

Teaching and learning among students' diversity: a project-based learning experience in higher education

*Ensino e aprendizagem em meio à diversidade dos estudantes:
uma experiência de aprendizagem baseada em projetos no ensino superior*

*Enseñanza y aprendizaje entre la diversidad de estudiantes:
una experiencia de aprendizaje basado en proyectos en la enseñanza superior*

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ABSTRACT

This study explores the efficacy of a project-based learning (PBL) experience in the particular context of “research methodology”. Qualitative data was collected from an online survey where students reflected upon their development and learning over the semester. PBL has generally shown to be an effective pedagogical practice regarding the aims of this curricular unit: to enhance the practical application of theoretical concepts as a way to facilitate the understanding of abstract and complex concepts; to stimulate active learning experiences as a way to engage students; to prepare students for the elaboration of a research project; and to stimulate the transfer of knowledge and skills to professional practice. Nonetheless, PBL is also a demanding pedagogical methodology, and this can be particularly relevant when students' profile is heterogeneous. The paper contributes with insights into how PBL can be applied to curricular units with high student heterogeneity and complex subjects.

Keywords: Project-Based Learning. Higher Education. Research Methodology. Students' Diversity.

RESUMO

Este estudo explora a eficácia de uma experiência de aprendizagem baseada em projetos (PBL) no contexto da “metodologia de investigação”. Foram recolhidos dados qualitativos de um inquérito *online* em que os estudantes refletiram sobre o seu desenvolvimento e aprendizagem ao longo do semestre. O PBL demonstrou ser, em geral, uma prática pedagógica eficaz diante dos objetivos da unidade curricular: melhorar a aplicação prática de conceitos teóricos como forma de facilitar a compreensão de conceitos abstratos e complexos; estimular experiências de aprendizagem ativas como forma de envolver os estudantes; preparar os estudantes para a elaboração de um projeto

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de investigação; e estimular a transferência de conhecimentos e competências para a prática profissional. No entanto, o PBL é também uma metodologia pedagógica exigente, podendo isto ser particularmente relevante perante estudantes de perfis heterogêneos. Conclui-se com reflexões sobre como o PBL pode ser aplicado em turmas heterogêneas e com conteúdos complexos.

Palavras-chave: Aprendizagem por Projetos. Ensino Superior. Metodologia de Investigação. Diversidade de Estudantes.

RESUMEN

Este estudio explora la eficacia de una experiencia de PBL en el contexto de “Metodología de la Investigación”. Los datos cualitativos se recogieron a partir de una encuesta online donde los estudiantes reflexionaron sobre su desarrollo y aprendizaje a lo largo del semestre. En general, el PBL ha demostrado ser una práctica pedagógica eficaz con relación a los objetivos de la unidad curricular: mejorar la aplicación práctica de los conceptos teóricos para facilitar la comprensión de conceptos abstractos y complejos; estimular experiencias de aprendizaje activo a fin de involucrar a los estudiantes; prepararlos para la elaboración de un proyecto de investigación; y estimular la transferencia de conocimientos y habilidades a su práctica profesional. No obstante, el PBL es también una metodología pedagógica exigente, frente a estudiantes de perfil heterogéneo. Se concluye que sobre cómo se puede aplicar el PBL en clases con alta heterogeneidad de los estudiantes y con contenidos complejos.

Palabras clave: Aprendizaje Basado en Proyectos. Educación Superior. Metodología de Investigación. Diversidad de Estudiantes.

INTRODUCTION

With the progressive implementation of the guidelines of the Bologna Declaration, teaching and learning in higher education (HE) in Europe has changed (González Jiménez *et al.*, 2009; European Commission, 2017). One of the reasons that led to these changes relates to the need that new graduates be prepared to proactively invest in their professional development to successfully face a continuously changing labour market (Inamorato dos Santos *et al.*, 2019; Ornellas, Falkner and Edman Stålbbrandt, 2019). This should necessarily be considered in students’ learning experiences during HE. For example, these days learning is less about students gathering information or acquiring knowledge but more about knowledge construction and skills development. In this framework, the teacher replaces the traditional lectures and, instead, provides students with active and meaningful learning situations creating, from the very beginning, opportunities to promote students’ initiative, participation and responsibility.

