

## **PBL methodologies in simulated environments in vocational higher education**

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Conference theme to which proposed contribution belongs to: The modernization of the curricula

This study reports a case study experience of a PBL (either as *project-based learning* or *problem-based learning*) methodology in simulated environments in vocational higher education. PBL was introduced to produce adaptable graduates whose professional competences are well attuned to the demands of a rapidly changing world. As main aspects of this development, we highlight the change from a teaching to a learning paradigm, the attention given to the social context of learning, the promotion of simulated environments of relevant real situations, the active responsibility of students for their own knowledge, and the global and interdisciplinary character of this knowledge.

Given this outline, the empirical study assumes as its object the course of *Projecto Profissional* (Professional Project) in ISCA-UA (Higher Institute of Accounting and Administration of the University of Aveiro).

It looks like that PBL-type methodologies in simulated environments add more value, essentially, at the beginning of the graduate's professional career, but there were concerns about what it seems to be a gap between employers and other stakeholders regarding, especially, social, personal and learning competences. A key impediment to such engagement was the differences in perception of the type of competences truly valued by employers. We also found a difference in behavior between academics that do and do not have professional experience outside academia. Furthermore, PBL methodologies suggest the possibility of developing the entrepreneurial spirit of graduates and it is understood that the rehabilitation of students' academic failure by feedback devices is important to this type of methodologies.

**Keywords:** methodologies, higher education, learning, teaching, PBL, simulation

### **Introduction**

Concurrent with a worldwide globalization is an increasing revolution in technological communications that has accelerated these transformations by bringing out new social and economic demands. These changes have challenged higher education institutions (HEI) to adapt new ways of production and dissemination of knowledge. Concretely, HEI are being face up to modify their curricula and strategies in order to meet the needs of diverse professional and social contexts (Kirschner et al., 1997; Rawson, 2000; Tillema, Kessels, & Meijers, 2000).

However, it is commonly assumed that most of higher education programmes do not yet prepare students to have the awareness, knowledge and skills in order to succeed in the culturally diverse and globally interdependent society. For all the discussion of changes, often profound, that is taking place about higher education systems, some authors' claim that conventional teaching methods are inadequate and that shifting learning and teaching methodologies is needed (e.g. Barnett, Parry & Coate, 2001).

This article bases upon a case study that was conducted in ISCA-UA (Higher Institute of Accounting and Administration of the University of Aveiro). This study reports teachers, students, graduates and employers experiences with simulated environments of professional contexts, and assumes as its specific object the syllabus of *Projecto Profissional*

(Professional Project) configured as a PBL methodology (either as *project-based learning* or *problem-based learning*) in vocational higher education.

The concept of PBL emerged relatively recently in teaching and learning processes (Donner & Bickley, 1999). It is a way of organizing teaching by introducing professional problems to provide the context and motivation for the learning that follows (Margetson, 1998). The most important innovative aspect of PBL is the shift from teaching to learning. In fact, PBL is concerned with both what students learn and how they learn it (Powell, 2001). As main aspects of this development, we highlight the change from a teaching to a learning paradigm, the attention given to the social context of learning, the promotion of simulated environments of relevant real situations, the active responsibility of students for their own knowledge, and the global and interdisciplinary character of this knowledge (Barrows, 1999a; Kolmos, 1996). In this context, this study aims to contribute to theory formation of a debate by providing further evidence on the roles of PBL methodologies in learning processes, triangulating teachers, students, graduates and employers perspectives.

The article is organized as follows. First, we will review theoretical research develop in learning and teaching methodologies domain, namely the effect of PBL methodologies on curricular developments and on students/graduates attitudes. Second, after describing the research method, the empirical findings are reported. This is followed by a discussion and the conclusion.

## **Theoretical framework**

### *Purposes of higher education, paradigms of learning processes and curricular development*

This thesis is about PBL methodologies in simulated environments in vocational higher education. Given this theme, the main objective of the present work is to analyze and interpret the way changes promoted by PBL methodologies in simulated environments produce implication at the learning processes level in a vocational higher education.

