

Co-creation Methodology to Promote 21st Century Skills in the Classroom Context

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Abstract: Research studies on learning processes provide strong empirical evidence that active-learning methodologies promote students' engagement which has a positive impact on students' learning outcomes, skills, and performance. Against this background, active teaching-learning environments have seen increasing popularity over the past few decades. Several studies suggest that the implementation of new methodologies based on “ask more, instead of telling” approaches lead to an increase of students' performance. The purpose of this study is to explore the impact of an active learning unit based on innovation co-creation methodologies on students' perceptions of their learning outcomes and on the so-called 21st century skills, such as critical thinking, creativity, collaboration, and communication, in the context of a Portuguese higher education institution - the Polytechnic Institute of Coimbra (IPC). Founded in 1979, the IPC is a public higher education institution, oriented towards the pursuit of the objectives of polytechnic education, with an intrinsic vocation for applied research and the transfer of knowledge to the society. The empirical study is carried out based on data derived from a questionnaire survey applied to a class of students. Preliminary results reveal that the implementation of innovation co-creation methodologies in the classroom context is perceived by students as having a positive effect not only on the development of soft skills but also on their learning outcomes. Additionally, results give evidence that students improve their performance and therefore their final grade is higher. Results also reveal that students would like to see this active-learning methodology applied to other courses.

Keywords: Co-creation, Active learning, Innovation, Students' perceptions, 21st century skills.

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1. Introduction

Since the founding of the first universities in Europe during the Middle Ages, teaching methodologies have been mainly based on lecturing (Brockliss, 1996). Conventional lecture-based classes or courses are centred on the teacher, who decides what really matters to be learnt (Michael, 2006). This traditional model often described as passive learning (Fidalgo-Blanco et al., 2017) doesn't allow the development of students' own way of thinking. Nonetheless, current empirical evidence suggests that the implementation of new teaching-learning methodologies based on “ask more, instead of telling” approaches lead to an increase of students' performance (Henderson et al., 2011). For example, in STEM (science, technology, engineering and mathematics) undergraduate courses, the average failure rates in traditional courses tend to be 1.5 times higher than the failure average rates observed in courses where active learning approaches are implemented, as shown by Freeman et al. (2014). These authors also give evidence that students who achieve the 50th percentile of a class based on traditional lecturing would reach the 68th percentile under active learning classes. In these student-centred learning environments, the pace of learning is customized to the student's needs, goals, and abilities (Michael, 2006).

Based on the above evidence, it is fundamental to adopt teaching methodologies that imply a greater involvement of students in the learning process, that focus on problem solving rather than only memorization, leading to a more long lasting and meaningful learning (Michael, 2006). This construct is the cornerstone of active learning approaches, which can be defined as a process where students are forced to reflect upon ideas and how to use them (Collins and O'Brien, 2003). By this process, students should be mentally and/or physically active in their learning by collecting information and solving problems and should often assess their skills, namely the so-called 4 C's of 21st century learning skills: critical thinking, creativity, collaboration, and communication. According to Pocol et al. (2022), in this active learning contexts students participate with greater motivation in their educational process, which leads to better results.

Among several examples of student-centred learning approaches summarized by Michael and Modell (2003) are problem-based or case-based learning and cooperative/collaborative learning/group work. As stated by Bovill (2020), co-creation methodology fits into the paradigm of active learning, since by enhancing greater interaction between students and teachers and among students themselves, the latter tend to adopt a more active role, developing several types of activities to gather information to solve problems and reflect upon the current state of the art and future trends (see also Michael, 2006; Freeman et al, 2014; Dollinger et al., 2018; Bovill et al., 2016). In addition, co-creation contributes to enhancing students' satisfaction and performance, bringing competitive advantages to educational institutions (Hofstatter, 2010). This statement is reinforced by Araújo et al. (2021), which stands out that co-creation methodologies improve students' engagement and learning outcomes. Furthermore, Gärdebo and Wiggberg (2012) demonstrate that students are an important and valuable resource, although underused in higher education, and that the collaborative work brings significant benefits, namely engagement, motivation, and relationship. Concerning learning outcomes, Michael (2006) states that students are likely to learn more when they study and work with other students than alone. In the same line, Crouch and Mazur (2001) show that the gains resulting from teamwork are significant and that students show an increase in conceptual reasoning and problem-solving competences.

