The Introduction of Professional Responsibility in the Civil Engineering Degree

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Abstract

The present work aims to create a space for reflection on the ethical training an engineering student receives during their degree studies. This training will facilitate the transmission of the value of responsibility as a quality essential to the proper development of the professional work of a civil engineer. Review of the curriculum of the civil engineering degree at The Universitat Politecnica Valencia in Valencia, Spain, in which it appears explicitly as a competition to the student acquired upon completion of their training "to understand and take ethical and professional responsibility for the activity of the civil engineer". This review suggests two different methodologies to acquire such competition, responsibility.

Keywords: *Responsibility, Competence, Civil Engineering, Profession, Professional, Ethics.*

1. Introduction

The recent implementation in our country of the European Higher Education Area (EHEA) from the Bologna Declaration has been an opportunity to review and update the degrees offered by the Spanish universities. [1]

The universities have adapted to the objectives of the EHEA, namely in:

a) Adoption of a system of comparable degrees which is easily readable.
b) Adoption of a system based on three cycles; grade, master and doctorate.
c) Establishment of an international system of credits (ECTS European Credit Transfer System.)
d) Promotion of the mobility of students, teachers, researchers and administration and services personnel.
e) Promotion of European cooperation to assure the quality of higher education.
f) Promotion of a European dimension of higher education.

In the field of engineering, this change has led to the disappearance of traditional research engineer and senior engineer education and generally, the students completing their graduate have been given similar attributes to those of civil engineers.

At the same time the European Council and the European Parliament approved in 2009 the creation of the European Qualifications Framework for Lifelong Learning (EQF-MEC) which aims to be a tool to standardize the qualifications obtained in different studies (from school education up to PhD) in the Member countries of the EHEA. To perform the correct qualification the framework divides learning into three categories: **Knowledge, Skills** and **Competence**. [2]

If we look at the evolution of the Spanish University system prior to the Bologna Declaration, you can see that the type of learning that has been most commonly described, which is more traditional, are those who fall into the category of knowledge, being theoretical, factual, events, processes, principles, etc. At the time the university questioned its role in believing it was no more than a mere transmitter of knowledge and was not involved in developing or enhancing essential skills to achieve excellence.

At that time the university began to introduce group work in the classes and began to focus so that students would acquire cognitive (use of logical, intuitive and creative thinking) and practical (founded in manual dexterity and the use of methods, materials, tools and instruments) skills.

At this point it was established that it was also important that the student, throughout his education acquire competencies described in terms of responsibility and autonomy. We shouldn't forget that once a student obtains a degree, being in possession of that degree allows them to sign projects that are not exempt from their responsibility towards society. All this is reflected in the EQF-MEC, without establishing a hierarchy of importance of one group to another.

The problem is we have very clear view of how to evaluate the knowledge of our students (tests of theoretical evidence, objective, etc.). We also know how to evaluate skills (problem solving exams), but how do we introduce in the curriculum competencies? How do we evaluate the competencies of the students? Do we know that a student has acquired the responsibility and the autonomy necessary for the proper development of their professional duties?

This paper aims to be a reflection and bring some ideas on how to develop the professional responsibilities of our students.

2. The profession of an engineer

As Cortina says [3], a profession is a type of social activity that must possess a number of characteristics, among others:
   a) It is an activity that provides a service to society in an institutionalized way.
   b) The profession is considered as a vocation, so it should have specific skills and with a peculiar kind of interest in the goal pursued by this specific activity.
   c) The professional, on entering their profession is committed to pursuing the goals of these social activities, whatever their private motivation is for having joined.

These reflections are in line with those published in other publications such as [4] which already specifically concerns the civil engineer (the professional field that encloses the professional activity of the Civil engineering degree), and says his work is fundamentally social and stresses the importance of the development and promotion of the dialogue between society and engineering. These authors also emphasize the importance of responsibility in the field of Engineering (where errors or inadequate decisions can cost lives or irreversible effects on the territory and the environment.)

There are also reflections from notable people such as Albert Einsten, who in 1952 proclaimed "is not enough to teach a man a speciality. Although this can make him become a kind of useful machine, he will not have a harmoniously developed personality. It is essential for students to acquire an understanding of values and a profound affinity towards them. He must acquire a vigorous sense of what is beautiful and what is morally good. In other words, with the specialization of their knowledge he will look more like a well trained dog than a harmoniously developed person" (Einstein a. 1952. The New York Times.)

For all these reasons and as pointed out by Professor Lozano [5] "If we want responsible professionals who make good use of their knowledge and thus contribute to the construction of a fairer society, we should train them for this purpose".

