The Improvement of the Engineering Education Analysis of a Case Study related to an Inquiry about Students' Perception

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Abstract **- The required promotion of periodic adaptations and improvements in the Higher Education Institutions demands the deepened knowledge of how students reflect, experience and evaluate their educational environment. Therefore, this study intends to describe, on one hand, the way Civil Engineering students of the Instituto Superior Técnico (IST) appraise their teachers and disciplines of the mentioned Course, what kind of concerns and expectations do they have relating to their future, while professionals of Civil Engineering and, on the other hand, what aspects would they like to see enhanced. Study results indicate that, despite students being satisfied with the different aspects of the Course, important and challenging questions are raised, regarding the excessive theoretical component of the academic curriculum. Students reveal themselves concerned about not having the accurate tools for dealing with the uncertain and competitive future, as Civil Engineering professionals.**

Index Terms - Civil Engineering, Expectations, Higher education, Satisfaction, Students' perceptions of teaching

INTRODUCTION

The Instituto Superior Técnico (IST) and particularly the Group of Hydraulics Disciplines have, as main purpose, to offer students the appropriate knowledge and the necessary tools to the suitable exercise, in a near future, of the Civil Engineer's professional activity. As known, the future is always shifting in direction of greater levels of challenge. To cope with such reality, Higher Education Institutions have the need to periodically promote adaptations and improvements that can assure the maintenance of good teaching quality standards [1]. In order to achieve this purpose, it is essential to acquire the knowledge of how students perceive, reflect and evaluate their educational environment, namely their teachers' performance [1].

In order to better understand student's perceptions and assure the improvement of teaching in Civil Engineering Courses of the Instituto Superior Técnico, a study was designed by the Secção de Hidráulica e Recursos Hídricos e Ambientais. This study, developed in three different evaluation moments, intends to deepen the knowledge of how these students appraise their teachers and disciplines of the mentioned Course, what kind of concerns and expectations do they have relating to their future and what aspects they would like to see improved.

The main results obtained from this study, which are divided in two different assessment dimensions - the global evaluation regarding Civil Engineering Course disciplines and more specifically, the evaluation of the Group of Hydraulics Disciplines - are presented in this paper.

METHODOLOGY

Participants. Even though the results of the two previous evaluation moments have been obtained in a thorough and consistent method, it is important to highlight that any investigation of this sort should be undertaken with a random obtained sample of participants or including all the students' population in question. In this specific case of analysis, the sample should enclose all the third, fourth and fifth years students of the Civil Engineering's Course of IST. Having this in mind, this third evaluation moment tried to guarantee this particular aspect, using a more appropriate and representative sampling technique, which would allow assembling inferences, based on the obtained results that could embody all the students' population.

Of a population of almost 300 Civil Engineering students in the IST, 204 participated in this study, from which 48% belonged to the third year, 45.6% to the fourth and 6.4% to the last year. The inquired subjects age varied between 20 and 29 years (M = 21.80; SD = 1.68). "Male" was the predominant sexual category present (68.6%). In majority, the participants have, in one hand, chosen as first option while applying for a Higher Education Institute, the Civil Engineering Course (91.7%) and, in the other hand, didn't have the need to change residence due to the entrance in the referred course (52.9%). Moreover, they take in average 34 minutes (SD = 21,4) to daily arrive to the IST campus.

Procedure. To evaluate the students' perception concerning the Civil Engineering Course disciplines and,

specifically, those of the Hydraulics' Group, an inquiry was prepared, under the form of a structured questionnaire. The questionnaires were delivered to each year class representatives of the Course, which were made responsible for its accurate distribution to all the remaining students.

The sample in study in this paper corresponds to those students that filled out the questionnaires; hence this is not a random sample and therefore representativeness guarantees on the obtained results cannot be assured.

The data analysis was carried out using the statistical program SPSS (version 13.0 for Windows). The analysis of the obtained results was made using the statistical tests considered more suitable [2].

RESULTS

Civil Engineering Course disciplines Global evaluation: Several indicators were taken into consideration on the evaluation of students' perception relating to the Civil Engineering Course disciplines. Those indicators were: the students' expectations and attitudes concerning the Course, commitment and identification levels with the Course and, satisfaction level presented regarding the teaching quality in general.

