

EVALUATION OF TECHNICAL UNIVERSITIES TEACHERS AND STUDENTS' EDUCATIONAL NEEDS – CURRICULUM PERSPECTIVE AND CASE STUDY

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Abstract

In a knowledge-based society, human capital is the source of competitive advantage. Learning is a process that transcends work, home or school. Learning is also critical to our ability to adapt and compete, especially in the digital economy/society. From this perspective, learning becomes the key to productivity, competitiveness and prosperity. The paper is aimed to analyze the possibility of improving the curriculum framework design and implementation in technical universities in order to revise and adapt appropriately the educational goals and objectives to the labor market's requirements and to create a mechanism and adequate instruments for learning opportunities extension. The case study is focused on a research carried out in 8 Romanian technical universities, partners in a national project co-financed by European social funds, for improving the university's curricula in mathematics and for developing new educational programs according to the qualifications system. The paper presents the conclusions of the initial study developed as a concrete investigation of teachers and students' opinions regarding the educational needs expressed as specific topics in questionnaires, referring to: the use of mathematics in technical universities (status, curriculum complexity and applicability etc.), teaching methods for increasing the attractiveness of mathematics for students, ways and means for improving the quality of teaching – learning process, key competencies valued by the employers in real-life situations etc.

Keywords: educational needs, curriculum framework, technical universities, mathematics curriculum, educational programs.

In a knowledge-based society, human capital is the source of competitive advantage. Learning is a process that transcends work, at home or school, essential to our personal development. Learning is also critical to our ability to adapt and compete, especially in the digital economy. Learning is the key to productivity, competitiveness and prosperity.

Today, technological innovations in informatics and telecommunications are once more revolutionizing capacity to store, transmit, access, and use information. The accelerated pace of technological development has made access to knowledge a crucial requirement for participation in the global economy. The impact of new information and communication technologies

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(ICT) has significantly changed the speed of production, use, and distribution of knowledge. A country's capacity to take advantage of the knowledge economy therefore depends on how quickly it can adjust its capacity to generate and share knowledge.

Such a society, which is called also an "Lifelong learning or E-Learning Society" needs well-prepared human resources, creative and rationale based, able to act independently and autonomously, to anticipate and lead the changes in any domain of social or economic life.

According to the lifelong learning society's challenges, an adequate approach to educational system in order to prepare the graduates for market work insertion have to pay attention to the specific strategies of career planning and management, especially for the graduates in their first year of professional employment.

Universities, among other educations institutions, assumed to play this major role of preparing the students/graduates for the labor markets requirements, taking into consideration not only the academic performance and expertise, but also the social, relations and entrepreneurial skills. From this perspective, the assessment of educational needs of the main actors involved in the process – teacher and student, is very important in order to pay attention of the trends, interests, motivation and needs expressed by them.

This paper is aimed to analyze the possibility of improving the curriculum framework design and implementation in technical universities in order to revise and adapt appropriately the educational goals and objectives to the labor market's requirements and to create a mechanism and adequate instruments for learning opportunities extension.

The case study is focused on a research carried out in 2009-2010, in 8 Romanian technical universities, partners in a national project co-financed by European social funds, for improving the university' curricula in mathematics and for developing new educational programs according to the qualifications system. The project is called *The teachers and students training in using the modern teaching-learning and evaluation instruments for mathematics* and involved technical universities from Alba Iulia, Cluj, Bucharest, Pitesti, Galati, Iasi, and Timisoara.

The paper presents the conclusions of the initial study based on which the mathematics curricula will be adapt in a inter- and cross-curricula approach developed in order to make the teachers and students more aware of their needs and interests, closely related to the labor market's requirements.

The study was developed as a concrete investigation of teachers and students' opinions regarding the educational needs expressed as specific topics in questionnaires, referring to: the use of mathematics in technical universities (status, curriculum complexity and applicability etc.), teaching methods for increasing the attractiveness of mathematics for students, ways and means for improving the quality of teaching – learning process, key

competencies valued by the employers in real-life situations etc. As investigation's instruments, specific questionnaires for teachers and students have been developed and administered at the universities-partners level.

We need to mention that our intention wasn't to have a representative sample of teachers and students. Consequently, the samples were designed for this intern goal of the projects, base on the variable defined, such as: teachers – academic position, gender, years of employment; students – specialization, year of study, awards get in mathematics' competitions etc. The total number of university's teachers' participants, from professors to assistants, was 127, and 84 students, distributed as follows:

Teachers:

- 30% female and 70% male;
- 65 professors and associated professors (first category of analysis) and 62 lecturers and assistants (the second category of analysis);
- 27% teachers – over 25 years of employment in university, 6% – between 0 to 5 years;
- the most frequent specializations: mathematics (63%), engineering sciences (28%), informatics (6%), and physics (3%);
- the number of subjects taught in these 4 specializations is 101!

