



ONGOING PROBLEM-BASED LEARNING AND PROFESSIONAL FEEDBACK

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1 THEME OF PROPOSAL, RATIONALE AND FORMAT OF CONTRIBUTION

a) Envisioning CPD future modes

b) This proposal is intended, on the one hand, to strengthen the interrelationship between universities and firms and society in general, and study in depth the complementarities between engineering and management, on the other. Thus it starts from the development, at the university level, of methodologies of teaching/learning based on problem resolution (problem-based learning), but extending the strategic management process beyond the analysis of opportunities, settlement of goals and strategy outline, in order to implement the proposed solutions and monitor and control their impacts on decision efficiency. This will support the definition of new intervention ways, turning firms into privileged laboratories to experiment learning contents and methodologies. This subject strictly relates to the chosen topic because it consists in a teaching/learning methodology with mutual implications, which results will cast on universities' and firms' environment.

c) This contribution consists in a paper.

2 DESCRIPTION OF PROPOSAL

a) The current methodological proposal – that strengthens the cooperation between universities and firms in order to promote the quality of education and its results both for students and for professionals – resorts to teaching/learning methodologies based on problem solving, but it extends its scope and its feed-back, conveying firms the consequences of proposed solutions and subsequent deepening of management control processes and continuous improvement of firm's decision processes.

b) The goals of this new model of continuing professional development are as follows:

- To deepen the interrelationship between engineering and management, in terms of knowledge and efficiency of professional practices and outputs;
- To make the most of theoretical updated knowledge for firms and of practical/empirical knowledge for universities, as well as of knowledge and experiences' share among people differently aged and with diverse educational and professional backgrounds;
- To achieve new and reinforced university funds, on the one hand, as a settleback of better solutions for firms' problems, on the other;
- To develop networking and consolidate technical and management expertise, and gain a closer mutual awareness of human resources' profile (abilities and skills of the involved stakeholders).

c) This methodology founds on two poles: university and firms. It intends to bring real problems of firms to the ground of universities (under the format of real and ongoing case studies), which resolution should be pursued either at the university level (based on previously obtained knowledge and respective interrelations), or at firms' level (where the information will be collected and proposals will be implemented), simultaneously fostering the development of personal and interpersonal, informational and decisional skills [8]. The implementation of this methodology should include, namely, short traineeships of university students in firms, professional education of firms' employees in universities,

nomination of mentors to monitor student's work in firms, nomination of students to convey scientific, social and management knowledge to firms' employees, firms' development of updated techniques and subsequent packages to support students' academic works, and theoretical-practical conferences involving both universities and firms, students' participation in firm's meetings or employee's participation in students' groups pursuing specific academic works.

d) The rational and integrated implementation of strategic management to the joint system universities/firms will bring significant mutual benefits: a closer look at management concept and instruments by students, and the awareness by firms of the practical results of the proposed solutions. It is expected that the reached results support the consolidation of continuing professional development and a substantial improvement both of the learning and the proper decision making processes.

3 OTHER RELEVANT INFORMATION

To warrant the efficiency of the proposed methodology, it will be necessary to make a list of the potential firms interested in collaborating (where they briefly expose the problems they would like to get solved), as well as the list of students that will undergo this cooperation, before the beginning of the corresponding school year or semester. It is also advisable the implementation, on a trial basis, of this methodology, in order to test some of its expectable results. Besides, in the control phase of the strategic decision process, a management information system should be developed that supports the monitoring throughout time of the results of the implemented decisions, and their implications and interactions with the results of other decisions and with the proper evolution of firms' internal and external conditions.