We start by putting at the centre of the discussion the different purposes of higher education. Although the idea of higher education has a history, it has developed over time, emerging from its institutional forms in classical Greece and in the medieval ages. The same conducting wire of the idea of higher education in ancient Greece and in medieval ages, still extends in the early XIX century, with Cardinal John Newman and, later, with Jaspers' idea. Although each version has to be understood in its own age, it is possible to recognize that there are certain recurring themes, such as knowledge, truth, reason, wholeness, dialogue and criticism, among the different ideas of higher education (Barnett, 1994).

The Portuguese higher education system is characterized by two main divides: polytechnic divide and the university divide. Theoretically, the situation of polytechnics is very different from that of universities because from the start the first were considerer to have a closer connection with economic and industrial situation, as well as a clearly regional emphasis. Therefore, an emphasis as been placed on the importance of the contemporary experience of *know* and *know how* in terms of polytechnics, and attention has also been paid to the sequential experience of *know* and *know how* in terms of universities (Magalhães & Amaral, 2000).

These set of problems induce some authors to claim that conventional methods of instruction were inadequate for professional education and so higher education methodologies were think again. The idea of higher education as enhancing new work values, from the collaboration between interested parties (students, academic staff, employers, and graduates) seems to justify a reflection on several paradigms of learning methodologies. *Learning to learn* has become part of the skills agenda. It involves learners in new ways of understanding reality, of interacting with others and of perceiving their own identities, motivating a conscious examination of the learning processes. Some authors argue that this will surely provide solid grounds for *lifelong learning* than the mere acquisition of a skill set (Neumann, 2001). Today, given the diversity of public that attends higher education and the

heterogeneity of its scientific knowledge, motivations, and professional projects, it seems urgent to emphasize new learning strategies. Conscious that the success of learning depends on various variables that promote student’s harmonious development, teaching models used at a higher education level will have to involve new technologies. So, the technologic revolution implies a revolution at the learning level, which involves competencies as flexibility, adaptability, sociability and commitment (Rawson, 2000). But if the previous reflections carry us to the analysis of higher education methodologies, it also brings us to the interrogation of knowing how these concepts affect the curriculums.

From this, it seems important to analyze the pertinence of an alliance between pedagogical and professional practices, and also between the elements considered fundamental for the enrichment of the professional profile of the individual (social and personal factors). The studies reviewed above have a second-order perspective. They explore different aspects of how the transition from a subject matter-based curriculum to a competency-based curriculum, make schools to be redesigned as workplace environments and as places for *lifelong learning*. In this perspective, it seems imperative to adapt the educational systems to latest realities, motivating new forms of curricular development. This means that to face challenges HEI cannot resume its role to a mere transmission of knowledge, but it has to face a reorganization, which will allow more diverse and heterogeneous answers to a demanding, informed and competitive society (Jackson, 1992). Despite other opinions we claim the social nature of the curriculum in defense of curricular changes that conceive student as a whole and active part in his own learning process (Harpe, Radloff, & Wyber, 2000; Rawson, 2000).

#### *PBL methodologies*

PBL methodologies are an example of these modern teaching methods, centered on the student-learning experience. The model developed by Barrows (1999b) for medical education is still used as a benchmark for a wide range of PBL’s programmes today. For the purposes of this article, the term PBL refers to the goals and processes of both *project-based learning* and *problem-based learning*. The main idea is to emphasize learning instead of teaching so that the most important innovative aspect of PBL is the shift from teaching to learning. In fact, PBL is concerned with both what students learn and how they learn it. Consequently, the task of the teacher is altered from transferring of knowledge into facilitating to learn (Kolmos, 1996). So and according to Hussain et al. (2007), we can say that a structural shift is required when students and teachers meet PBL methodologies, since it challenges several conventional ideas about learning objectives, process and methods of evaluation. With this standpoint and remembering the social vision of the curriculum, we can define PBL as a learning methodology for a purpose and with a purpose made to fit each one’s measure. This means that also the teacher is no more the master of the class but has to develop new skills to support learning. Like in a game, the teacher is comparable to a coach, as he is neither a team player (he is not a student) nor a leader (he doesn’t assume a magisterial role).