These (re)orientations are in line with the most recent learning theories that advocate the benefits of a pedagogy that focuses more on learning than on teaching (Gargallo, Morera and Garcia, 2015; Christersson *et al.* 2019). However, even if learning is mainly the students’ responsibility, the teachers’ action is paramount given the diversity of variables that interfere with the organisation and pursuit of these learning experiences (Marroquín Yerovi and Valverde Riascos, 2018; Sáiz-Manzanares *et al.*, 2021). Organisation of the curriculum, classroom management, active methodologies, continuous assessment or the use of new technologies are just some examples that make us uphold the need for HE teacher development (European Commission, 2017; Ponce Ruiz, Álvarez Gómez and Viteri Intriago, 2019), grounded in previous empirical research. This development may even make

more sense when the admission process and the careers of HE teachers are more determined by their research activity than by the teaching itself, or when they, in their own experience as students, have not been in contact with or experienced active learning methodologies (Sadler, 2012; Higuera-Rodriguez, Garcia-Vita and Medina-Garcia, 2020).

Various teaching methodologies focused on student learning are available today, such as problem-based learning, collaborative learning, flipped classroom or mobile learning. Among the active learning methods, those organised around project works can be particularly useful in curricular units that require the integration of complex theoretical and abstract knowledge into a project. According to Savery (2006), project-based learning (PBL) is “an instructional (and curricular) learner-centred approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem” (p. 9). It represents a teaching-learning methodology in which specific problems are intentionally identified, along with the knowledge and skills needed to solve them, and contexts for meaningful student learning are structured through the construction, implementation and evaluation of projects. Due to its popularity and effectiveness, this teaching-learning methodology is now widely used at all levels of education, particularly in higher education and technical or vocational education (Almeida *et al.*, 2023; Crestani and Machado, 2023).

In this student-centred approach learning occurs in small groups, under the guidance of the teacher that acts as a tutor. The projects or problems to be addressed usually do not have a “right and unique way” to be approached. Instead, they are unstructured and complex, with several valid ways to be carried out, and require the combination of different sources of information, in order to find a solution. This self-directed learning process seems to be an effective way to increase students' motivation and to develop their problem-solving competencies (Dochy *et al.*, 2003; Ball and Pelco, 2006; Reay, David and Ball, 2006; Tiwari, Arya and Bansal, 2017; Silva *et al.*, 2019).

The implementation of PBL places various demands on teachers and students, which are also assumed to be part of the effectiveness attributed to this methodology. Teachers are required to move away from expository practices and adopt ways of teaching that are close to mediation and mentoring, taking the role of facilitator; students are required to play a proactive and self-regulated learning role based on research, formulating hypotheses, argumentation and reflection (Cecílio and Tedesco, 2019; Almeida *et al.*, 2023). It also calls for students to work in small groups, taking advantage of the beneficial effects of cooperative or collaborative learning (Kalaian, Kasim and Nims, 2018).

These requirements or ingredients of the operationalisation and effectiveness of this methodology explain its recognised contribution to the development of competences. Active learning methodologies, such as PBL, are generally considered to be more effective, not only regarding the quality of the learning achieved, more comprehensive and thorough, but also for the development of students' self-regulation skills and metacognitive strategies that foster better future learning and the development of a wide range of soft skills. Regarding these skills some of the literature emphasizes the development of abilities to problematize and investigate current issues and the immediate reality, to reflect on the multiple cause-effect relationships underlying diverse phenomena and situations, to articulate theory and practice, to find relevant sources of information, and critically use and analyse them, according to their current needs and the ethical imperatives of research (Biggs, 2000; Monteiro *et al.*, 2012). In parallel, PBL also seems to make learning situations more practical, interdisciplinary and the unfolded skills are perceived by students as easier to transfer to their future professional practices (Powell and Weenk, 2003; Spinks, Silburn and Birchall, 2006). Other authors have also pointed to teamwork,

