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TECHNICAL FACULTY
"MIHAJLO PUPIN"
ZRENJANIN**



ITROCONFERENCE¹²

INFORMATION TECHNOLOGY AND EDUCATION DEVELOPMENT



ITROCONFERENCE¹²

INFORMATION TECHNOLOGY AND EDUCATION DEVELOPMENT



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ZRENJANIN, November 2021



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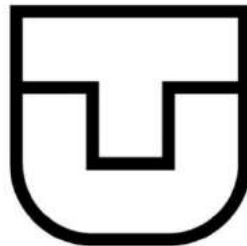
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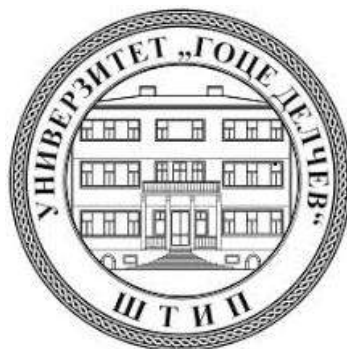


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With this publication, the CD with all papers from the International Conference on Information Technology and Development of Education, ITRO 2020 is also published.

INTRODUCTION

This Proceedings of papers consists from full papers from the International conference "Information technology and development of education" - ITRO 2021, that was held at the Technical Faculty "Mihajlo Pupin" in Zrenjanin on November 26th 2021.

The International conference on Information technology and development of education has had a goal to contribute to the development of education in Serbia and the Region, as well as, to gather experts from natural and technical sciences' teaching fields.

The expected scientific-skilled analysis of the accomplishment in the field of the contemporary information and communication technologies, as well as analysis of state, needs and tendencies in education all around the world and in our country has been realized.

The authors and the participants of the Conference have dealt with the following thematic areas:

- Education in crisis situations
- Educational challenges
- Theoretic and methodology questions of contemporary pedagogy
- Digital didactics of media
- Modern communication in teaching
- Curriculum of contemporary teaching
- E-learning
- Education management
- Methodic questions of natural and technical sciences subject teaching
- Information and communication technologies

All submitted papers have been reviewed by at least two independent members of the Science Committee. There were total of 94 authors that took part at the Conference from 12 countries, 3 continents: 52 from the Republic of Serbia and 42 from foreign countries such as: Macedonia, Bosnia and Herzegovina, Hungary, Slovakia, India, Bulgaria, Rumania, Albania, USA, Canada, Malaysia. They were presented 49 scientific papers.

The papers presented at the Conference and published in Proceedings can be useful for teachers while learning and teaching in the fields of informatics, technics and other teaching subjects and activities. Contribution to the science and teaching development in this Region and wider has been achieved in this way.

The ITRO Organizing Committee would like to thank the authors of papers, reviewers and participants in the Conference who have contributed to its tradition and successful realization.

Chairman of the Organizing Committee
Snežana Jokić, Ph.D, Ass. Professor

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Case Study: Which Math Topics Students Have a Problem with when They Start University Studying

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Abstract - After graduating from high school, many high school students decide to continue their studies. The decision of what they want to be and what they will study is made by some of them a long time ago, but for some there is hesitation until the last moment. Due to some reasons, there are some of them who decide to continue their education at the technical faculty, even though they have problems with the topics they have learned in mathematics subjects. It happens to almost every new generation of students. That led us to research to find a solution and change that practice. In this paper, a questionnaire has been prepared for students in first study year from technical faculties with questions with which we want to see which mathematical topics students have the most problems with, i.e., facing difficulties in solving tasks. Research results are given by statistical analysis. Then, a conclusion from the results is drawn. Finally, in the end of the paper, a possible solution for the identified problematic topics is stated.

I. INTRODUCTION

Technical faculties are a good choice for students. Many of the graduate's students of those faculties in a very short time find work and profit with their knowledge. But studying at a technical college cannot be considered an easy and simple obligation. By the end of high school, the students themselves already know which subjects are their favorite and which are not, which are easier to master and for which they need a lot of time and commitment. It is very important for the choice of faculty to study but also for the remaining period of life in which one must profit from the profession. But it also happens for different reasons: lack of financial means to study at a university in a city other than the hometown, lack of company, i.e., the other acquaintances did not enroll in that faculty, etc. In that way, under the influence of some factors, the future students decide, realize it and thus encounter other problems.

All the above affects the results achieved by students in colloquia and exams in the subjects they take in the current semester. Realizing the situation primarily for the difficulties in mastering the material in mathematics subjects taught by students at technical colleges, we decided to do research that wants to determine which previously studied topics

are difficult and incomprehensible to students. With the research we also want to determine the reasons for those difficulties that occur in students to find a solution, and to determine the reasons for those difficulties that occur in students to find a solution to eradicate them. It is important to do all this because mathematics is associated with many sciences. Without mathematical knowledge, we cannot explain some complex physical and natural phenomena, and cannot solve some more complex problems of everyday life. For that, students must learn at least mathematics at university level (low-level mathematics aimed for all university students, no matter on which faculty the students are). Paper [2] is aimed at data analysis of student's outcomes for the subject mathematics at university level. The results obtained from the overall testing is processed with statistical data analysis.