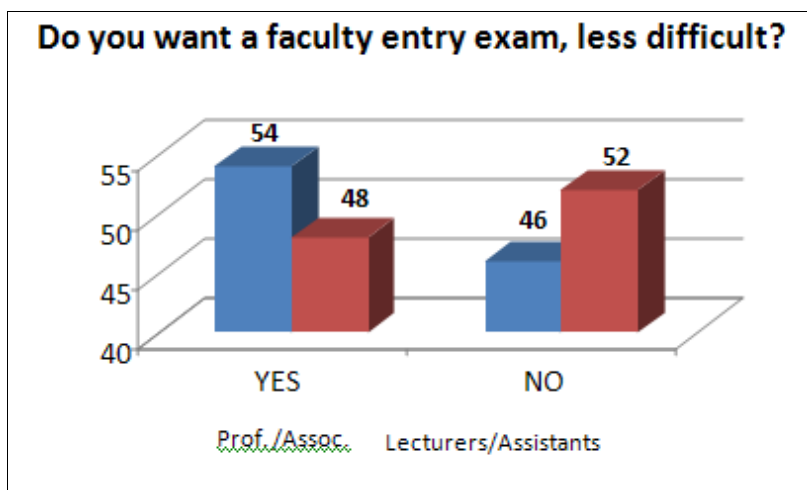
Students:

- 33 female and 51 men, from all years of study;
- 119 awards/mentions in competitions, 37 at national level and 82 at the international level;
- 20 gold medals winners in international competitions, out of 119;

Taking into consideration this structure of each target group, the questionnaires' data analysis pointed out the following aspects, which will be detailed in several items below.

The teachers' questionnaire

The first questionnaire's item investigated the teachers' opinions referred to the reduction of the discrepancy between the level of difficulty in upper secondary education level (lyceum) and the first year of faculty, perceived by the majority of students as being demanding and difficult in terms of learning tasks and practical work/projects. One solution proposed was the introduction of entry exam at the faculty level, internally administered and evaluated. The results of this item are presented in the next histogram.

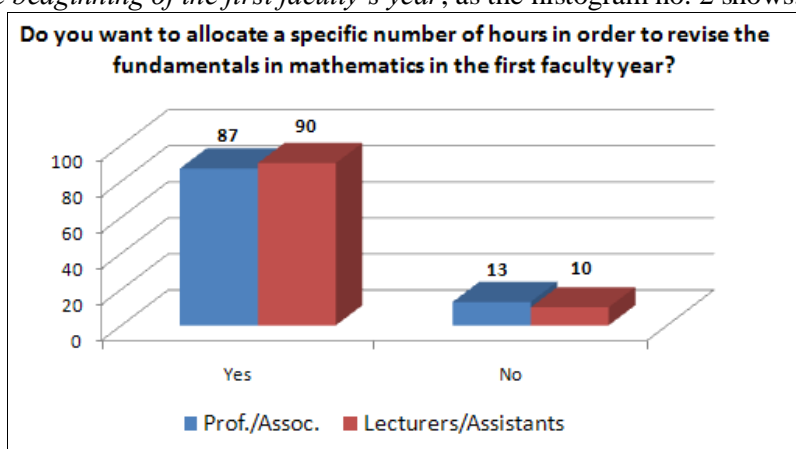


Histogram no.1. *Item Answers' distribution*

It is interesting to notice that those two categories of university teachers (professors and associated professors, on the one hand, and lecturers and assistants, on the other hand) are on the contrary positions in a comparable percent (54% and 52%) referring to the proposal of introduce an entry exam, less difficult (first category's demand) or more difficult (second category's vote)!

The next item proposed *testing the mathematics specific aptitudes*, and both categories of teachers agreed as a more valuable solution for reducing the discrepancy we mentioned above.