oral and written communication, self-awareness, confrontation of perspectives between students, leadership and collaboration skills, scientific and critical thinking, self-determination, analysing and synthesising information or strengthening students' intrinsic motivation, responsibility as specific skills promoted through this type of learning methodology (Barreto *et al.*, 2017; Cecílio and Tedesco, 2019; Zakaria, Hashim and Yunus, 2019; Alt *et al.*, 2023). PBL's objectives go beyond curriculum contents, and focuses on the development of critical thinking, creativity and problem-solving competencies. Integrated in the constructivist approach to learning (Hmelo-Silver, 2004), PBL acknowledges the centrality of the student who learns how to learn by selecting, planning, researching and creating products Holm (2011), favouring tutorials and teacher feedback, including digital platforms (Yilmaz, Karaoglan Yilmaz and Keser, 2020). PBL is also expected to promote the development of self-planning and self-assessment strategies (De Kock, 2016; Noroozi, Järvelä and Kirschner, 2019; Yoon, Hill and Kim, 2021), fostering students' deeper approach to learning and self-regulation, as well as helping to develop intrinsically motivated and autonomous learners (Bannert *et al.*, 2015; Chen *et al.*, 2020).

Although the effectiveness of active methodologies is demonstrated in the literature (Strobel and Van Barneveld, 2009), it also seems to depend on a dynamic set of variables or conditions. For example, active participation and task involvement seems to increase students' perceived efficacy or competence (Bannert *et al.*, 2015), a traditionally valued variable of the students' academic success. In addition, these active methodologies also tend to promote cooperative and collaborative learning through the frequent use of small group work (Michael, 2006; Krauss *et al.*, 2008; Edström and Kolmos, 2014; Gillies, 2014; OECD, 2019). On the other hand, as the teacher is less busy transmitting information, he/she can give feedback more frequently, increasing the opportunities to adapt this feedback to the needs of each group or individual students (Sáiz-Manzanares *et al.*, 2021). This effort to customize teaching practices is increasingly valued given the growing diversity of students entering HE, many of them lacking skills to meet the demands of HE (Jackson *et al.*, 2000; Reason *et al.*, 2006).

THE PRESENT STUDY

The study here presented aims to explore the efficacy of a PBL experience in the particular context of "research methodology", a curricular unit that integrates the 1st semester of a Master's Degree Course in Special Education. This curricular unit (CU) is frequently considered a challenging subject due to the technical complexity of its contents and the students' relatively scarce background and interest regarding its contents. Students that usually attend this course have a heterogeneous profile in terms of their previous educational background, motivations to engage in the course, life roles and, consequently, different levels of availability to dedicate their time to fulfil the academic tasks. Taking these circumstances, we were particularly interested in exploring the students' perspectives regarding the utility and efficacy of this active learning approach as a way to accomplish the specific goals that were defined for this CU.

The learning outcomes that describe the CU of research methodology are: (i) to understand the characteristics and stages of the research process; (ii) to systematically review the scientific literature in a given area or subject, delineating the research problem; (iii) to outline variables, questions and/or hypotheses of a study; (iv) to define research samples in a research project; (v) to identify the typology of analyses and steps in the construction and validation of observation and evaluation instruments; (vi) to identify and apply quantitative methods of data description and hypothesis testing according to research's aims; (vii) to identify and apply qualitative methods of data analysis according to the research study's aims; and (viii) to demonstrate a critical and reflective attitude towards research data.

PARTICIPANTS

Thirty-four students (33 female and one male), with an average age of 30.16 years (standard deviation — SD = 9.42), composed this class and participated in the experience. Twenty-six students were Portuguese, six were Brazilian, and two were Angolans. Seventeen students were working students, the majority of them employed in the educational field (kindergarten or elementary school teachers).

