HUMAN REVIEW | 2022 | ISSN 2695-9623
International Humanities Review / Revista Internacional de Humanidades
https://doi.org/10.37467/revhuman.v11.4182

IMPROVING SKILLS IN MASTER'S DEGREE CONTEXTS

New experiences with professionals and craft companies

MEJORA DE COMPETENCIAS EN MASTERES UNIVERSITARIOS:
Nuevas experiencias con profesionales y empresas de artesanía

Mª PAZ SÁEZ-PÉREZ[1], SUSANA ROBLES SÁNCHEZ[2]
[1]Universidad de Granada, Spain
[2]Universidad da Coruña, Spain

KEYWORDS

Active Methodologies
Professional skills
Master's Degree
Cultural Heritage
Craft companies
Innovation
Building-renovation

ABSTRACT

This research evaluates the improvements that the use of Active Teaching and Learning Methodologies entails regarding the acquisition of professional skills of future graduates of the Masters dealing with intervention in Architectural Heritage, including product and resource improvements. The objectives address students' training, oriented toward professional activity, determining the effectiveness of innovation. The real problems were exposed to be faced at a professional level and were solved through different parts, which were developed in different phases. The results obtained allowed us to conclude that teaching and performing practical tasks related to professional competencies are verified as an advance in the subject.

PALABRAS CLAVE

Metodologías activas
Competencias profesionales
Máster Universitario
Patrimonio cultural
Empresas artesanales
Innovación
Rehabilitación de edificios

RESUMEN

Esta investigación evalúa las mejoras que supone el uso de Metodologías Activas de Enseñanza y Aprendizaje en la adquisición de competencias profesionales de los futuros egresados de los Másteres que aborden la intervención en el Patrimonio Arquitectónico, las cuales incluyen la mejora de productos y recursos. Los objetivos se centran en la formación del alumno, orientado a la actividad profesional, el cual determina la eficacia de la innovación. Se expusieron los problemas reales a afrontar y se desarrollaron en diferentes fases. Los resultados obtenidos permiten concluir que enseñar y realizar tareas prácticas relacionadas con las competencias profesionales ofrece buenos avances.

Recibido: 14/ 04 / 2022
Aceptado: 30/ 06 / 2022

1. Introduction

Today, the globalization is part of everything, including educational systems. In the field of education, this paradigm makes it necessary for students to increase their vision of current needs. This also makes it necessary to carry out a critical analysis of the technical, economic, and social aspects, among others, in which students become participants in their training.

As background to this current situation, in university contexts, the implementation and development of the European Higher Education Area (EHEA) highlighted, which limited the structure of the different degrees in which future professionals are trained, what involved the adaptation of methodological approaches, the inclusion of new teaching methodologies, and hence the new evaluation systems. Currently, and before a moment of transition in its didactic and methodological models with the incorporation of virtuality and the use of ICT, it is necessary to include the different participants and activities that are contained in the teaching and learning, such as students, teachers, evaluation and methodologies, etc. In this context, the methodologies are the main element to guide the training process, especially those that the student is the most important and active actor in learning and skills (Sáez-Pérez et al., 2021).

It is not possible to separate these circumstances from the professional context and its field of development, mostly business, which ultimately will be the destiny of the students and on which the main training objectives focused in the context of the master's degrees.

In the case of intervention in architectural heritage, complying with the highest quality standards and enhancing the value of rehabilitated monuments and buildings are the main objectives of the companies and professionals involved. It is considered important, for example, the use of new natural materials, as a differentiating factor, which come of original materials from the artisanal field. Furthermore, it is crucial the selection of the best products and the implication in the improvement of resources. In this field the reduction of consumption and emissions, as well as such as the recovery and reuse of products being outstanding and fundamental aspects of this type of interventions. In the current labor context, these considerations, together with productivity and quality, are the main strategic indicators used to evaluate the results and the fulfillment of said objectives, and the achievement of improvements. For this, teamwork is necessary, which guarantees working efficiently and doing it in the most complete and appropriate way (Ronnie, 2017). For these purposes, a multidisciplinary team is added, which is capable of carrying out all the necessary actions, which means, according to Lakin et al. (2020), that each of the agents involved carries out the tasks correctly, with the precise design and proper execution. Each part requires specific knowledge about the materials used, the energy saving of the processes and the incorporation of crafts, reuse, and recycling, recognition tests, compatible construction solutions, intervention criteria as well as necessary means for specialized professionals.

Along with knowledge, the work team must maintain continuous communication during the work, since each part of it cannot be carried out independently, if a good joint result is intended (Marín-Granados et al., 2019). In short, several minds with different but interrelated knowledge must be able to work together on the assigned task, understanding that each part performed belongs to a common whole (Revilla-Cuesta, 2021).

Finally, the economic situation of each territory should not be overlooked, as in the case of Spain, which suffered a large economic crisis that was the responsible for the distance between the professional and university fields, moving away more and more the interests of the former, in search of solutions to its lack of activity and economic solvency, to the detriment of the second, which requires contact with reality and experiences in which all agents are involved in order to offer quality training, its disconnection represented a step backwards that in today is reversing rapidly.

To all the above mentioned, the teaching situation is added, a consequence of the adaptation to the European Higher Education Area (EHEA), which implies the implementation of a new methodological and evaluative approach, being the group of active methodologies the most common and continuous evaluation the one that prevails. In this line, De la Fuente Arias et al., (2010) confirm that its application requires group work as the most frequent option, being according to AlMunifi & Aleryani (2019) the team work as the most important employability skill.

The need to address improvements and advances in teaching requires establishing effective teaching-learning systems, for which a basic characterization is made of the problems/proposals that are accepted in the teaching field and those that are carried out in professional performance. The comparison allowed to know their differences and try to bring positions closer.

