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Francesc Miralles  
*Universitat Pompeu Fabra*

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# European Higher Education Area (EHEA) Convergence: Comparison of two Approaches for the Implementation of a Competencies and Student-Centered Learning Framework

**Francesc Miralles**  
Universitat Pompeu Fabra  
Department of Technology  
francesc.miralles@upf.edu

## ABSTRACT

Most European Schools are involved in designing learning-oriented curriculums in the process of adapting to the EHEA framework. The ESUP of the University Pompeu Fabra has launched adaptation projects with varying degrees of change in the teaching methodology. In this work two experiences are compared. On the one hand, courses in the engineering management area were fully adapted to an active learning model. On the other hand, a Master's Program was deployed using a PBL approach but without using active learning resources.

Both experiences have led up to distinct adaptation models that are compared and contrasted in this work. The main conclusion to be drawn is that students, contrarily to what some lecturers may think, really prefer active learning methods. In addition they expect an overall implementation and reject a mix of activities from old and new methodologies, where students can only partially cooperate in their learning.

## Keywords

European Higher Education Area, EHEA, Competencies, Project-based learning, Engineering Degree

## INTRODUCTION

The deployment of the Engineering of Telecommunication (Telematics) studies at the Universitat Pompeu Fabra (UPF) began in the 2001-2002 course. The class of 2003-2004 was the first group to graduate as Engineers and the class of 2005-2006 will be the first graduating class of master engineers. In this stage of development, the program directors and teaching staff are focused on assuring that the training of Engineers of Telecommunication at the UPF is based as much as possible on the adjustment of the studies according to society's needs and on recognizing the importance of Telecommunication Engineers in the twenty-first century. While this interest is independent of any other initiative and corresponds to the vision the course promoters have of Telecommunication Engineering, the course's environment and objectives also coincide in an attempt to maintain the European Union initiative based on its convergence with the European Higher Education Area (EHEA).

In order to realize these intentions, the deployment of the studies has been developed jointly with a project of pedagogical innovation that includes distinct lines of activities. Among them, a focus on the student's learning, to carry out a plan to improve on teaching techniques, and to develop innovative interventions in the teaching process. Each one of these lines includes different subprojects of innovation that are oriented to better align the studies with the EHEA.

In this work two innovation initiatives that have developed from two distinct fields of the study are presented and compared: the area of engineering management and the deployment of the Master's program. In the engineering management courses of the undergraduate program the adaptation of subjects was carried out as per the criteria outlined by the EHEA. Specifically, a design based on competencies was realized, seminar modules were established, and active learning activities were organized (Johnson, Johnson and Smith, 1991). Equally important was the development of an educational plan that identified the teaching structure and outlined necessary parameters to give students a guide to their learning process.

The deployment of the Master's program was realized by using the Project Based Learning method (PBL) (Hadim and Esche, 2002). This methodology consists of preparing a project around which students' knowledge will develop. In pre-arranged

work groups, the students advance in the project while acquiring the knowledge which has been conformed for their adaptation. PBL allows, among other things (Miralles, Sala and Gallego, 2004), for the development of a group of soft skills that traditional education does not develop. Also, it helps to bring the student closer to the professional world and further allows them to be able to apply this acquired knowledge to real life (Sfard, 1998).

The main difference between both experiences is that active learning activities were introduced in the engineering management courses as the main axis of course development. Contrarily, in the Master's program active learning activities were not introduced. Some lecturers were afraid of using active learning activities. They thought that students were not prepared to or were reluctant to be committed in their own learning process. Others maintain that students may react adversely to being challenged or new methods may not be successful in terms of learning outcomes. These contrary reactions are commonly found in college education (Johnson et al., 1991), therefore lecturers in the Master's program were not inclined to include active learning activities in lectures and lab classes, arguing that PBL was enough to appeal to students' interest in the new methodology.