STUDY DESIGN

The pedagogical experience under study was planned in a way to respond both to the particularities of the CU, and to the heterogeneous characteristics and backgrounds of the students. For this purpose, students were organized in nine groups of three to five elements, in order to develop a research project during a 13-week semester. The activities completed during the semester followed the six stages of a research project: (i) stage 1 — literature review and delimitation of the problem; (ii) stage 2 — definition of variables, hypotheses and/or research questions; (iii) stage 3 — planning and sampling; (iv) stage 4 — instruments; (v) stage 5 — data analysis; (vi) stage 6 — research projects' presentation and discussion.

The specific aims that grounded the selection for this learning approach were: (i) to enhance the practical application of theoretical concepts as a way to facilitate and ensure the understanding of abstract and complex concepts involved in the successive phases of the research project definition and implementation; (ii) to stimulate active learning experiences as a way to engage students on quantitative and qualitative methods of data collection and analysis; (iii) to prepare students for the elaboration of future research projects and their master's dissertation in the following year; (iv) to stimulate the transfer of knowledge and skills to their professional practice. Three general principles were established as relevant for the accomplishment of these goals throughout the learning experience: (i) *collaboration* between students, so that those students who were more confident and at a more advanced stage could support their peers. Such principle was fostered by a free web-based application available online, called *Padlet*, that works as a "wall" where users can post documents, links, videos or images and where the students uploaded their work. Because the wall was open to the whole class, it was expected to stimulate collaborative practices. That way, for example, students who were struggling with difficulties had the opportunity to learn and improve with colleagues who were at a more mature stage of the work; (ii) *continuous development* throughout the semester, in order to foster opportunities for students to continuously review and improve their research project as the different steps of the methodological process were presented and matured, while simultaneously stimulating reflection about their learning processes. Such principle was implemented by the continuous feedback given by the teacher as soon as the group presented each new stage of the project in order to support the transference of the contents learned during the theoretical classes to each research project. Such work was accompanied by an online survey in which students were asked to reflect upon their development and learning processes in three different moments of the semester. Finally, the third principle was (iii) *equity*, understood as a way to ensure, as far as possible, that students who were struggling with more difficulties could benefit from specific conditions which would help them to get as far as their peers. In order to accomplish this principle, additional tutorial sessions were provided to these groups whose difficulties were diagnosed throughout the different stages of the project.

DATA COLLECTION

Qualitative data collected for the purpose of this study resulted from an online survey where students were asked to reflect upon their development and learning experiences in three

different moments of the semester, based on the following open questions: (i) Moment 1 (first week of the semester): *What would you like to learn within this CU? Which are your major fears regarding this CU? Which characteristics, previous experiences, knowledge and/or skills do you consider as key assets for your success in this CU? What relevance do you think that this CU can have on your personal and professional life?*; (ii) Moment 2 (sixth week of the semester): *What are the most important lessons learnt so far considering your personal and technical-scientific skills' development? What difficulties have arisen so far and how do you have (or plan to) overcome them?*; (iii) Moment 3 (thirteenth week of the semester): *What were the main difficulties you experienced throughout the CU and which strategies did you use or suggest to overcome them? What were the most relevant skills you accomplished in this CU (personal, technical and scientific)? What relevance do you attribute to this CU regarding your personal and professional life?*

DATA ANALYSIS

The data collected were analysed with the software NVivo 12. In the first step, the data were separated into three major categories, corresponding to the three different moments of data collection, or to the categories of level 1. In the second step, the data were organized and categorized according to the different questions assigned to the students, generating the categories of level 2: *expectations and perceptions about learning development; anticipated and experienced difficulties; and strategies to overcome difficulties and suggestions for improving the CU*. In the third step, the data were analysed within each category, bringing out higher-level themes (latent themes) that captured the interpretations of meaning, which corresponded to the categories of level 3. In the fourth step, the categories of level 3 were compared with each other, and because similarities emerged the decision was to attribute the same labels that had been attributed to these categories in the three different moments. In this process of data analysis, we followed the position of authors such as Graneheim and Lundman (2004) and Tesch (1990), considering that the association of part of a text could fit in more than one category simultaneously, due to the intertwined nature of human experiences. To ensure accuracy and trustworthiness of data analysis, prolonged engagement on data, constant comparison of themes across moments of data collection and participants, and peer revision of data analysis (two of the authors were responsible for data analysis) were used, following the recommendations of several authors (Lincoln and Guba, 1986; Baxter and Eyles, 1999).

