacts of co-creation and generative coaching on self-regulation skills, self-efficacy and academic efficacy. The results suggest that in order to boost students' learning, it might be worthwhile to invest in co-creation and generative coaching in learning environments.

Keywords: *Innovative teaching and learning experiences.*

1. Introduction

According to MIT-researchers Scharmer (2018) and Kaufer (Scharmer & Kaufer 2013, 2025), the main challenge for education is to now move from Education 2.0 which is testing-centric, to Education 3.0 and 4.0. Education 3.0 is learner or student centric with the lecturer as a facilitator of learning processes. Education 4.0 is co-creation or innovation centric with generative coaching as a major role of the lecturer. In Education 4.0 learners and educators co-create and co-shape the future, acting from an eco-system awareness with respect for the well-being of all. The concept of generative coaching refers to the lecturer acting as a coach who

initiates, enables and facilitates generative dialogue, an open and meaningful type of communication that captures the interests of participants by focusing on what excites them and what frustrates them (Shaw 2002, 2005).

Evidence on the effects of co-creation and generative coaching in the context of (higher) education is still very sparse and anecdotal, most of it is based on document analysis (e.g. individual student logs, student portfolios, notes and observations), interviews and evaluation/reflection meetings (e.g. Iversen et al. (2015), Aarup and Krogh (2017)). No quantitative analysis has yet been done to measure the effects of co-creation and generative coaching. Research on the effects of co-creative learning revealed an increase in student engagement, student involvement, and high-level learning outcomes (Iversen et al., 2015). Aarup and Krogh (2017) showed that most students wish to be part of the co-creation processes regarding teaching activities and that those who are involved in some of the decision-making processes express much more contentment. Based on research in positive psychology, this contentment (cf. positive affect) may in turn increase self-regulation, self-efficacy and academic efficacy amongst others (Lyubomirsky, 2005). Iversen and Stavnskær Pedersen (2017) studied the effects of co-creative generative dialogue between students and teachers (which is strongly related to generative coaching) and argued that this enhances the societal relevance of education and at the same time prepares students for becoming 21st-century knowledge workers.

Over the last years, we set up a pilot study in the bachelor program of Computer Sciences at a Belgian university to introduce co-creative learning and generative coaching in the context of mathematics education. We applied the main principles of action research and developed appropriate questionnaires. In this paper, we present the results of our quantitative analysis based on descriptive statistics and paired t-tests. In this way, we like to contribute to the understanding of the effects of co-creation and generative coaching on students' learning. This study shows a statistically significant impact of co-creative learning and generative coaching on students' self-regulation skills, self-efficacy and academic efficacy.

2. Research design, instruments and methods for data analysis

2.1. Research context

In this action research study, we selected six bachelor mathematics courses at university that are curriculum embedded and compulsory and have lecturers with excellent teacher evaluations. In the three experimental courses – denoted E1, E2 and E3 - we introduced co-creation and generative coaching. The other three courses are control courses, denoted C1, C2 and C3. The mathematics courses C1 and E1 are attended by the same student group in the first semester of their study. The same holds for C2-E2 in the second semester and for C3-E3 in the third semester. That way we selected for each experimental course a control course as similar as

possible with regard to characteristics of study context: class size, level of expertise of the students, time and place. This yields an experimental design in which the experimental and control group are the same: in three successive semesters, participants attended both an experimental and a control mathematics course and filled out a questionnaire for each at the corresponding final exams.

2.2. Research questions

With the first research question (Q1) we verify whether students actually perceive differences between learning environments with and without co-creation and generative coaching. Q1: To what extent do students perceive a difference between a traditional learning environment (i.e. without co-creation and generative coaching) versus a learning environment with co-creation and generative coaching?

With the second research question (Q2) we look at the impact of co-creation and generative coaching on various learning approach aspects. Q2: To what extent is there a difference in (1) regulation strategies of learning (self-regulation, external regulation, lack of regulation), (2) self-efficacy (self-confidence, self-image, self-appraisal) and (3) academic efficacy (confidence in academic competence) in the experimental learning environments with co-creation and generative coaching vs. in the control learning environments without co-creation and generative coaching?

