

Lecture Notes in Educational Technology

Francisco José García-Peñalvo
María Luisa Sein-Echaluce
Ángel Fidalgo-Blanco *Editors*

Trends on Active Learning Methods and Emerging Learning Technologies

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Chapter 1

Introduction



Francisco José García-Peñalvo , **María Luisa Sein-Echaluce** ,
and **Ángel Fidalgo-Blanco** 

As in other areas of knowledge, education must progress and evolve, adapting to new demands, new ways of learning, new ways of managing information and knowledge, and the inclusion of technologies (Alonso de Castro & García-Peñalvo, 2022).

Educational Innovation has marked and continues to mark the path of learning progress in any educational field and level (Fidalgo-Blanco & Sein-Echaluce, 2020). In this book, we work with two key aspects of Educational Innovation: active learning and learning technologies.

Active learning methodologies have always been a challenge (García-Peñalvo et al., 2019), and some have been widely used, such as teamwork (Sein-Echaluce et al., 2021), problem-based learning (Basilotta Gómez-Pablos et al., 2017), or case studies (Ramírez-Montoya, 2015). The incorporation of technologies has generated new active methodologies such as gamification (Villegas et al., 2019), the flipped classroom (Sein-Echaluce et al., 2021), or collective intelligence (Fidalgo-Blanco et al., 2019) among others. Likewise, technologies have transformed both the way of assessing learning (Grande-de-Prado et al., 2021; García-Peñalvo et al., 2021) and decision-making during the teaching-learning process through artificial intelligence (Yu, 2020), big data (Daniel, 2019), and learning analytics (García-Peñalvo, 2020; Hernández-García et al., 2020). Also, digital transformation (García-Peñalvo, 2021; García-Morales et al., 2021), online education (Crisol-Moya et al., 2020; Conde-González et al., 2014), computational thinking (González-González, 2019), and

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Table 1 Responses to question Q1 (previous experience)

Q1—How many educational innovation experiences have you carried out?	
This is my first experience	13.9
I have between one and two years and more than one experience	21.2
I have between three and five years and more than one experience	18.8
More than five years and more than one experience	46.1

open education (Nascimbeni & Burgos, 2019) influence the transformation of active methodologies.

The need for integration of methodologies and technologies was evident during the transformation that teaching and learning processes underwent due to the restrictions resulting from the COVID-19 pandemic (Daniel, 2020; García-Peñalvo et al., 2020). Technology by itself helped, but it also proved to be insufficient to achieve effective learning if only face-to-face classes were transformed into online classes through video-conferencing systems (Hodges et al., 2020; García-Peñalvo & Corell, 2021). Similarly, it was shown that the integration of technologies could open up new learning scenarios by incorporating hybrid methods (García-Peñalvo et al., 2021; Fidalgo-Blanco et al., 2020).

This book aims to contribute to the transformation of learning through best practices that integrate active methodologies with technology, improve the usual learning scenarios, and open expectations for new ones. The chapters of this book correspond to good practices selected and extended from the CINAIC 21—International Conference on Innovation, Learning, and Cooperation held in Madrid from October 20 to 22, 2021, in hybrid mode (face-to-face and online) (Sein-Echaluze et al., 2021).

CINAIC is an academic event that tries to bring the scientific method to develop good practices in educational innovation. Teachers from different educational fields present their latest work in educational innovation, most of them integrating active methodologies with technologies. During the development of the congress, round tables are also organized where different aspects that can contribute to improving educational innovation are analyzed, as well as workshops where methodological and technological trends are shown. Studies and analyses are also carried out, considering the participants' experience in the international conference.

To show the relevance of this book, we include below the results of a study conducted during CINAIC 2021 in which 165 teachers with experience in educational innovation participated, as shown by the percentages of the answers to question Q1 in Table 1. Almost half of the participants (46%) have been applying educational innovation for more than five years and have had more than one experience.

Applying educational innovation has a very different motivation than industrial innovation. While the latter is carried out for competitive reasons, educational innovation is usually carried out by the vocation of teachers to improve student learning and their own decision. Some 55.8% of the participants in the study affirm this, as shown by the answers to question Q2 in Table 2.

