

LA DOCENCIA UNIVERSITARIA: A DOCENCIA UNIVERSITARIA: DESAFÍOS Y PERSPECTIVAS DESAFÍOS E PERSPECTIVAS

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(EDITORES)



SEPARATA



**La docencia universitaria:
desafíos y perspectivas**
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42. What university students think about context-based learning? A case study in an industrial management course for future engineers

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Abstract

This paper aims to contribute with a reflection on the adoption of context-based learning in higher education, offering some insight on how this approach can enhance students' learning. It presents and discusses the results of an academic semester experience linking university students and companies, and characterizes the impact of this approach at the students' level with the analysis of their perceptions.

Keywords

Context-based learning, problem-based learning, students' perceptions, engineering education.

Introduction and background

CBL refers to a pedagogical methodology in science and technology education that uses real-life cases in order to help students to learn through the practical experience on a subject rather than just by its mere theoretical knowledge (Rose, 2012; de Putter-Smits et al., 2013). Some authors (Kelley and Kellam, 2009) highlight that contextual learning and problem-solving skills approaches can work together in order to produce highly conceptualized and meaningful learning experiences that focus on real-world problems, thus helping students to develop flexible problem-solving activities. In turn, Problem-based Learning (PBL) is a form of active learning that positively influences student attitudes and study habits, as well as critical thinking skills (Prince, 2004; Smith et al., 2005). Some studies found positive influence of PBL in the improvement of labour market outcomes (Borghans and Coenen, 2010).

However, Context-based Learning challenges teachers in the acquisition of new competencies, such as: context handling (the transfer of concepts to other contexts); regulation (the guide and regulation of students' own learning); emphasis (the practical reason that argues why the concepts should be learnt); design (the flexibility and skill to adapt learning activities to student's needs); and school innovation (this approach should be supported by a large number of teachers in a collaborative way of professional development) (de Putter-Smits et al., 2013).

This paper aims to present the experience and discuss the results of a context-based approach adopted during the last semester of a Master in Mechanics Engineering course, focusing on one component of the syllabus of the Industrial Management course (operations and lean management). This experience had the objective to allow students to get acquainted with the business/industrial world and to learn about how companies tackle the challenge of constant improvement of their operations. Our research objectives were to characterize the impact of this approach at the students' level with the analysis of their perceptions in relation to the learning process and outcomes.

Description of the approach

The experience involved 21 mechanical engineering students and was designed to allow them to get acquainted with: 1) the difference between activities which generate value and those which produce waste in an industrial environment (and in general), 2) the potential benefits (and drawbacks) of using some of the most popular tools of lean management, 3) the key performance management metrics. One of the main personal and interpersonal objectives included the improvement of self-confidence in solving problems and in tackling the real entrepreneurial world's challenges.

The teacher established a close collaboration with 13 different companies willing to collaborate, either by coming to a classroom session (2 hours) and interactively discuss their case, or receiving the class for an interactive visit in which industrial processes challenges were presented as well as how the companies tackled them. A previous talk between the teacher and each one of the professionals was held in order to clarify the objectives and the content of the component of the course. She focused, in particular, in the need for the professionals, either in class (3) or in the visits, to give conditions for students to observe and question the problems (inefficiencies in the processes) and the tools used to solve them.

At the final stage of this component, students organized in groups of 4, were challenged to characterize/draw the flow of operations of a real company (a new one in general), to identify the main wastes pointed out by the lean management literature and offer a solution for one of the identified problems using the Toyota A3 systematic problem solving sheet (Shook, 2009). Finally they were incited to share their work with the companies. In this course component, students were evaluated with a classification of the individual visits' reports and a classification of the A3 output.

Research methodology and results

Our research methodology was supported by a questionnaire of quantitative and qualitative questions applied to all students. Out of 21 students involved in the experience (71 %) responded to the questionnaire. A large majority were male (66 %), their average age was 23 years old with a very small deviation and 33 % had a previous part-time work experience in small businesses like shops or bars.

Almost all of them had high expectations at the beginning of the semester with this course. Only one student had a similar experience of participating in this kind of activities during his academic pathway.

Most of the students (66 %) found the total number of visits/talks adequate. The others found it excessive, the main reason being the repetition of the same theoretical concepts in the first part of the talks/visits: “Despite being interesting and realize how companies work, there was a repetition of unnecessary content. It is important to understand how lean is applied in different contexts (I was surprised with the application in the case of the hospital, for example), however in the total of the 13 lectures there were some cases that constantly addressed the same theoretical concepts and became repetitive” (Student 4, 29 December 2014). This aspect will lead us to question the design of the activity, namely the preparation of the visit/talks and the selection of the professionals (e.g. objectives, goals, related topics, necessary background, communication skills and expert profile, etc.).

