

ISSUES OF LEARNING PROCESS IN ENGINEERING EDUCATION

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Abstract

Higher Education in Albania has been subject to dramatic changes, especially in the last decade. Part of this reform is also the Polytechnic University of Tirana. Debates on the implementation of programs, harmonization and professionalization of education were very intense. However they lack in a unified reflection on teaching methodology and its application. This paper deals with the hypothesis that good knowledge of the difficulties faced by students during the learning process helps to improve teaching methods closer to the students' interests and transforms the concept of school by making it more useful and more competitive from the professional viewpoint. The study was conducted in Faculty of Electrical Engineering at the Polytechnic University of Tirana. The results of study are based on two sources: student questionnaires, and class observations. The reason of using these sources was to understand better the difficulties that students encounter while learning scientific knowledge. Data analysis has been pointed out the importance of knowing difficulties faced by students while learning scientific knowledge and the teacher's role through didactic means or instructions in terms of their consistency. The paper has aim to show how the students perceive learning science by providing good insights into the scope and substance of didactic for future professionals who would survive in the world change of technology which is considered as rapid. This information is important for anyone teaching at any level of education and helps the pedagogues to adopt their teaching methods in accordance with the students' needs.

Keywords: *learning process, student, teaching methods.*

Introduction

Polytechnic University of Tirana (PUT) is the oldest Technical University and the only of its kind in Albania. It may be considered that PUT represents the whole Albanian Engineering Higher Education. PUT is composed of seven faculties: Faculty of Civil Engineering, Faculty of Electrical Engineering, Faculty of Mechanical Engineering, Faculty of Information Technology, Faculty of Mathematical Engineering and Physical Engineering, Faculty of Geology/Mining, Faculty of Architecture and Urban Planning, the Research Institute of Geosciences and Energy, Water and Environment (UPT, 2013).

PUT's main tasks are highly professional education of specialists, postgraduate qualifications, training of young scientists and conducting scientific research activities in different engineering fields.

PUT is the first public Higher Education Institution in Albania that has begun the accreditation process since academic year 2011-2012. The accreditation process is a powerful instrument in directing the education of engineers and over the longer term, the capacity of the engineering profession (Byrne, 2010). The first step during the accreditation process was the internal evaluation. The internal evaluation was done based on Albanian state standards and Declaration of Barcelona (EESD, 2004) which outlined how universities and engineering educators need to change;

'to prepare future professionals who should be able to use their expertise not only in a scientific or technological context, but equally for broader social, political and environmental needs. This is not simply a matter of adding another layer to the technical aspects of education, but rather addressing the whole educational process in a more holistic way, by considering how the student will interact with others in his or her professional life, directly or indirectly. Engineering has responded to the needs of society and without a doubt, today's society requires a new kind of engineers.'

The Declaration of Barcelona (EESD, 2004) also made a radical call for universities to *'redirect the teaching-learning process in order to become real change agents who are capable of making significant contributions by creating a new model for society.'*

The internal evaluation was done keeping in mind this call of Declaration of Barcelona, for a period of five academic years 2007 -2008 up to 2011-2012, in order to have a full picture of Bologna process implementation based on SWOT method (Strengths, Weaknesses, Opportunities, Threats) aiming to improve our work in near future (FEE, 2012).

During the internal evaluation process at the Faculty of Electrical Engineering (FEE), one of the indicators that were evaluated was the passing rate of the students of bachelor degree and master degree. It is seen that this indicator was low for the bachelor degree students. The total passing rate for three years of study during academic year 2007-2008 was 83.6%, for academic year 2008-2009 was 54.4%, 2009-2010 was 56%, 2010-2011 was 57.5% and academic year 2011-2012 was 52.98%. This indicator was higher for the students of Master Degree. It changes from 65%-75%. It is important to emphasize that the students at Faculty of Electrical Engineering come from secondary school with high average weight mark 8.3.

The reason why this study was undertaken was to investigate the difficulties faced by students and to understand the challenges they encounter while learning/teaching scientific knowledge. The analysis of students' perceptions on the teaching process would help in identifying and finding ways to overcome some of these difficulties. The hypotheses which

will be discussed in the paper are handling and overcoming the difficulties faced by students during the knowledge acquisition process requires that teaching is based on their needs.

Methodology of Research

The study was conducted at the Faculty of Electrical Engineering of Polytechnic University of Tirana. The research methods used were questionnaires analysis, formal discussions and interviews. In order to get an idea on the changes disclosed by the sample, it was paid attention to the following features: the level of study program and gender. The sample included 64 students of whom 48 were males and 18 were females. This proportion clearly demonstrates that male students are more numerous in number at this Faculty. Furthermore, keeping in mind low passed rate at bachelor study cycle the majority of students were in the bachelor level, 49 students, and only 15 were in the Master of Science study cycle. This questionnaires' distribution was done in order to reflect the actual distribution of students at both levels which is in the ratio 6:1. The purpose of this selection was to obtain a wider generalization of the results and, in some cases, their comparison.

Regarding interviews, they were conducted with 10 teachers from Faculty of Electrical Engineering aged over 30 and who had no less than 5 five years of work experience in the higher education. Furthermore they agreed to take part in this study and in this case the quality of the opinions was more important than the number of people being interviewed.