Cowan (2000) and Powell (2001) add some others characteristics to the profile of a student that made use of a PBL learning methodology. This author refers the strong motivation, the ability of *learning how to learn*, the better teamwork or the understanding of syllabus in context. Such an educational strategy has proven valuable not only in enhancing problem-solving capability, but in the acquisition of such skills as the holistic approach and self-directed learning. In this context PBL methodologies appear as a support of real professional situations that students can integrate in the future. This leads to an important issue: to know how we can integrate workplaces into HEIs’ learning environments. In the discussion about simulation’s processes, it is fundamental to bring to the classroom real life situations. That means that instead of putting more reality into the learning, HEI will need to put more learning into reality (Dillinger, 2001).

The institutional vocation of HEI made it necessary to provide practice. On the one hand, because a lot of schools could not afford to recreate the workplace environment and its

infrastructures, on the other hand, because traineeship was often impossible to achieve as it was difficult to find enough work placements for all the students, new learning pedagogies need to be adopted. These leads to an important issue: to know how to integrate workplaces into HEIs' learning environments. With the advent of new ideas on learning and with the development of new technologies, we can now recreate certain types of virtual workplaces within HEI. The computer is a useful tool to manage this technique. In problem solving strategies the computer can provide background knowledge and can offer a tool to explore solution strategies. It can organize and manipulate information, allowing the user to test tentative solutions before adopting the most appropriate. PBL strategies in simulation contexts can present new information in ways that approximates concrete real life situations. The present study focus on PBL in higher education contexts. Based on a descriptive, evaluative and developmental research, we aim at a better understanding of simulation and PBL methodologies, in order to determine the impact of these methodologies in the learning and teaching processes, and to verify if the implemented methodologies are working according to the expectations of those involved. Thus, the proposed research integrates PBL methodologies, as organizational models, which are, theoretically, between the traditional roles of students and academics, and the necessity to give meaning to the changes that are occurring in the field of learning and teaching processes in higher education.

This set of issues led us to formulate several research questions. Generally, we aim to know: (1) how students, who have participated in PBL-type methodologies, assess the impact of these on their motivations and performance; (2) if there is any kind of change at the level of how students involved in PBL-type methodologies access and produce knowledge; (3) what are the potential effects on the graduates' profile of changes promoted by PBL-type methodologies; (4) to what extent PBL-type methodologies contribute to a more professionalized graduate profile; and, finally, (5) what specific type of strategies are susceptible of being modified in the teaching practices of the academic staff involved in PBL-type methodologies.

## **Method**

### *The context of the study*

The research setting for the investigation was the course of Projecto Profissional at the vocational higher education institution ISCA-UA. A case study approach is used, to describe and ascertain the impact of Projecto Profissional, as a PBL type methodology. In implementing this approach, the aim is to enable students to act as professionals. At the same time, the objectives refer to the pursuit of a wide interface between academic and professional environments, involving different working areas in a multidisciplinary perspective. As a final synthesis, it is acquainted with a practical and interactive view of entrepreneurial contexts, increasing abilities, attitudes and competences previously identified with the graduate in accounting profile.

The Projecto Profissional course was introduced in May 1996. The new course had the duration of a semester (3<sup>rd</sup> year, 2<sup>nd</sup> semester) with 8 tutorial-type hours per week. The idea of creating this new type of teaching methodology was initially related to the difficulty of having tutorials with a great number of students, on the one side, and the need for practical preparation for the graduates, which would satisfy as much as possible potential employers, on the other side. Taking the opportunity that the school was restructuring the degree, and putting aside the idea of having traineeships within the syllabus (which would entail finding placements for around 160 students per year), the idea of simulating the business reality within the school arose. The basis of the Professional Project lays in a simulated market of virtual enterprises, which small groups of students must manage an undertaking. Nowadays, students meet in tutorial groups 12 hours per week. The Projecto Profissional's importance is recognized by the Chartered Accountants Association (CTOC), as it has the same objectives that this association has, by requiring its associates to have had contact with real business

situations before they can join as members. The association considers that the candidates who have done Professional Project are dismissed of the traineeship demanded by the association before a person can join it as a chartered accountant.

