

## Analysis of Factors Involved in the Teaching of Technical Subjects in Higher Education

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### Abstract

*The new context of the European Higher Education Area (EHEA), aims to train students not only in specific competencies that will enable them to acquire knowledge, but also on general competencies that allow them to deal with the different situations they will face in their future professional. Besides the importance of quality teaching in the teaching-learning process of the students, there are numerous factors that have a decisive influence in the process, with the assessment, defined as the average of relationship between the objectives and the results obtained, one of the most important factors, which in turn depends not only on the method used, but the human factor, i.e. the student's perception of the subject and their motivation.*

*The benefits of continuous assessment are reflected in student learning and it is important to determine what factors influence this process, in order to continuously improve. These factors do not remain constant, but change among other factors based on studies conducted and of the academic year in which the student is, it does give us valuable information. Moreover, the gradual incorporation of women into the EHEA, both as a teacher and student, has been an added value, and in many cases women who achieve better academic results.*

*Starting from these premises, the objective of this work is to study the factors involved the teaching-learning process from the point of view of the evaluation of technical subjects of the Degree in Building at the Polytechnic University of Madrid, in order to obtain influence of these factors in the teaching-learning process in terms of the course and student sex. To do this, data were taken, analyzed and compared results of two complementary subjects and pertaining to the area of knowledge "Continuum Mechanics and Structural Analysis," of second-year and fourth year respectively, "Resistance of materials and elasticity" and "Concrete as a structural", both with 6 ECTS credits.*

*The results show how the intrinsic capacity of students and their perception of the subjects are determining factors in their motivation, and therefore the acquisition of competencies that must be reached. The influence of the student's ability in the results achieved is more evident in the second year, for similar grades in both sexes. In the course of the fourth grade, this effect is not so important; however the percentage of women passed exceeds that of men. The perception by students of both subjects, both in its development and the type of evaluation has been very positive in both cases, relating almost linearly, the perception of the subject with the grades obtained.*

### 1. Introduction

The new context of the European Higher Education Area (EHEA) has been an important and constantly evolving change in the educational field. Now, it aims to train students not only in specific competencies that enable them to acquire knowledge, but also on general competencies that allow them to deal with the various situations they will face in their professional future. So currently aspects like oral and written communication are taught and trained, teamwork skills and the ability to construct knowledge, are taught and practised are. A change from repetitive learning to significant learning is proposed by an active process to help students to understand knowledge [1].

Based on the importance of high quality teaching in the teaching-learning process of students, assessment and all facets implies, is a good item to analyze the factors influencing in the teaching-learning process, in order to improve the global teaching process.

In the evaluation process there are three phases: first decide what is going to be evaluated (criteria, type of necessary information, collection mode information), second information (appropriate collection instruments) and finally collect, evaluate the information and decide based on established criteria and dissemination of results [2]. Continuous assessment is beneficial in student learning, being a good

method to learn the knowledge and abilities of students, and keep track of their learning path in order to help them in the learning process. Results show that with the use of objective assessment instruments and involvement of students in the assessment process, the gradual acquisition of competencies, both generic and is facilitated [3, 4, 5]. Another aspect to consider is the gradual incorporation of women into professional life both as a university, first as a student and later as a teacher. Studies on learning profile of the excellent university students show a preference for theoretical and reflective styles, women being more partners than men and they still often women, who achieve better results [6].

Although there are numerous studies that relate objectives and evaluation [2, 7, 8], the aim of this study goes a step further, to study the factors affecting the teaching-learning process from the point of view of the evaluation of technical subjects in the Degree in Building of the Polytechnic University of Madrid, in order to obtain the influence of these factors in the teaching-learning process depending on the grade and sex of the students.

## **2. Approach Work**

### **2.1 Study phases**

To achieve the objective of the present work, we have studied the factors involved in the teaching-learning process from the point of view of the evaluation, in two subjects for the same area of knowledge "Continuum Mechanics and Theory of Structures" in the Degree in Building of the Polytechnic University of Madrid. The subjects under study are complementary and are "Strength of materials and elasticity" second grade and "Structural Concrete" fourth grade, both with 6 credits ECTS.

The type of continuous assessment is similar in both subjects, as shown below:

- Partial tests, no minimum score, conducted throughout the semester, so that each test includes a different part of the subject.
- Practices class, homework, work group, etc., made throughout the semester.
- A global test conducted at the end of the semester. In this test of global character include all the issues of the course and is required a minimum grade of 3 over 10, in order to pass.