Methods used for learning such as: visual learning, verbal, physical, logical, and so on are also important to apply when studying some mathematical topics. In [1] authors want to see how and how many of the learning methods as: visual learning, aural, verbal, physical, logical, social, and personal learning are used in the study of computer science subjects [1]. All these methods are important because each one is good in its own way and has a big impact on the student, because it uses different parts of the brain.

Testing the knowledge of students at technical faculties is an interesting and intriguing research topic. In [3] authors analyze the impact of the knowledge acquired from the previous mathematical education in correlation with knowledge gained from lectures and exercises in Mathematics. Analysis was based on a test. Testing was conducted on students of technical faculties. One part of these students was tested with electronic tests, and the other part were tested on classical way. In the end of their research, they see that both ways i.e. classical and electronic diverge each other and we cannot precisely define what results are less reliable. Researchers in [7]

comparing the knowledge of students in the subject Calculus 2 from two technical faculties (marked in the paper as technical faculty 1 and technical faculty 2) in two different academic years 2014/2015 and 2015/2016. In 2014/2015 academic year, teaching was implemented with classical method with blackboard and chalk. In 2015/2016 academic year, teaching was implemented as combination of classical method with using of mathematical software such as MatLab and Mathematica.

Some math topics like the theory of Fourier series is complicated but their application is simple. Matlab as program package is suitable for easily plotting trigonometric series and the most convenient way for understanding their characteristics. In [4] authors present a program written in Matlab that plot partial sums of three trigonometric series, as a way of finding periodic functions that series represent.

Explanation for solving problems in the field of mathematics, solved in the Matlab programming language are given in [5]. The goal in [5] is to show that Matlab is a user-friendly programming language easy to use. Commands are invoked in a very simple way with a simple syntax, where in comparison with other programming languages; they require detailed knowledge of the language itself.

Connection between the mathematical notions and using the computer as educational support at university level is very important. In [6] mathematical notions used in integral calculations will be explained with help of computer program. The notions, indefinite and definite integral, their calculations and their applications can be easily understand using the computer programs for their presentation. Images obtained with computer programs allows the students to better understand and learn integrals and give them appropriate training to use this knowledge for current real problems. The authors use mathematical package Mathematica, as computer program to help learning integral calculations.

II. RESEARCH METHODOLOGY

The research methodology consists of one test. The test contains 5 tasks and 5 questions, which are given below:

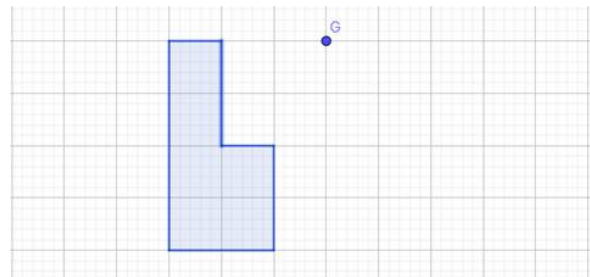
1. Draw the graphs of functions: $f(x)=\sin x$, $f(x)=\cos x$, $f(x)=\tan x$, $f(x)=\cot x$, $f(x)=\log_2 x$, $f(x)=2^x$, $f(x)=5$, $f(x)=x^2-6x+5$.

2. Calculate
$$\frac{\frac{4}{3} + \frac{1}{3} \cdot \left(-\frac{4}{5}\right) - 1}{\frac{3}{2} + \frac{1}{2} \cdot \left(-\frac{5}{6}\right) - 2}$$

3. Solve the system of equations with at least two methods
$$\begin{cases} 2x + 5y = 3 \\ -3x + 2y = 1 \end{cases}$$

4. The base of a straight prism is a triangle with sides 15 cm, 26 cm and 37 cm. Calculate the area and volume of the prism, if its height is 12 cm.

5. Translate the given figure for 3 squares on the right and 1 square down. Then rotate the resulting image at an angle of 90° counterclockwise around the point G.



6. Which topics in math were harder for you to master in high school?

7. Did you have a high grade in math subject in high school?

8. Did you want to teach math in high school?

9. Why your choice was a technical college?

10. Do you want to work by profession when you graduate from college?

Students took the test online through Microsoft Teams. They had one hour and thirty minutes to solve the tasks and answer the questions. The test was answered by groups of 25 students from the first school years of academic year 2020/2021, from University Goce Delcev Stip.

III. MAIN RESULTS

First, we will show the results for tasks. Results are given in Figure 1.