As summarized by Bovill (2020), there are several types of co-creation approaches: *i)* students co-researching university-wide projects; *ii)* students collaboration with staff in research and scholarship projects; *iii)* students representatives working together with staff on committees; *iv)* students participating in course design review committees, being involved in redefining courses and their curricula; *v)* students as consultants, assessing teachers and providing teaching feedback; *vi)* students proposing their own final projects of masters' thesis topic. During the process, and whatever is the type of co-creation, three main dimensions can be identified: co-production, experience, and relations (Dziewanowska, 2018). These dimensions are characterized by several components, as illustrated in Figure 1. The co-production dimension refers to the participation itself of students, i.e., what students really do in the co-creation process. The experience dimension reflects on how deep the participation of the student during the process is. Finally, the last dimension is related to collaboration skills during the process. Additionally, according to Prahalad and Ramaswamy (2004), co-creation processes are characterized by some intrinsic features, such as dialogue, clear risk-benefit assessment, equal access, and transparency, based on cooperation systems, aiming to apply science, technology and innovation policies in personal, educational and business contexts.

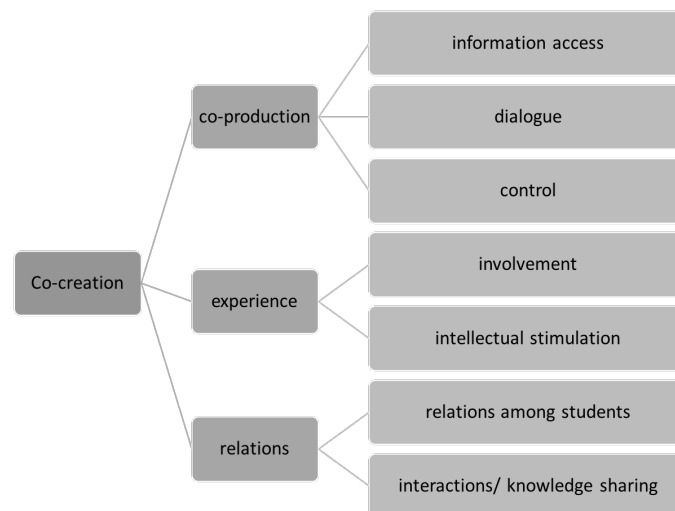


Figure 1. Dimensions and subdimensions of co-creation processes (adapted from Dziewanowska, 2018)

Considering that the co-creation methodologies are based on a joint initiative, in which providers and beneficiaries create value together, the aim of this study is to examine the impact that the implementation of this method brings to the quality of Portuguese higher education. Specifically, this paper explores the impact of an active learning unit based on innovation co-creation methodologies on students' perceptions of their learning outcomes and on the 21st century skills, such as critical thinking, creativity, collaboration, and communication, in the context of a Portuguese higher education institution - the Polytechnic Institute of Coimbra (IPC).

The remainder of the present paper is organized as follows. Section 2 describes the methodology used to carry out the empirical analysis. Section 3 presents and discusses the main findings. Section 4 sets out the main conclusions and policy recommendations.

2. Research design

The present study is based on the implementation in the classroom context of the innovation co-creation model developed by Demola Global (2022) and applied in several higher education institutions around the world. The methodology has been applied in the course Journalistic Writing Workshop of the 1st cycle degree in Social Communication, which is taught at the Higher Education School of the Polytechnic Institute of Coimbra. This course represents the students' first contact with the techniques of collection, selection, hierarchy and writing of information. It is intended that students master the main techniques of journalistic production, being able to identify sources, collect and process information, write texts for journalistic publications, in printed or digital support, understand infographics and articulate their content with the text, title and subtitle. The syllabus focuses on the main techniques of research, selection, collection, and processing of information with a view to their application to the production of journalistic texts, providing students with skills in the management of information sources and in informative writing.