The questionnaires' analysis show that two phenomena may have affected data collection: First, the fact that reflection on teaching/learning activities through questionnaires is a new practice for the Albanian students. Second, they are suspicious about the impact that their opinion will have in changing situation of their results.

Instruments

A questionnaire was administered in January 2012 and consisted of following questions: it seeks to provide answers to the following fundamental questions: (1) what are the difficulties that they encounter in the learning process at University? (2) What are the knowledge gaps? (3) In what way the academic staff is helping them? (4) What about their motivation? (5) What do they like more to learn? (6) What would be the best methods to educating engineering students?

The questionnaire was drafted with the help of Questionnaire Design, module 8 (Siniscalco, 2005). It consisted of closed-ended questions which took into consideration the interests and requirements that students demonstrate in receiving professional training at the university. Questions were prepared in relation to students' interests and requests towards school education, difficulties that they faced in acquisition of knowledge, their needs and changes they would welcome in order to school education to be closer to their interests and needs as future engineers.

A structured interview was conducted with 10 university science teachers in order to reflect in the questionnaires even the problems raised by them. The purpose was to later enable us to compare data between the two groups of participants. The interview focused mainly on the methods they use in the classroom, their teaching aids, and the workshops and trainings they have recently attended. They were also asked to express their opinions on students' motivation and preparation in respect to the knowledge given to them.

Findings and Discussions

Regarding the question about the choice of Faculty of Electrical Engineering, more than half of the students, 57.8%, had willingly chose majors in engineering, 40.63% did not answer this question, while only 1.56% think they are there by chance. The question about what it means for them to learn science in school most of them 79.69%, answered that it meant learning knowledge and concepts to use in professional work, 18.75% think that the general scientific knowledge plays an important role in their professional training. A part of the students 17.81% stated that they expected from schools to equip them with research methods that are important in further professional work,

Regarding the question about difficulties in obtaining scientific knowledge, a significant number (65.63%) responded positively. More than half of the students, 53.13%, think that their difficulties derive from high school.

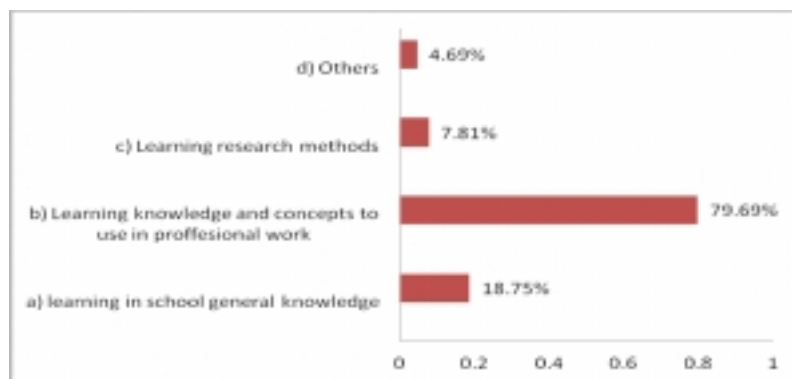


Fig.1 What do expect students to learn in school?

The reasons for these difficulties they consider:

- ✓ The use of inappropriate methods of teaching, especially in science subjects such as physics, mathematics and computer science.
- ✓ Lack of practice and consolidation of knowledge.
- ✓ Low level of teaching especially in science subjects.
- ✓ Inadequate work with students of different levels.
- ✓ Low foreign language proficiency.
- ✓ Students do not work independently.

Students at Faculty of Electrical Engineering come from different regions of the country where the level of teaching and the textbooks are different (Spahiu, 2012).

The lack of correlation between concepts, for 50% of them, continues even in higher education. Among the difficulties they run into when learning concepts, they also rank the application of a theoretical approach to knowledge, the low number of practical tasks they perform, the lack of rooms and laboratories as well as lack of facilities for conducting experiments. Furthermore, they experience difficulties even in understanding the science materials provided to them in English because not all students have a satisfactory level in mastering this language.

The indicators related to students' perceptions about teaching have been summarized in the following figure.

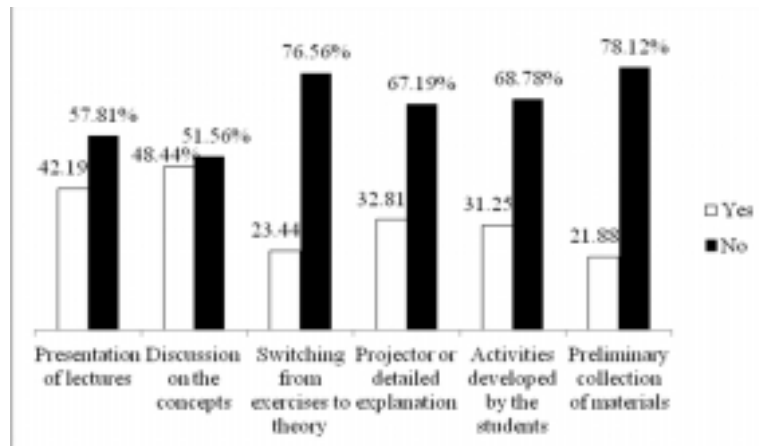


Fig.2 Students' perceptions on the teaching process

As it can be seen from the figure 2, students manifest resistance to changing their attitudes towards teaching. So, only 42.19% of students agree with the presentation of summarized lecture and then make independent work and browse as much literature about the topics of lecture. 57.81% of students require a more detailed explanation of the lecture. 48.44% of students agree to discuss the concepts presented in lecture, as a way to get a deeper and better understanding and to raise questions about the problematic review. While 51.56% of them think that it is better to hear the lecture prepared by the teacher without discussion on the various issues addressed on it.