The factors affecting the teaching-learning process that will be analyzed in this work are:

- The student ability, relating the influence of knowledge with those who come to the course with the grades obtained.
- The perception of the subject by the student, which influences the learning outcomes achieved in the planning of the course, etc.
- The students' perceptions of the evaluation, which influences motivation, acceptance of the type of evaluation, feedback, etc.

All these factors will be studied at a general level, comparing between the two subjects and the sex of the students and relating to the grades obtained.

### **2.2 Data collection strategy**

To carry out this study, data from the subjects mentioned were compiled, based on the following documents:

- Qualifications obtained in the continuous evaluation at the end of the semester by several teachers for each subject, in their groups.
- Each participating teacher, distributed among his students a survey that was completed individually in class.

The survey was divided into three sections, allowing the collection of data regarding the following aspects: the convocation in which the basic and fundamental subjects for understanding and learning from each subject were approved as a determining factor in their ability to understand, valuation by students of the subject in different aspects: adaptation to the ECTS, specific objectives achieved in the subject, etc. and valuation of the assessments made as to whether it is appropriate or not to the subject, if it's any feedback, etc. All valuations were made on a scale of 1 to 5, as follows: 1- totally disagree; 5- totally agree.

## **3. Results and analysis**

Table 1 show in general terms data collected on students for this work. As can be seen, the number of women and men is similar in the course of the second year, but number of men is higher than women in the course of the fourth grade.

Courses	Subjects	Number of students			Perception by students	
		Total	Women	Men	Subjects	Assessment
2 <sup>nd</sup>	Strength of materials and elasticity	172	82	90	3,45	3,65
4 <sup>th</sup>	Structural Concrete	182	76	106	3,89	3,83

Table 1.- Data generals of the work.

Fig. 1 show the grades obtained in continuous assessment, in both subject and by sex. As can be seen, pass rates for continuous assessment is more than 75% in both subjects, being similar in men and women in the course of the second year, and increasing the percentage of women in the course of the fourth grade.

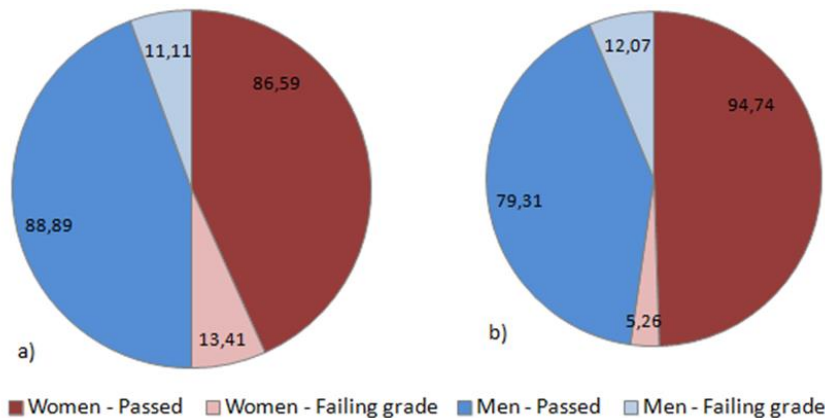


Fig. 1.- Qualifications obtained in continuous assessment by sex in "Strength of materials and elasticity" a) and "Structural Concrete" b).

Fig. 2 shows the relationship between students' grades and subjects considered base, which should be overcome before study the subjects under study. In both subjects clearly shown, how students who have approved 100% of course have a pass rate much higher than those without approved the considered base, regardless of the course and sex of the students.

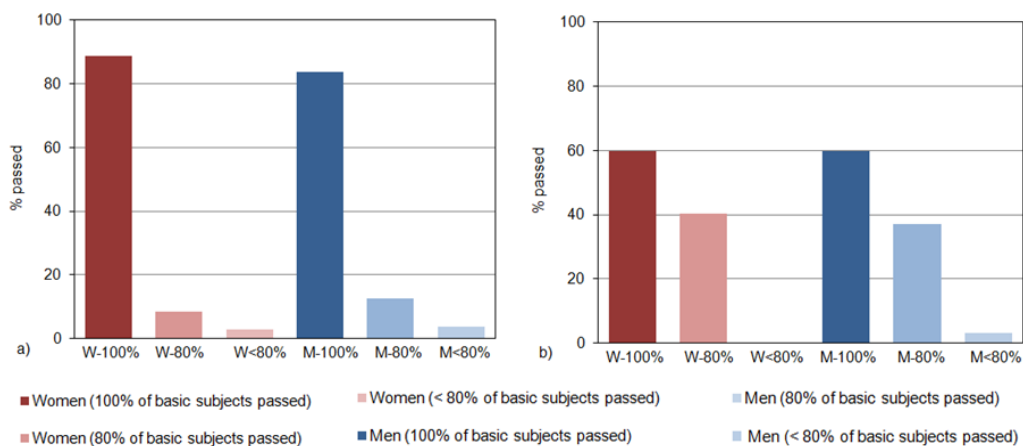


Fig. 2. Relationship between the percentage of passing students and subjects previously approved based on the subjects "Strength of materials and elasticity" a) and "Structural Concrete" b)