From a professional point of view, the field of intervention in architectural heritage as a specialty, differs from the environment of new construction, starting from totally different concepts, therefore the interveners must be specialists in their field and capable of dealing with the casuistries that the exceptionality of each intervention requires. In actual practice, according to Jonassen & Hung (2008), cases often have "vaguely defined objectives, multiple solutions, multiple solution paths, and undeclared constraints" (p. 20) and unforeseen occurrences are common. Solutions can be very subjective, change over time, or even be unknown until the end of the process (Jonassen & Hung, 2008). In addition, in this type of action, professional activity does not follow a linear sequence

in its difficulty; that is, it does not respond to an increase in its complexity depending on time or the training and knowledge of the technician who deals with said activity. Also, in recent research, Graham & Porterfield (2018) confirm that the broad learning have to include the impact of engineering solutions in a global, economic and environmental context.

Faced with this, in the educational context the problems, cases or assumptions addressed are characterized by proposing well-structured approaches, using very specific and strategically designed approaches to address the specific learning of established objectives. As such, they must constrain, limit, or problem-solving to fit within their particular context. They usually recognize a single solution, in a context totally shielded from external situations and are proposed in a much simpler gradual and linear learning scheme or structure. Finally, being important on occasions, there are no professionals specialized in specific issues, so it is common not to take into account important details for its resolution.

In line with what was commented by *the Accreditation Board for Engineering and Technology* (2018) and the National Academy of Engineering (2022) it is important to consider the participation in the resolution of complex and real cases, the ability to define and solve problems in the training of future professionals. Furthermore, it is necessary to identify which the solutions are in using technical and professional knowledge and to be capable of resolving "real technical problems" (National Academy of Engineering, 2022). Therefore, the curricula that require the acquisition of professional skills should focus on the formation of technical-analytical skills and problem-solving.

Traditionally, university teaching has been carried out through master classes, so that the teacher focused on presenting the concepts to the students during the classes (Revilla-Cuesta et al., 2020). In that case, the student worked alone, not having active participation in their learning in the classroom.. This has caused for years that not only students, even having completed the master's or specialization Master's degrees, had to experience a period of intense learning when entering the working environment, not only in relation to the new technical knowledge that all recent graduates must acquire, but also in relation to the development of teamwork skills (Osman & Warner, 2020).

The concern to achieve improvements allowed knowing through the experiences of various authors (Hopster et al., 2019; Hortiguela & Pueyo, 2016; Revilla, 2021; Sáez-Pérez et al., 2021; Yan et al., 2018) how to improve or enrich the methodological proposal within the context of the studies of the subject treated.

The origin of the research carried out in the field of teaching given in the subjects taught in the Master's in Architectural Rehabilitation and Master's in Heritage Science and Technology (field of engineering and architecture) results from the combination of two situations; the one carried out in the classroom during the teaching-learning phase and the one provided by the professional reality, counting for this with the participation of companies and professionals from the sector.

Guaranteeing double involvement meant incorporating active methodologies, in which student participation and case resolution were the backbone, making the student the protagonist of their learning.

For this, problem-based learning was implemented, which highlighted as a methodology with the ability to connect students with reallife, being able to put their knowledge into practice. In addition, motivation and participation are two factors that achieve maximum progress during their development, with the student becoming the center of teaching methods, and achieving participatory, constructive and evolutionary learning, being investigated in previous experiences (Rodriguez-Esteban et al, 2018; Sáez-Pérez, 2011; Sáez-Pérez, et al., 2015; Sáez-Pérez, 2018).

In its application, the cases were thought to help students in their learning (Savery, 2006) using active methodologies, incorporating in them the material to be taught during the year as well (Eberlain et al., 2008; Evensen, 2000).

At the same time, the analysis of the professional context at that time was carried out in order to have knowledge about the training needs. The results were obtained through contact with the profession, with the different professional associations, companies, and public administrations that carry out actions in the field of intervention, restoration, and rehabilitation both in construction and, in a more specific context, heritage buildings. Repeatedly, the need for professionals with knowledge of real cases, development of different skills and competencies, as well as the recognition of professional attributions and actions in relation to the topic of the subjects that are part of the teaching experience, was highlighted.

2. Objectives

After these reflections, the objectives were to advance in the knowledge of the subjects by the student and to develop the actions that allow their contact with the profession, thus having knowledge of the professional activity. Furthermore, the objectives related to the teaching activity were to prepare future professionals to be skilled in the most specific, efficient and issues demanded.

In this context, the main objective did not focus exclusively on developing problem-solving per se, but on providing the basic structure to be able to achieve the required skills as well as the motivation for students

to discover and use the knowledge acquired in the development of the skills that the profession requires. In addition, an evaluation was carried out to verify that the commitment to the application of these methodologies and the improvements implemented in the European systems were achieving the improvement of skills and the acquisition of skills.

The development of new teaching practices was proposed in this experience as a first need in the training field, approaching its application from a multidisciplinary perspective. The experience was carried out on various contents that could be addressed by different formations in which the teachings were taught intersecting different work dynamics, which had previously been developed in the research field, making various publications, in which Sáez-Pérez & Burgos (2010) and Sáez-Pérez (2010) showed how the incorporation of skills to the objectives of the subjects always contribute to improving the quality of learning. Recent researches of Beagon et al. (2019), Graham & Hopkins (2018) and Saleh, H. & Lamsali, H. (2020) agree on highlight the importance of skills in these types of experiences.

The experiences published in Fittipaldi (2020), Strobel et al. (2013) and Yildirim et al. (2012) showed that these types of proposals are not designed to exclusively address learning objectives or to guide students in learning fundamental concepts, but instead seek to achieve other much broader objectives that are totally necessary for the construction of the professional future. For this reason, they were proposed to solve as a team.

On the teaching side, the main objective focused on improving student learning in solving real problems without sacrificing knowledge of fundamental concepts, putting the methodology to the test.