*Data research*

Our study employed both a qualitative and a quantitative research methodology with data collection phase informed by the concept of close-ended questionnaire (students and graduates’ data), and semi-structure interview (employers and academics’ data) (Ghiglione & Matalon, 1985; LessardHébert, Goyette, & Boutin, 1990). To provide anonymity none of the participants were named. Simultaneously, contributors were fully informed about the study. In addition, we used document analysis that included course outlines and materials used in the class. Finally, the researcher maintained field notes throughout the study. Table 1 presents the research methodology used in data collection and data analysis.

**Table 1: Collection and analysis of data**

<b>Research methodology</b>	<b>Students and graduates</b>	<b>Employers and academics</b>	<b>Software</b>
Data collection	Close inquiry Document analysis	Semi-structure interview	Cardiff Teleform
Data analysis	Factorial analysis of multiple correspondences hierarchical classification	Content analysis	SPSS SPAD NUD*IST

A total of 132 (out of 138) students and 423 (out of 881) graduates took part. The questionnaire was ministered to the Projecto Profissional’s students in the year this empirical part of the investigation run, and was sent by post to all the graduates with Projecto Profissional, since its beginning. The names and addresses of graduates were obtained from the ISCA-UA’s data base. The questionnaires had different sections organized in different areas: professional, social and self competences, learning, and performance and motivation. As stated in literature, questionnaires’ structure was also shape diversified. Thus, we used Likert scales either in as increasing or decreasing way, dual yes and no questions, and fact questions. Optical reading was used with Cardiff Teleform software. Examination of data was done using either SPSS (Statistical Package for Social Sciences) for descriptive statistics analysis or SPAD (Système Portable d’Analyse des Données) for factorial analysis of multiple correspondences and hierarchical classification (Grangé, 1994; Lebart, 1982; 1995).

Fourteen academics and five employers were interviewed. We recognize that the employer’s group is a relatively small sample and data may not be representative of all employers. However, we emphasize that the lack of generalization that characterizes qualitative data lead us to hold a heterogeneous sample. Though, we look for different situations. In the first place, as Projecto Profissional is much more acquainted with private accounting rather than public accounting, it seemed pertinent to focus on private employers. Secondly, as we found a large variety of activities, it looked important to include diverse situations. At last, and as a suggestion of an academic, we decided to add a self-employer graduate. The names of appropriate employers were obtained either from academic staff or from students and graduates. Purposively and in what concerns academics, the ones who took part had at least four years experience in Projecto Profissional and all the coordination’s teams were represented. A semi-structure interview guide, including six domains, was used: (1) professional competences, (2) social competences, (3) self competences, (4) learning, (5) performance and motivation, and (6) assessment. The interviews were audio-taped and transcribed. Transcriptions were made immediately after the field work and data was coded using QSR N6/NUD\*IST (Non-numerical Unstructured Data Indexing Searching and Theorizing) for qualitative data analysis.

## **Results**

The results section explores five different sets of categories referring to students', teachers', graduates' and employers' experiences. The five sets are: (1) professional competences, (2) social competences, (3) self competences, (4) learning, and (5) motivation and performance. Overall, the evidence found reveal dissonant opinions between employers and the other participants', mainly in social and self competences and performance items.

### *Professional competences*

This theme examines how informants understand students' performance at a professional level in response to issues of PBL methodologies. All participants were overwhelming positive about the impact of PBL either in dealing with real problems or promoting interdisciplinarity. In addition the Projecto Profissional enables not only continuous learning but also a global vision of practical situations. Overall, comments made by teachers and employers as well as results obtained with students and graduates surveys, can be interpreted as an indication that PBL methodologies predisposes transfer of knowledge to new situations that can cope with professional problems in a contextual environment. Furthermore, it appears that in respect to professional success, PBL-type methodologies seem to add more value, essentially, at the beginning of the graduate's professional career. However, informants are entirely aware of the fact that PBL graduates' potential professional advantages also comprise a transversal perspective of social and personal competences.