RESULTS

For each of the categories of level 2, a summary table will be presented with the respective categories and frequencies. Next, the content and relation between the categories will be discussed and illustrated with the students' words.

EXPECTATIONS AND PERCEPTIONS ABOUT LEARNING DEVELOPMENT

This theme involves the students' expectations about learning (moment 1) and perceptions regarding their learning processes and achievements (moments 2 and 3). The frequencies for each category, corresponding to the categories of level 3, are synthesized in Table 1.

Taking a longitudinal perspective, the increasing diversity of aspects when comparing expectations and perceptions regarding learning progresses is perceptible. At the beginning of the semester, students' expectations mostly addressed the development of *technical knowledge and skills*, the transfer of *knowledge and skills to personal and professional life*, and *preparing for dissertation*.

Table 1 – Frequencies of the categories of expectations and perceptions about learning development.

	Learning expectations (Moment 1)	Learning perceptions (Moment 2)	Learning perceptions (Moment 3)
Technical knowledge and skills	21	22	25
Application of knowledge and skills to personal and professional life	6	10	29
Preparing for dissertation	3	2	10
Transversal skills	-	14	22
Pedagogical method	-	3	14
Motivation for research methodology	-	4	8
Self-efficacy and autonomy	-	8	6

Source: author (2021).

When asked about their learning progresses in the middle and the end of the semester, the students identified, in addition to the former three aspects, the development of *transversal skills*, such as team-working skills, goal orientation, and oral and writing communication. Additionally, to search for knowledge and the ability to critically analyse reality were also identified as relevant for their personal development.

I've learned to be aware of the rigour of words, not to make value judgements, not to put down sentences without grounding.

Whenever I need to consult any study, to substantiate a practice or explore various technical concepts, I will certainly analyse everything with critical eyes. This way I will have the possibility to apply the practice that the CU made available.

Students also referred to the relevance of the *pedagogical method*, particularly the close interconnection established between theory and practice and the step-by-step progression of work. This approach seems to have contributed to the students' increased *motivation for research methodology* and increased *perceptions of efficacy and autonomy* in conducting a research project.

(...) it was interesting to realise that each time I read our text, there was a tendency to improve, not only in terms of literature, because in the meantime another article/ book had already entered my reading list, but also in terms of writing.

Along the UC we've had the chance to acquire the theory part together with the practical part since we've built a research project by stages, that is, each theoretical component given in class would correspond to a stage to implement in the practical part. So, we've had the opportunity to put into practice all the knowledge transmitted in class and thus verify which were our greatest difficulties.

Overall, by the end of the semester, the aspect that students mostly referred to, while reflecting on their learning experiences, was the development of *knowledge and skills to apply in their personal life and professional practice*. This category includes the explicit references to the intention to transfer learning to these other contexts, whether in terms of the goal-oriented method adopted

in the CU, whether in the application of the scientific method (rigor, critical thinking, capacity for reflection) to professional contexts:

This CU was surely important for my professional and personal life. In addition to giving me the essential tools for writing a scientific article (important for the recognition and implementation in my professional area), it also helped me to have critical thinking regarding the articles already published (...) this CU enhanced my skills to “look” at scientific writing, achieving something that until now was a little bit difficult for me: to reflect on what is written and how it is written.

The category “*technical knowledge and skills*” included specific learning contents that students considered relevant for their learning process, such as:

(...) steps to follow in carrying out a study, how to collect data and carry out statistical analysis.