This study allowed reaching the main following conclusions:

- **Expectations**: According to the inquired students, the Civil Engineering Course is running as previously expected (M= 3,50; SD= 0,78).
- **Attitude**: Students have a quite positive attitude towards all Course aspects, considering it as useful, advantageous and pleasurable (M=3,74; SD= 0,67);
- **Identification**: Inquired students hold a high identification level with this Course (M= 3,83; SD= 0,71), seeing their belonging to it as truly important.
- **Teaching quality**: The characteristics that students consider more admirable in a professor are, in one hand, the "ability of plain subjects exposition" (93,1%), and, on the other hand, the "aptitude to motivate and encourage students" (82,8%).
  Mainly, students are satisfied with their professors' characteristics (M= 3,31; SD= 0,43), however, they evaluate their "aptitude to motivate and encourage students" as being significantly lower, when compared to the other aspects in appraisal (M= 2,45; SD= 0,73) (Table I).
- **Disciplines quality**: Inquired students declare themselves satisfied with their disciplines' characteristics (M= 3; SD= 0,54), however they evaluate the "theoretical lessons" as being significantly worse relatively with the other aspects on assessment (M= 2,52; SD= 0,82) (Table II).

TABLE I
PROFESSORS CHARACTERISTICS IN EVALUATION

Characteristics	Mean	SD
Ability of plain subjects exposition	2,96	0,71
Aptitude to motivate and encourage students	2,45	0,73
Theoretical wisdom	4,04	0,68
Practical and Professional experience	3,61	0,79
Punctuality	3,62	0,82
To explain doubts	3,30	0,74
To explain doubts in the office	3,30	0,74
To explain doubts out of the classroom	3,16	0,76

TABLE II
DISCIPLINES CHARACTERISTICS IN EVALUATION

Characteristics	Mean	SD
Organization	3,08	0,78
Study elements	3,12	0,83
Theoretical lessons	2,52	0,82
Practical lessons	3,42	0,72
Use of technology adapted to the needs	2,86	0,90
System of evaluation	2,99	0,87

Group of Hydraulics Disciplines evaluation: Several indicators were taken into consideration on the evaluation of students' perception relating to the Hydraulics disciplines. Those indicators were: students' expectations and attitudes concerning these particularly disciplines and the satisfaction level presented towards teaching quality and classes content.

This study allowed achieving the main following conclusions:

- **Expectations**: According to the inquired students, the Hydraulics disciplines are running as previously expected (M= 3,07; SD= 0,8).
- **Attitude**: Students hold a positive attitude towards the Hydraulics disciplines aspects, considering them as useful, advantageous, and pleasurable (M=3,09; SD= 0,76). On average, students consider the frequency of these disciplines as significant for a good future performance while professionals of Civil Engineering (M=3,18; SD= 0,77).
- **Teaching quality**: Students are generally satisfied with the characteristics of their Hydraulics disciplines' professors (M= 3,52; SD= 0,58). Nevertheless, they evaluate their "aptitude to motivate and encourage students" as being significantly lower in comparison with the other aspects in appraisal (M= 3,17; SD= 0,87) (Table III).
  Moreover, the data analysis demonstrated that the satisfaction level showed regarding the Hydraulics disciplines' professors is significantly superior, compared to the level observed in the evaluation of the Course professors in general (t (186)= 6,1; p<0,001).

TABLE III
HYDRAULICS PROFESSORS CHARACTERISTICS IN EVALUATION

Characteristics	Mean	SD
Ability of plain subjects exposition	3,40	0,78
Aptitude to motivate and encourage students	3,17	0,87
Theoretical wisdom	4,04	0,71
Practical and Professional experience	3,63	0,82
Punctuality	3,73	0,83
To explain doubts	3,61	0,85
To explain doubts in the office	3,32	0,87
To explain doubts out of the classroom	3,29	0,87

- **Disciplines quality**: Those inquired, on average, consider themselves as having a medium preparation to comprehend the content of the Hydraulics disciplines. Even so, they perceive their preparation in the area of "application of knowledge of computer science for resolution of problems" as significantly lower (M= 2,55; SD= 1,03), in comparison with the other aspects in assessment (Table IV).