### *Social competences*

This theme examines how experiences on the PBL tutorial may have impacted on social values. In this context, PBL was understood as part of a broad strategy for ensuring students to develop different social competences than those obtained from conventional methodologies, so that they would be able to cope in a changing world. Responses from students, academic staff and graduates reveal that consensus exists about work team and interpersonal relationships being positively changed. In a small way the same informants call attention to possible variations in leadership and exchange of ideas, even if these items seem to be strongly related with students' individuality. Particularly, the comments that emerge from the interviews of teaching staff appear to describe PBL processes in terms of contextually appropriate workplace dimensions.

Although students, teachers and graduates data shows that social competences are highly valued, data from employers suggests that PBL methodology does not exercise influence over the social values of the graduates. Two main cases seem to distinguish. On the one hand the idea of individual performance valuation instead of group performance expressed by some employers. On the other hand the perception that there is no difference amongst PBL and traditional graduates. It is also interesting to note that there seems to be a gap between employers and other stakeholders regarding, especially, the type of social competencies truly valued by employers.

### *Self competences*

This category represents a view about the impact of PBL methodologies on personal competences. Similarly to what happens with social competences it is possible to distinguish two brands: the one displayed by employers and the one displayed by the further groups inquired. While the earliest tend to reject PBL methods as able to promote the development

of individual competences the latest seem to value the methodology in increasing students' self experiences. However, variations in the conceptions that employers have of personal transformations is also perceived. In fact, managers declare that it is possible to denote some changes in graduates' behavior towards more confident attitudes. Similarly to social competences employers' outputs give the perception that there is no significant distinction amongst PBL and conventional former students.

Students and graduates' perceptions of the clarity of personal competences appear to differentiate two main positions. More positive perceptions are related not only to planning and organization features (time management and task scheduling) but also to knowledge production (critical analysis, synthesis, creativity, decision basis, enterprise and dynamism). Less positive observations are related to oral and written communication paths and goals. For academic staff there is greater clarity as to what is expected of PBL students in comparison to traditional students. In teacher's perspective, PBL methods clearly promote planning and organization features, as well as knowledge production schemes and communication paths. A remarkable feature, as it was not theoretically quoted, acquaints with possible relations between PBL methodologies and self-esteem and self-confidence mechanisms. This means that teachers expect to find more spirit of enterprise between PBL students rather than between conventional undergraduates.

### *Learning*

This theme analyses two main categories in response to issues of PBL methodologies: students' learning and teachers' role.

Students' learning category reflects the relation between learning processes and PBL environments. Though it is difficult to bring together a global agreement, nevertheless some references seems to be noteworthy. Some of the main contributions recurrent pointed out by all the study's participants refers to the methodological potential of PBL in promoting knowledge transferable to new situations, in encourage self-learning, and in supporting interdisciplinarity. Additionally, employers suggest that some of these advantages, mainly in terms of contextual application of professional concepts, tend to vanish as times goes by. That is, PBL methodologies seem to enable a softer incorporation of graduates into the entrepreneurial world.

The second category, teachers' role, describes how PBL environments might modify teachers' tasks. Statements about the challenges of being involved in non traditional methods and about rethinking ideas on teaching practices are mentioned by most of the tutors. Because of the different roles played by PBL students, teachers are required to re-evaluate their ideas about their own practices. The research shows that such changes have the potential to drive epistemological concerns on tutors. In that sense, teachers refer to PBL as a method structurally innovative in comparison with normal curricula activities. That means that, once students and teachers embark on PBL, it forces them to play diverse roles than the ones traditionally played. Tutors recognized that they now need not only to (sometimes) give instruction but, mostly, need to guide and prompt students in a self-learning way. Most teachers recognize there are varied strategies in the way their peers deal with PBL learning environments. There seems to be different performances between teachers with and without professional experience. While teachers with professional experience tend to deal with PBL learning environments in a more contextualized and practical way, teachers without professional experience tend to exhibit more academic solutions. Some teachers reported that maybe it would be important to rethink the PBL teacher's profile eventually more suitable to the non-traditional mould of the method.