Both experiences were supervised and analyzed by the pedagogical innovation support services at the UPF, and their results are exhibited and commented on in this work. Certain lessons can be obtained from both experiences and the comparison of both experiences can allow new lines to be drawn up and followed. Perhaps the most important conclusion to be drawn is the switch from a classical education to one based on student-centered learning, which demands the complete integration of the students in all facets of learning, and also demands that the teaching staff facilitate this integration using a complete set of active learning resources.

This work is structured in the following manner: the first chapter describes the project for educational innovation that has developed in the deployment of telecommunication studies and the characteristics of the subprojects study objective. Second, the research strategy that has developed in this work will be detailed. The objective of the next chapter is to present the results reached by the engineering management area and the implementation of the Master's program. Finally, the two experiences are compared and the paper concludes with a discussion of conclusions.

## **PEDAGOGICAL INNOVATION IN THE TELECOMMUNICATIONS STUDIES AT THE UPF**

The deployment of the Engineering of Telecommunication studies at the UPF resulted in the development of a project of pedagogical innovation that is made up of three main lines of performance (Gallego and Miralles, 2004): the teachers' focus on the students' learning process, a plan to continually improve teaching instruction, and the introduction of educational innovation methodologies in the teaching organization.

Each of these three lines of performance is made up of a series of subprojects that develops each one of the aspects that are to be obtained. For example, the focus on student learning has instilled two important innovative projects: the deployment of the Master's program by means of the Project Based Learning (PBL) method, and the adaptation of engineering management studies to EHEA. In the following sections the characteristics of each one of these projects are described.

### **Engineering Management Courses**

The role of the engineer in the business world continuously demands for a variety of competencies. The socio-economic demands push engineering professionals towards the development of entrepreneurial experiences that allow them to realize their own ideas in the business world.

With this approach, these courses have been developed with a vision of integration that intends to cover three distinct competencies. First, the description of the elements that constitute a company or technological organization. Second, the development of a business plan to create an Information Technology company that allows for the application of the previously mentioned concepts. Finally, to practice the abilities that professionals in the business world need in their daily work life. By means of this triple development, the students will have focused their knowledge on the IT company, while using active learning techniques in a cooperative working environment.

#### *Learning Objectives Vision*

From the point of view of competency, learning objectives (Adam, 2004) from this area have to tackle a group of competencies that have not, until now, been developed in engineering (Hoffman, 2003; Selinger, 2003). This kind of training cannot come exclusively from an economics or management background, as they do not focus on the professional skills that Telecommunication engineers must acquire. It is for this reason that the courses have been designed to integrally incorporate business competencies that can be necessary in the students' future professional life. The courses also introduce the students to soft skills that they must acquire in order to completely develop in their professional lives (Miralles et al., 2004). In order

to obtain this objective an integration of the soft skills was made to bring together the educational activities that were being carried out in conjunction with the materials being used.

This approach is made clear by using activities such as case discussions, presentation of results, development of role play activities for the acquisition of concepts and suitable enterprise management skills, and also, to practice the soft skills, activities such as: public speaking, debate, negotiation skills, decision-making and others.

#### *Techniques of Active Learning*

The involvement of the students in their learning process is primarily manifested in self-study or in the cooperation between the students themselves. Active Learning techniques (Johnson et al., 1991) try to contribute mechanisms that urge the students to adopt an active role in all their learning. Some of the following are active learning techniques: work in groups or cooperative learning, co-evaluation, self-evaluation, problem based learning, Project Based Learning, etc.

There have been basically two active learning axes in the courses. First, the classes have been developed on a problem based learning orientation. This means that themes to be worked on were introduced through a situation that allowed for discussion or contrast, and in continuation the conceptual framework could be addressed as well. The second line was the business project. This project developed in groups and throughout the semester they presented its progress by means of various checkpoints. This type of activity falls under the Project Based Learning methodology.

On the other hand, as has already been mentioned, the use of the active learning allows us to add depth to the acquisition of communication skills and other soft skills.

#### *The Educational Plan*

The tool selected for the organization of educational activities has been the Educational Plan. This tool unites the set of activities that must be developed through the course. Also it includes the evaluation instruments that will be used to assure that the competencies have been obtained. Finally, the Educational Plan contains a calendar of the educational activities related to each one of the competencies.