2.3. Participants and instruments

Bachelor in Computer Science students participated anonymously and voluntary by attending the courses involved and completing four times a questionnaire for a pair of courses: E1pre-C1pre, E1post-C1-post, E2-C2, E3-C3. The questionnaire combines nine validated scales of the instruments LEMO (Donche et al., 2010), Modified WIHIC (Afari et al., 2013) and MJSES (Jinks & Morgan, 1999), that are relevant for the research questions. These scales and their meaning are presented in Table 1.

The items on social aspects of learning, regulation strategies, and academic efficacy are scored on a five-point Likert scale ranging from 1=almost never, over 2=rarely, 3=sometimes, 4=often to 5=almost always. The items on self-efficacy are scored on a five-point Likert scale ranging from 1=disagree, over 2=rather disagree, 3=neither agree nor disagree, 4=rather agree to 5=agree.

Acceptable Cronbach's alpha values were found for the following scales: Self-regulation (Cronbach's $\alpha = 0.81$), Lack of regulation (Cronbach's $\alpha = 0.77$), Self-efficacy (Cronbach's $\alpha = 0.93$), Student cohesiveness (Cronbach's $\alpha = 0.87$), Teacher support (Cronbach's $\alpha = 0.95$), Student involvement (Cronbach's $\alpha = 0.92$), Student cooperation (Cronbach's $\alpha = 0.94$), and

Academic efficacy (Cronbach's α = 0.90). Only the External regulation scale turned out to be unreliable (Cronbach's α = 0.59) and could therefore not be used for further analysis.

Table 1. Scales used in this study and their meaning

	Scales	Meaning
Social aspects of learning	Student cohesiveness	The extent to which students are supportive of one another.
	Teacher support	The extent to which the teacher helps, trusts, and shows interest in students.
	Student involvement	The extent to which students have attentive interest, participate in discussions, perform additional work.
	Student cooperation	The extent to which students cooperate rather than compete with one another on learning tasks.
Regulation strategies	Self-regulation	The extent to which students actively steer their own learning process.
	External regulation	The extent to which students rely on teaching staff or the learning material to steer their learning process.
	Lack of regulation	The extent to which students experience a lack of clarity on how to steer their learning process.
Efficacy	Self-efficacy	The extent to which students have confidence in their learning approach and believe in their own ability.
	Academic efficacy	The extent to which students have confidence in their academic competence.

2.4. Data analysis

First, we applied descriptive statistics and paired t-tests on the data for the scales regarding social aspects of learning - Student Cohesiveness, Teacher support, Student involvement and Student cooperation - to verify whether, and to what extent, students perceive differences between a traditional versus an experimental learning environment with co-creation and generative coaching (Q1).

Next we used descriptive statistics and paired t-tests to examine to what extent students' self-regulation, self-efficacy and academic efficacy differ in a learning environment that they perceived as experimental versus in a learning environment that they perceived as traditional (Q2).

3. Research results

To answer research question **Q1**, we consider paired t-tests for the following 3 combinations:

- C1pre-E1pre (Table 2) to verify if there is a difference in students' perceptions of the learning environments of the courses E1 and C1 at the midterm before which both courses applied a traditional learning environment.
- C1post-E1post (Table 3) to verify if there is a difference in students' perceptions of the learning environment with co-creation and generative coaching in the experimental course E1 after midterm versus the traditional learning environment of the control course C1.
- E1pre-E1post (Table 4) to verify if there is a difference in students' perceptions of the learning environment with co-creation and generative coaching in the second half of the experimental course E1 versus the traditional learning environment (without co-creation and generative coaching) of the first half of E1.

