

# Peer evaluation in the context of PBL, a cross-cutting and cohesive approach for university degrees.

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**Abstract-** Two of the main objectives pursued by teaching innovation are the acquisition of transversal competences and the adaptation and improvement of the evaluation and grading systems. Regarding the first, it is already evident that, along with academic knowledge, developing other capacities such as teamwork, leadership or autonomous learning is a complementary but fundamental question. These skills make it possible to apply academic knowledge to its full potential, and in a modern society, access the labour market with guarantees. The evaluation and grading systems considered as element of the learning process should help and guide the student to identify their strengths and weaknesses, also in these matters. In doing so, the two elements contribute to notable successes in environments such as PBL. To do this, peer review brings unquestionable benefits, but it also entails risks and difficulties. The pandemic year also forced to chase new alternatives. In this work we present two solutions adopted in the Design Workshop I subject, of the Degree in Industrial Design Engineering and Product Development at the University of Zaragoza.

**Keywords:** *PBL, peer evaluation, learning results.*

## 1. INTRODUCTION

Acquisition of certain transversal skills has acquired special relevance within the innovative teaching strategies focused on the development of new university learning models (Meléndrez & Meza, 2017). And although when it comes to enunciating them within the set of learning outcomes, their precise definition is still taking shape and there is still much to be discussed, little by little they become part of the study plans and in one way or another are included within the syllabus of many subjects. Some of the most common are the capacity for teamwork, the capacity for autonomous learning, the responsibility of self-learning, the capacity for leadership, or the attitude towards continuous learning. These are complementary but fundamental elements to academic learning, since they allow the application of academic knowledge to its full potential, and in a modern society, access to labour market with greater guarantees (Riera, 2017).

Learning processes based on PBL are shown as the most appropriate environment for the acquisition of some of these competences, since they favour open collaboration frameworks,

are oriented towards continuous assessment models and leave space for students to assume different roles (Blanco et al., 2017). Thus, they are a profitable framework in which to fit certain good teaching practices, specifically oriented to the satisfaction of these objectives, such as peer evaluation procedures and evaluation based on rubrics.

There are also some barriers to overcome in order for these methods to exploit their full potential. Thus, it is true that clarity and information are provided by the use of evaluation rubrics that helps students' self-evaluation, but to be truly effective, the rubric must not only be well explained but also be credible and convincing for students, which must somehow accept it as valid. But in the case of the evaluation of certain aspects of the projects that are not easily quantifiable, rather qualitative in nature, there is often a tendency to include too many ambiguities. And sometimes it is not clearly explained to the students why it is so important to achieve certain achievements over others, or how their degree of achievement could be accurately measured.

Furthermore, it is very important to understand that evaluation should not be confused with qualification (Shepard, 2000). We often invite students to self-assess their performance or the satisfaction of certain objectives but we provide them tools with which, in the best of cases, project a grade expectation. This is different as being able to assess the skills obtained by following the subject or carrying out the tasks in one way or another.

In this sense, the evolution of evaluation techniques and those for assigning grades are not parallel, and the challenge of conducting an adequate assessment involves too many times great difficulty in reconciling at the same time the assignation of individual and precise numerical grades, as required by some university regulations. Consequently it is observed that the distribution of numerical grades in subjects based on PBL and assessment by rubrics often tends to be especially uniform and to adopt a bell shape with a peak around 7 or 7.5 out of 10.

As it is known, there are already some European universities that instead of using numerical qualifications they employ qualification criteria such as Fair, Good, Very Good. This is something that can, certainly, be considered excessively ambiguous and lacking in commitment by some specialists. In any case, it is clear that we can view the grading process as a different one from that of evaluation. In the case of this work, we will focus solely on the latter.

Evaluation, to be effective and provide learning (Black & William, 2004), must involve feedback, discussion, presentation of points of view, dialogue, justification from a more expert or qualified position before the students, if it is the case, of the arguments that allow to analyze the progress of the outcomes. It serves to compare the intended and achieved objectives, putting the learning experience in value. If it is a continuous process, it helps to establish corrective mechanisms during the learning process to contribute to the student's success within the intended timeframes and within an adequate effort / result ratio.