The teachers also agreed referring to *the possibility/need of allocating a number of teaching hours for revising the fundamentals in mathematics, at the beginning of the first faculty's year*, as the histogram no. 2 shows:



Histogram no.2: *Item answers' distribution*

The questionnaire's items no.3 and no.4 are closely correlated. These require from respondents their opinions and assessment regarding different aspects specific to *teaching activities*, respectively, to *practical/seminar activities*. The answers's synthesis is presented below:

- *teaching activities*

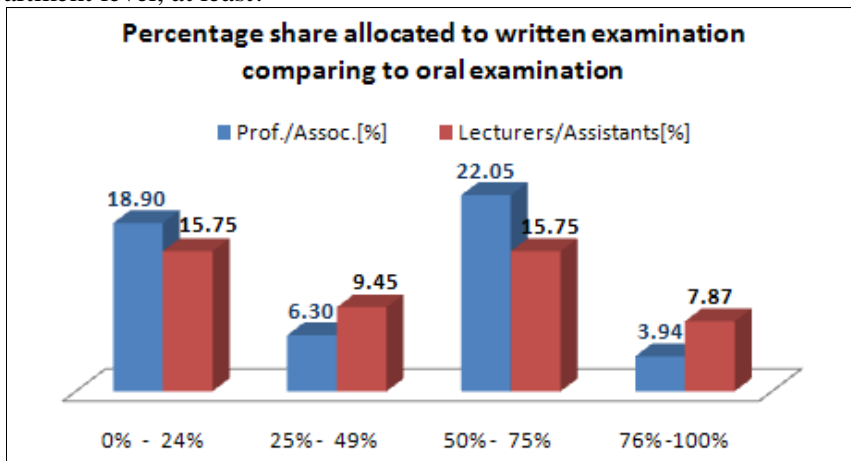
- *concerning the concepts' evolution, scientific presentation of great mathematicians lives* – 50% professors and associated professors and 47% lecturers and assistants consider that these topics need revision and reduction of time allocation;

- *group's activities and homework* – similar as above mentioned percentage consider that these activities need reduction of time allocation!

- *group's activities/tasks in final students' examinations* – the majority of respondents consider that these activities are not significant/relevant in final examinations, generating difficulties in term of individual performance measurement;

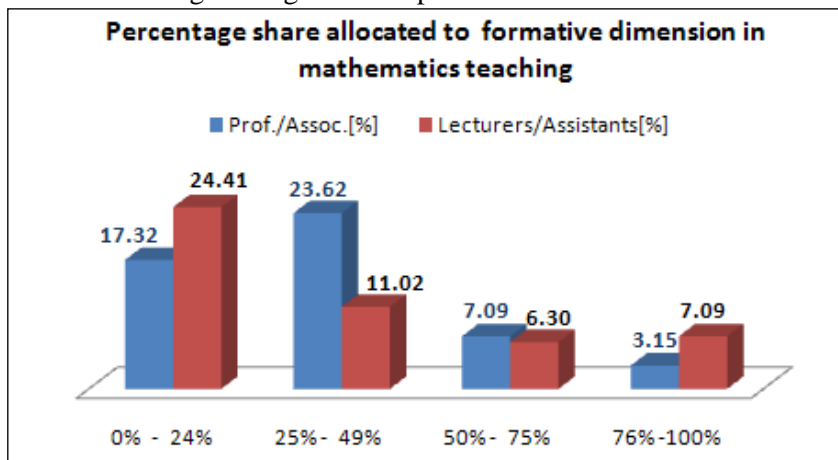
- *theoretical aspects included in final and periodical students' examinations* - the majority of respondents consider that theoretical items have to remain under 50% allocation in tests!

- *written examination comparing with oral examination* – respondents' opinions are divided into different intervals, as next histogram shows: the same teachers agree to allocate an increased percentage to written examination in balance with the oral examination, but there is another significant number of teachers expressing a contrary opinion. This could be an evidence of the lack of unity and coherence in teachers perceptions of the role and use of those two types of examinations (written and oral) in educational process! They need common goals and work in designing and applying common tasks, projects etc. in teaching and evaluation situation, at the department level, at least!



Histogram no.3. Item answers' distribution

-the formative dimension in mathematics teaching – the professors and associated professors granted a bigger percentage in favor of critical thinking and rationaments’ development, models’ presentations etc. Lecturers and assitants (24,4%) consider that formative dimension in teaching activities mentains at a low level (0-24%), practical/seminar activities being more focused on kind of students’ tasks able to develop mathematical thinking at a high level of performance.



Histogram no.4. *Item answers’ distribution*

-the aspects concerning *computer’s technology and Internet use* obtained relative similar low procentage of allocation in teaching activities (0-24%), the majority of teachers considering that computer and internet are both intruments to use more in documentation and research for study, but not during the courses effectively.

- *practical/seminar activities* – the aspects analyzed above have been assessed and correlated adequatly from the practical activities’s perspective, as well.