Table 2 Responses to question Q2 (motivation)

Q2—What encouraged you to carry out the educational innovation you presented at CINAIC21?	
The innovation services of my university/center	10.3
Other faculty who had already innovated	12.7
The need for educational innovation in my CV	9.7
Improving student learning in my subject area	55.8
Other	11.5

Table 3 Responses to question Q3 (assistance received)

Q3—Where have you found the most helpful in making this innovation happen?	
In the training courses of my university/center	35.2
In similar experiences of congresses and scientific journals	39.4
In social networks	2.4
In open courses (MOOC and OCW)	4.8
Other	18.2

Table 4 Answers to question Q4 (barriers)

Q4—What has taken you the most effort in the realization of your innovation?	
The use of technology	7.3
Methodological change	16.4
Measuring and contrasting results	42.4
Adapting or creating content	26.1
Other	7.8

On the other hand, conferences on educational innovation and dissemination media such as books and scientific journals are the primary source of help for carrying out educational innovation (question Q3). Specifically, 39.4% say so, followed very closely by 35.2%, who say that it is the courses on educational innovation held at schools and universities. All the response options to question Q3 are shown in Table 3.

Nevertheless, methodology and technology are not the main obstacles to carrying out educational innovation experiences. As indicated by 42.4% of the responses, the main obstacle is the measurement and contrast of results, as shown in Table 4, with the answers to question Q4.

Another aspect studied was the transferability of the educational innovation carried out among the different experiences presented. Transferability is a crucial aspect for incorporating the experience of teachers who have innovated in the implementation of new innovations (Sein-Echaluce et al., 2014). In this way, a more significant and faster impact is achieved in the transformation of the learning process.

Table 5 Answers to question Q5 (transferability)

Q5—What do you think is the status of your innovation in terms of transferability?	
Can only be used in my subject	1.2
Can be used in subjects with similar content	21.8
Can be used in any subject of the same subject area	24.2
Can be used in any subject	50.9
Other	1.9

Table 6 Answers to question Q6 (most transferable part)

Q6—What do you think is the most transferable part of your innovation?	
Contents	11.5
Methodology	76.4
Technology	7.3
Other	4.8

Table 7 Answers to question Q7 (motivation)

Q7—What do you think can serve as an indication of the quality of the educational innovation you have done?	
Learning outcomes	55.8
The novelty of the technology or methodology used	3.6
Publication in conferences and scientific journals	10.3
Transferability	27.3
Other	3

Most of the answers to question Q5 about transferability of the educational innovation, 96.9%, indicate that the educational innovation experience is transferable, for subjects with similar contents, in the same area of knowledge or any other subject, the latter being the majority with 50.9% of the total answers. Only 1.2% of the respondents indicated that their experiences were not transferable. Table 5 shows these results.

Question Q6 refers to the part of the experience that seems most transferable. The majority indicated that the methodologies were 76.4%, the contents with 11.5%, and the technologies with 7.3%, as shown in Table 6.

Confirmation of the motivation that encourages teachers to carry out educational innovation can be found in question Q7 on the quality indicator of innovation. 55.8% of the answers favor learning results, followed by 27.3% who believe that it is the transferability itself, as shown in Table 7.

Concerning the aspects that could most help carry out educational innovation, Table 8 shows the most usual comebacks. Some 50.3% of the participants in the study indicated that they would have been helped by a definition of indicators known globally to measure the level of educational innovation.

Table 8 Responses to question Q8 (drivers)

Q8-What do you think could have helped you improve the educational innovation you have done?	
Global and known measurement indicators that define the level of innovation	50.3
Salary increasing	3
Increased weight in accreditations	9.7
Decrease in teaching load	24.8
Other	12.2

Thanks to this survey, it can be concluded that:

- The dissemination of this book is appropriate (Table 3).
- The scientific method used in the chapters of the book will help reduce the effort to carry out innovations (Table 4) and improve the innovation itself (Table 8).
- The transferability of the innovation experience is achieved chiefly through the methodologies (Tables 5 and 6) used in the book.
- In all the good practices, improvements in learning are achieved, which most motivates the teachers who innovate (Table 2) and is the ultimate goal of their work (Table 7).