Lastly, the category “*preparing for dissertation*” reflects the perceived utility of the knowledge acquired in the CU specially for those students that are planning to do their master’s degree thesis:

All the process of the CU was relevant since it gave us the necessary bases for the former elaboration of our thesis and possible future research projects.

DIFICULTIES ANTICIPATED AND EXPERIENCED

In this topic we present the difficulties anticipated by students at the beginning of the semester (moment 1), as well as in the middle (moment 2) at and the end of the semester (moment 3). The frequencies for each category are synthetized in Table 2.

Table 2 – Frequencies of the categories of difficulties anticipated and experienced by the students.

	Learning expectations (Moment 1)	Learning perceptions (Moment 2)	Learning perceptions (Moment 3)
Technical knowledge and skills	22	23	18
Time and learning process management	2	-	11
Anxiety	2	-	-
Conciliation between academic, professional and family life	3	3	9
Team work	4	3	7
Impossibility of fieldwork due to the pandemic	2	2	1
High workload/workpace	-	3	6
No difficulties	3	-	1
Other	1	2	3

Source: author (2021).

Taking a longitudinal view of the data throughout the semester, we can observe some consistency between the difficulties that students anticipated at the beginning of the semester and those difficulties that were effectively experienced in moments 2 and 3. Overall, *technical knowledge and skills* represents the category that aggregates more references. The difficulties mostly mentioned by students in this category — in moment 1, 2 and 3 — were related to the understanding and application of concepts specifically related to research methodology, such as the definition of research objectives and variables, hypotheses or sampling techniques. Awareness of these difficulties among students seems to essentially emerge when they are asked to apply theoretical concepts of the UC to their own research projects. In this particular moment, students seem to realize that, contrary to what they thought during the theoretical lectures, they did not quite understand those concepts.

Sometimes, the major difficulty is to apply what is taught in a more theoretical way during classes to the practical context of our study, that is: to apply to our research the several concepts learned during classes.

Until now, the main difficulty was to conciliate the theory with its practical application. To define the study hypothesis and to define the variables were felt as difficulties.

The aspects related with “*workload and the work pace*” demanded by the CU were also present in students’ answers, particularly in the case of students who had other life roles, such as professional activities or parental responsibilities. The references related to this latter group were organised in the category “*time and learning process management*”.

The main difficulty identified until this moment has been time management. Managing the daily professional routine, that frequently requires homework, plus conciliating the weekly tasks that are necessary for this CU, and completing the additional readings for the other CUs has proven to be quite difficult (...) for professional reasons.

Regarding this topic, one of the criticisms that emerged in the students’ reflections was lack of time to assimilate and consolidate the learning contents. According to the students’ perspective, this lack of time seemed to affect the overall quality of their work:

The fact that I have never worked with quantitative methodology makes this work more exhaustive, since time is short to assimilate all the content and experience it in a consistent way (...) I feel that the time allowed to complete each phase is not adjusted to the required efforts.

The pressure felt by some of the students seems to have enhanced their *anxiety* at the beginning of the semester:

I am quite a perfectionist, very dependent on organization; I have an exacerbated sense of commitment, which often generates anxiety since I become very strict with myself. I believe that these internal barriers are my main fear when taking into account the organisation of the CU.

“*Team work*” was also perceived by the students as a difficulty, despite their positive comments regarding its important contributions to their learning progress. This means

that there is some ambiguity concerning this way of learning. If, on the one hand, the students perceived the experience of working with their peers as relevant for their personal development, on the other hand, in some cases, teamwork also seems to have resulted in conflicts or communication difficulties.

There has been some lack of communication and interaction amongst some of the elements of the group; all the rest is fine, it has been flowing quite well.

Communication difficulties were also referred to as a consequence of the pandemic situation, which prevented students from meeting in person.

The main difficulty and the one that I emphasize more is, no doubt, the fact that we are living through an atypical period which doesn't allow us to get together and work in person.

Still regarding the pandemic context, some students referred to the *impossibility of fieldwork* (despite this not being required by the CU's program). These comments were especially made by those students who were interested in making contact with institutions in the community for data collection.