It is interesting another finding of the questioner the students like more traditional way of lecturing. Most of students 67.19% did not agree with the use of Audiovisual tools to deliver knowledge. Students believe that they understand and acquire knowledge more easily when the professor writes formulas or draws figures in the blackboard than when he/she explains through a PowerPoint presentation. During different consultations made with students, it is seen that students raise more questions for lectures developed through PowerPoint presentations compared with lectures explained on the board. This information would help the teacher to observe and reflect on the way he/she imparts knowledge to the student.

Another indicator about student's perception was the ratio between the exercises solved by teacher and students. 31.25% of students think that they have better understanding solving the exercises by themselves. It is easier for the students when the lecture materials are provided by the professor. Thus, only 21.88% of students think that is effective and helpful collecting materials for a specific topic by themselves and then discuss them in class moderated by the professor.

All these figures clearly reflect the old way of getting knowledge from high school and Albanian school in general, which does not promote active and independent learning for students.

The last question about the reasons of their knowledge gaps, 32.18% of students did not answer. The main issues raised by most of students (67.82%) who answered this question, are:

1. Teaching methods
2. Inability to perceive the relation between different modules.
3. They are no longer active in seminars, the seminars are not organized in the form of discussion.
4. Lack of facilities and funds for conducting experiments.

5. The large number of students creates difficulties for the teacher and students to discuss about the different topics covered in the lectures, especially for bachelor level.
6. Lessons focus sometimes simply on imparting knowledge but not properly handling the engineering concepts that are essential to the students.
7. Different levels of students because not all of them have vocational education.

Since the teachers' perceptions play a very important role in changing the young people's perceptions the involvement of science teachers in this study provided a new approach of study object. The teachers' interview was focused primarily on the methods they use in the classroom, teaching tools, their opinion on Higher Education Reform, their professional and didactic qualifications and their opinion about the level of students and their motivation for learning.

Regarding teaching methods they say that the presentation of lectures in most cases is done in the form of the presentation and less, 20%, in the form of discussions, questions or verification of a hypothesis or encouraging students to solve exercises by themselves. The main tools that they use are books, written lectures, Power Point presentation, but also electronic resources where students can directly consult the materials mostly in English language, mainly in the Master of Science level, 80%. About their scientific qualification they point out that efforts are more individual than institutional. The only way that has helped to shape their research has been participating in national and international scientific conferences.

The teachers think the reforms carried out in higher education are necessary, but their implementation will take time. There are continuously happening changes in secondary school education and these require constant changes in higher education programs in order to coordinate the dissemination of knowledge and to ensure compliance of programs from year to year. They feel overwhelmed due to these changes, the teaching load, the design of new materials etc.

The teachers acknowledge that the main obstacles to the students' knowledge acquisition are "significant gaps in the fields of science and language". It is observed that the main deficiency is related to the learning techniques which rely on reproducing facts. The teachers say: "the students are not used to assimilating theory" and "the students demonstrate the lack in analysis and discussion of the practical' work they perform". They have also noticed that students coming from vocational schools possess more practical skills than those who come from general high schools. This is what assists them in gaining knowledge more easily.

Conclusions

The analysis of students' difficulties shows that they feel unprepared to solve the problems they might encounter in the professional life. That is why redefining teaching/learning in order to develop a set of disciplinary and communicative competences would enhance their trust to face the real world. Consequently, the approach towards knowledge would be more elaborate, more diverse and more beneficial to the students.

Student's resistance to change shows that traditional methodological skills in science learning are strongly entrenched in them. Moving from a learning model to another can not be achieved immediately, or without taking the students as the subject or object of this process. For this reason, the development of dialogue and interaction between the teachers and students would enable the latter to acquire knowledge more easily and effectively. On the other hand it would encourage teachers to reflect on their teaching practices in order to select and use more efficient models.

The growth of communication between universities regionally, nationally and beyond would influence a better understanding of various practices in the field of teaching/learning as well as in their correction or experimentation.

Well-trained young people in sciences directly contribute to a productive and competitive economy. Therefore, the quality of school's training directly affects how they will integrate into the professional life and contribute to the society in general.

Based on the results of the internal evaluation and the presented study during academic year 2011-2012 was reviewed the bachelor degree curriculum in FEE with goal to increase the ability of students to apply their knowledge and understanding to analyze engineering products, processes and methods; the ability to select and use appropriate equipment, tools and methods; an understanding of applicable techniques and methods, and of their limitations.

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