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Technical treatment and design:
Ivan Tasic, Ph. D, Professor
Dijana Karuovic, Ph. D, Professor
Marjana Pardanjac, Ph. D, Assistant Professor
Erika Eleven, M.Sc, Assistant
Dusanka Milanov MSc, Assistant

Lecturer:
Erika Tobolka, Ph. D, Professor

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Erika Eleven, M.Sc, Assistant, Technical Faculty "Mihajlo Pupin" Zrenjanin, Republic of Serbia

Dusanka Milanov, MSc, Assistant, Technical Faculty "Mihajlo Pupin" Zrenjanin, Republic of Serbia

With this publication, the CD with all papers from the International Conference on Information Technology and Development of Education, ITRO 2015 is also published.

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INTRODUCTION

This Proceedings comprises papers from the **International conference on Information technology and development of education** that is held at TECHNICAL FACULTY ”MIHAJLO PUPIN”, ZRENJANIN, on June 26th 2015.

The International conference on Information technology and development of education has had a goal to contribute to the development of education in Serbia and in the region, as well as, to gather experts in 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 have been realized.

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

- Theoretical and methodological questions of contemporary pedagogy
- Personalization and learning styles
- Social networks and their influence on education
- Children security and safety on the Internet
- Curriculum of contemporary teaching
- Methodical questions of natural and technical sciences subject teaching
- Lifelong learning and teachers’ professional training
- E-learning
- Education management
- Development and influence of IT on teaching
- Information communication infrastructure in teaching proces

All submitted papers have been reviewed by at least two independent members of the Science Committee.

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

The Organizing Committee of the Conference

CONTENTS

ATTITUDE OF SECONDARY STUDENTS TOWARDS MATHEMATICS AND ITS RELATIONSHIP TO ACHIEVEMENT IN MATHEMATICS

T. Atanasova-Pachemska[*], L. Lazarova[*], J. Arsov[*], S. Pacemska[**], Z. Trifunov[*], T. Kovacheva[***]

[*]University "Goce Delcev", Stip, Republic of Macedonia
[**]Bureau of educational development of the Republic of Macedonia
[***]Technical University – Varna, Republic of Bulgaria
tatjana.pacemska@ugd.edu.mk, limonka.lazarova@ugd.edu.mk (corresponding author), arsovjoce@gmail.com, zoran.trifunov@ugd.edu.mk, sanja.pacemska@gmail.com, tsetska.kovacheva@tuvarna.acad.bg.

Abstract - Human beings are not only cognitive individuals, but also social persons with beliefs, emotions and views that influence their development as learners. Attitude towards mathematics plays a crucial role in the teaching and learning processes of mathematics. Study of Mathematics at secondary level is the foundation stage of Higher Education. The number of appointed students who take mathematics as a subject of the state graduation is so small. From the other side, mathematics is required for continuing education in technical and natural sciences and mathematics. The subject of this paper is determination the students' attitude towards mathematics in the higher classes in the secondary schools, in Stip, Republic of Macedonia. The results of the survey are processed with statistical software SPSS 21. The ANOVA is applied in order to determine whether there is a significant difference between students' attitudes towards mathematics and the factors, which are the goals of the research. Conclusions and recommendations for improvement are given.

I. INTRODUCTION

Mathematics is a very worthwhile and necessary subject at all levels at primary, secondary and university education. Several studies and researches have been done in many countries to find the factors that influence the students' performance in mathematics. Among these factors, students' attitude towards mathematics is one important factor that has been consistently studied. Students' attitudes toward mathematics have been known to influence students' participation, engagement, and achievement in mathematics. Attitudes are not innate but result from experiences and they can be changed. Attitudes are more stable than emotions and feelings, but at the same time, they are malleable influences on participation, because attitudes are formed in response to curriculum, teaching practices, and organizational arrangements, [2]. An early contribution in the study of attitudes toward mathematics was by Neale, who underlined that, "attitude plays a crucial role in learning mathematics and positive attitude toward mathematics is thought to play an important role in causing students to learn mathematics" [10]. Neale in [10] defined mathematical attitude as "a liking or disliking of mathematics, a tendency to engage in or avoid mathematical activity, a belief that one is good or bad at mathematics, and a belief that mathematics is useful or useless" (p. 632). The teaching method, the support of the structure of the school, the family and students' attitude towards school affect the attitudes towards mathematics. Usually, the way that mathematics is represented in the classroom and perceived by students, even when teachers believe they are presenting it in authentic and context dependent way stands to alienate many students from mathematics [9]. Researchers concluded that positive attitude towards mathematics leads students towards success in mathematics [8], [5]. In [11] it is observed that the concept of attitude includes at least three verbs: to think, to feel, and to behave. Thus, students' attitudes toward mathematics affect how well or how often they do it, and how much enjoyment they derive from it, [7]. Recently, many connected concepts have been studied, such as conceptions and beliefs of Mathematics and its learning, motivation and self-regulation, self-concept, self-esteem and self-efficacy. The general tenet is that human beings are not only cognitive individuals, but also social persons with beliefs, emotions and