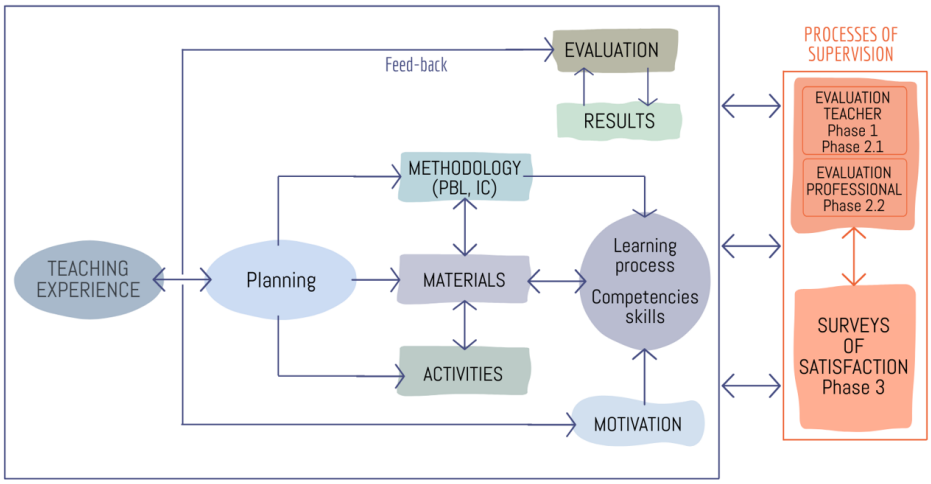
As a whole and focused on active methodologies, previous experiences (Falco et al., 2012; Strayer, 2012; Mason et al., 2013a; Bishop & Verleger, 2013), confirm that these help the P?roposal for a mixed system that combines traditional sessions with work done outside of class.

3. Methodology

This section describes in detail the experience carried out, as well as the necessary aspects for an adequate understanding of the results obtained.

Schematically, the developed proposal can be represented as shown in Figure 1.

Figure 1. Methodology



Source: Own elaboration, 2022.

3.1. Participants

The students of the subjects in which the innovation proposal was implemented participated in this project, with a total of 75 students on average per year in the last four years (Years 2017-2018 to 2021-2022). The same methodology was applied to all of them, as will be explained below. Indicate that the teaching of the subjects in the first term prevented them from being affected by the non-attendance imposed during the COVID-19 confinement period.

In addition to the theoretical sessions in which the fundamental concepts, specific applicable regulations and formal questions were taught, the necessary documentation (basic material) was also provided to be able to learn about the most common professional actions and skills. Their contribution was considered an added value (Mason et al., 2013b), since, in this case, it was supported by the lack of knowledge that the students had about these issues. Furthermore, they were proposed within the necessary contents, in addition to assuming that they would not entail any loss or reduction in student performance in the proposed activities.

Based on the planned chronology, the proposals and development of the project have been concentrated in all cases in the second half of face-to-face teaching. In relation to the participating agents, contact was made with companies and professionals before the start of the school period in order to facilitate their adaptability to face-to-face hours and guarantee their completion. For their part, the students were aware of the new methodological proposal from the beginning of the year, having to consider face-to-face and continuous development as a requirement to be part of the innovation proposal.

3.2. Proposal of study cases: Selection process

The proposal of cases in this study focused on real experiences carried out in the real professional field by the participating agents who collaborate with the teaching staff, the so-called teaching collaborators (companies and technicians). In all cases, the proposals were part of their real and daily experience.

On the other hand, one of the requirements for their election was that they were already finished, thus having prior knowledge about their resolution and starting information. Evidently, this informative pack was not part of the sources of knowledge, nor was it previously provided to the students.

The selection of cases and proposals was made after analyzing the skills and abilities that were intended in the different subjects. For this reason and as part of the collaboration, a pooling was carried out trying to combine the objectives of the university and teaching context with the objectives of the professional context. Therefore, different cases were determined, according to the specific theme of each subject.

The criteria focused on providing students with the implementation of their skills and thereby being able to solve assumptions that had a relevant significance in their context of the application, trying to publicize requests-commissions and purposes and being able to develop with them the proper professional performances, through the use of different documentary and instrumental techniques.

3.3. Procedure

In each subject, the students were divided into teams of three people. Those who were randomly assigned one case from those selected for each group/subject. The responsible agent (teacher collaborator) of each one of them dedicated a first session to present the problem. During that session, questions were asked and knowledge of the case.

The students spent the next few? weeks researching the topic and locating sources of information to deal with, as well as other means by which they could resolve the case with their teammates, as well as prepare for their oral presentations.

The students had complete autonomy with respect to how similar cases could be solved. During the face-to-face class periods in which the students were working on their cases, the teaching staff collaborated in the group discussions as well as in the doubts and questions raised.

The last two weeks were devoted to the presentation, exposition and defense of the resolution proposals. For this, the students were attended by the teaching collaborators. At the end of the presentations, the teaching collaborators gave their opinion to all the students, and the solution adopted in the real case and the ones developed in the teaching proposal were discussed.

3.4. Implementation

The achievement of the planned objectives required different chronologies and levels of difficulty, for which an individualized study was carried out analyzing the different cases to be proposed.

In relation to the chronology, the start and end dates of the proposals were determined, offering an indicative calendar to the different groups and subjects.

The difficulty level was variable in different periods, as this is the reality of professional practice. Consequently, this had negative implications in the resolution of problems by students, because of they needed to resolve them in these particular periods.