### **Deployment of the Master's program by means of Project Based Learning**

During the deployment of the first year of the Master's program it was intended to gather all the experience in developed pedagogical innovation throughout the undergraduate program. That is to say, to incorporate the orientation towards learning objectives and to prepare the studies for their convergence with the EHEA (Miralles, 2005). The deployment of the Master's program was based on the specification of a suitable group of learning objectives that orients the training of the students and the development of a pedagogical methodology that is centered on the student (Rada and Hu, 2002; Sfard, 1998). The methodology that has been taken as a point of reference for the Master's is that of Project Based Learning (Kolmos, 1996).

#### *General Concepts of the PBL Model*

The basic idea behind the PBL model is that the linking element in the learning process is a project (Brown, 1996; Daems et al., 2003). The project has a batch of data, results to obtain, restrictions and conditions, all of which demand the learning of concepts, procedures and attitudes. This project must be developed throughout the entire course. The students, immersed in the development of the project, learn everything necessary so that their project arrives to a good end.

The objective of Project Based Learning is to situate the student within a problematic context related to the real world with which they will one day be faced. This is meant to activate their learning while being faced with reality (Kolmos, 1996; Kolmos and Algreen-Ussing, 2000). Project Based Learning has been used in different areas in the academic world, in general, and particularly in the world of engineering (Hadim and Esche, 2002). The project becomes the leading point of the learning process and its development gives a base to the teaching structure, which groups together diverse yet traditional courses subjects. These elements are described, along with the main characteristics of PBL that have been used for the project, in a previous work (Miralles et al., 2004).

The structure of the educational plan of the first and the second year of the Master's has been described in (Miralles, 2005; Miralles et al., 2004), where one can find a detailed structure of the contents and a layout of the projects with the acquisition of the contents.

### **ANALYSIS OF REALIZED EXPERIENCES**

Two types of instruments were used for a review into the evolution of the experiences. First, the deployment of the Master's set out to review the experience through periodic meetings with the students and the professors in order to successfully obtain

their opinion on the evolution of PBL methodology. These meetings are considered to be qualitative instruments that were used to focus and to clarify the conclusions obtained in the quantitative analyses. On the other hand, a questionnaire was also used, with the same format for both experiences, in which information was successfully obtained on the three course aspects. First, the general competencies contained in the Turing project, second, the specific competencies of each of the courses, materials, and third, the perfection of the experience of the educational innovation. In this work the analysis of the last one is made.

In the perception section on the experience of educational innovation, the questionnaire proposed questions relative to the different scopes of the experience: pedagogical model, course content and aspects of the implementation. The main conclusions will be described next. This survey was available to all the students and it was analyzed by means of the principal components technique. Due to its length the data is not included in the analysis, although the author can provide them at the request of those interested.

### **Description of the Results in the Area of Engineering Management**

The results obtained in the area of engineering management courses are grouped into two levels. First the results of the different aspects that the questionnaire approaches will be described, followed by comments on the analysis of main components that have been carried out.

In the field of the pedagogical model, the general opinion of the students was very positive. More than 85% of the students described their new learning experience as positive or very positive, and more than 90% of them found the value of the course content to be positive in a global aspect. As far as the content is concerned, although they valued the content in a positive manner, a non-negligible percentage put the applicability of the content in doubt. It is necessary to consider that this study discusses training for engineering management within engineering studies. From the point of view of implementation, the students gave a very positive evaluation. Two aspects stand out, that of the evaluation system and the communication between professors and students. On the other hand, an exception must be mentioned, that of the management of study time.

In the subsequent analysis by means of principal components, four components whose *eigenvalue* is greater than one appear that assimilate different facets that influence the perception of the experience.

The first component introduces the aspects relative to the acquired knowledge. In line with what has previously been mentioned in the analysis of the basic aspects, the evaluation of the received content is positive although they have put in doubt its applicability in the professional scope. On the other hand, they showed a great deal of satisfaction in reaching the expectations they had. This aspect endorses the experience since, although some of the students doubt its applicability, a greater percentage does not put in doubt what they have learned, and feel that it has served them in some way.