Self-evaluation and peer evaluation, logically, adds a lot in this sense since it enriches the number of contributions and establishes empathic processes that help the students to analyze their evolution and project acceptable expectations and goals (Baena & Renart, 2017). But students, especially in the first years, must learn to develop it correctly, and for this it is convenient to separate it clearly from the assignment of grades. It should also be remembered at this point that the grade must be assigned by the teaching staff, who is responsible for the subject, not by the students. And that, in this sense, the only admissible is that the teaching staff take into consideration, as another source of information on the performance achieved by the students, the evaluations carried out among peers. But students cannot, in any way, be the ones who qualify other students: neither is it their role, nor is it their obligation, nor is it their responsibility, nor are they trained to do so. It is the teacher who has the capacity, the responsibility, and must implement the means of gathering information to assign grades, taking into account the right of students to a fair, equitable grade supported by solid arguments and criteria.

Failure to distinguish self-evaluation and peer evaluation from the assignment of grades is an error that implies that these good practices, of enormous value, are contaminated by attitudes based on cronyism, segmentation by other kinds of affinities, or petty revenge and other personal motivations. These are circumstances that constitute a barrier to the development of their potential and that can end up generating toxic environments in the group.

In the case of first-year students, there is also a feeling of insecurity and instability; it is even more complicated, since they do not have references with which to establish comparisons or previous experience to rely on. Barriers appear such as the fear of exposing oneself or being signified, the fear of being ridiculed, or the need of seeking the approval of the group, which is contrary to the formation of an autonomous criterion, the capacity for leadership, self-evaluation or well-understood teamwork. As if that were not enough, in these last two academic years, affected by the restrictions imposed by the

pandemic, the links of new students with students in higher courses that could contribute to providing some guideline or reference have abruptly disappeared, and have been impossible to re-establish. Also, the personal relationship between students who have just arrived at the University has not been fully developed.

The Degree in Industrial Design Engineering and Product Development at the University of Zaragoza is characterized by having a study plan conceived and structured to facilitate the development of PBL, in the context of projects and activities participated by subject modules, in an environment fully designed for face-to-face and experimental learning (Manchado & López, 2012). The development of activities aimed at achieving learning results of the so-called transversal competences is common within the degree, and, however, some of these results are not yet evaluated in a timely manner, nor do students receive, consequently, an adequate feedback. Although, it is an aspect in which work is carried out intensely from the Coordination of the degree and those responsible for its teaching and the School Dean.

However, there are other strengths: there are workspaces shared by students of the same subject, in practical classes in which interventions are produced by the whole group around the monitoring of a common project. And there are other spaces shared by students -study and work open rooms, or model and prototype workshops, available to students during open hours- as meeting points where different teams from different courses work on completely different projects, establishing alliances and complicities, and where the students of more advanced courses spontaneously guide the students of the first courses, becoming their reference.

In addition, complementary activities are usually offered in the form of contests, talks, or leisure activities promoted by the School, the coordination of the degree, or from the or student associations. Graduates or professionals belonging to different companies participate in many of them (Manchado et al., 2017).

All of this fosters close contact, support and cohesion among all the students who study the Degree, increasing the opportunities for students to receive contributions applicable to their work. But during the two courses affected by the year and a half of the pandemic, all these activities have been cancelled or severely reduced, and the non-presence of the classes, or the partial presence and under strict rules of capacity and social distance have impeded normal development of the same.

In response, and from a resilient attitude, alternatives have been sought by the teachers of the Design Workshop I subject of the Degree in Industrial Design Engineering, which would allow recovering these benefits, obtaining some findings whose potential suggests that perhaps some of these strategies it should be maintained on a sustained basis once post-pandemic normality is restored.