Table 2. C1pre-E1pre (cohort 1, N = 39)

Scale	C1pre		E1pre		paired t-tests			
	M	SD	M	SD	t	df	p-value	Cohen's d
Student cohesiveness	2.86	0.76	3.06	0.84	1.34	37		**0.22 (S)**
Teacher support	3.72	0.60	3.76	0.59	0.29	30		0.05
Student involvement	3.06	0.62	3.02	0.73	**-0.23**	34		- 0.04
Student cooperation	2.64	0.84	3.06	0.79	**2.69**	31	*	**0.48 (S)**

Table 3. C1post-E1post (cohort 1, N = 31)

Scale	C1post		E1post		paired t-tests			
	M	SD	M	SD	t	df	p-value	Cohen's d
Student cohesiveness	2.93	0.63	3.72	0.62	5.67	28	***	1.05 (L)
Teacher support	3.65	0.49	4.01	0.47	3.58	25	***	0.70 (M)
Student involvement	2.96	0.57	3.67	0.38	5.84	28	***	1.08 (L)
Student cooperation	2.59	0.77	4.04	0.46	8.02	25	***	1.57 (L)

Table 4. E1pre-E1post (cohort 1, N = 35)

Scale	E1pre		E1post		paired t-tests			
	M	SD	M	SD	t	df	p-value	Cohen's d
Student cohesiveness	3.02	0.79	3.70	0.60	4.04	33	***	0.69 (M)
Teacher support	3.77	0.51	3.95	0.49	1.40	28		0.26 (S)
Student involvement	3.09	0.68	3.60	0.36	3.82	31	***	0.68 (M)
Student cooperation	3.11	0.74	3.95	0.50	4.97	29	***	0.91 (L)

We find statistically significant differences with large effects in favour of the experimental setting for all scales considered: Student Cohesiveness, Teacher support, Student involvement and Student cooperation.

To answer research question **Q2**, we consider paired t-tests for the combinations C1post-E1post, C2-E2 and C3-E3 for the scales self-regulation, self-efficacy and academic efficacy. The results are shown in Tables 5-7.

Table 5. C1post-E1post (N = 58)

Scale	C1post		E1post		paired t-tests			
	M	SD	M	SD	t	df	p-value	Cohen's d
Self-regulation	3.01	0.84	3.30	0.76	2.26	55	*	0.30 (S)
Lack of regulation	2.70	0.81	2.32	0.66	-3.34	53	**	-0.45 (S)
Self-efficacy	2.94	1.00	3.62	0.61	5.89	56	***	0.78 (M)
Academic efficacy	2.43	0.82	3.10	0.70	5.48	53	***	0.75 (M)

Table 6. C2-E2 (N = 46)

Scale	C2		E2		paired t-tests			
	M	SD	M	SD	t	df	p-value	Cohen's d
Self-regulation	3.08	0.92	3.22	0.90	1.3	45		0.19
Lack of regulation	2.53	0.78	2.47	0.74	-0.54	45		-0.08
Self-efficacy	2.98	1.11	3.26	0.91	2.27	45	*	0.33 (S)
Academic efficacy	2.58	0.98	2.76	0.70	1.58	45		0.23 (S)

Table 7. C3-E3 (N = 38)

Scale	C3		E3		paired t-tests			
	M	SD	M	SD	t	df	p-value	Cohen's d
Self-regulation	3.16	0.86	3.43	0.84	2.33	37	*	0.38 (S)
Lack of regulation	2.68	0.68	2.22	0.70	-3.52	37	**	-0.57 (M)
Self-efficacy	3.40	0.88	3.59	0.95	1.29	36		0.21 (S)
Academic efficacy	2.75	0.79	3.05	0.81	1.86	36		0.31 (S)

All of the significant differences are in favour of the experimental courses. In table 5 (semester 1), we notice a statistically significant difference for the scales self-regulation, lack of regulation, self-efficacy and academic efficacy. For the regulation scales, the effects are small practically significant. For self-efficacy and academic efficacy, the effects are medium

practically significant. In table 6 (semester 2), the scale self-efficacy differs with small statistical significance and small practical significance. For the scale academic efficacy, the difference that can be observed is not statistically significant. In table 7 (semester 3), we notice a statistically significant difference for the scales lack of regulation and self-regulation, the effects are medium respectively small practically significant. For the scales self-efficacy and academic efficacy, the effects are small practically significant.