When evaluating the Hydraulics disciplines' characteristics, students in general, present an average level of satisfaction with the presented aspects (M= 3,24; SD= 0,54). However, the satisfaction levels towards "the use of technology adapted to the needs" (M=2,97; SD= 0,79) and the "system of evaluation" (M= 3,14; SD= 0,97) are significantly inferior, in comparison with the other aspects in evaluation (Table V).

Furthermore, the data analysis demonstrated that, the satisfaction level showed regarding the Hydraulics disciplines is significantly superior, by comparision, with the level verified in the evaluation of the other Course disciplines in general (t (191)= - 6,66; p<0,001).

TABLE IV
CONTENT OF HYDRAULICS DISCIPLINES IN EVALUATION

Characteristics	Mean	SD
Course of general preparation	3,06	0,57
Absorption of theoretical concepts	3,08	0,72
Differential equations	2,94	0,89
Integral calculation	3,32	0,77
Algebra	3,28	0,77
Application of knowledge of computer science for resolution of problems	2,55	1,03
Other aspects	3,22	0,68

TABLE V
HYDRAULICS DISCIPLINES CHARACTERISTICS IN EVALUATION

Characteristics	Mean	SD
Organization	3,34	0,78
Study elements	3,45	0,90
Theoretical lessons	3,22	1,05
Practical lessons	3,51	0,94
Use of technology adapted to the needs	2,97	0,79
System of evaluation	3,14	0,97

Improvement of the Hydraulics disciplines' procedures: Students' suggestions. The main suggestion given by the inquired students points out the need of increasing the practical component of the Hydraulics disciplines, either by the conception of theoretical-practical lessons, instead of theoretical and practical ones, or by a higher number of practical demonstrations of the theoretical concepts. Thus, students are concerned that the excessive theoretical component of the academic curriculum will not give them, in the future, the accurate tools for dealing with the uncertain and competitive labour market, as professionals of Civil Engineering.

CONCLUSIONS

The results' analysis of the evaluated dimensions in this study show that the inquired students appraise in a positive way the general aspects of the Civil Engineering Course of the Instituto Superior Técnico (IST).

Students hold positive attitudes and expectations towards their Course and, specifically, to the Hydraulics disciplines, considering that, on one hand, they are running as previously expected and, on the other hand, that its frequency is essential for a good future performance, as professionals of Civil Engineering.

Students are mainly satisfied with their professors' characteristics. Nonetheless, they evaluate their ability to motivate and encourage students as being significantly lower, comparing to the other aspects appraised. Given that the presented characteristic is one of the most appreciated by students in their professors' performance, it possibly represents a problematic aspect that could be responsible for the lack of motivation or students' frustration, and consequentely, for the weak performance in the disciplines in question.

This aspect can be overcome by promoting internal trainings directed to all university professors, which should underline that their mission consists of more than the subjects' exposition, but primarily to motivate students' interest in the areas in study, to stir up the spontaneous research and promoting the discussion and the creative development in classroom context.

On average, inquired students proclaim to be satisfied with their disciplines' characteristics. Nevertheless, they consider the "theoretical lessons" of the Course as being less satisfying, compared with the remaining aspects in assessment. This aspect can be surpassed by a higher investment on the Course's practical component, promoted through a higher number of theoretical concepts' practical demonstrations and/or through the establishment of theoretical-practical lessons, instead of theoretical and practical ones.

In conclusion, the results obtained in this third evaluation moment, validate those in the two previous moments: students are satisfied, in a general way, with their Course and, specifically with their Hydraulics disciplines.

Finally, it is assumed that, although the results have been taken under a consistent form of sample method, these study results cannot be generalized to all the Instituto Superior Técnico (IST) Civil Engineering students.

ACKNOWLEDGMENT

The authors are grateful for the commitment and generous contribution of all the Civil Engineering students involved in this study, especially to the class representatives, which were responsible for the hard work of assuring questionnaire response. They would also like to thank the Secção de Hidráulica e Recursos Hídricos e Ambientais of the Instituto Superior Técnico, for this important initiative in deeply understanding student's perceptions in order to improve the teaching quality in Civil Engineering Courses.

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