This work does not constitute a scientific study, but a case description from the experience of the authors. This experience corresponds to an adaptation against the clock of some of the activities programmed by the teaching team in response to the difficulties encountered in the pandemic context, and consists

mainly of an a posteriori reflection that presents and analyzes in a more orderly way some of these strategies and the observed benefits.

## 2. CONTEXT

The degree in Industrial Design Engineering and Product Development at the University of Zaragoza consists of a study plan divided into four courses. The first semester is dedicated to the acquisition of basic knowledge of Design Engineering, but in all other semesters there is a compulsory subject of the Design Workshop subject (six in total), which with a vertical distribution articulates a continuous line of acquisition of learning outcomes.

In this matter, the different subjects have an analogous structure, and based on PBL patterns constitute a workshop for carrying out projects of increasing difficulty and a cumulative level of demand.

As they pass the courses, students have a clear reference to the structure of the theoretical classes (mainly, exposition of content supported by case studies), the approach to practical classes (consisting of group review sessions of progress in the projects and partial deliveries of the same), the format of the evaluation tests (consisting of continuous deliveries of portfolio and oral presentations and some theoretical exams at the end of the course, generally of the type test or short answers), and they acquire transversal skills that facilitate teamwork, self-assessment, development of leadership skills, collaboration among equals, etc. Normally, first-year students who do not yet have any experience, meet with the rest of the students from other groups in spaces such as the study room, the library, or the model and prototype workshops, having the opportunity to observe the ways of working, the routines and learning strategies of more experienced students.

The School of Engineering has a Tutor Project through which students from more advanced courses offer to give support and guidance to first-year students, mainly in matters such as the Erasmus program, the choice of optional subjects, work placements, etc. . In addition, the relatively small number of students (75 new students per year), together with the offer of complementary activities transversal to the degree, proposed as described above from the coordination of the Degree, from the Head of School, by the associations of students ... it facilitates the appearance of complicities that end up being reflected in a good relationship between the students, the perception of a certain sense of belonging and identity, the stability course after course of good results in the success and performance rates and, in general , a strong cohesion between all the agents involved in the degree.

Thanks to this, it has been possible, during the time of the pandemic, and with great effort and personal involvement from all parties, to sustain the learning outcomes in a acceptable way. The 2nd, 3rd and 4th grade students had increasing levels of experience that gave them a degree of autonomy that facilitated the development of PBL tasks even without the essential face-to-face contact. The first-year students, however, have experienced a completely different situation. Without previous

experience or close references, the amount of help they have needed from teachers to achieve acceptable results has been much higher than in other years, a demand whose satisfaction difficulty has been aggravated by the absence of presence. The lack of close contact with the students of the same course (and others) provoked that the contributions in the form of constructive criticism that were made between peers in a natural way have practically disappeared. The capacity for teamwork has been seriously diminished, and consequently, the appearance of leadership initiatives, or the development of autonomous learning strategies within a collaborative group.

Alerted by this situation produced in the second semester of the 2019/20 academic year, the professors of the Design Workshop I subject decided to implement during the 2020/21 academic year some techniques aimed at minimizing these damages, preserving as much as possible good practices and strengths of previous courses. Thus, two complementary activities were proposed: one, to be developed within the group of first-year classes and another, of a transversal nature, intercourse.

## 3. DESCRIPTION

Activity 1: Peer evaluation (first year students from the same group of practices).

Within the subject, students carry out different practices, in the form of short projects. Each of these short projects consists of at least three sessions: i) description of the task to be carried out (the students later develop it through autonomous work outside the classroom, ii) intermediate follow-up reviews and iii) delivery and verbal presentation of results.

