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COLLEGE STUDENTS ATTITUDE TOWARDS ENGINEERING PROFESSION, INNOVATION IN MATHEMATICS EDUCATION AND MATHEMATICAL MODELING

Tanja Sekulić*
Technical College of Applied Sciences
Zrenjanin, Serbia

Smiljana Mirkov
Technical College of Applied Sciences
Zrenjanin, Serbia

Marija Matotek
Technical College of Applied Sciences,
Zrenjanin, Serbia

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Abstract

Observiations and analyzes of the interest and motivation of students to active participation in education process, led to the data which confirmed increase of number of students who expressed interest for the innovation of education process and teaching methods. The paper presents results of research conducted at the Technical College of Applied Sciences in Zrenjanin. The case study was the impact of innovations in the educational process through modernization of teaching methods to increase in popularity and interest in the engineering profession. The results related to student's interest for teaching process, and their proposals for improvement of it, were analyzed and compared. Impact of teaching process innovation to the students attitude towards the engineering profession and their future employment as engineers was specially analyzed. Part of the study deals with the comparison of the attitudes of students whose mathematics lectures were conducted using the method of mathematical modeling, and students who attended classes using traditional teaching methods.

Keywords: Innovations, improvements of teaching process, mathematical modeling, engineering profession.

INTRODUCTION

Considering the current status of the engineering profession and the education of engineers, leads us to the conclusion that it is urgent to work for its improvement. In order to overcome the current situation in society and in the economy, it is necessary to initiate the development holders – engineers. That consideres the return of the former status to the engineering profession and to increasement of the young people motivation for this profession.

This paper presents the research conducted with students of the Technical College of Applied Sciences in Zrenjanin, and it refers to the impact of the introduction of innovations in education process. Survey data focused on the innovation of teaching process and students' attitudes towards the impact of them on their professional orientation were compared and analyzed.

First section of the paper gives a detailed overview and description of the survey, as well as the structure of the questions that the students had to answer during the interview.

The second section is an analysis of the obtained results with special emphasis on the attitude of students towards their future profession and engineering innovations.

In the third section were compared attitudes of students who attended classes using mathematical modeling with those students whose mathematics classes were conducted through traditional teaching methods.

DESCRIPTION OF THE RESEARCH

Speed of life and progress of technical and technological development inevitably place new demands on all people of all professions, and especially on the educational system that has yet to give birth to new professionals and holders of the future development of human society.

Engineering education today has many new challenges, because engineers are always the ones who are bringing innovations and were pillar of development of any society. Therefore, management of the engineering education must be efficient, innovative and in accordance with the requirements of the time in which we live.

Although the level of technical and technological development of modern society is calling for professionals - engineers, this profession in recent years, in the scale of professions that young people are fond of, and which are popular, ranks very low. The reasons for such attitude can be found in a very unfavorable economic situation, which imposes the belief that higher education is not necessarily a prerequisite for success in their future profession. Also, a very important factor is the duration and severity of studies, particularly those related to the engineering profession. Prospective students are therefore turning to occupations for which the learning process is much shorter and also regarding the complexity and the difficulty of study - far simpler.

Taking into account this situation, it is bound to raise

* tanja.sekulic@vts-zr.edu.rs

questions about the attitudes of future engineers towards their profession. When it comes to the engineering profession, it is understood that this is a profession which requires a man ready to constantly innovate its work developing new and better solutions ... Also, it is important to identify all aspects which encourage engineers to improve their attitudes towards the engineering profession, and the possible impact of the education on the formation of such a position.

A survey conducted with students of the Technical College of Applied Sciences in Zrenjanin was aimed to find out what students think about the process of their education and what they consider to be changed, and how, in order to encourage by themselves a positive attitude towards their profession and tendency towards the introduction of innovations.

In addition to standard questions, the survey had given students the opportunity to write some of their own observations and suggestions which could lead to more effective teaching methods and contribute to more effective achievement of the objectives of their education.