One of the major difficulties that I constantly feel is the fact that we wish there was more contact with the community where we want to work (the deaf community) and we end up dealing with the frustration of not being able to make it happen. It becomes frustrating not having the chance to establish this contact. COVID-19 has made this hypothesis even more distant.

STRATEGIES TO OVERCOME DIFFICULTIES AND SUGGESTIONS FOR IMPROVING THE CURRICULAR UNIT

In this topic, we present the strategies mobilised by the students to overcome the difficulties previously described (moments 2 and 3) and also their suggestions for the improvement of the CU (moment 3). The frequencies for each category are synthesized in Table 3.

Table 3 – Frequencies of the categories of strategies used to overcome difficulties and suggestions for improving the curricular unit.

Strategies		Implemented strategies (Moment 2)	Implemented strategies (Moment 3)
		Peer collaborative learning	12
	Autonomous study	8	10
	Teacher support/guidance	6	9
	Other	2	1
Suggestions	Annual curricular unit	5	
	Students choose between individual or group work	3	
	Increased practical and illustrative component	3	

Source: author (2021).

Among the strategies used by the students to overcome the perceived difficulties, “*peer collaborative learning*” was the most mentioned in both moments of data collection (moments 2 and 3). Peer support seems to be particularly relevant for working students who were not always able to attend classes and could therefore be updated about learning contents with the help of their peers:

The group colleagues have been keeping me updated and informed about what they have been learning, and I try to attend as many classes as I can.

“*Collaborative learning*” seems also to have been a frequent strategy used for clarifying technical aspects of the CU through group discussions that stimulate the sharing of questions and exchange of ideas:

The constant group debate for a better understanding and reflection has been an important help.

“*Autonomous study*” was another strategy frequently cited by students in both moments of data collection (moments 2 and 3), as a way to complement classes. The reading of books and articles, and checking class notes and other academic papers was a recurrent strategy used by students in order to overcome their difficulties:

The way that I always try to help myself with the difficulties I deal with is to re-read the information that was transmitted to me and make searches in order to find more information and/or practical examples.

“*Teaching support and guidance*” represents a third strategy used by students, particularly when the difficulties were not overcome within the group or through further reading:

The help of the teacher has been essential in the moments when the literature doesn't give the answers to my doubts.

Regarding the “*suggestions for improving the curricular unit*”, some students mentioned that they would prefer this CU to be organised on an annual basis, giving them more time to assimilate the learning contents and to develop the research projects:

What I propose is that this CU becomes annual in order to have time to explore all the methodological aspects that are most important for those who want to defend their thesis.

Other suggestions for the CU's improvement referred to the possibility of students choosing between the modalities of individual or group work, according to their interests and the intention to proceed (or not) with their academic studies:

I think that the opportunity should be given to those students that intend to move on with the dissertation, of working alone in order to work on their own project.

Interlinked with the idea of extending the CU's length, some students also suggested the inclusion of a *more practical and illustrative component*, particularly regarding data analysis:

(...) it would have become clearer if we had put into practice all the analysis of the results. We know that it would be quite complicated in such a short time to implement the whole project; however, it would be an added value to overcome this difficulty.

DISCUSSION AND CONCLUSION

In a global balance between the objectives presented for the CU here analysed and the results obtained based on the students' considerations, we assume that the proposed targets were generally attained. This is particularly supported by the emergence of the categories "*application of knowledge and skills to personal life and professional practice*", that demonstrates the students' intentions to apply the knowledge and skills developed in this CU to their personal or/and professional life; the category "*preparing for dissertation*" that evidenced students' recognition of the relevance of this CU as a way to prepare them for the development of future research projects, namely their master's dissertation; lastly, the category of "*self-efficacy and autonomy and motivation for research methodology*" suggests that some of the students felt engaged and motivated to learn more about research methods and succeeded in developing their project, which increased their self-efficacy about this subject. Although academic performance did not represent the central focus of this study, students' perceptions about the positive influence of PBL in their learning course were confirmed by the general positive ratings obtained in the UC, which ranged between 14 and 18 values (0–20 points scale), with the exception of one student who decided to temporarily suspend her participation on the master's course due to personal reasons.