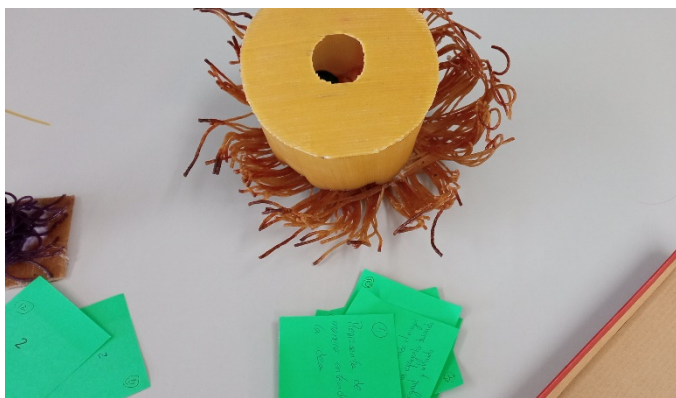
In the task description session, students are told what the practice consists of, what are the objectives to be achieved (learning results), if the work to be carried out refers to a partial or total achievement of said objectives and how and why developing the practice in the right way will help to achieve these objectives. They are also told the mode of evaluation, on which the grade to be obtained will depend, and a rubric is provided. Finally, students are invited to raise their doubts regarding the statement before ending the session.

In the second session, the mid-term review session, students make a brief presentation of their work up to that point before the whole class. To facilitate dialogue while maintaining interpersonal distance, students sent captures of their work to the teacher using Moodle, which were shared using a projector and screen, or shared from the students' own personal computer through a session on Google Meet. This has also allowed the participation of students subjected to confinement. In this session, the teacher is not so committed to evaluate the works as well as to act as a mediator or facilitator of a discussion or dialogue between the group of students, who as a discussion group analyze the interest and potential of each of the works, making contributions and constructive criticism. In their role of facilitator and moderator, the teacher can invite to carry out certain observations according to the contents of the rubric, give or withdraw the turn to speak, or encourage participants to seek to establish complicities between them, collaborations, pointing

out coincidences and differences. It is important that the discussion does not develop in terms of comparison between works and “worse than / better than” considerations, but rather about the degree of adaptation of each work to the desired learning outcomes, the initial statement and the evaluation rubric, considering the latter not an objective to be achieved but a reference guide.

In this second session, once the work has been launched and counting on the material provided by the students, it may be convenient to review the rubric with them to achieve an understanding of it and its acceptance as a fair criterion for weighting, that is: i) ensure that they understand the usefulness of the practice to achieve the learning objectives ii) ensure that they understand the assessment criteria that make up the rubric, iii) and ensure that they accept them as valid so that iv) serve as guidance about of how to improve their work and be able to focus it to the satisfaction of the objectives pursued, as an indispensable requirement - but this, as the last element - to obtain a good grade.

In the third session, the students deliver their work and, using the same media, make an oral presentation. To promote greater complicity, the teacher initiates the session with a random student and then each one indicates the next student, for whose work he/she is curious, having to indicate a motivation when inviting him/her to make his/her presentation. At the end of the session, each student receives a red post-its and two green post-its. They must sign them and indicate in each one the work of the partner, who in their opinion, further (red) or closer (green) has remained from the objectives set, the learning results and, consequently, the grade. They can write down brief observations indicating their criteria.



**Figure 1.** Assignment of post-its to one of the works.

Once all the students have filled in the post-its, they are distributed among the works submitted, each receiving the evaluations of their classmates. From here, the teacher leads a new discussion, inviting participants to explain more extensively why they consider that certain works are especially noteworthy in positive or negative, always looking for constructive approaches such as "what would you like to have applied to your own work of the works that seem most successful to you?", "What advice would you give, from your experience, to improve the less accomplished work?" "What would you like to change about your work?" The objective is to

generate a habit of consultation between equals, cross-support and generate sustainable self-learning strategies.

Activity 2: Peer evaluation (students of different grade and group).

To carry out this activity, the group of 3rd grade and 4th year of the Bachelor's and Master's degrees students were contacted by email. They were told about the extra difficulties that the 1st graders were encountering and they were asked for their help, calling them to a telematic meeting in case they wanted to collaborate. 16 students were interested in the proposal. Two actions were proposed to them: i) presentation of projects from the last courses and ii) mentoring.