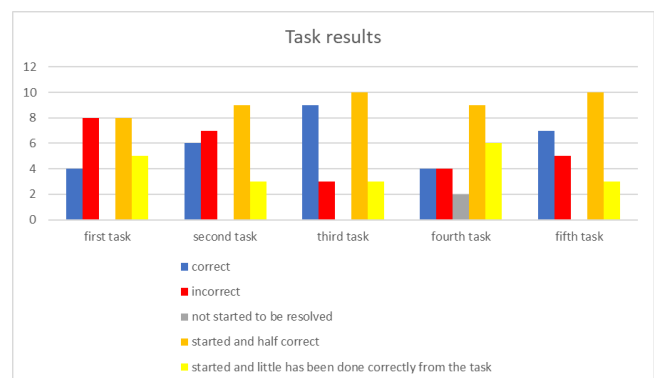


Figure 1. Task results

The blue column shows how many students correctly solved the appropriate task, the red how incorrectly, the gray how many did not start solving the task at all, the orange one started, and half correctly solved and the yellow one started but solved the task a little bit correctly. Figure 1. clearly shows that students have the most problem with the first and fourth task. For the third and the fifth we can see that they are not very problematic to solve, while for the second we can see that there is a few students who know and few that did not know how to solve it.

Statistical analysis of the results obtained from tasks are given in Figure 2 to Figure 6.

Statistics	
n	5
Mean	5
σ	2.9665
s	3.3166
Σx	25
Σx^2	169
Min	0
Q1	2
Median	5
Q3	8
Max	8

Figure 2. Statistical analysis of the results obtained for the first task

Statistics	
n	5
Mean	5
σ	3.1623
s	3.5355
Σx	25
Σx^2	175
Min	0
Q1	1.5
Median	6
Q3	8
Max	9

Figure 3. Statistical analysis of the results obtained for the second task

Statistics	
n	5
Mean	5
σ	3.8471
s	4.3012
Σx	25
Σx^2	199
Min	0
Q1	1.5
Median	3
Q3	9.5
Max	10

Figure 4. Statistical analysis of the results obtained for the third task

Statistics	
n	5
Mean	5
σ	2.3664
s	2.6458
Σx	25
Σx^2	153
Min	2
Q1	3
Median	4
Q3	7.5
Max	9

Figure 5. Statistical analysis of the results obtained for the fourth task

Statistics	
n	5
Mean	5
σ	3.4059
s	3.8079
Σx	25
Σx^2	183
Min	0
Q1	1.5
Median	5
Q3	8.5
Max	10

Figure 6. Statistical analysis of the results obtained for the fifth task

From the answers to the questions, we can see that students have problems with stereometry, planimetry, functions, fractions, inequalities, solving some equations and transformations. About the grade for subject Mathematica, several students had grade 5, some grade 4 and three of them grade 3. Half of students included in the survey wrote that they liked math subjects in high school, wanted practice tasks and spend good time learning math. The other half stated that they did not like math subjects because it was difficult to them to learn math, the lessons were not interesting, and they wasted a lot of time at home to master the material without some satisfied results. On the question “Why your choice was a technical college?” students gave different answers. Some because they had private companies in which they would work by profession after graduating from college, others because the majors they enrolled in were tempting, some because there were math subjects quite in the direction they enrolled in, and they wanted math but there were also answers that some enrolled because their parents were pressuring them to enroll in technical college. One student

replied that he had enrolled in this college because his friend had enrolled there. To the tenth question most students answered that they want to work after graduation with their profession. Only a few of them answered that after graduation they will think and decide what to do in their life and career.

IV. CONCLUSION

Considering the presented results, we can say that some of the students who were enrolled at the Faculty of Natural and Technical Sciences at the University Goce Delchev Stip in the first year have more mathematical topics that are problematic and uninteresting, of course taking in advance the opinion of all students. Thinking about how to overcome the difficulties and lack of interest in mathematics, we decided for the students involved in the research to include additional introductory classes before the regular lectures and exercises that will solve tasks from topics unclear to students. In the same classes, students will be able to ask questions about different topics and will be able to open discussions about some of their ambiguities related to topics in mathematics. We worked on tasks such as fraction operations, double fractions, solving equations, solving systems, probability.

For the other problems, uninteresting and difficult material such as geometric transformations, functions, circle and round, inequalities, we decided to advise students to use GeoGebra software when learning math topics. This will make the content more accessible to them, learning more interesting and the time spent learning math will not last for hours because the software will help them when they encounter problems.

Only by daily monitoring of students by monitoring their knowledge, their thinking, class behavior, commitment, activity at home and in class we can draw conclusions about the problematic mathematical topics among students in the latest generation of students. The importance of perceiving them is important to see what to pay more attention to in class and what to give as advice to students when studying independently at home.

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