3. Competence in the Degree of Civil Engineering

As already mentioned, the arrival of the European space of higher education has forced the redesign the Spanish university degrees to match them to the characteristics in terms of duration (number of credits) and contents of the courses in the rest of the EHEA. In the year 2003 the Ministry of Education and Science published several reports which speak of "providing a university education that harmoniously integrates the basic generic competence, competence that are related to the integral formation of persons

and more specific competence that enable a professional orientation that allow graduates integration into the labor market ". [6] [7]

From these reports the Technical Schools began to write the curricula of different degrees by incorporating the competence that students should acquire. In Figure 1 you can read some of the Competences that a student must acquire to complete graduate studies in Civil Engineering at UPV (data published on the website of the Civil Engineering School of the Universitat Politècnica de València). [8]

As you can observe, the third competence listed states: "Understand and assume the ethical and professional responsibility for the activity of the Civil Engineer", however if you look at the curriculum (available at http://www.upv.es/titulaciones/GIOP/indexc.html) followed by students, you can't see any subject in whose content deals directly with this competence. How will students to acquire it?. The same happens with the curricula of the degree in Civil Engineering from other Spanish universities, for example of the University of Alicante (UA), in which one of the core competence of the degree in Civil Engineering stats: "Students have the ability to gather and interpret relevant data (typically within their field of study) for making judgments that include a reflection on relevant social, scientific or ethical topics" also mentioned is: "Awareness for the need of a high level of professionalism and ethical conduct in engineering".

Figure 1. Some Competences in Bachelor´s Degree in Civil Engineering.

4. The Responsibility of students in Civil Engineering Degree

One of the most common criticisms in the implementation of studies, in which a continuous monitoring of progress in the knowledge of the students is done, is that they are "infantilized ". There is becoming less difference in the style of education received by students in high schools and the University. Moreover, traditionally in our country the majority of college students don't leave the family home to pursue their degree studies and helps to perpetuate the eternal adolescent state of our youth. In the majority of European countries, it is customary to leave the family home for university studies. This fact changes the daily scene of students dramatically, in addition to a change of level of studies, addressing a personal change, which in most cases leads them to assume new responsibilities in their daily lives. They begin to feel and to be autonomous individuals with everything that that entails (yet almost always they

are "sponsored" by their families who invested much of their savings in the University studies of the children).

In the circumstances that exist in the present scenario to pursue graduate studies, it can be said that the environment does not favor the acquisition of autonomy, neither personal nor professional responsibility by students, and society expects that when they finish their studies and acquire the appropriate professional attributes, our engineers are completely trained. So where does the student takes responsibility?

On the other hand the implementation of the ECTS grant, the workload measurement system required for a student to achieve the objectives proposed by a subject (each ECTS can be measured in 25-30 hours between teaching and individual work), promotes the autonomy of the student work. The student already knows that it is not enough with presence in the classroom during lessons that teachers teach, it is necessary, it is their responsibility to complete these hours with individual work to achieve the learning objectives, it is assumed that the student has enough maturity to work individually. For many people, the acquisition of responsibility or values should be acquired before arriving at the University, they are competence that people must acquire throughout their education, beginning at the time of the birth. But in many cases this is not true and the University is the last chance to acquire responsibility and autonomy to develop the profession with excellence. [9]

However in very few technical schools are students prepared to be professionals or is there any subject that opens a space for learning, reflection and debate about the ethics of the profession. In the development of the curricula in place, you can choose to work competence from specific subjects, or may well be left in the hands of technical subjects teachers that introduce small reflection exercises in their daily activities that encourage the development of these values.

In the opinion of the authors of this paper, the first option, including specific courses in the curriculum is the most appropriate; it is the only guarantee that certain competences are acquired in university studies. It could offer subjects that would teach values like professional ethics, study of moral dilemmas in professional practice etc. Only in this case would the importance be given to: "A society demonstrates that a subject seems essential for the formation of a professional when it explicitly includes it in its curriculum". [10]

If you choose the second option, we leave the development of professional responsibility in the hands of the teaching staff voluntary (without addressing the ability to transmit these skills) and unable to ensure that students receive appropriate training during their graduate studies. Provide ethics training transverse nature even with a common approach can lead to sacrifice this content in favor of those relating to the subjects in which they intend to introduce.

Moreover it would be necessary to review the assessment system we do of every student, to introduce evidence that will allow us to know whether students have acquired the required competence.

5. Conclusion

In the framework of the European Higher Education Area, optimal conditions are given to improve the training of our students and not only focus on the transmission of knowledge, but increase training and extend it to knowledge, skills and competence. Currently the tradition is to evaluate and assess the degree of compliance with acquisition objectives of knowledge and skills, but not the competence, where among others things we need the development of professional responsibility and autonomy of the students.

As instated in the current curriculum (in particular the GIC of UPV, but easily translatable to the degree of Civil Engineering taught at other universities in Spain) there is no guarantee that at the end of the degree, students have acquired these competence.

For this reason the authors suggest the need to really introduce these competences and how to evaluate them in curricula. Preferably creating subjects that adequately train students, through the proposal of moral dilemmas, professional ethics classes etc. or from the help of teachers whose professional career are able to transmit these competences to their students, making them think and realize what professional development is so that they can perform their duties with full knowledge, autonomy and responsibility. In this way, the curricula could guarantee not only the ability of their graduates, but also their professional attitude.

6. Acknowledgements

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[7]   Web page Conference of Chancellors of Spanish Universities, crue.org/espacioeuropeo/

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[9]   Real Decreto 1393/2007 of 29 October, on the organization of official university studies.

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