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Chapter 2

Improving the Motivation of First-Year Undergraduate Students Through Transversal Activities and Teamwork



David Fonseca , Silvia Necchi , Marian Alaez , and Susana Romero 

Abstract Promoting an increase in motivation in first-year undergraduate students not only results in an improvement in their follow-up, performance, and therefore their satisfaction, but can also lead to a reduction in early dropout due to any situation of frustration or poor results. To confirm the initial assumption, the present research work demonstrates how the work of certain competencies in a transversal way allows the first-time student to increase empathy with the degree while improving interpersonal relationships with their peers being an aspect that significantly affects the intrinsic motivation of the student. The chapter focuses on analyzing the results of two transversal tasks carried out through a teamwork process and monitored during the first year of the Bachelor's Degree in Architecture. For the analysis, we used a mixed approach that allowed us to identify the strengths (enhanced in the new iterations) and weaknesses of the proposal on which we are already acting in subsequent replications of these types of transversal activities.

Keywords Transversal competencies · Teamwork · Pedagogical innovation · Educational assessment · Student motivation

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2.1 Introduction

The early years of university degree courses generally provide students with generic learning to equip them with the foundations for more specific subjects. The problem of the heterogeneity found in student entry profiles (Beqiri et al., 2009; Rodenbusch et al., 2016) has been exacerbated by the lockdown in force at the end of the final year of upper secondary education during 2019–2020. This general situation has been linked with issues of student motivation, and studies into the matter are currently being conducted. Online teaching and the consequent lack of person-to-person contact result in low levels of knowledge and motivation which make it harder to follow classes and therefore affect potential performance (García-Peñalvo & Corell, 2020; García-Peñalvo et al., 2020). One way of mitigating the initial impact of this problem on university courses is to design introductory subjects, activities, and/or practical tasks focused more on generic competencies. A more transversal approach to working on specific competencies through more generic methods is directly correlated with better academic performance (Fonseca & García-Peñalvo, 2019; Fonseca et al., 2014, 2015; Necchi et al., 2020; Sanchez-Sepulveda et al., 2020).

The study reported here was conducted under a research project awarded by the Aristos Campus Mundus association (ACM, <https://aristoscampusmundus.net/>) to investigate how transversal approaches can increase motivation among undergraduate students. The improvements noted are not only limited to motivation, which has been widely proven to be linked to curriculum improvements, but also extend to the level of autonomy of students. Mastering transversal competencies in the course of their studies not only increases students' general competencies but also their future skills (Peña et al., 2016, 2018; Wagenaar, 2014).

The study analyzes and compares two specific activities carried out in year one of the Architectural Studies degree course, in which students are required to hand in a number of tasks completed in teams. These tasks enhance specific subject-related skills in a multi-disciplinary format featuring visits and explanations given on site in areas of action. This type of work forms part of the set of academic activities known as Aula-BCN (Fonseca et al., 2019), which is being included as an active method in the process of change in education called New Learning Context (NLC) (ARLEP LSD, 2020). This process is being implemented at all La Salle schools in Spain, from primary through all intermediate stages to the university level.

Section 2 below looks at the overall context and framework of the project. Section 3 describes the pills assessed. Section 4 sets out the main results and Sect. 5 presents a discussion and conclusions.

2.2 Context

2.2.1 Motivation

Numerous studies (Kahu & Nelson, 2018) have shown that the students entering universities today are very different from those who are now teaching them in terms of both previous skills and their attitudes and motivation to acquire new ones (Bunce et al., 2010). This has led universities to consider the need to take into account students' own characteristics and opinions to enable them to succeed in their studies (Escudero et al., 2016; Fonseca et al., 2017, 2018, 2021; Sanchez-Sepulveda et al., 2019; Villegas et al., 2021). Motivation-enhancing aspects include methodologies for holding their attention, which must be active to substantially improve students' performance (Freeman et al., 2014).

Active student-centered learning methods such Project Based Learning (PBL) have been mentioned by several studies as a solution to increase motivation and competence and decrease dropout ratios (Blumenfeld et al., 1991). PBL has also been found to be better suited to the new challenges of competence-based education, as an approach that allows students to learn while actively participating in the design of the assigned project (Kolmos et al., 2020).

With this methodology, students can acquire knowledge that is more permanent since learning by doing yields more permanent results than simply listening to a lesson. According to studies, students who participate in project-based learning attain higher levels of accomplishment than students who participate in traditional teaching methods (Kolmos et al., 2020; Petchamé et al., 2020; Strobel & Barneveld, 2009).

Besides, PBL is especially suitable for teaching students of architecture degrees, since its approach tries to reproduce the way of working in the architecture field. Working on a common project allows students to better understand architecture as a transversal discipline, where different areas of knowledge contribute to the success of the result.