Questions in the survey were directly related to the attitude of students towards mathematics education and its importance for their future education and profession, but with one special point - the introduction of innovations in the learning process through the implementation of contents related to real-life examples and practices. Survey actually represents the final part of the research carried out with students from the Technical College of Applied Sciences in Zrenjanin, and is related to the application of mathematical modeling in mathematics. The aim of the research was to present to the future engineers through teaching as much content from the real life and practice, in order to encourage them that one day, as independent engineers, move towards further development and study in their profession, and eventually to new discoveries.

ANALYSIS OF THE RESEARCH RESULTS

Hereinafter will be shown some of the relevant data and the conclusions which were obtained through a survey.

The teaching of mathematics is illustrated with a sufficient number of examples from real life.

On the question of whether the teaching of mathematics is illustrated by a sufficient number of examples from real life, the students gave the following answers, which are shown in Figure 2.1.:

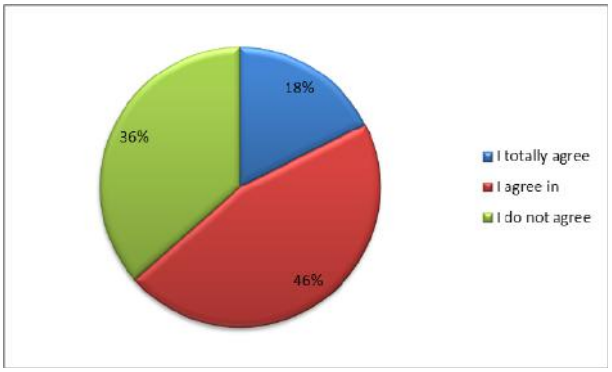

Figure 2.1.: *The presence of illustrative examples in mathematics education*

It may be noted that only 18% of students totally agreed with the statement that mathematics education is ilustrated with a sufficient number of real examples from practice, which suggests that most students actually expect more such examples, in order to get them to spread their horizons and greater mastery of the application of theoretical knowledge into practice.

Referring to real examples would have a positive impact on the understanding of mathematical concepts.

Very interesting data were obtained by analyzing the students' responses to the question of whether the reference to real examples would have impact on the better understanding of mathematical contents. The results are shown in Figure 2.2.:

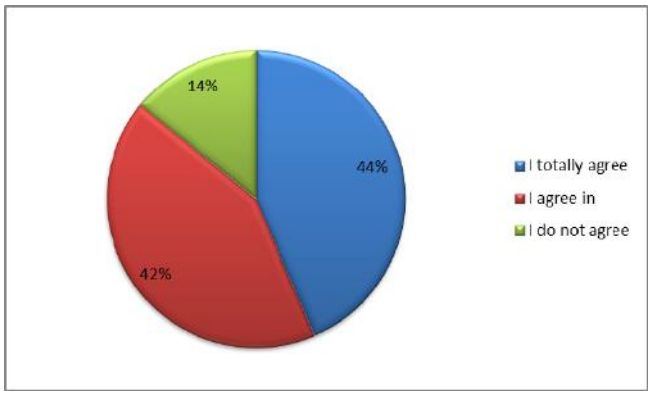

Figure 2.2.: *Impact of real examples to concepts understanding*

The results undoubtedly show that students recognized the positive impact of real examples on the better understanding and adoption of mathematical contents.

Visual examples have positive impact on your understanding of the mathematical contents.

The research included investigation of the influence of visual examples to understanding of mathematical contents. In particular, effects of visual examples on the students creation of the concept image and concept definition were observed. The results confirmed that visual examples enhance creation of better mathematical concepts which later leads to their successful implementation. Figure 2.3. shows the results related to the impact of visual examples.

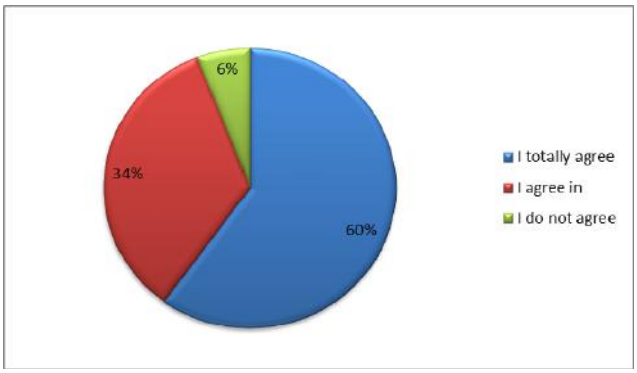

Figure 2.3.: *Effects of visual examples to concepts understanding*

Examples (graphics, animations, simulations) would have a positive effect on your understanding of mathematics.