**Figure 2.** 4th grade students course present projects of their course to 1st graders, in a hybrid face-to-face / telematics session.

The presentation of projects from the last courses sought to contribute references to 1st year students. Being clear about the different level of applicable demand, those from more advanced courses were invited to select the project with which they felt most satisfied with the learning results obtained, preparing a brief presentation in petxakutxa format that included a description of said results and a relationship with those acquired in the first year. They should also indicate the difficulties overcome and the resources used. They all selected projects in which transversal competences were reflected in the way “we worked very well as a team”, “we discussed, but we reached agreements”, “we did it in collaboration with a company”. In this way, the first-year students were provided with reference to ways of working, presentation formats on which to rely, and exciting and realistic goals in the short, medium and long term. A second objective was to establish a certain ancestry in the students of more advanced courses, creating a bond of recognition and trust, in which to support the next activity, mentoring.

The mentoring activity consisted of assigning a final year student to each of the first year teams, as an available support to which they could resort to when they should carry out their last practice, in which they apply all the knowledge obtained during the course, so that they could request advice and guidance, complementary to those provided by the teacher in class.

#### 4. RESULTS

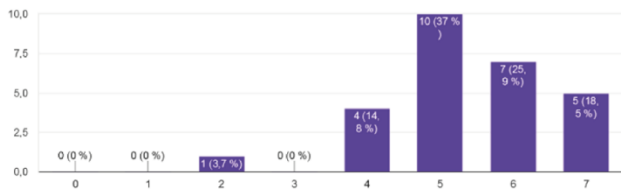
To analyze the results, the success and performance rates and the distribution of the grades obtained by the students (with respect to the 2018/19 academic year and earlier) have been observed. In all cases, they have been maintained at levels

similar to previous courses, without notable deviations. In addition, a questionnaire was voluntarily completed for first-year students and a debate was held with the mentor students.

The results have been the following:

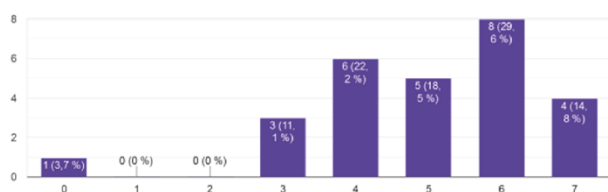
The comments and contributions of the rest of the students in my group during the practices are: (0 not at all useful, 7 for very useful)

27 respuestas



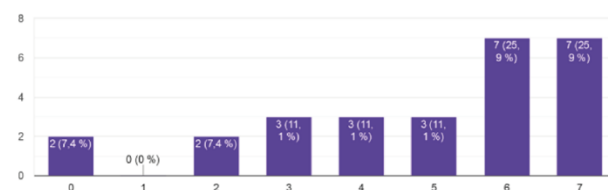
The comments and contributions of the rest of the students in my group after the presentations -for example, in the discussions after marking projects with post-its- are: (0 not at all useful, 7 for very useful)

27 respuestas



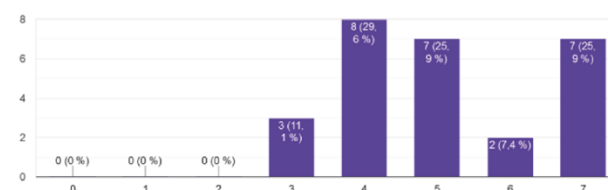
The comments and contributions of the mentor students are: (0 not at all useful, 7 for very useful)

27 respuestas



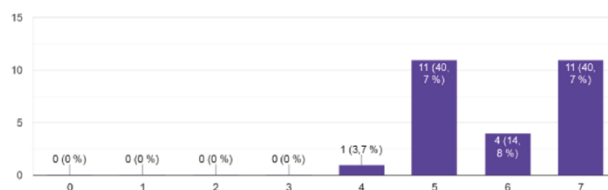
I found the final year project presentations of the mentor students: (0 not at all useful, 7 for very useful)