The PBL is suitable for assessing soft curricular skills such as critical thinking, capacity for analysis and synthesis, strategic planning, leadership and adaptation to teamwork, motivation, and communication, among many, all of them necessary for the professional future (Necchi et al., 2020). Most of the Architecture syllabus includes, besides specific engineering knowledge, other topics that provide an all-round formation. In fact, both specific technical knowledge and non-technical competencies are required including teamwork, communication, problem solving, and leadership skills (ABET, 2019; Chan et al., 2017; International Engineering Alliance, 2014; Passow, 2012; Passow & Passow, 2017).

According to some studies into ways of improving performance, (Partanen, 2020) improvement is even greater with direct interaction with peers and teachers. The character of Aula Barcelona's teaching generates, as the space is different from the classroom, greater cohesion between peers and reinforces links with teachers.

In other words, although students may initially be reluctant to work in teams and fearful of presenting their ideas to their peers, the development of these competencies improves not only their motivation but also the final experience and results (Fidalgo-Blanco et al., 2015; Necchi et al., 2020).

2.2.2 Teamwork Competence

On the basis of these initial premises, a project was designed under the name “Improving social and collaborative competences of undergraduate students using active methodologies. A mixed assessment approach”. Funding for this project was approved at the 6th Call for Research Projects organized by the Aristos Campus Mundus association in 2020. The project goal is to develop educational pills based on teamwork and on communicating the ideas to be implemented, without losing sight of motivation. Thus, from the outset of their university courses, students become aware of the enormous potential of teamwork, based on synergies and key points for fostering effectiveness. The underlying idea is that teamwork must be carefully encouraged from the initial formation of groups through to communication and final assessment (Alaez et al., 2021).

This competency, defined as “Actively joining and participating in the attainment of shared objectives with other persons, departments and organisations”, can be broken down into three levels. Level one, which is considered to be the most suitable for first-year students, works on the responsibility that team members must show in performing tasks within the time given and in prioritizing team goals over individual interests. Level two deals with participation and involvement in team goals, and level three with ensuring a good atmosphere and team leadership (Fig. 2.1 shows the rubric we have used to evaluate its first level of mastery, following the guidelines of the University of Deusto (Villa Sánchez & Poblete Ruiz, 2007)).

2.2.3 Assessment

To evaluate the pills, the MUSIC® instrument (Jones, 2009) is used. As indicated in its definition, the model weights five indicators that work with different variables that influence a student’s motivation, both positive and negative. In turn, MUSIC® also considers the role of the teacher of the course being evaluated and the student’s assessment of the proposed learning activities. The MUSIC® has different questionnaires allowing the user to customize it according to the variables to be measured.

The questions that make up the MUSIC® model used are based on the following aspects:

- Usefulness and enjoyment of the activities performed.
- Perception of the importance of the knowledge acquired for their future.

LEVELS OF MASTERY	INDICATORS	DESCRIPTORS				
		1	2	3	4	5
First level of mastery: <i>Actively participating and collaborating in team tasks and promoting confidence, cordiality and focus on shared work</i>	Completing assigned tasks within deadline as group member	Doesn't complete assigned tasks.	Partially completes assigned tasks or does so with delays.	Reports before the deadline on the outcome of the assigned task.	Quality of work on the assigned task is a noteworthy contribution to the team.	In addition to completing assigned task well, his/her work orients and facilitates that of rest of team members .
	Participating actively in team meetings, sharing information, knowledge and experiences	Often absent from group work and his/her presence is irrelevant.	Takes little part, mostly at the request of others.	In general is active and participative in group encounters.	His/her work fosters participation and improved quality of team results.	His/her contributions are fundamental for the group process and for the quality of results.
	Collaborating in defining, organising and distributing group tasks	Manifests resistance to the organisation of work within the team.	Simply accepts the organisation of work proposed by other members of the team.	Participates in the planning, organisation and distribution of teamwork.	Is organised and distributes work with effectiveness.	Fosters organisation of work by taking best advantage of team member talents and know-how.
	Focusing on and being committed to agreement and shared objectives	Pursues own objectives.	Has difficulty in integrating personal and team objectives.	Accepts as own the objectives of the group.	Promotes a clear definition of objectives and the group's integration round them.	Motivates and marshals group round more demanding objectives. Groups where he/she participates noteworthy for performance and quality.
	Taking into account the points of view of others and giving constructive feedback	Doesn't listen to classmates and systematically disparages them, wanting to impose own opinions.	Listens little, asks no questions, does not want to know others' opinions. His/her contributions are redundant and not very suggestive.	Accepts the opinions of others and knows how to give own point of view constructively.	Promotes constructive dialogue and inspires quality participation from other group members.	Integrates others' opinions into a higher perspective, maintaining atmosphere of collaboration and support.

