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NEW APPROACHES IN THE EUROPEAN HIGHER EDUCATION AREA (EHEA): AN EDUCATIONAL INNOVATION PRACTICE IN STRUCTURAL ENGINEERING USING SCALE MODELS

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Abstract

The implementation of the European Higher Education Area (EHEA) has realigned educational programs. There is therefore a need to adapt to the new student profiles. Knowledge is imparted over shorter periods of time and using innovative educational methodology.

The teaching of structural topics in engineering faculties has to adapt to these new teaching methodologies, without forgetting the final goal of preparing future professionals in the construction sector. In this research, the new methodologies are described in the context of a Bachelor thesis. The aim is to initiate the student in active learning, in accordance with the attitudes and skills needed to negotiate the Master's studies and future professional activities.

The Bachelor thesis is assessed by a supervisor, who will guide the student in the preparation of the thesis. In this case, the analysis of a wooden bridge built was proposed, as a structural engineering problem, which also formed part of an annual competition organized by the university. A special characteristic of the bridge is that no additional load may be added to the structural components. The high level of interest expressed by the student should be underlined, who firstly characterized the material, by performing various tests and then prepared a Final Elements Method (FEM) model and finally a load test to adjust the model. The student had not used the FEM program before so the time spent on the whole process was extremely lengthy for both the student and the supervisor, nevertheless, a high level of satisfaction was reached in terms of the skills that the student acquired.

Keywords: Active learning, bridges, scale models, Engineering, monitoring, structures.

1 INTRODUCTION

The implementation of the new European Higher Education Area (EHEA) has meant a change of attitude among students and teachers towards teaching and traditional educational methodology at university. The decision not to attribute professional accreditation to graduates holding the Engineering Degree in Industrial Technology, which precedes the Master's Degree in Industrial Engineering (both degree courses taught at the Faculty of Engineering of Bilbao - UPV / EHU), has limited the preparatory training of future Industrial Engineers to three subjects in the field of structures: Applied Mechanics (2nd year and 6 ECTS credits), Material Elasticity and Resistance (3rd year and 6 ECTS) and, an optional module, Structural and Construction Theory (4th year and 6 ECTS credits).

This approach limits the knowledge of the student in the field of structures and construction, on the Industrial Engineering degree. The annual organization of a competition to build scale-models of an arched bridge made of wooden ice-cream sticks or modelling sticks led us to consider the use of this voluntary student activity as a basis for active student learning, among the innovative possibilities to introduce in the current teaching methodology.

In the competition that took place in the 2014/15 academic year, the model builders of the two finalist structures would have been declared the winners, which were built to support a load of 1300 kg without collapse. However, the panel, impressed with the models and concerned about the possibility of an actual collapse, decided to suspend the competition, declaring both finalists as the winners. So, the final load that would have caused the collapse of the bridges was never established.

As a result of the competition, the completion of an End-of-Degree Project (EDP) was raised, entitled "Analysis and simulation of service loads of a parabolic arch prototype bridge made with ice-cream sticks" [1]. The proposal was of great interest to one of the winners, who was enrolled on the study module "Theory of Structures and Construction", a subject that also formed part of his EDP (June 2016).

- This methodology motivates students, who acquire knowledge in a more natural way, through their own experiences. In addition, students are responsible for the implementation of the planned activities.
- However, both students and teacher (EDP Director) need enough time to plan and design the activities to be done. Therefore, the evaluation processes are longer. In any case, these activities give feedback to the system.
- Addressing the modification of traditional teaching methods requires a continuous process, where there must be room for reflection on pedagogical conceptualization of knowledge, teaching and the education of each teacher.

4 CONCLUSIONS

There are several conclusions that may be drawn from the proposal that has been expounded. Undoubtedly, task-based learning provides a very extensive and highly flexible field to communicate practical knowledge to the student. Learning rests with the student and the teacher is the facilitator of that learning.

Moreover, as practical dynamic learning, it contributes directly to:

- The promotion of teamwork, even in some cases of multidisciplinary nature and to develop the possibility of empathy in students in their active interaction with others.
- The implementation of an integral concept of the various areas of knowledge gained in the course of their work, encouraging the use of knowledge, skills and experience gained in previous work and in various subjects related to the Degree.
- Facilitation an appropriate environment for developing more effective knowledge learning processes.
- Stressing the need for planning the activities and timing necessary for the development of the work, due to the temporal restrictions in place and having to ensure that all the members of the team advance simultaneously in the learning process.

It is in addition clear that this long and laborious process can sap the morale and the commitment of the student, in such a way that the teacher becomes something like a coach - consultant and psychologist of a still immature student, who needs to learn to make decisions.

A critical reading of the competencies and attitudes established in the ABET accreditation and certification with respect to the innovative proposal discussed in this paper, might lead us to contemplate with some hopefulness the possibility of achieving all of the objectives in the near future, by introducing active learning methodologies in the development of the EDP and, by extension, the End-of-Master Projects, in the area of Industrial Engineering and especially in the field of structures and construction.

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