Regarding the three principles that were established as relevant for the accomplishment of the CU's goals, they partially emerged in data analysis, with *collaboration* between students and *continuous development* assuming the most relevance in students' answers. Although collaboration between students — integrated in the category "*peer collaborative learning*" — was referred to by the students as a strategy to overcome difficulties, this collaboration was apparently limited within groups and not between different groups, as it was initially expected and stimulated by the use of Padlet. Further experiences should consider other strategies in addition to technological resources in order to foster between-groups collaboration. One possibility to address this limitation could be to include a peer assessment in a mid-term presentation, while the rest of the class would be encouraged to raise questions and give suggestions for their peers' work improvement. Regarding the perception of *continuous development*, this was particularly evidenced in the content of the category of *pedagogical method*, where students acknowledged their step-by-step progression over the semester guided by the teacher's feedback and peer discussions. This seems to represent a positive strategy for their learning process. This set of positive findings suggests the effectiveness of the PBL methodology. As suggested by previous research, it empowers students (Savery, 2006), increases their levels of motivation to learn and promotes the development of competencies (Reay David and Ball, 2006; Tiwari, Arya and Bansal, 2017; Silva *et al.*, 2019), favouring students' self-esteem and perceptions of self-efficacy even in curricular domains where they could start off quite insecure (Bannert *et al.*, 2015).

Despite the general positive aspects that this learning experience has provided, it is important to reflect on the difficulties that emerged, based on the students' considerations. The difficulties most emphasized were related with learning and the development of technical knowledge and skills, although these issues were also the most easily addressed by means of a diversity of strategies reported, namely group discussions, individual study and teacher support. Time and learning process management, conciliation between academic, professional and family life, and a considerable workload were aspects that were reported as less controlled by students and particularly difficult to manage, especially among those students who had several life roles. These aspects should be considered in further editions of the CU, attending to the diversity of students' motivations for the subject. Taking that into consideration, as well as the students' suggestions, it could be interesting to allow more flexibility in project development. For example, students might choose between individual or group work, according to their individual interests and availability. Regarding the heavy workload reported by students, and taking into account the suggestion of teaching this CU on an annual basis, this could be a more complex solution since it would interfere with other CUs of the master's course.

A final reference to one aspect that, despite not being mentioned in the study, could not be ignored by the authors who were also the teachers of this CU regards the heavy workload involved in giving regular feedback to the students, most of the time on a weekly basis. Although the students considered this regular feedback one of the most valued aspects, it is important to consider more efficient alternatives, particularly in view of the scenario of students choosing individual projects, which would increase teachers' workload. One of the possibilities refers to peer formative assessment, as previously proposed, as a strategy to stimulate collaboration between groups, but also as a way to relieve the feedback focused solely on the teacher.

To conclude, despite the particularities of the learning experience here described and analysed — which limits its generalisation to other contexts —, some aspects can still be highlighted as relevant to the field of learning processes and pedagogical research. The first is that PBL has generally shown to be an effective pedagogical practice regarding the aims defined for the context of this CU. Nonetheless, PBL is also a demanding pedagogical methodology, for both teachers and students, and this can be particularly difficult when the students' profile is heterogeneous. This can be considered as an increasingly common challenge in times when students who apply for post-graduate courses in search of continuous training are more and more diverse in terms of their academic, professional, personal, and even geographical backgrounds. They are also driven by different interests, needs, work paces and professional goals. From the results described in this study and taking into account the current literature around the variables of learning, we believe that given the current diversity of HE students' profile, particularly in post-graduate courses, it is essential to devise more flexible learning approaches that, in the first place, consider the students' individuality within their diversity. More research regarding how such flexibility can be implemented with PBL experiences and other pedagogical methods would be useful to support teaching and the quality of the learning processes and results of our students.

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