In the academic year 2021/2022, applied to this course and chose a continuous assessment regime 31 students. It is observed that, in terms of gender distribution, the student's population is dominated by females who constitute about 65% of the collected data, while males represent around 35%. All sample students are aged between 18 and 22 years.

The weekly workload of the course is 4 hours and has a total duration of 13 weeks. For the implementation of the innovation co-creation process, which lasts for 8 weeks, the class was divided into teams of 6 students and each team worked on a specific challenge. Although the students have roughly the same background, the professor (who assumes the role of facilitator of the learning process) tried to ensure that there was some heterogeneity in the teams to enhance the creative process. The co-creation process follows the double diamond model, as firstly proposed by Banathy (1996). This process comprises two distinct phases: Discovery and Creation, as illustrated in Figure 2.

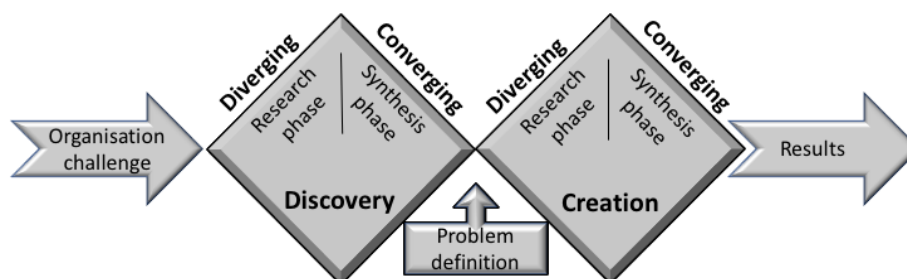


Figure 2: Double diamond model applied to innovation co-creation process (adapted from Banathy, 1996)

The first stage of the process (Discovery stage) consists of collecting and examine several information to understand the challenge in all its dimensions (week 1). Through the following weeks, students develop several tasks which can be divided in a Research phase and a Synthesis phase. Firstly (weeks 2 and 3), students make a list of all the stakeholders that directly or indirectly can impact or be influenced by the problem under analysis, and then group them by interests, influence, etc. This list allows identifying potential experts to be interviewed whose knowledge will allow completing the documentary information already collected. All the information is compiled in collaborative and visual tools, which facilitate the tasks of the next phase. In the Synthesis phase (weeks 4 and 5), students are invited to elaborate empathy maps, where each target group is described based on what it says, does, feels or thinks, and perform a PESTLE analysis, by looking at the political, economic, socio-cultural, and technological factors affecting the phenomenon under study. Once the previous tasks have been completed, students are able to prepare their midway report. During this first stage, the professor acts as a facilitator, providing guidance and works on the team's motivation. The facilitator also proposes tools for collaborative work, helps to identify relevant sources of information, and moderates weekly team meetings.

The second stage of the innovation co-creation process is the Creation phase (see Figure 2), in which the team carry out speculative work anticipating future trends and solutions to the challenge under study (weeks 6 and

7). This phase starts producing lots of ideas and prototyping different solutions and is carried out with the help of several tools, namely:

- i) Weak signals. There are several definitions in the literature for weak signals. The co-creation model follows the definition resulting from the compilation carried out by Van Veen and Ortt (2021) who refer: “a perception of strategic phenomena detected in the environment or created during interpretation that are distant to the perceiver's frame of reference”.
- ii) “What if...” and “How might we....” questions. This type of questions allows a speculative view, in which students should be bold and provocative and not be limited to factual situations. These questions are part of a creative thinking methodology, whose application makes it possible to frame complex problems, discover needs still unknown and propose more appropriate solutions (Lahiri et al., 2021).
- iii) Future scenarios. Based on the weak signals and the speculative questions, the team build future scenarios, specifying the main vectors of change.

The Creative stage ends with the elaboration of a final report (week 8), which brings together all the information compiled in the midway report as well as all the speculative work carried out in this second stage, given special emphasis to the future scenarios, which are the main outcomes of the innovation co-creation process.