Fig. 2.1 Rubric for assessment of the generic competency of Teamwork, level 1 (Villa Sánchez & Poblete Ruiz, 2007)

- Ability and control of the student to perform the tasks successfully and obtain a high grade.
- Attractiveness of the teaching methods used.
- Support and attitude of the teacher in the performance of the practice.

The obtained parameters are quantitative and are widely validated (Fonseca et al., 2016, 2017; Valls et al., 2017; Villegas et al., 2021), although the model stresses that they should be considered independently.

2.3 Project Description. Methodology

This proposal has been gradually honed since it was first published in the academic year 2016–17, and in a more coordinated fashion in 2017–18 (Centeno Hernández, 2018; Fonseca et al., 2019). The practical tasks set involve activities organized following site visits/routes to locations to provide a context for them with the help of teachers of different subjects. These site visits are intended not just to enhance synergies between subjects and teaching staff but also to spark interest and improve teaching methods based on actual case studies, moving architectural concepts outside the classroom setting. The activities are set out to reinforce motivation in first-year students in an indirect fashion, so that even though the early part of their course comprises largely basic, more instrumental subjects they can still glimpse the potential extent of their chosen profession. This is intended to help decrease year one dropout rates.

This proposal falls within the lines of action of the “New Learning Context” (NLC), a new teaching model based on active learning methods that is currently being implemented internationally at establishments of all types linked to La Salle (primary, secondary, upper-secondary, vocational training, and university education) (ARLEP LSD, 2020; Salle, 2018). La Salle Campus Barcelona (Universitat Ramon Llull) and La Salle Campus Madrid were among the 104 centers involved in the design and execution, which began in 2018.

The concept learning environment was widely studied and analyzed from different academic viewpoints, e.g. (Land & Hannafin, 1996; Moore et al., 2011). A learning environment, according to the NLC, is a pedagogical setting that combines all the elements that students require to obtain their learning outcomes in a holistic manner. As a result, the learning environment is an important component of the NLC educational approach. The environment can be thought of as a separate space with its own educational goal in terms of approach and teaching. NCL learning environments are Seminar, Workshop, Project, Welcoming, and Closure (Petchamé et al., 2021). Project is a key learning area at the NLC, where students develop skills by completing complex assignments. These projects are characterized by their transversal knowledge integration, which is created in an interdisciplinary manner using a variety of sources (scientific, social, historical, artistic...). Projects normally focus on one source, which is then complemented by the others, resulting in a learning environment in which students may effectively develop and construct knowledge.

This paper focuses on the way in which two of the pills developed are implemented and analyzes the results for the case study involving transversal visits in year one of Architecture.

2.3.1 Pill1: Sagrada Familia Schools. Historical Context

Le Corbusier visited Barcelona in 1928. From here, he began a period of collaboration with the GATCPAC (the Spanish acronym for Grupo de Arquitectos y Técnicos Catalanes para el Progreso de la Arquitectura Contemporánea), which allowed young Catalan architects to contact the master, notably Josep Lluís Sert and Antonio Bonet. It seems that this is where the use of the “Catalan vault” comes from in some projects, such as Le Maison Jaoul. It is known that he took advantage of his stay in Barcelona to visit La Sagrada Familia, and that he noticed a modest building next to it, the schools. We know it because, among the notes he took, there is one of these buildings. Perhaps the Chapel of Ronchamp and other projects find their origin here ... Years later he wrote: *“What I saw in Gaudí was the work of a man of extraordinary strength, faith and technical ability ... Gaudí was an artist; only those who touch the sensitive hearts of men remain forever. It means the architecture that triumphs over all the problems gathered in the line of fire (structure, economy, technique, use), thanks to an unlimited interior preparation of observation. Architecture is the fruit of character, just that: a manifestation of character.”*