### *Motivation and performance*

The category of “motivation and performance” has a dual perspective. On the one hand it refers to the capability of students being interested in learning in PBL environments. On the other hand it refers to students' achievement.

Generally, we find it possible to distinguish between two different sectors. Research on students, teachers and graduates reveals that those informants recognize PBL methodologies as able to contribute to a greater interest and, consequently, to a better achievement from students. A change in perspective of the phenomenon is denoted in employers' comments.

PBL environments whereas simulated backgrounds grant students and teachers to move as professionals. In this context it is possible to understand either an extrinsic motivation or an intrinsic motivation on students' behaviors. In fact, students, teachers and graduates refer that practical features and almost real characteristics of PBL methods conjugates to contribute to major extrinsic motivation on undergraduates. An interesting fact is that also teachers value the same PBL features and refer that those are responsible for their own motivation too. In the intrinsic argumentation, students, teachers and graduates talk about the innovative structure of PBL methods. Importantly, attitudes of feedback were recognized as key processes for enhancing learning and identified as benefits on students' self-esteem and motivation. What is surprising is that all the informants (students, teachers and graduates) describe feedback devices as motives for the rehabilitation of students' academic failure and, therefore, as motivation devices. Relatively to students' performance, students, teachers and graduates state that PBL methods seem to somehow contribute to a better accomplishment, especially in what concerns learning how to learn processes. Particularly, the same informants bring up feedback responses as mechanisms of a more satisfactory performance. A weak support is also named in the articulation between theoretic and practical sides, in the autonomy and in the initiative.

Employers' arguments about motivation and performance seem to guide in a different way. Consistent with previous employers' speeches, nor the motivation nor the performance of PBL students are valued by this group of informants. In fact, employers show somehow disappointment with the general performance of graduates. However, professional entities classify PBL graduates as bearers of some pre-professional sensibility able to promote an easier transition between the academism and the professionalism.

## **Discussion**

The present research explores how students and teachers experience learning processes in PBL environments, how graduates previously involved in PBL mechanisms adjust to professional atmospheres and how employers deal with these same graduates. Based on the case study results, it is possible to corroborate some conceptual proposals about PBL methodologies in simulated backgrounds. However, some others proposals do not seem to be verified from the empirical outcomes. The study setup allows us reasoning and discussion different approaches concerning professional competences, social competences, self competences, learning, and motivation and performance.

### *Professional competences*

Though our informants' evidence denotes positive changes on PBL-graduates in terms of professional competences, not all the theoretical values are equally appraised. The results with respect to forestalling professional environments, knowledge application to contextualized situations and learning as a continuous process are closer to theoretic developments than others. Similarly, graduates' perceptions are nearer the conceptual framework than those from the students. This differentiation is possibly due to the students' reflections upon ideological fields while graduates' reflections concern their daily practice. Comparatively, employers have exposed a contrast between PBL graduates and the remaining ones, with the formers denoting a more satisfactory professional global vision. This is probably because PBL's former students had to work in interdisciplinary environments as they act as professionals. The results also explore that simulation learning in vocational higher education help on a positive and attractive attitude that enables a softer changeover

between the academic and the professional world. As a consequence of the specific focus of this study, the advantages recognized to PBL methodologies appears to be particularly worthwhile in early stages of professional integration.

A personal consideration upon virtual models proposed by PBL methods and the traditional traineeship model seems relevant. Traineeship, as it is usually performed, is often limited to specific tasks. As a result, the multidisciplinary perspective and the employees' influence on enterprises' decisions, have almost no meaning. So, the PBL virtual model looks as an alternative proposal susceptible to preventing these limits pointed to traditional traineeship.