Most of the students found the talks/visits diverse, covering a large scope of situations and contexts: “Having a talk with the head nurse of a hospital and a visit the Air Force shows how diverse the activities were” (Student 6, 5 January 2015). Most of the students (80 %) found the length of each visit (from 2 to 4 hours) and/or talk (2 hours) adequate. They also agreed that the topics presented in each visit/talk matched the curricular cognitive objectives. However, two students would have wished a longer contact with the each professional/company.

Although some students found the visits more useful than the talks in class, the great majority found both important and complementary. If in the talks they had the opportunity to know indirectly what professionals did, with the visits they could observe by themselves and confront different realities: “Nothing better than checking what each professional transmits in relation to the reality of companies. Professionals explain in detail that information, but it is also important to see how it really happens and is processed, in real, because sometimes a picture is worth than a thousand of words” (Student 9, 10 January 2015).

Students had a high attendance rate: they were present in 10 or more visits/talks, the average being 12 (92 %). However, when asked about their level of participation, results show that the average number of questions per student in each visit/talk was very low (2) - which we found quite worrying. Although we already know that the main cause of this situation seems to be students’ shyness in public settings (50 % of

the students who had a low level of participation said that the main reason was shyness, and the others did not question so much because they did not have any doubts), these results will lead us to reflect on how to improve this level of participation.

Most students felt they had their expectations overcome (only 2 didn't). They all felt motivated to repeat this experience in other courses of the syllabus. When asked about the teaching and learning approach, 5 students agreed that this approach clearly allows a deeper learning than a traditional one (e.g. lectures). The majority however found that the efficacy of this method depends on the course.

At the end of the experience, almost of the students (87 %) felt that they understood, in general, what is lean management, as well as the challenges of its application in the enterprises' environment (73 %). 53 % had a better perception of what is expected from them (as future engineers) by real companies. However, only 33 % of the students felt more confident to work in a company, and more than half would have wanted a deeper exposure to specific lean management tools.

In the end of the experience more than 60 % of the students found that they were prepared to identify problems of management, analyse and find the causes of inefficiencies, propose strategies to solve them, present and discuss these strategies with other experts or peers.

In general, students found this experience satisfactory (73 %) or very satisfactory (27 %) and 93 % found it essential for their preparation to work as future engineers. The main reasons are related to the possibility of getting to know more closely the challenges of the industrial companies as stated by a student: "A mechanical engineer needs to have sensitivity and management skills in order to contribute with the continuous improvement of the company where he works. We have a critical role on that, and we can't be lazy with the reality that the company lives in, but we must always try to improve its processes and operations" (Student 7, 6 January 2015).

Similarly, 73 % of the students thought that this course was undervalued in terms of credits: "It should be, at least, equivalent to the credits of the remaining courses, because it gives us very important tools for the labor market – many of them more important than in other theory-based courses" (Student 2, 20 December 2014).

As to which visits/talks they liked the most and why, 3 companies were identified as not so interesting, whereas the others were considered by all the students as very interesting and motivating, either because they presented different contexts of application (diversity) or because the professionals' communication skills were outstanding and their profiles were closely related to the students field (mechanics).

Discussion and conclusions

This paper contributes with a reflection on the adoption of Context-Based Learning in higher education. It offers, from the students' point of view, some insight on how this approach can enhance learning. Students made a positive appreciation in relation to the Context-Based Learning experience and manifest-

ed enthusiasm in having similar activities in the future, confirming the findings of Prince (2004) on the benefits of Context-based learning. Not only because they became more familiar with the concepts of lean management, to the point of feeling more confident in finding and presenting their solutions to problems presented by some companies, but also because they got a better understanding of the real companies' challenges and of what is expected from them at the workplace.

At the pedagogical level, like some authors suggest (de Putter-Smits et al., 2013), it was possible to identify some key conditions for the experience to succeed, such as trust building between companies and the teacher (which takes time), clear objectives for each intervention (seminars and visits to the companies), the design of learning tasks and the assessment criteria which should promote a higher students' participation (through the development of critical thinking skills such as questioning). It is also important to ensure an adequate number and diversity of visits/talks, as well as the involvement of professionals with good communication skills.

In future work it would be interesting to confront the presented results with the analysis of the companies' perspective and with the students' cognitive outcomes (Toyota A3 systematic problem solving sheet).

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