In the second component the elements that show the effect of the educational activities and the students' general satisfaction with the experience are displayed. It seems to lead to the conclusion that the high satisfaction with the experience seems to be related with the study activities that take place throughout the course. On the other hand, this component has little information related to the concepts that have to do with course content, which, as previously mentioned, are related to the first component. In an initial analysis, this component includes information about the communication between professor and students. This effect was extracted in another component that will be explained later on.

The third component has to do with the accounting of study time. Forty-nine percent of the students showed their dissatisfaction with this accounting. This can be interpreted as the students spending more time studying than they had expected. The fourth component exhibits the distinct vision of this experience with respect to the others. It must be said that the satisfaction shown for this difference is very high. Almost 90% of the students perceive the experience as different from their previous experiences. In addition, this factor presents an important effect in the opposite direction of the expectations the students had regarding the course content. It shows that the students were not expecting this type of course and that they endorse this experience.

### **Experiences of the First Year of the Master's program. Teaching Project Based Learning.**

Unlike the analysis of the experience in the engineering management area, the evolution of the implementation of the first year of the Master's was made by means of two instruments. The first, of a qualitative character, was based on periodic meetings between the students and the professors involved in the initiative. The second consists of a quantitative analysis of the perception the students had about the same questionnaire. The detailed results of this experience can be seen in the previous work and here a short summary is included (Miralles, 2005). The results are not described in this work, as the primary focus is on the comparison of the two experiences.

Regarding the pedagogical model, the generalized opinion of the students is positive. Some 70% of the students describe the new learning process as positive or very positive. As far as the content is concerned, acquired knowledge and its applicability

in the future were highly valued, although they did mention that the expectations that had been created were superior to what they had actually received. In the scope of the implementation, the students reflected a slight displeasure. Most of them showed little or no satisfaction with themes such as pedagogical resources, the amount of work assigned and the relationship with the guidance tutors.

In the following analysis four components appear, whose *eigenvalue* is greater than one, which assimilates to different factors that influence the perception of the experience. The fifth component has also been analyzed in order to bring a fresh perspective to the analysis.

All aspects related to the pedagogical method are reflected in the first component. Aspects such as the learning mechanism, benefits related to previous teaching methods, the evaluation system and the value of the training innovation, are reflected in particular. Among other things, it is made up of the first component that can be interpreted as perception of the novelty of the pedagogical experience. As previously mentioned, the concepts that make up this component received an evaluation of high or very high.

The second component demonstrates the perceived knowledge of the subject matter. Although this does not form a part of this work, it is worth mentioning that the following paradoxical situation does exist. In general, the students considered the application of their acquired knowledge valuable, although, at the same time, they felt that the expectations that were created were not within their reach. The fact that their concepts form a part of the same component and that the evaluation of the course content is high whereas the expectations are very low, leads us to believe that the dissatisfaction with expectations is not related to the content itself but rather that there must be an additional factor to explain this. Thus, as the analysis of the rest of the components suggests, the teaching methodology and the pedagogical resources influence the creation of expectations.

The third component demonstrates information related to the pedagogical resources used in the experience, referring to the activities realized in the learning process and to the resources used in the learning sessions. The evaluation reflects little satisfaction. It has been deduced that the students did not recognize the usefulness of the resources used or that they were waiting for other instruments more in accord with the methodology used. As previously mentioned, the dissatisfaction with the expectations is related to the learning instruments. Taking into consideration these last few elements with which the students felt dissatisfied, it can be assumed that the students' dissatisfaction was the result of disappointment with the resources used. On the other hand, the component that puts forward the value of the resources, shares information with the evaluation of the educational methodology. Being that the values are of opposite signs, it can be deduced that students were expecting different resources, perhaps more in accordance with the methodology used. It seemed as though the students were trying to say "we were expecting to be offered new resources, and those used were not what we were expecting...".