#### *Social competences*

As several studies indicate (e.g. Kirschner et al., 1997; Rawson, 2000) PBL methods promote positively significant changes in students social competences. However, in our research, these changes are only partially confirmed. Based on empirical evidence gathered from students, academics and graduates involved in our study, it is possible to value competences about work team and interpersonal relationships, or even in a small amount, competences about leadership and exchange of ideas. Yet, employers suggest that PBL methods do not establish by evidence graduates' social competences. The general trend of employers in not recognizing the impact of PBL over social fields suggests, once again, some personal reflections. The question here is to know if employers really value competences as work team, interpersonal relationships, leadership or exchange of ideas. According to employers' comments some enterprises seem not to fit in theoretical models that support social competences as crucial to the graduates' performance. On the contrary, some companies seem to like better more individualized paths. In this point of view, employers give the impression that they do appreciate no social contact among employees (while doing their job) rather than social relationships. So, perhaps this is one of the reasons that there seems to be a gap between employers and other stakeholders regarding, especially, the type of social competencies truly valued by employers.

#### *Self competences*

As indicated by this study (e.g. Tillema et al., 2000), self competences evidence also distinguishes between no variations denoted by employers and a positive self change denoted by the other stakeholders involved. Hypothetically, an explanation can be based on the differences between the virtual and the real, even though simulation tries to be like reality. As suggested by an employer, perhaps this is due to the graduates' lack of communication with a very specific arena that surrounds entrepreneurial reality. As a consequence, citizenship is of special interest. In fact, when taking into account the influence of self growth, as well as openness to community, path analysis results in a different model from that used when graduates, while citizens, close their minds over themselves. Being, from the very instant, difficult to reach consensus on this issue we questioned if the onus of student/citizen's integral schooling fits to HEI or to society, in general. Nevertheless, assuming a vocational higher education's idea, changeable enough to permit students direct their education in agreement with diverse job's opportunities, it appears to be consistent that new methodologies turn into higher levels of personal and social investments.

#### *Learning*

The results with respect to learning processes are, possibly, the ones which more closely confirm previous research findings (e.g. Kolmos, 1996; Powell, 2001). In fact, and inspired on the information and opinions that we form after doing research, it seems possible to identify some issues worthy of note.

First, that acquired knowledge or skills may be deployed in different situations. As some authors outline (e.g. Cowan, 2000; Kolmos, 1996), vocational higher education curriculum settles, at the same time, the concepts of “knowing how to do” and “do”. So, those paradigms

appear to legitimate our findings about the potential of PBL methodologies to provide knowledge in the same degree that is needed. As a consequence, the conceptual interdisciplinarity model appeals for a mutual relation between diverse disciplinary curriculums. But this leads us to the problem of how to manage teachers' wills. As a matter of fact, our concerns turn towards the question of knowing what openness upstream teachers reveal in modify their teaching models. Additionally, we speculate if academic staff really encourages exchange of ideas that may drive to possible methodological or curricular changes. We attempt an answer that emphasizes the importance of the academic community participation or that underlines emergent learning methodologies features.

A second issue that seems to us important to analyze respects the employers' needs. As mentioned before, employers come out with the idea that even PBL graduates do not answer all their professional needs. Assuming that is important to satisfy those needs, our apprehension turns to the way prospective analyses of employers' requests is done. We suggest that maybe it is necessary to carry out some evaluative structures that enable to identify what kind of situations graduates need to satisfy. However, this can not be seen in a straight line. In fact, this leads us to another question. If it is possible to recognize to vocational HEI the mission to produce future graduates for a specialized professional activity, it is also important not to forget that those same institutions have also the charge to produce graduates that fit diverse professional options within a scientific area. These concepts also provide the structure to introduce the paradigm of the onus of student/citizen's integral schooling fits to HEI or to society, in general. But this has already been mentioned above.

A third point put forward by our data reveals that learning issues are able to drive epistemological concerns on tutors. Making use of the information gathered with teachers' beliefs, it is possible to identify different attitudes between those with professional experience and those without. The different approaches reflect, namely, in the way teachers exhibit path solutions: teachers with professional experience have a propensity to present more contextualized enlightenments, while teachers without professional experience tend to provide more academic explanations. These findings enable to join another important piece of information to the theoretical framework. The impact of PBL methodologies in teachers' performance do not develop in a single path but rather unfold in a distinct way in agreement with or without the existence of professional practice. If, on the one hand these inferences arise some questions concerning the advantages of linking to PBL methodologies mostly teachers with professional experience, on the other hand, and once again, it seems important to reflect over the pedagogical mission of HEI. Hence, our personal consideration advertises to the discussion regarding the benefits of including diverse profiles in PBL academic staff.