To propose the levels of difficulty, based on which the evaluation is carried out, this study was based on those established by (Jonassen & Hung, 2008). Specifically, these authors determine four key internal factors to take into account: level of knowledge, experience in solving problems, reasoning skills and epistemological development. The level of knowledge, mastery and experience in solving problems refer to previous knowledge related to the problem and therefore the assimilation of what has been studied. Reasoning skills are related to the ability to make appropriate assumptions, viable proposals and lastly the epistemological context is based on development, especially important to solve complex and poorly defined problems.

Given the diversity of cases and resolution developments, the levels of difficulty are simplified in such a way that they are established based on the activities to be carried out. The maximum level of difficulty=5 and the minimum level of difficulty=1.,

3.5. Analysis

In order to carry out an adequate evaluation and based on previous experiences (Sáez et al., 2015; Sáez-Pérez et al., 2021), the following analysis and evaluation system was developed:

1. Evaluation carried out by the teaching team (teachers and collaborators). This evaluation was carried out in 2 phases.

PHASE 1. Individual evaluation, once half of the time provided for the resolution of the case has finished andPHASE 2. Group evaluation (at the teaching and technical level) after the final delivery.

PHASE 1 consisted of completing a questionnaire in which the process was evaluated (See Figure 2). In its realization, the student answered questions related to the work carried out in the activities, knowledge of chronology, development of a work plan, use of techniques and means, advancement in knowledge, bibliographic use, etc. The results obtained were intended to know if the processes were assimilated during the project.

Figure 2. Assesment 1. Phase 1

Ref. evaluated case:	PHASE 1. EVALUATION 1.
ITEMS	
1	Recognizes the case to develop within the professional activity
2	Apply the chronology in the plan to be developed
3	They use different means for the development of the case
4	Progress has been made in the development of its actions
5	There is involvement in the multidisciplinary context

Source: Own elaboration, 2017.

In PHASE 2, the solutions adopted by each group were evaluated. The materialization of this evaluation was carried out through rubrics, both for the delivery document (result of the real case) and for the presentation and defense phase.

The first of them focused on the document generated after the proposal was made. The evaluation was carried out jointly between teachers and collaborators. In this case, the assessment is global and analyzed the documentary context of the activities carried out, within the skills and objectives set, as well as the use of media and technologies.

The proposed rubric was structured into four items, classified into five evaluation levels (Figure 3).

Figure 3. Assesment 1. Phase 2

Ref. evaluated case:		PHASE 2. EVALUATION 1. TEACHING AND FORMAL OBJECTIVES				
ITEMS		1	2	3	4	5
1	Minimum contents					
2	Documentary organization					
3	Compliance with formal aspects					
4	Use of technology and media					

Source: Own elaboration,2017

The second evaluation focused on the achievement of professional objectives, starting from the time dedicated to being able to deal with the case and making valid assumptions, knowing the work plan in which the resolution of the problem was addressed and how it is done in reality, following deadlines and proposing a realistic solution and finally learn about the verification of the solution being contrasted with other similar ones. The different teams presented it in the classroom, completing the evaluation by previous rubric of each of the teams.

The proposed rubric was structured in eight items and five evaluation levels (see Figure 4).

Figure 4. Assesment 2. Phase 2

Ref. evaluated case:		PHASE 2. EVALUATION 2. EVALUATION PROFESSIONAL OBJECTIVES				
ITEMS		1	2	3	4	5
1	Understanding of the problem, action to develop					
2	Realistic and feasible work plan proposal					
3	Development of the plan, adjusted to the proposal					
4	Solution Verification					
5	Teamwork					
6	Expression, use of language, communication skills					
7	Use of media during the exhibition					
8	Defense of solutions and procedures					

Source: Own elaboration, 2017.

In Phase 3, Group evaluation (comparison between groups) was carried out after the final delivery, during the presentation and defense of the cases carried out, and was carried out by the teams that participated in the experience, evaluating the rest of the teams.

For this evaluation, a rubric was used again with which the form of perception and recognition of compliance with the formal aspects and requirements demanded during the performance of the activity as well as the exhibition and defense was analyzed. For this case, a more extensive rubric was proposed, consisting of ten items. (See Figure 5).

Figure 5. Assesment Phase 3

Ref. evaluated case:	PHASE 3. GROUP EVALUATION					
Evaluate and score with 0 (does not include, does not comply, ...), 1 (very low) and up to 5 (very high)						
1. The report conforms to the established contents	0	1	2	3	4	5
2. All members of the group present	0	1	2	3	4	5
3. The duration of the exposure is established	0	1	2	3	4	5
4. Develop content related to the case	0	1	2	3	4	5
5. Properly solve the problem	0	1	2	3	4	5
6. Performs the tasks of this type of case	0	1	2	3	4	5
7. Expose and deal with necessary documentation	0	1	2	3	4	5
8. Clarity of expression during exposure	0	1	2	3	4	5
9. Regarding the presentation, evaluate the design, the presentation, ...	0	1	2	3	4	5
10. The resolution of the case represents an advance in their knowledge	0	1	2	3	4	5
TOTAL SCORE =						

Source: Own elaboration, 2017.

3.6. Experience? final assessment (Overall assessment?)

The final evaluation was composed as a weighted average between all those obtained in the different stages and phases.

Finally, on the last day of class, a satisfaction survey was carried out in order to know the impressions of the students once the experience had been developed. The surveycan be seen in Figure 6.

Figure 6. Final survey

	FINAL SURVEY Answer YES, NO, EVER or Don't know/Don't Answer each of the questions	YES	NO	SOMETIMES	DK/NC
1	He prefers to work individually to carry out the practices				
2	Prefers to work cooperatively with teammates to carry out case development				
3	Working in a group to carry out professional activities improves teamwork skills				
4	Working cooperatively increases the ability to dialogue with teammates				
5	Working cooperatively improves progress in learning				
6	The methodological proposal allows to associate real theoretical and practical contents				
7	The proposed methodology allows contact with professional reality				
8	The methodology represents an advance in their learning				
9	Working with real cases supposes greater dedication to the analysis of documentation and other activities				
10	The participation of collaborators improves class dynamics				
11	The development of the case represents an advance in his training				
12	Considers the cases proposed for resolution adequate				
13	Considers the evaluation carried out with this methodology adequate				
14	Considers adequate the time dedicated to the development of the case				
15	Considers this methodology applicable in other subjects				

Source: Own elaboration, 2017.