4. Main conclusions

The results show that between the two types of learning environments – traditional versus experimental with co-creation and generative coaching – students perceive significant differences in their relationships towards their peers, in learning together, in working together and also in teacher support.

Moreover, this study illustrates positive effects of co-creation and generative coaching on students' self-regulation, lack of regulation, self-efficacy and academic efficacy. The largest effects can be observed in semester 1. While in semesters 2 and 3, the learning environments of the experimental courses are the same, the significant impact in the latter is far larger. A possible explanation could be that the extent to which students steer their own learning process and to which they have confidence in their academic competence is challenged by the comprehensive assignment to co-create and realize their own project proposal, which is new to students in the second experimental course and pushes them beyond their comfort zone. In semester 3 they can build on their experience gained in semester 2.

In the context of this action research we co-created examples of Education 3.0 and 4.0 learning environments in the experimental courses. These courses are currently being spotlighted as good practices in several European universities, thus improving educational practice. We see this action research as a stepping stone towards Education 4.0 in which students become fully fledged learning partners and co-creators/innovators.

Moreover, this study suggests that it might be worthwhile to invest in co-creation and generative coaching in learning environments, in order to boost students' self-regulation, self-efficacy and academic efficacy, essential qualities for 21st-century skills such as lifelong learning.

References

Aarup Jensen, A., & Krogh, L. (2017) Re-Thinking curriculum for 21st-century learners: examining the advantages and disadvantages of adding co-creative aspects to problem-based learning. In *Co-creation in Higher Education,* 1-14. ISBN: 9789463511186.

Afari, E., Aldridge, J., Fraser, B., & Khine, M. (2013). Students' perceptions of the learning environment and attitudes in game-based mathematics classrooms. *Learning Environments Research*, 16, 131-150. doi:10.1007/s10984-012-9122-6.

Donche, V., Van Petegem, P., Van de Mosselaer, H., & Vermunt, J. (2010). *Een instrument voor feedback over leren en motivatie [An instrument for feedback on learning and motivation]*. Plantyn: Mechelen. ISBN: 978-90-301-0834-4.

Iversen, A., Pedersen, A., Krogh, L., & Jensen, A. (2015). Learning, leading, and letting go of control: Learner-led approaches in education. *Sage Open*, 5(4), 1–11. doi: 10.1177/2158244015608423.

Iversen, A., & Stavnskær Pedersen, A. (2017). Co-creating knowledge: students and teachers together in a field of emergence. In *Co-creation in Higher Education*, 15-30. ISBN: 9789463511186.

Jinks, J., & Morgan, V. (1999). Children's perceived academic self-efficacy: an inventory scale. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, *72*(4), 224–230. doi: 10.1080/00098659909599398

Lyubomirsky, S., King, L., & Diener, E. (2005). The benefits of frequent positive affect: does happiness lead to success? *Psychological Bulletin, 131*(6), 803-855. doi: 10.1037/0033-2909.131.6.80.

Scharmer, O. (2017). edX-MITx U.Lab 2x Live Webcast The future of learning & creativity. (accessed on February 7, 2025). http://webcast.mit.edu/u.lab2x/live/6/ .

Scharmer, O. (2018). *The Essentials of Theory U*. Berrett-Koehler Publishers. ISBN: 978-1-60509-926-2.

Scharmer, O., & Kaufer, K. (2013). *Leading from the emerging future.* Berrett-Koehler Publishers. ISBN: 978-1-60509-926-2.

Scharmer, O., & Kaufer, K. (2025). *Presencing: 7 Practices for Transforming Self, Society, and Business*. Berrett-Koehler Publishers, ISBN: 979-8890570284.

Shaw, P. (2002). *Changing conversations in organizations: A complexity approach to change*. Routledge: London, ISBN: 978-0415249157.

Shaw, P. (2005). Conversational inquiry as an approach to organisation development. *Journal of Innovative Management, Fall 2005,* 19–22.