- *Group activities/homework*: 52% of teachers consider these activities useful and valuable, with a frequency of 25-49% in seminar activities. Although, the development of team work competency is one of the key-competencies relevant on the labor market, it is not enough practiced through the course and seminar activities. This is correlated to the *low frequencies allocated to group activities in students’ final examinations* (67% of teachers are very much in favor of maintaining low levels for these activities!). Obviously, not paying enough attention to this team work competency, which influences the relationship dimension of students’ personalities, neither in course or seminar activities, nor in evaluation process, the medium and long term effects are not longer hidden. Giving up to the „team” as an educational concept in favor of transmitting information

and knowledge, without any know-how and concern for developing relationships, the educational goals are only half achieved, or maybe less.

- Moreover, using or not group activities influences the methodological and pedagogical approach, which could be prioritized in favor of *formative dimension of learning, modern strategies in teaching-learning and evaluation process* etc. All these competencies are very clearly defined in universities' curriculum framework and are stipulated in graduate's profile of competencies, but there are less evidences leading to the idea of genuine development of them by today teaching activities.

- Not only the team work concept is not appropriately integrated in university educational activities, but also *the use of Internet in stimulating students' research keep a low profile in teachers options*, no matter they are very experienced (professors) or beginners (assistants) in teaching career. A majority of 78% of respondents consider that computer and internet use in classroom's applications and research is not priority in the economy of a course or seminar activities (0-24% allocation out of 100%).

The students' questionnaire

On the other hand, *students' opinions* regarding *the ways/methods which could increase the attractiveness of mathematics at university's level*, the answers point out the following aspects to pay attention to:

- 35% of respondents want more real examples from daily life integrated into course's content;
- 23% of respondents consider interdisciplinarity through homework and team teaching as a valuable solution;
- 35% of respondents answered that an interactive teaching and evaluation style could help;
- 7% of respondents suggest the use of less technical details in specific content.

It is relevant for our analyse that implementation of at least *two key-aspects mentioned above would lead immediately to more interesting, usefull, and attractive courses for students*, such as: (i) *the contents' increasing pragmatism/applicability, doing teaching closely related to real life*; (ii) *interactivity expresed not only in methodological approach, but also in evaluation process*, which becomes this way, more transparent and effective. There is no doubt that, if the educational activities would be focused more on these two dimensions, the quality and performance of teaching-learning-evaluation process would increase significantly.

Another item of student's questionnaire explores their opinions about introducing of a serious admission exam/entrance exam, which includes a special exam in mathematics. 87% of respondents answered in favor of this issue, giving as frequent argument, among others, a better selection of students, which improve certainly the quality of education, and would offer

the possibility to set up special training groups in mathematics in order to achieve high performance and excellence!

Moreover, studying engineering in technical universities includes important skills in mathematics. Consequently, an entrance exam with maths among other selection's subjects, would influence positively the in-training performance during faculty and help students to keep the pace in teaching-learning activities.

Conclusions

In order to sum up all these ideas mentioned above, related to evaluation of technical universities teachers and students' educational needs in studying/using mathematics for adapting the specific curriculum to the labor market requirements, there are some critical starting questions which need an immediate answer:

- How could technical universities to match their most important educational goals, academic performance and research' values with the real trends of the labor market, with interests, skills and competencies required by the employers?

- Are the teachers' personality, values, teaching and evaluation's styles adapted, critical and flexible enough to estimate the change and lead the students to achieve those educational goals that the system intend to develop in terms of competencies, values, interests, attitudes?

This contemporary society is so complex and dynamic that the change and movements are key-concepts the people face with increasingly. From this perspective, the study presented in this paper is only an attempt to analyze the multiple problems and issues regarding to the relationship between educational system's goals and labor market's trends and requirements.

Regardless the pedagogy we use, to be a student means to do something, namely to carry out ordinary activities suggested/controlled or on the contrary. The teaching strategies, less stereotype, are those to force the student: to be curious, to ask questions and formulate hypotheses; to participate to the (re)construction of education environment; to follow his/her own way without needed to do what the others do, assuming the freedom of expression and initiative; to become a character in a common project; to contribute to a common activity; to listen, negotiate and cooperate; to ensure a transparent climate in the communication process between the school and the family etc. As we already mentioned, the student's ability to think strategically and effectively is a critical aspect of the process of moving ahead during the faculty or adjusting to a new job, for instance.

We consider all issues presented above as valuable starting points for future developments and analysis in order to contribute to the improvement

of educational programs' quality, including those dedicated to revising the mathematics curricula for technical universities.

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