27 respuestas



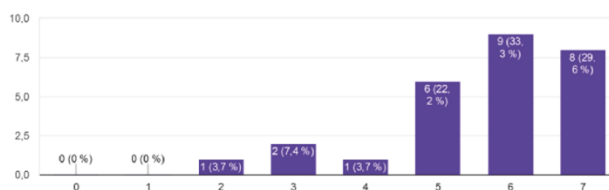
I believe that this course I have acquired skills to carry out projects that I will apply in the future

27 respuestas



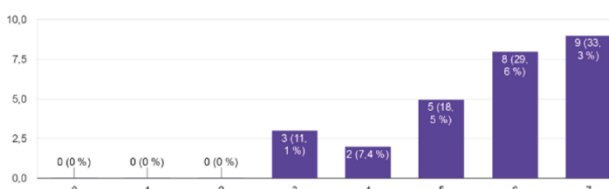
I believe that this course I have acquired skills for the presentation of projects that I will apply in the future

27 respuestas



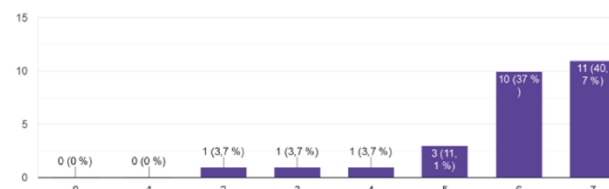
I believe that this course I have acquired skills to work in the future in a more autonomous way

27 respuestas



I believe that this course I have acquired greater security and confidence in what this Bachelor's degree will bring me

27 respuestas



The positive answers to the last questions regarding the security obtained about the opportunities for the future offered by the degree and the value of the partial results acquired in the first year are especially significant.

It seems that students value the analysis of their own classmates more, once they have finished each of the practices than in the development of these, possibly because being at the same level of knowledge, their contributions are not so valuable. However, they appreciate the contributions of colleagues in more advanced courses more positively than the presentations of their projects, possibly because they are more immediately applicable to them.

Mentor students indicated that not all 1st grade groups were taking advantage of their mentoring offer. About a third of the first graders had not made any contact. With a similar number, however, close and continuous contact had been established. The mentor students had been involved to the point of referring to "their" students and projected in an argued and decisive manner their expectations of success in achieving the objectives of the subject, relating grades and learning outcomes ("I think they will have a good grade because they have understood what they had to do and are working well"). In addition, they were able to identify risks ("they are working well, but they are having trouble managing time" or "I suggested that they should organize the information collected in a way that would be more useful to them"). In general, they considered their contribution to be valuable to 1st grade students, they were personally satisfied and regretted not having had such support at the time.

Those who had failed to establish such a strong bond were disappointed and even somewhat frustrated.

## 5. CONCLUSIONS

Observing the results obtained, it is clear that the different activities developed have been valuable, collectively and individually, to different degrees and for different purposes. In the first place, in an overall assessment, the result is satisfactory, given that the main objectives have been achieved: to maintain the success of the subject, which is reflected in the success and performance rates and the distribution of grades, but above all in the appreciation of the performance obtained, shown by the students who participated in the survey.

It is interesting to note that, although the activity was designed to meet the needs of first-year students, it was very satisfactory for fourth-year and Master's students. They were able to appreciate the leap they had made from the moment they took the first year (3 years before) and put into value all the knowledge acquired during the Degree.

Some of the teachers of other first year subjects, upon learning about the high level of the projects carried out and exposed by the 4th year students, also expressed their surprise and satisfaction at the growth observed in former students, of whom they had no further follow-up, appreciating their own personal contribution to the overall learning process of these students, which certainly has a motivating effect also on first-year teachers.

It is, in short, an enriching experience for all participants, cohesive and easy to implement, so its sustainability and maintenance will undoubtedly be considered in future courses.

## ACKNOWLEDGEMENTS

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