Table 1 summarizes the stages and main tasks proposed to the teams during the innovation co-creation process.

Table 1: Stages and tasks of the innovation co-creation process

Stage	Week	Tasks
Discovery Stage	Week 1	Collecting and examine several information to understand the challenge in all its dimensions
	Week 2	List of all the stakeholders and identification of potential experts to be interviewed
	Week 3	Conducting interviews/questionnaires and collecting information
	Week 4	Empathy maps, PESTLE analysis
	Week 5	Midway report, personal interpretation
Creation Stage	Week 6	Signals, “What if...” and “How might we....” questions
	Week 7	Speculative questions, future scenarios
	Week 8	Final report (assessment)

Once the innovation co-creation process was completed, all the students were invited to participate in questionnaire survey, designed to evaluate both their degree of satisfaction with the methodology and their perception of the skills developed. The questionnaire comprises a set of questions about the students' perception of the skills improved with the application of the co-creation process and another set of questions referred to the students' perception of the methodology impact in the classroom context, aiming to evaluate and understand the degree of satisfaction with the process and its impact on students' performance. The questions in the questionnaire were applied on a multi-item scale from 1 to 7 (Likert type scale). In this scale, 1 represents “completely dissatisfied” or “completely disagrees”, while 7 indicates “completely satisfied” or “I totally agree”.

3. Results

This section presents and discusses the main outcomes of this research with the purpose of assessing the effect of implementing an active learning unit based on innovation co-creation methodologies on students' perceptions of their achievement of the learning outcomes, satisfaction, skills improvement, motivation, and engagement with their studies.

The results give evidence that students, when inquired about their degree of satisfaction with the application of the innovation co-creation methodology in a classroom context, reveal to be satisfied, with levels of agreement

of 90%, as illustrated in Figure 3. Results also show that about 50% of the students are mostly satisfied with their participation in the innovation co-creation process.

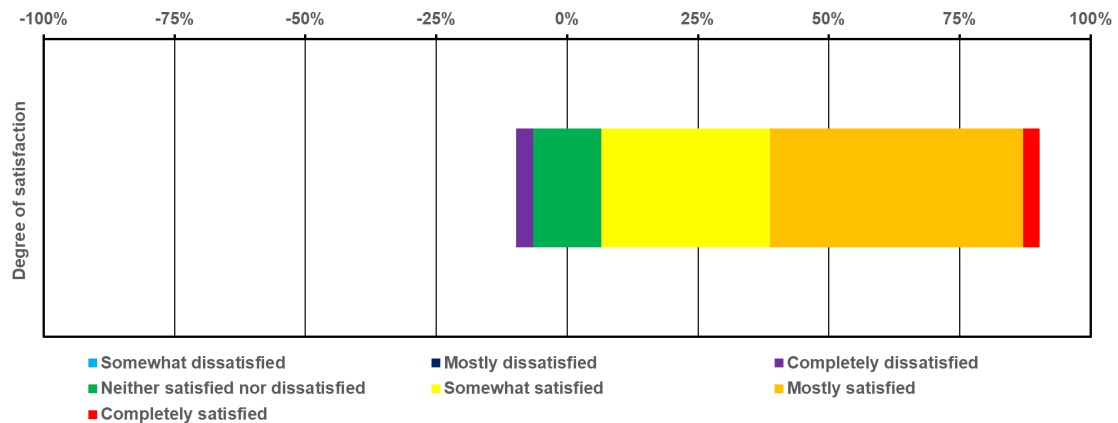


Figure 3: Students' degree of satisfaction

As can be observed in Figure 4, when asked about the positive impact of the co-creation methodology on the classroom dynamics and productivity, most students reveal a high level of agreement. They also consider that the implementation of this active learning methodology has a positive impact on the final grade, with a level of agreement of around 90%. These results allow us to validate the acceptance of the co-creation methodology by the students, who become an active part of the teaching-learning process, with positive impacts on their level of motivation and, therefore, an increase in performance and achieved outcomes. Similar results were presented in other studies that also focus on co-creation methodologies in the classroom context, namely Araujo et al. (2021, p.226), who reported that: "it is noted that the student, in general, does not seek a passive role but an active one in the teaching processes, and this view should prevail in the relations of value co-creation". From the teachers' perspective, students present themselves within the classroom with a greater openness and motivation to actively participate in the application of the syllabus of the curricular unit. On the other hand, participation, sharing, and focus become consistent and last until the end of the course, essentially because they feel part of the process and not just as information receivers.