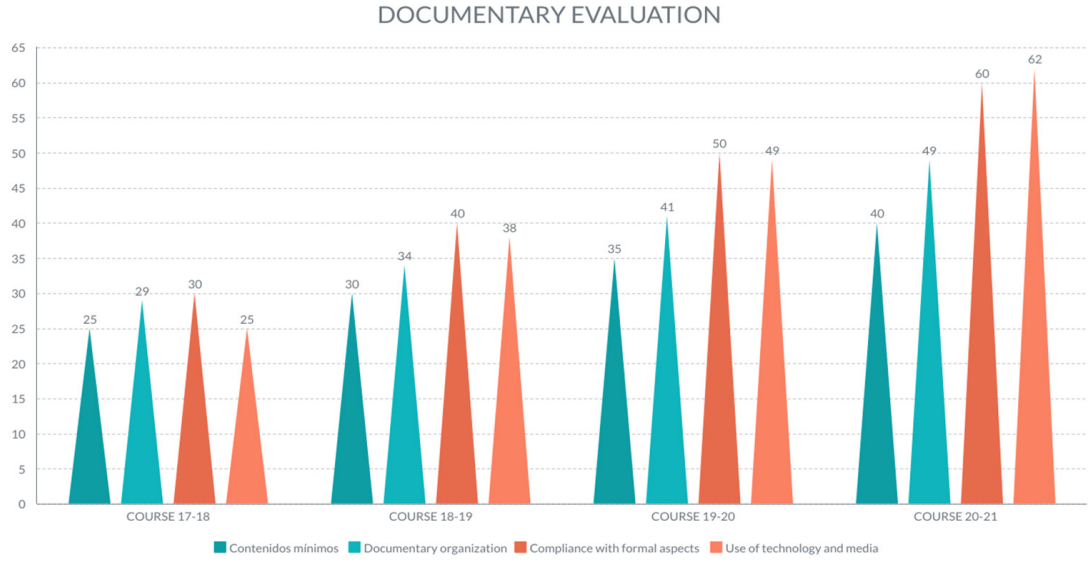
4. Results

After carrying out the experience during four academic years, the results obtained will be presented in relation to the improvements found after the evaluation of the different subjects and in relation to the experience itself.

The results obtained in the Phase 1 partial evaluation questionnaire? (this sentence is not complete). Evaluation 1 was only used to verify the follow-up of the activity during its performance, without the results being considered in the final evaluation. All the possible options of coincidence or divergence have been verified, so it is considered that in many cases it depends on the momentary situation of each team and not on their real progress.

The results in Evaluation 1 in Phase 2 (see Figure 7), regarding advances in relation to formal aspects, showed a significant increase in all items. However, those related to the use of technologies and media (>50% increase) and compliance with the formal aspects established for each issued document (≈50%) highlighted for their greater evolution. The aspects more typical of the professional field, content and document organization, also received an improvement, but to a lesser extent.

Figure 7. Assesment results 1. Phase 2.



Source: Own elaboration, 2022.

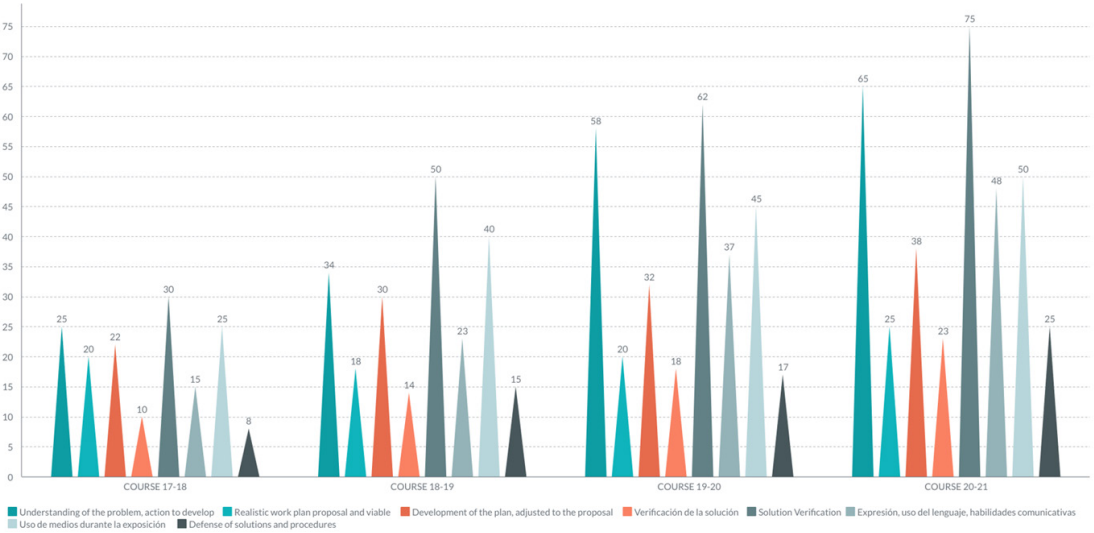
On the other hand, the results of Evaluation 2 of Phase 2 (see Figure 8), carried out to determine the repercussion in the professional context (skills and competencies), showed positive results and improvement in the total computation of the evaluation (monitoring four years). The individual analysis was ruled out as it was not the same students and, therefore, there was casuistry specific to each year that could not be controlled.