New principles of mathematics education are based on the implementation of new techniques and technologies. Thus, for example, insists on more frequent use of computers in teaching and describing content using animations and simulations. Recent research shows that the application of these methods in classes are directly related to a better understanding of the contents and its application in practice. The results of the survey confirmed the expectations.

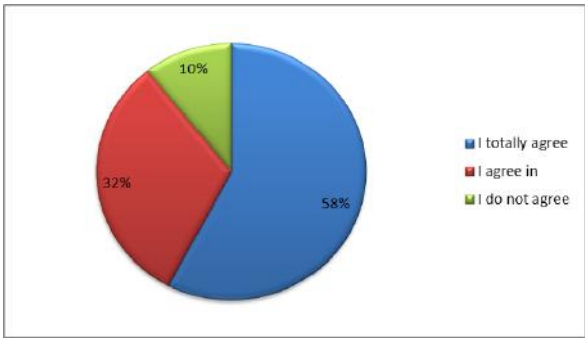

Figure 2.4.: *Computers, animations and simulations and contents understanding*

The Figure 2.4. shows that 90% of students in more or less opted for teaching empowered by computers, animation and simulations, and to justify such attitudes, students alleged that such a method of teaching motivated them to deepen their knowledge but also inspired them to apply the acquired knowledge in practice.

Active teaching and creativity in mathematics teaching contribute to your greater interest in mathematics as a science and its application.

Mathematics is characterized by students as a science which is difficult and as the science which application can not be seen in real life. Research offered students real examples, visualization, animation and learning mathematics through simulation. Asked, whether such a method of teaching encourages their interest in mathematics, the results were extremely positive. Results are given in Figure 2.5.:

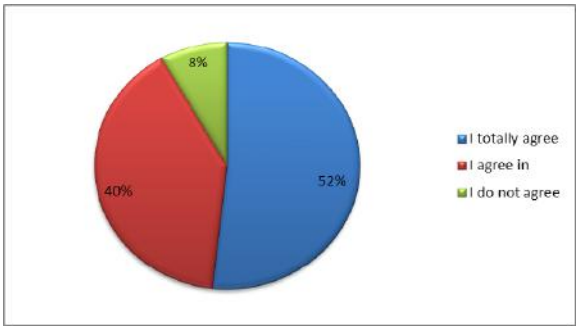

Figure 2.5.: *Active learning, creativity and interest in the teaching of mathematics and its application*

Although the conducted survey was related to innovations in mathematics education, there's no doubt that this type of teaching can be applied to a wide variety of cases, especially in technological and technical field which is rich in real examples from practice. Students positive reactions have only confirmed the good side of this approach.

The organization of teaching process in order to encourage students to work independently and to draw conclusions, is an essential prerequisite for obtaining properties of good engineers. Such organization enables the improvement of the educational process objectives towards production of engineers who will not only use their knowledge, but who will improve it life long, and use it as a source of future innovation.

COMPARISON OF THE STUDENTS ATTITUDES CONCERNING MATHEMATICAL MODELING

The mathematical model is a mapping between reality and mathematics. The purpose of the mathematical model is reflected in drawing conclusions about reality based on the model. The crucial thing for any mathematical model is that it has to lead to something, meaning that mathematical model is the basis for drawing conclusions about reality which can then be tested experimentally.

Mathematical modeling is the concept about which researches are still leading very lively debate. This term has a very different interpretation, and because of its importance and application in the mathematics education, it is suggested that these interpretations join together, in order to make a starting point for any researcher.

The central point in mathematics education should be creation of students ability to apply mathematics in a variety of situations in real life.

Mathematical modeling is connected to one of the main goals of education, which is related to the understanding of real-world phenomena and their connection with mathematics. In any case, the use of mathematical modeling in mathematics education is inevitable if we are to fulfill the ultimate goal - to train students to recognize the real-world situations where different mathematical theories can be applied.