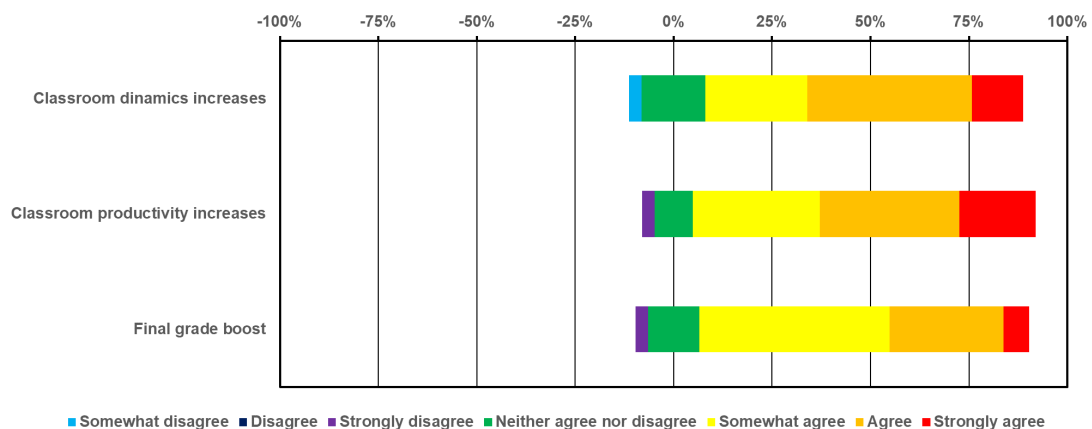


Figure 4: Students' perception of the impact in the classroom and performance

Results also show that most students consider that the participation in the innovation co-creation process contributed to an improvement of the so-called 21st century skills (WEF, 2016), namely critical thinking, creativity, collaboration, and communication (Figure 5), with a level of agreement greater than 90%. It should be noted that these four skills are essential today and will be essential in the future as well for students to succeed in school and in the workplace. These findings are corroborated by previous research conducted by Costa et al. (2021) that concludes that the implementation of co-creation methodologies generates high levels of satisfaction among students and are perceived as having very positive impact in skills' development.