In relation to the items evaluated, the first four focused on competencies and specifically on knowing the evolution in the recognition of the action, its approach, development, and verification. In the first place, it highlighted the recognized improvement in the identification of the action and in the knowledge of the problem,

which was followed by the development of the established plan, with the one related to the verification of the actions being the one with the least evolution.

The last four items referred to skills in the professional context, highlighting in the first place the progress made in teamwork (=60%), which indicated that the repercussion was the majority in the teams. The improvement in communication skills (>30%) was also important, including acting more naturally in their daily activities. In the same level, although with lesser repercussion, was the evolution in those aspects that were more directly linked to the professional context in which the experience must be taken into account. For this reason, the explanation of its solutions and procedures was not always favorable.

Figure 8. Assesment results 2. Phase 2



Source: Own elaboration, 2022.

Regarding the results of the survey (see Figure 9), the one carried out in the last academic year (2021-2022 academic year) was included in the present investigation, where the experience is much more consolidated and, therefore, the assessment of the research experience offers more reliability.

In general, the good acceptance by the students . highlights.

Concerning issues related to teamwork and cooperation were well accepted (being the results ≥ 70% in all cases). The application of the methodology in their learning process was also very well valued in the questions, highlighting 85% the progress of the same and 90% the contact that its realization supposes with the professional reality. The acceptance of collaborators was still timid, although it has been increasing every year. After the last survey, 65% was obtained. Finally, the aspects related to the evaluation and the time dedicated also offered very positive evaluations exceeding 80% and 70%, respectively.

About the time that the students needed, the result of the survey indicated that the planned dedication is not exceeded nor is it greater than in the previous learning system.

Finally, the possibility of applying this methodology in other subjects exceeded 60% of the possibilities, which confirmed its suitability, at least as far as the approach is concerned, taking into account its acceptance by the participants.

Figure 9. Survey results

Source: Own elaboration,2022.

The results provided, based on the opinion of the students themselves, showed numerous aspects in which teaching based on active methodologies, and in this case on learning based on problems and cases, was more advantageous for teaching in the Master's than teaching master classes traditionally taught. These detected advantages were found especially relevant because they were obtained through the students' own assessment of the experience (Seifan, Dada, & Berenjian, 2020). In addition, all of them are inevitably linked to the work environment in which the graduate carries out his professional activity. After the experience, the most outstanding aspects for the work of the Master's graduates in the field of Architectural Restoration are the following:

They are capable of developing of autonomy to solve problems and the capacity to decide which option is better. As Poole (2013) explains that students develop the ability to work for themselves, assessing the different options and choosing the most appropriate is a fundamental aspect of their job success. On the other hand, in line with Chu, Chen, Hwang & Chen (2019), it is highlighted that this experience offers students to develop the necessary skills to work in a group.

The development of autonomy to solve problems and the capacity to decide which option is better.The usefulness of the formative debates carried out, which were considered useful by the students, should also be valued. This aspect is essential in teamwork. As stated in the introduction, a team is usually multidisciplinary. That is, it is made up of professionals from different specialties.

5. Discussion

In this research, the improvements implemented with the application of the active problem-based learning methodology have been analyzed so that future Masters develop necessary and essential skills for their professional work. In addition to exposing the experience developed, it has been possible to validate, through

the opinion of the students themselves, the usefulness of this teaching methodology and to detect new beneficial aspects of this type of activity.

In view of all that has been said, it becomes clear that it is necessary to modify the teaching methodology in the Master‘s to provide students with specific skills and competencies beyond theoretical knowledge, and that there are teaching methodologies that, in principle, allow it to be carried out.

The ultimate purpose of this study is to show that another way of teaching is possible in all types of subjects, regardless of their requirement and level of complexity, in addition to detecting new aspects in which the application of this teaching methodology is useful for adaptation. to the work environment. In this way, it is intended to promote the adoption of new teaching methodologies in Master‘s teaching, for which the involvement of teachers is essential.

The development of the applied methodology allows students to be prepared for their incorporation into the world of work by considering specific situations that they may encounter in their professional career, whether in the public or private sphere, as a liberal professional, or in the business context. In addition, and as stated in the evaluations carried out, capacities (skills and competences) improve, having the opportunity to discover new tools and techniques related to the professional field contained in the development of the proposal. On the other hand, a greater dedication to its application is not verified.

6. Conclusions

Regarding the learning results, it is confirmed that the incorporation of changes and improvements in the processes has revealed the added value that their relationship has and how the joint participation even related to the artisan and producer world, in the case of singular works, guarantees improvements even in the geographical context of the area. What supposes an added value to the professional implication.

Regarding the results of the evaluation, comparing the performance of the students in tests and exams after carrying out the real cases, it is observed that these exceed those obtained in previous years. A possible explanation may lie in the trust and capacities generated after the resolution and defense of the resolved cases.

In relation to the teaching staff, it is important to bear in mind that the application of this innovation does not cause the loss of content and learning of the subject with respect to that traditionally taught. On the other hand, including complimentary teaching activities to the current ones in the degree and master‘s subjects allow new options in the student‘s autonomous learning, thus complementing the training through another route parallel to the face-to-face and directed. In relation to the temporary dedication, in the case of the teaching team, greater dedication is initially required, placing more emphasis on the design and evaluation phase than with the previous system. An issue that more than compensates by being able to work with multidisciplinary teams.

In addition, after the analysis done and given the knowledge on the part of the teaching of the limitations that exist to the possibility of having opportunities for real and direct professional experiences, it has been thought that the proposal helps to provide students a specific training in professional areas of the subject and the development of the skills. As Flening et al. (2022, p.21) explain „Finding ways to show and motivate understanding engineering practice through legitimation codes might give early engineers an edge in their core activity of problem-solving“.

Finally, it should be noted that proposing and presenting innovative proposals that take the continuous dedication of teachers out of the monotony by having to establish documentary proposals, different learning strategies, and exchanging information with the rest of the team promotes attractive dynamics, often forgotten.