The perception of students on the subject and evaluation are shown in Fig. 3 and Fig. 4. The items adopted to assess the perceptions of students on the subject are their perceptions regarding the relationship employee time comparison to funds that have subjects, the learning outcomes achieved, the practices in class level of motivation, learning support, feedback, using the moodle virtual platform, the usefulness of work group, in terms of information search, work group and oral presentation and support gained through conferences by companies. Figure 3 shows that in both subjects perception is very good, being very similar in both men and women and in both subjects.

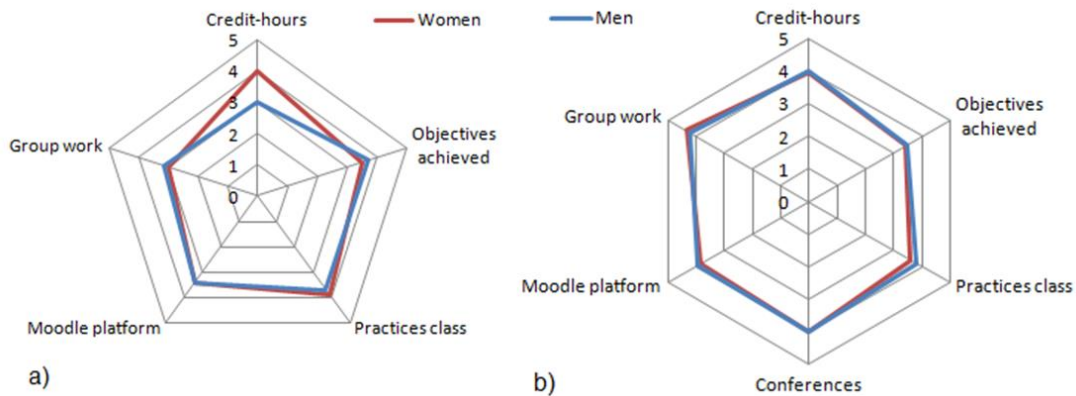


Fig. 3. Perception of students in the subjects "Strength of materials and elasticity" a) and "Structural Concrete" b)

In Fig. 4 was used as items, the students' assessment on the type of evaluation, the benefits that the type of assessment has on learning, motivation and detecting weaknesses and the relationship between grades and the acquired knowledge and efforts made. Valuations in both subjects are high and similar by sex, accepting better the best type of assessment in the subject fourth.

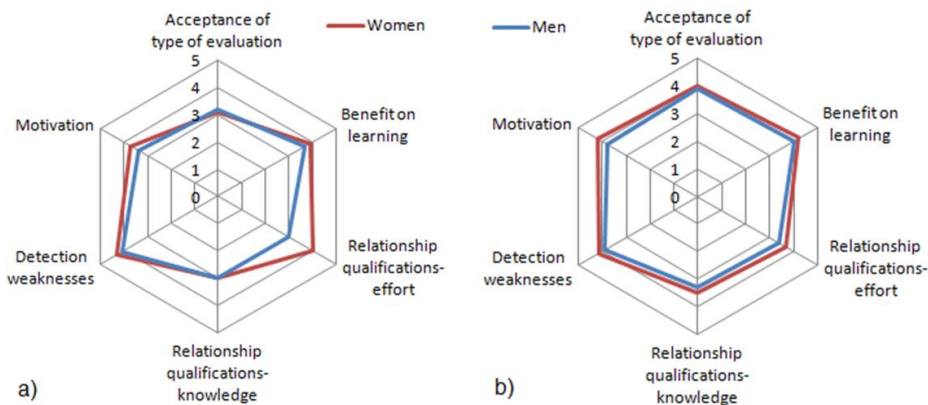


Fig. 4. Perception of students of the evaluation. "Strength of materials and elasticity" a) and "Structural Concrete" b)

Fig. 5 shows that in the subject of the fourth year, there is a direct relationship between the perception of the subject and the grades, making it essential student's perception and acceptance of the teaching process in the results. The results are surprisingly by sex equal. In the subject of the second year, the relationship is not linear, although students with better perception of the subject are those who have achieved it.