views that influence their development as learners [6]. Actually, a person's behavior and choices, when confronted with a task, are determined more by her/his beliefs and personal theories, rather than by her/his knowledge of the specifics of the task [3]. The complexity of factors that can influence mathematics performance is demonstrated by Singh, Granville, and Dika [3] where they show that high achievement in mathematics is a function of many interrelated variables related to students, families, and schools. It can be said that students' attitude towards mathematics are very subjective and varies among the students. Many studies claim that there is no significant difference between attitude towards mathematics among male and female students, [8], and [4]. Several studies had been conducted to find out the relationship between attitude towards mathematics and academic achievement of the students. Most of these studies showed that there is a positive correlation between students' attitude towards mathematics and academic achievement of students, [8]. The studies has also shown that students attitude towards problem solving in terms of patience, confidence and willingness has a positive relation with students' mathematics achievement, [8]. The emotional dispositions have an impact on an individual's behavior, as one is likely to achieve better in a subject that one enjoys, has confidence in or finds useful [1]. For this reason, positive attitudes towards mathematics are desirable since they may influence one's willingness to learn and the benefits one can derive from mathematics instruction [1].

II. METHODOLOGY

The mathematical education is in the main focus of attention in the last few decades. On one hand, scholars, designers, and practitioners have produced exciting new developments in research, curriculum, and assessment. New standards for instruction and curriculum have been developed and an international discourse community on mathematics education has grown. On the other hand, mathematics education has been the target of intense criticism and debate among different stakeholders and communities. All these measures which have been taken in many countries, in order to emphasize the importance of mathematics, and to improve the quality of teaching mathematics do not give the expected results with the students, [12]. In the last few years in the Republic of Macedonia, in primary and secondary schools, the Ministry of Education implements more reforms, so that students can gain better knowledge. The problem of improving the capacity of staff in educational institutions has been popularized in order to improve the process of teaching mathematics. Reforms are implemented several years in order to achieve long-term results. Taking into account the current needs of the economy and industry, Ministry of Education of the Republic of Macedonia has developed a campaign to increase the number of students enrolled in a vocational school and the number of graduates who will enhance their education at technical faculties.

The international tests that were made about comparing the achievement of students in the mathematics showed that the level of achievement of the students in Macedonia is under the European countries student's achievements. Because of that, several projects are implemented in the field of mathematical education. However, it seems that the intention of the government institutions does not give the satisfactory results. The number of appointed students who take mathematics as a subject of the state graduation is so small. From the other side, mathematics is required for continuing education in technical and natural sciences and mathematics, so the number of the students in this faculties and schools is also small. The same can be said for the number of students in vocational schools. This situation has encouraged us to try, at least regionally, to identify the factors that affect the formation of the students' attitudes in teaching and learning mathematics. In order to determine the impact of various factors that influence in students' attitude about mathematics, a survey is conducted. This survey is conducted on a sample of students from fourth class at secondary schools in Stip, before they make a decision for their next education.

Similar research was made in [12] for the students in primary schools.

The objective of the research is getting information about students' attitudes in teaching mathematics. For achieving the goal, we had determined several tasks:

1) Is the gender of the student, factor in the formation of positive / negative attitude?
2) Does the grade of mathematics / computer science from previous year affect the formation of positive / negative attitude?
3) Does the grade of mathematics / computer science from half year affect the formation of positive / negative attitude? (In the context of this task, we did not decide to

conduct a test of knowledge, but we based on the grade given by the teacher.)

4) Does the method of implementation of mathematics by the teacher influences the formation of positive / negative attitude?
5) Does the teacher's personality affect to the formation of positive / negative attitude?
6) Does the attitude towards mathematics influences the choice of students' future education?