7. Acknowledgment

This work was supported by Teaching Innovation Project “Laboratorio de estudios previos e informes sobre patrimonio histórico edificado” of the Master in Science and Technology in Heritage Architectural (CiTPA-Ugr) and University Master’s Degree in Architectural Rehabilitation (MARA-Ugr) was carried out under the auspices of Research Groups RNM 0179 and HUM 629 of the Junta de Andalucía. Also the author want to thank to the Unidad de Calidad, Innovación y Prospectiva de la Universidad de Granada, WARMEST and RRRMAKER Projects H2020-MSCA-RISE (Marie Skłodowska-Curie Research and Innovation Staff Exchange).

References

Accreditation Board for Engineering and Technology (ABET), criteria for accrediting engineering programs 2017–2018, http://www.abet.org/accreditation/accreditation-criteria/accreditation-policy-and-procedure-manual-appm-2017-2018/

AlMunifi, A. A., & Aleryani, A. Y. (2019). Knowledge and Skills Level of Graduate Civil Engineers Employers and Graduates' Perceptions. *International Journal of Engineering Pedagogy (iJEP)*, *9*(1), 84–101. https://doi.org/10.3991/ijep.v9i1.9744

Beagon, U., Carthy, D. & Bowe. B. (2019, September 16-19) Graduate Engineering Skills A Literature Review & Call for Rigorous Methodological Approaches. 47th SEFI Annual Conference. Budapest. Hungary.

Bishop, J. L., & Verleger, M.A. (2013 June). The Flipped Classroom: A Survey of the Research, Proceedings of the Annual Conference of the American Society of Engineering Education. Atlanta, USA.

Chu, H. C., Chen, J. M., Hwang, G. J., & Chen, T. W. (2019). Effects of formative assessment in an augmented reality approach to conducting ubiquitous learning activities for architecture courses. *Universal Access in the Information Society, 18*(2), 221-230. https://doi.org/10.1007/s10209-017-0588-y

De La Fuente Arias, J., Vicente, J. M. M., Sánchez, F. J. P., & Berbén, A. B. G. (2010). Perception of the teaching-learning process and academic achievement in diverse instructional contexts of Higher Education. *Psicothema, 22*(4), 806-812.

Eberlein, T., Kampmeier, J., Minderhout, V., Moog, R., Platt, T., Varma-Nelson P., & White, H. (2008). Pedagogies of engagement in science: A comparison of PBL, POGIL, and PLTL. *Biochemistry and Molecular Biology Education 36*(4), 262-273. https://doi.org/10.1002/bmb.20204

Esteban-Rodríguez, M. A., Frechilla-Alonso, M. A., & Saez-Pérez, M. P. (2018). Implementation of the evaluation by pairs as a learning tool in large groups. Teaching experience between universities. *Advances in Building Education 2*, 66–82. https://doi.org/10.20868/abe.2018.1.3694

Evensen, D. (2000). Observing Self-Directed Leraners in a Problem-Based Learning Context: Two Case Studies. In D. Evensen, and C. Hmelo (eds). *Problem-based learning: A research perspective on learning interactions* (pp.263-298). Routledge, Taylor and Francis Group.

Falco Boudet, J. M., & Huertas Talon, J.L. (2012). Use of Wiki as a Postgraduate Education Learning Tool: A Case Study. *International Journal of Engineering Education*, *28*(6), 1334-1340.

Fittipaldi, D. (2020). Managing the dynamics of group projects in higher education: Best practices suggested by empirical research. *Universal Journal of Educational Research, 8*(5), 1778-1796. https://doi.org/10.13189/ujer.2020.080515

Flening, E.,Asplund, F. & Grimheden, M.E. (2022): Measuring professional skills misalignment based on early-career engineers' perceptions of engineering expertise. *European Journal of Engineering Education*, 47(1) 117-143 https://doi.org/10.1080/03043797.2021.1967883

Graham, R.H. & Porterfield, T.E. (2018, june 24-27). Preparing Today's Engineering Graduate: An Empirical Study of Professional Skills Required by Employers. 2018 ASEE Annual Conference & Exposition. Salt Lake City, Utah, USA. https://doi.org/10.18260/1-2--30887

Hopster-den Otter, D., Wools, S., Eggen, T. J. H. M., & Veldkamp, B. P. (2019). A General Framework for the Validation of Embedded Formative Assessment. *Journal of Educational Measurement*, *56*(4), 715-732. https://doi.org/10.1111/jedm.12234

Hortigüela Alcalá, D., & Pérez Pueyo, Á. (2016). Peer assessment as a tool for the improvement of the teaching practice. *Opcion*, *32*(7), 865-879.

Jonassen, D. H., & Hung, W. (2008). All problems are not equal: Implications for Problem-based learning, *The Interdisciplinary Journal of Problem-based Learning 2*(2), 6-28. https://doi.org/10.7771/1541-5015.1080

Lakin, J. M., Wittig, A. H., Davis, E. W., & Davis, V. A. (2020). Am I an engineer yet? Perceptions of engineering and identity among first year students. *European Journal of Engineering Education, 45*(2), 214-231. https://doi.org/10.1080/03043797.2020.1714549

Marín-Granados, M. D., Bláquez-Parra, E. B., Mora-Segado, P., Miravet-Garret, L., Ortiz-Zamora, F. J., Gómez-Hermosa, F., & Olvera-García, E. Implementation of learning by doing method in the graphical engineering field. In . F. Cavas-Martínez, B. Eynard, F.J. Fernández Cañavate, D. G. Fernández-Pacheco, P. Morer , V. Nigrelli (Eds.) *Advances on Mechanics, Design Engineering and Manufacturing II, (pp.*789-797). Springer International Publishing.