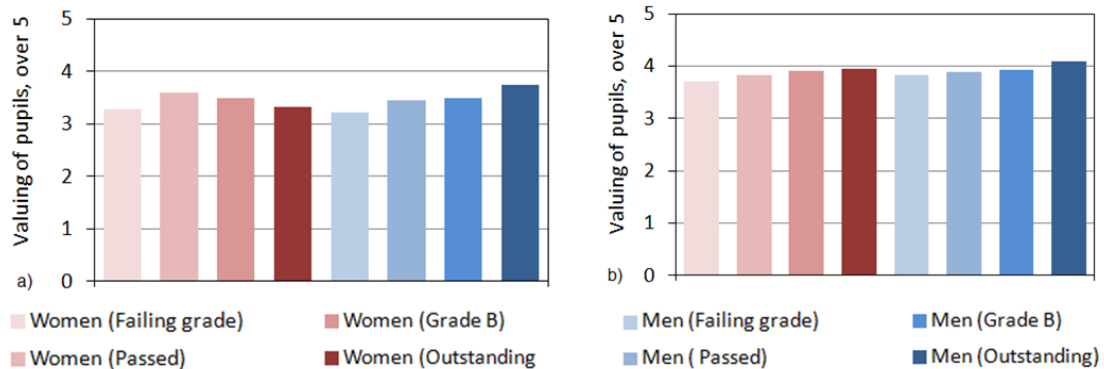


Fig. 5. Relationship between the grades obtained by the students and their perception of the subject "Strength of materials and elasticity" a) and "Structural Concrete" b)

Fig. 6 shows the relationship completely linear in the subject of the fourth year, between the perception of the evaluation and grades obtained for both women and men. In the subject of the second year, in the case of women, a better perception of the assessment course better grades, but in the case of men the relationship is not linear, since in students suspended or only have passed, the perception is similar.

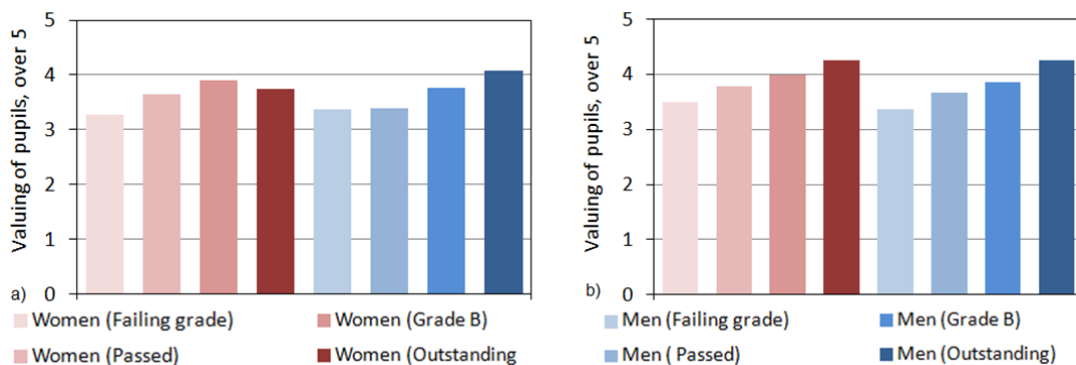


Fig. 6. Relationship between the grades obtained by the students and their perception of evaluation "Strength of materials and elasticity" a) and "Structural Concrete" b)

#### 4. Conclusions

From the analysis of the results, one can obtain the following conclusions:

- The intrinsic ability of the student and the base who come to the subjects, is a determining factor in the teaching-learning process, being more evident in the lower grades and subjects regardless of the sex of the students.
- The perception of the subjects by students is a crucial factor obtaining better results students with better perception of the subject. This effect has been more pronounced in the four year subject , where criteria are more mature.
- The perception of evaluation by students is linear with the grades obtained in both men and women, in both subjects obtaining a very high rating.
- The percentage of students who pass the course in the second year is similar in both sexes, while women have better pass rates in the course of the fourth grade.
- It is essential that the learning benefit assessment, fostering feedback, motivation and the compressibility by students in their own learning.
- The knowledge basis of students, their perception of the subject that affects their motivation, evaluation understood as feedback and teacher-student relationship is the foundation of good teaching-learning process.

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