Taking into account the basic principles of mathematical modeling, it was important to determine the degree of this teaching method affection onto students' attitudes towards mathematics and engineering profession as their future career.

Hereafter are presented and commented results of comparison between students who attended mathematics classes where were used teaching methods based on mathematical modeling with those of students who had been tought using clasical teaching methods

The teaching of mathematics is illustrated with a sufficient number of examples from real life.

Comparing the responses that students gave to the question whether the teaching of mathematics is illustrated with a sufficient number of examples from real life, and taking into account the teaching methods used in teaching process, the following results were obtained and shown in Figure 3.1:

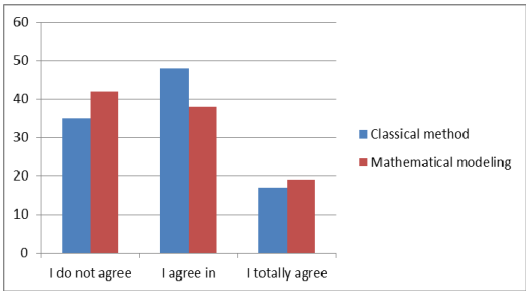

Figure 3.1.: *The presence of illustrative examples in mathematics education*

Students who attended mathematics classes where mathematical modeling was used, are determined in their attitude that mathematics is illustrated by a sufficient number of interesting and colorful examples. These results are expected since the method of mathematical modeling is very illustrative and includes real examples so students easily spotted it's advantage, in mathematics and in particular, the engineering profession.

Referring to real examples would have a positive impact on the understanding of mathematical concepts.

Figure 3.2. summarizes comparisons of students' attitudes regarding the positive impact of real examples to mathematical concepts understanding.

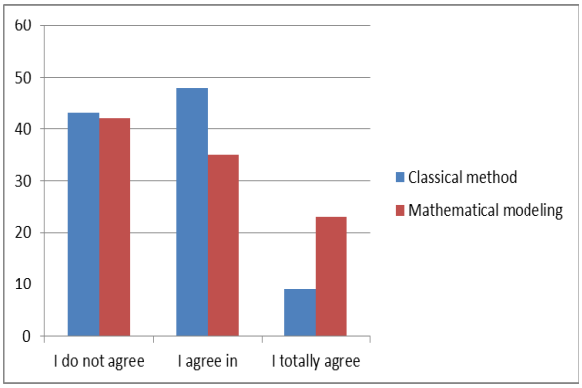

Figure 3.2.: *Impact of real examples to concepts understanding*

Here is also noticeable that the students who had contact with the mathematical modeling recognized it's positive influence because more of them agree with the claiming above.

Visual examples have positive impact on your understanding of the mathematical contents.

Discussing and comparing students' attitudes regarding the positive impact of visual examples shown Figure 3.3. it can be concluded that the differences in attitudes are less than in the previous two questions. These results may be interpreted by students impressions about visual examples, because students have not seen them as real examples from everyday life, and therefore they do not attach any particular significance to them. Visual examples are equally present in the traditional learning and therefore we have equalized students' attitudes on this issue.

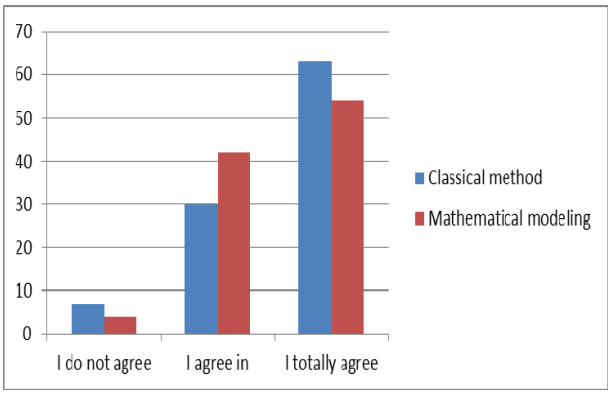

Figure 3.3.: *Effects of visual examples to concepts understanding*

Examples (graphics, animations, simulations) would have a positive effect on your understanding of mathematics.