Directly related with these problems, we can mention a fourth topic acquainted with the challenges that teachers involved in PBL methods have to face. The problem of teachers' practices is a strong one because changes concerns deep differences far behind applications. In fact, teachers are aware of the different roles they now need to play but, more important than this, are aware of the epistemological concerns that takes place when it is possible to speak of “learning” instead of “teaching”. In our interpretation, this suggests that the teachers' profile is an important feature of PBL methodologies. As a result, two pertinent questions arise: (1) what are the profits of selecting only teachers that identifies themselves with the innovative characteristics of PBL methods; (2) what are the advantages to engage traditional teachers to PBL methodologies? On the one hand, we argue that perhaps it is possible to find some positive answers if, occasionally, traditional teachers feel identified with emergent methodologies. On the other hand, to impose ideas, habitually, revert on behalf of a visibly opposition to what is imposed.

A fifth concern respects to the student point of view. In other words, if PBL methodologies motivate reflections about teachers' practices it seems obvious to think over the different roles proposed to the students. So, our question is to know how students surrounded by traditional methodologies all their lives react to non-conventional methods. In our point of view that insertion can be as hard as it is suddenly presented. Following this idea, our proposal goes to the explanation of the methodological frame of PBL methodologies not only

to the academic staff but also to the students. It is possible that a major commitment of the students with their own production of knowledge, find echo in the students' consciousness about their different responsibilities.

#### *Motivation and performance*

It our findings it is clear that the experience of PBL was motivating both for students and teachers. Particularly, they valued practical features and the innovative structure of PBL methods. Somehow it is surprising that academics refer to PBL environments as motivational ones. In fact, theoretic background indicates that the shift from teaching to learning impels different competences from academics which demands for more active and synchronized attitudes.

The results with respect to students' performance confirm previous investigation findings (e.g. Donner & Bickley, 1999; Margetson, 1998): PBL methods seem to contribute to a better accomplishment. Our findings partly confirmed it, especially in learning how to learn processes. We emphasize attitudes of feedback, recognized as key points for improving students' learning and, consequently, to a more satisfactory performance. A possible explanation can be that a suitable rehabilitation of students' academic failure is being developed by feedback mechanisms inherent to PBL methodologies. As one of the tutors said

*“In this discipline everyone succeeds. What we do is like this: we always give a second chance. When students fail, they learn with their own mistake and learn to do it well.”*

Once again, we feel that we must explore the problem of the reverse relationship between graduates and the other groups. In fact, some managers show some disappointment with the general performance of former students. As a justification for this feeling, those employers refer to the graduates' quality decrease. Our explanation is that, perhaps, the opportunity that is given to students to access higher education with low marks can play as a two-edge knife. Unlike the theoretic argument that PBL theories is a worthwhile for employers, those have let it be known that graduates, although may posses a substantial stock of skills, do not always know how to use them correctly. Assuming the huge importance for vocational higher education institutions to satisfy employers' future prospects, the problem is to know how the prospective analysis of the effective needs of entrepreneurial organizations is done. Using this as a starting point, maybe it becomes indispensable to bring in some assessment structures that can clearly identify the enterprises' requests.

#### **Conclusions**

This study explores PBL methodologies in simulated environments in vocational higher education. A case study setup provided data that enabled analysis of a PBL experience and the results were conducted in order to find rational justifications to theory formation relating to learning processes. As main contributions of this study we highlight the following: there seems to be a gap between employers and other stakeholders regarding, especially, social, personal and learning competences; PBL-type methodologies in simulated environments seem to add more value, essentially, at the beginning of the graduate's professional career; the possibility of developing the entrepreneurial spirit of graduates; the difference in behavior between academics that do and do not have professional experience outside academia; differences in perception of the type of competencies truly valued by employers; and the rehabilitation of students' academic failure by feedback devices inherent to this type of methodologies pedagogical development.

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