4 TEXT GUIDELINES

Experience shows that a solid high engineering education doesn't imply in itself neither professional success nor efficiency in solving firms' problems, either in short, medium or long run terms. Continuing professional development (CPD) – understood as the means by which people maintain their knowledge and skills related to their professional lives – consists in continuing education as applied to professional development [1]. The strong bet of many universities in teaching/learning methodologies based on problem solving (problem-based learning) settle an important attempt to overcome these kind of problems, resorting to students' collaborative participation [2]. These teaching/learning methodologies are faced as the main alteration to the traditional education paradigm ([3]; [4]). They have been broadly and widespread used in pre-university, university and professional contexts [5], in different scientific fields, and in diversified geographic locations (Europe, Asia, Australia, and United States of America) [2]. Meeting the concerns expressed in the Bologna Process, these methodologies point out the need to foster students' flexible reasoning, and long-run learning processes [5]. Students become to be faced as active learning agents ([6], pp. 294) both in knowledge building and in its autoregulation [4]. The central nuclei of the learning process now focus on the problem that should be formulated according to real situations [7], without an a priori knowledge of the answer [4], what enables realizing knowledge utility during problem resolution [8].

It is recognised, on the other hand, the increasing importance of management in engineering enterprises' implementation, despite many engineering planning studies don't include deep enough concerns in this field. It is generally accepted that the professional experience that results from the application of technical knowledge will naturally enable the development and consolidation of management skills ([9]; [10]).

Problem-based learning pursue the following steps: (i) problem understanding and analysis; (ii) identification of the previous knowledge required for problem discussion, and of knowledge gaps to be bridged in order to solve problems efficiently; (iii) identification and planning of learning goals in a collaborative context; (iv) auto-learning phases and subsequent knowledge sharing with other work group's participants; (v) problem resolution through previous and acquired knowledge integration; and (vi) analysis and reflection on used methods and obtained results ([5]; [4]; [7]).

These teaching/learning methodologies – that search to develop knowledge in a sustained and flexible way -, are susceptible to be used transversally in other contexts through integration of acquired knowledge with previously detained one. They are also aimed at developing assessment, reflection and choice of problem resolution strategies, and at engendering autonomy in long-run learning processes. They often resort to collaboration skills in work group, thus reinforcing a flexible mental rationale that bets on previous and acquired knowledge diversified applications. The scope of the problem and its

adequacy to work groups are especially relevant in order to engender an intrinsic learning motivation ([11]; [5]).

In the current article is proposed that this problem-based learning progressively approaches reality and turns into a major integration among knowledge, learning processes and firms' and universities' human resources, thus reaching more efficient results for both stakeholders. The management process indeed remains incomplete when problems are simply theoretically assessed, even in depth. University contents that resort to problem-based solving generally diagnose external and internal constraints to organizational decisions, identify goals (duly hierarchized, quantified and scheduled), and select the better strategy from a set of alternative strategies. However, implementation, monitoring and control of results' phases - which are required conditions for continuous improvement of decisions proper efficiency - fail in current teaching/learning methodologies. These phases, as integrating continuing professional development, also point out the need to resort to universities to collect updated knowledge, new perspectives for data collection, analysis and systematization and its treatment, so to reach concrete results.

And it is precisely in the interaction between these two poles of the same teaching/learning reality - university and firms - that stays the potential of the herein proposed methodology. It enables, first of all, to deepen the inter-relations between engineering and management, either in terms of knowledge or in terms of the efficiency of professional practices. It enables, on the other hand, firms to take the most of theoretical updated knowledge, and university students to take the most of practical and empirical knowledge from those that develop their professional activities. Knowledge and experience share among people with different educational and professional backgrounds is highly enriching for both parts. It may substantiate either through monitoring of students work in firms by assigned mentors or, conversely, through the choice of students able to disseminate updated technical and management knowledge into the professional groups they are going to integrate in firms, through the implementation of training programs, conferences, participation of students in meetings in organizational units or of professional people in academic working groups, swot analysis application both under the university and the firms' perspectives, and even the development of techniques, methodologies or computational packages to support problem resolution in academic grounds. It is also important to stress the relevance for university of alternative funding sources that support their own sustainability, resulting from strongly founded works guided to improve the efficiency of organizational decisions, reasons that justify a stronger support assured by firms to universities, even because consultancy to specialized firms is generally very expensive, and doesn't necessarily warrant higher quality.

Finally, the great trump of the herein proposed methodology lies in the proper networking that it strengthens that not only supports knowledge and experiences' sharing, but also fosters the integrated development of abilities and skills, and a closer look at knowledge and mutual trust, essential condition for the success of working teams.

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