Simulation and animation are the key part of mathematical modeling. Over 70% of students who were tought mathematics using the method of mathematical modeling are fully agreed with the statement that the examples in the form of animation and simulation have a positive impact on their understanding of mathematics, Figure 3.4.:

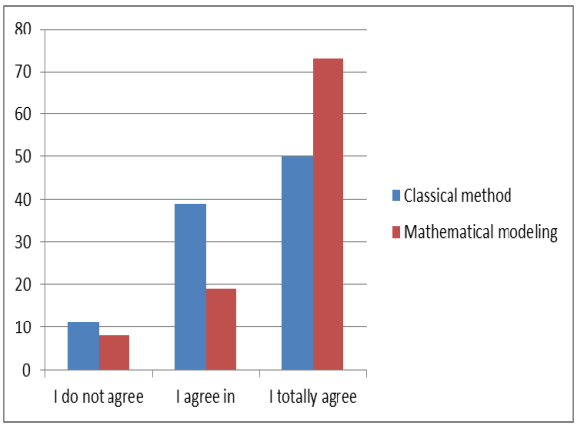

Figure 3.4.: *Computers, animations and simulations and contents understanding*

The students who were tought mathematics by conventional methods of teaching evidentely have the contrary opinions than their colleagues. Lack of animations and simulations in teaching process make for these students impossible to look at mathematics from a different perspective, especially the one connected to real life. Therefore, they can not apply their knowledge in practice, and that is counterproductive for future engineers.

Active teaching and creativity in mathematics teaching contribute to your greater interest in mathematics as a science and its application.

This question was posed to students not only to examine their attitudes towards mathematics, but also to the engineering profession. Comparing the results given in Figure 3.5. it can be seen that students who worked with mathematical modeling are far more open to applying the acquired knowledge into practice, which is particularly important for future engineers.

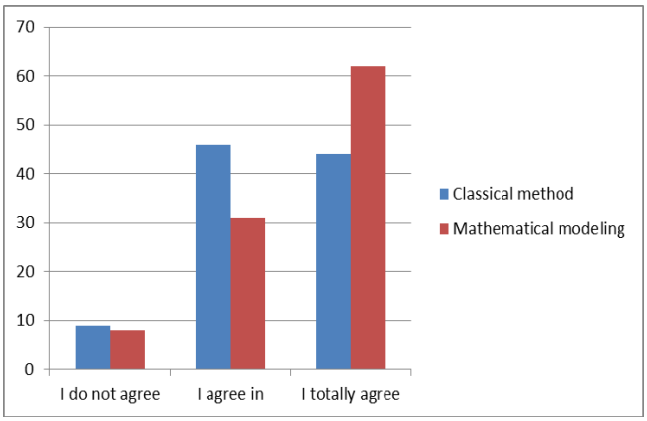

Figure 3.5.: *Active learning, creativity and interest in the teaching of mathematics and its application*

All the results undoubtedly indicate that it is necessary to innovate teaching methods at all levels of education, especially taking in mind the ultimate goal that we want to achieve: to provide students with knowledge that is broadly applicable, and especially that is applicable in practice and real life.

CONCLUSION

We live in the time when of all members of society is required to be prepared, educated and innovative. To give people an opportunity to acquire such qualities and to live in pace with their time, it is necessary to work on themselves, their education and advancement in their profession.

On the education is to bear the burden of training and to increase the knowledge of people and on the engineers is to improve life in all spheres of society through innovation and development. Improving the educational process and educational institutions can implement innovation at all level of education of future professionals, and that will inevitably lead to the main goal - the return of the engineering profession to the place it should occupy, and that is the bearer of human society.

On the example of the research conducted with students of the Technical College of Applied Sciences in Zrenjanin, it can be concluded that the interest for progress in the engineering profession and the peoples pursuit for innovation does not disappear, but it just needs to be adjusted to the current demands of the educational process and to keeps pace with technical - technological developments.

Only in this way, motivation for the engineering profession by young people can be encouraged and their willingness for pushing the boundaries of science and its application to a higher level can be achieved.

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