The fourth component reflects the evaluation of time dedicated on the part of the students. It leads us to believe that students felt the amount of dedication necessary for the course was not accounted for correctly, and was in fact worse than it had been in previous methodologies. In addition, 70% of the students felt that the amount of time necessary superseded that which they were expecting.

The last component is associated to the relationship between the professors and the students. As previously mentioned, using the PBL method, students were formed into groups that made use of a tutor in order to help them work through their project. Some 60% of the students found this relationship unsatisfactory. In order to explain this result, one must take into consideration the fact that activities, the learning process and evaluation all influence this component. All of this seems to indicate that in some cases, the tutors have not been perceived as useful in the learning process or in the realization of certain activities, also, the tutor's evaluation has been criticized by the students.

## **A COMPARISON OF THE TWO EXPERIENCES**

Both experiences coincide in several aspects. The first aspect that coincides, is the ascertainment that the students value their satisfaction with their acquired skills separately from the teaching methodology used. In both cases, a differentiating component appears which incorporates information from distinct signs. In the case of the engineering management area courses, there exists a noteworthy opinion which places doubt on the applicability of the acquired knowledge, but, on the other hand, places a positive value on the realized experience. In the deployment of the Master's program, the acquired knowledge is backed up in a unanimous manner, however the students put into question relevant aspects of the methodology employed.

The second aspect of coincidence in both experiences is the accounting of the amount of study time. The immediate conclusion would be that the students had an excess of work. Although to place a value on the anticipated time of dedication is always an arduous task and can result in an overload for the students, another aspect exists that should be analyzed in a future study. In both experiences the dedication of the students was expected to be more uniform throughout the course,

avoiding a final effort at the end of the quarter. This orientation, completely in line with the recommendations of the EHEA, clashes with the mentality of the traditional student in the Spanish higher education system. Most students only put a slight effort to pursue the subjects during the course. They share their studies with other activities which, in some cases, take an important part of their day. They realize the necessary effort in order to attempt to pass the final exam at the end of the period. With the implementation of the work activities throughout the course, the perception of the student can not be any other than that of an excess of work.

The main divergence between the two experiences is in the satisfaction with the learning activities. It has already been mentioned that in the PBL experience, the students felt a sense of satisfaction with their experience, however asked for different educational resources. The implementation of PBL in the Master's program, was realized by focusing on the project as a link to the learning process. The classes provided, by means of traditional educational methodologies, the content that the students had to acquire both for their learning, and for the completion of the project objectives. Students clearly differentiate on these two fronts. On the one hand, they placed a lot of value on PBL, however, on the other hand, they seemed to lack different teaching techniques. This situation did not occur with the students in the engineering management area. In the analyzed results, the students' satisfaction with their experience is linked to the active learning techniques that were developed throughout the course.

## CONCLUSIONS

Conclusions from this work can be grouped in two different area. First, students really appreciate and value a more active role in their learning process. Second, this appreciation is independent from the contents of the course they are involved in. In this research work, it has been found that on the one hand, students doubted the applicability of the knowledge acquired from the engineering management courses, but gave support to the learning experience they lived. On the other hand, knowledge acquired in the Master's program received unanimous support, however students questioned the learning methodology used.

In the same area of conclusions, learning activities that propose a more student-centered role require a change in the students perception in terms of their involvement in the learning process.

Finally, in the second area of conclusions, it seems that active learning techniques, which require greater student participation, must be present in pedagogical innovation proposals. This accounts for the students involved in the PBL experience who didn't feel comfortable only participating in the development of the project. While participating in the development of the project they requested active learning techniques in the lecture and lab sessions. For the most part, the extent of active learning is in the hands of teaching staff. In the PBL experience the project represents the axis around which learning is made. This axis is in the hands of the students and the intervention of the tutor is focused only on the correct advancement of the project. However, the teacher that gives lectures or laboratories but doesn't use active learning techniques is seen as less useful to the students for their learning process. It can be concluded that the involvement of the student in the learning process cannot be limited to the accomplishment of a project, but that it must be continued in the teaching sessions as well.

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