Mason, G., Shuman, T.R., & Cook, K.E. (2013a june 23-26). Inverting (Flipping) Classrooms – Advantages and Challenges. Proceedings of the Annual Conference of the American Society of Engineering Education. National Academy of Engineering, Atlanta, Georgia, USA.

Mason, G., Rutar, T. Shuman, & Cook, K. (2013b). Comparing the Effectiveness of an Inverted Classroom to a Traditional Classroom in an Upper-Division Engineering Course, *IEEE Transactions on Education*, *56*(4), 430-435. https://doi.org/10.1109/TE.2013.2249066

Osman, D. J., & Warner, J. R. (2020). Measuring teacher motivation: The missing link between professional development and practice. *Teaching and Teacher Education, 92*. https://doi.org/10.1016/j.tate.2020.103064

Poole, G. (2013). The coming and going: the work of educational developers when admission criteria and desired outcomes change simultaneously. *International Journal for Academic Development, 18*(4), 344-355. https://doi.org/10.1080/1360144X.2012.696195

Revilla-Cuesta, V. (2021). Aprendizaje colaborativo en ingeniería como herramienta para la adaptación al entorno laboral: Análisis de un caso práctico. En A.L. González-Hermosilla (Coord.), Reflexiones y propuestas para los desafíos de la educación actual (pp. 56-65). Adaya Press.

Revilla-Cuesta, V., Skaf, M., Manso, J. M., & Ortega-López, V. (2020). Student perceptions of formative assessment and cooperative work on a technical engineering course. *Sustainability, 12*(11),. https://doi.org/10.3390/su12114569

Ronnie, L. (2017). Dyadic processes in postgraduate education: Insights from MBA student experiences. *International Journal of Management Education, 15*(3), 513-519. https://doi.org/10.1016/j.ijme.2017.09.002

Sáez-Pérez, M.P., Kelert, K., Rodríguez-Navarro, C., Ruiz-Agudo, E., Ibáñez-Velasco, A., Cardell-Fernández, C., Blanc-García, M.R., Cultrone, & G., Bel-Anzue, P. (2021). Virtual environments of teaching learning for training in experimental techniques. Innovation in multidisciplinary groups. *Advances in Building Education*, *5*(3), 27–40. https://doi.org/10.20868/abe.2021.3.4736

Sáez-Pérez, M. P., Frechilla-Alonso, M. A., & Rodríguez-Esteban, M. A. (2015). La rúbrica: metodología evaluativa-formativa en el grado en edificación. Experiencia interuniversitaria, *Opción*, *4*, 846-867.

Sáez-Pérez, M. P. (2010, june 15-18). Binomio formación-competencia profesional, en busca del tándem perfecto (la innovación docente en ingeniería de edificación). VII Foro sobre evaluación de la calidad de la investigación y de la educación superior, Murcia, Spain.

Sáez-Pérez, A. Burgos-Núñez, J.C., & Olmo-García, J. C. (2011, september 26-27). Metodologías activas y aprendizaje. Propuesta de innovación en el grado de ingeniería de edificación. II Jornadas sobre innovación docente y adaptación al EEES en las titulaciones técnicas, Experiencia docente interdisciplinar: colaboración metodológica entre asignaturas, Granada, Spain.

Sáez-Pérez, M.P., & Burgos-Núñez, A. (2010, september 9-10). Innovación metodológica para la adquisición de competencias propuesta entre distintas asignaturas de la titulación de grado de Ingeniería de Edificación. Granada. I Jornadas sobre innovación docente y adaptación al EEES en las titulaciones técnicas, Granada, Spain.

Sáez-Pérez, M. P. (2018). Innovación docente y profesión. Competencias y metodologías activas en áreas técnicas. *Advances in Building Education*, *2*(3), 45-64. https://doi.org/10.20868/abe.2018.3.3832

Sáez-Pérez, M.P., Verdú-Vázquez, A., Nicolau-Corbacho, A., & Gil-López, T. (2021). PBL in university technical subjects, improvement in professional skills. Evaluation of teaching-learning process as teaching innovation. En Buzón-García, Romero-García y Verdú-Vázquez (Coord), Innovaciones metodológicas con TIC en innovación. Colección conocimiento contemporáneo. (pp. 3552-3571). Dykinson S.L.

Saleh, H. & Lamsali, H. (2020). Fundamental general skills and engineering skills as an important skills for engineering graduates employability: a fundamental study. *International Journal of Scientific & Technology Research,* 9(2):3370-3373.

Savery, J.R. (2006). Overview of problem-based learning: Definitions and distinctions, *Interdisciplinary Journal of Problem-Based Learning*, *1*(1), 9-20. https://doi.org/10.7771/1541-5015.1002

Seifan, M., Dada, O. D., & Berenjian, A. (2020). The effect of real and virtual construction field trips on students' perception and career aspiration. *Sustainability*, *12*(3), 1200. https://doi.org/10.3390/su12031200

Strayer, J. F. (2012). How learning in an inverted classroom influences cooperation, innovation and task orientation, *Learning Environments Research*, *15*, 171-193. https://doi.org/10.1007/s10984-012-9108-4

Strobel, J., Wang, J., Weber, N.R., & Dyehouse, M. (2013). The role of authenticity in design-based learning environments: The case of engineering education, *Computers & Education*, *64*, 143-152.
https://doi.org/10.1016/j.compedu.2012.11.026

Yan, J., Li, L., Yin, J., & Nie, Y. (2018). A comparison of flipped and traditional classroom learning: A case study in mechanical engineering. *International Journal of Engineering Education*, *34*(6), 1876-1887.

Yildirim, T. P., Shuman, L., & Besterfield-Sacre, M. (2012). Model-Eliciting activities: Assessing engineering student problem solving and skill integration processes, *International Journal of Engineering Education*, *26*(4), 831-845.