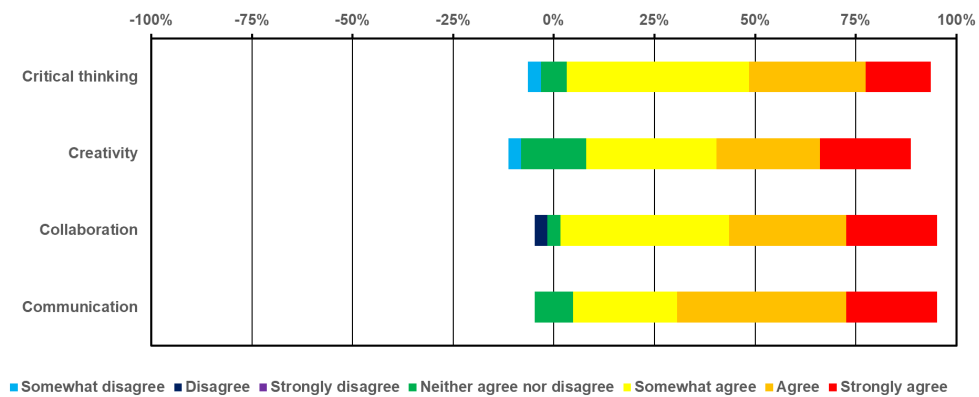


Figure 5: Students' perception of 4 C's 21st century skills improvement

When questioned about the implementation of this innovation co-creation methodology in other courses, the students demonstrated a high level of agreement (> 80%), as illustrated in Figure 6. This finding reinforces the importance of disseminating the application of the innovation co-creation process as an active teaching-learning methodology in the classroom context, as stated by Freeman et al. (2014). Active learning approaches as regular teaching practice in classrooms should be preferred over traditional lecturing. The implementation of these active strategies promotes both students and teacher's engagement and tend to maximise students learning outcomes. Furthermore, these approaches can contribute to the social integration of students, who in more conventional lectures would probably go unnoticed (Gregory, 2013).

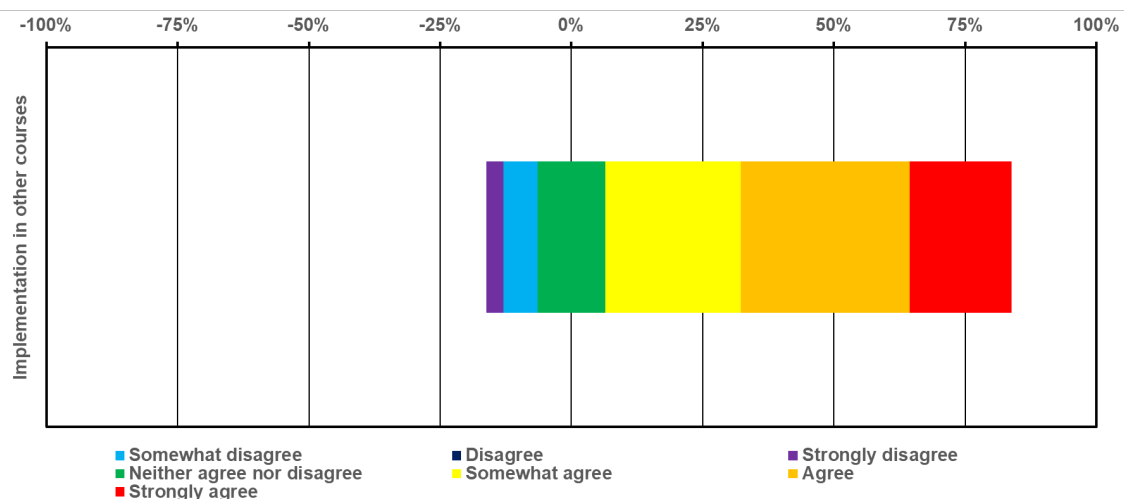


Figure 6: Students' perception of the application of the methodology in other courses

4. Conclusions

The main purpose of this paper is to examine the impact of an active learning unit based on innovation co-creation methodologies on students' perceptions of their learning outcomes and the so-called 21st century skills, namely critical thinking, creativity, collaboration, and communication, in the context of the Polytechnic Institute of Coimbra (IPC), as a Portuguese public higher education institution oriented towards the pursuit of the purposes of polytechnic education, with an intrinsic vocation for applied research and knowledge transfer.

The results corroborate previous findings that active teaching-learning methodologies, by implying that students become engaged in their learning process by thinking, discussing, investigating, and creating, have a positive impact on students' learning outcomes and enhances the development of competencies considered essential for career success in the 21st century. The empirical findings also provide evidence that this type of cognitively activating learning environment enhances the classroom dynamics and productivity with positive impacts on students' final grade. Furthermore, results reveal that students would like to see this active-learning methodology applied to other courses. The degree of students' satisfaction with the application of this

innovation co-creation methodology in a classroom context compared to more traditional approaches is nearby 90%, which allows concluding about the importance to extend its implementation.

This study reinforces the need for a paradigm shift in current teaching and learning models towards more active learning approaches that engage and develop problem solving, communication, and collaboration skills. Efforts should be made by the decision makers to support this paradigm shift to meet the expectations of new generations of students as well as the needs of the labour market in the 21st century.

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