This is a quantitative study, which explores secondary students' attitude towards mathematics in a selected secondary school in Stip.

Questionnaire for measuring attitude toward mathematics of students in secondary school was constructed for the purposes of this research. The survey had several sets of questions. Questions relating to the assessments that students have in mathematics, questions about their choice of future education, issues related to the way of teaching by their mathematics teacher, questions that express their own attitude about mathematics, questions related to the way that solve the problems faced during the study of curricula in mathematics and issues related to their engagement in mathematics out of the school.

The results of the survey were processed with statistical software SPSS 21. For determining the influence factors, factor analysis was applied. In addition, the strength of the connections between various factors was calculated.

In the survey, 187 students from the secondary schools in Stip were examined. There are 103 male and 84 female students. They were from a wide range of social and economic backgrounds. Data used in this study were collected at school. Letters describing the study were sent to the parents who gave their written consent to the head teacher. Questionnaires were administered in the classroom under the supervision of a member of our research team.

III. RESULTS AND DISCUSSION

In the research the descriptive statistics of participants' attitudes, motivation and perceived social support towards mathematics, and their differences considering gender, grades are presented. By using the parametric statistics, more research hypotheses have been checked. One factor analysis ANOVA is applied, also.

TABLE I.

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Attitudes	Male	103	71.5825	19.83882	1.95478
	Female	84	73.5833	23.17467	2.52856

55,1% of respondents are male and 44,9% are female. The subjects were students in two secondary schools in Stip. 55.1% are from Kole Nehtenin (vocational technical school), and 44.9% are from the high school Slavco Stojmenski. In the survey 89.8% reported that they would continue their education at some faculty and 10.2% that they will not continue their education. 5.9% said that they would continue on natural and mathematical sciences at the university, 45.5% on technical sciences, 29.4% on social sciences, 4.3% at art and 5.3% at medical sciences at the university.

Regarding to the reliability of the instrument, the coefficient of internal homogeneity Cronbach's alpha was 0.93 and it can be concluded that the internal consistency of the whole instrument is solid (Cronbach's alpha is larger than 0.90).

In order to determine, if there is any correlations between the students' attitude and the students' gender, we apply Student's t-test. By using t-test we can compare the means of these two samples even if they have different numbers of replicates.

We applied the t-Test for independent groups, the male students (M = 71.58, SD = 19.84) and female students (M = 73.58, SD = 23.17) in terms of attitude for mathematics. From the table 2, the value of the t-Test $t(97) = -0.636 < 1.433 = F$, $p > 0.05$, so it can be concluded that there are no differences between students' gender and attitude for teaching mathematics.

TABLE II.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Attitude towards mathematics	Equal variances assumed	3.556	.061	-.636	185	.526	-2.00081	3.14611	-8.20767	4.20605
	Equal variances not assumed			-.626	164.147	.532	-2.00081	3.19606	-8.31149	4.30988

According to the results which were obtained by application of t-test, there are differences between students from vocational school and students from the high school, in terms of attitude towards mathematics, t (159,904) = - 4.39, $p <$ .001, the students from high school Slavco Stojmenski (M = 79.86, SD = 22.48) have more positive attitude toward mathematics, than students form vocational school Kole Nehtenin (M = 66.47, SD = 18.44). That means that the null hypothesis is declined and the research hypothesis is accepted. The Levene test for equality of variances is important F(159,90) = 7,64, p< 0,001), that means that the assumption for equal variances of the groups is impaired, according the degrees of freedom are moved from 185 to 159,904. (Table 3)

TABLE III. **INDEPENDENT SAMPLES TEST**

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Attitude towards mathematics	Equal variances assumed	7.648	.006	-4.476	185	.000	-13.39112	2.99171	-19.29337	-7.48887
	Equal variances not assumed			-4.388	159.904	.000	-13.39112	3.05209	-19.41872	-7.36353

One factor analysis ANOVA (table 4) showed that there are not differences between students who have different choice for the next education in terms of their attitude towards mathematics F(4,164) =13.36, p < .001 It follows that a positive attitude towards mathematics does not depend on the choice for next education.

TABLE IV.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	19377.634	4	4844.408	13.358	.000
Within Groups	59478.366	164	362.673		
Total	78856.000	168			

According the results which were obtained by application of t-test, the students who replied that they will continue their education (M =74.15, SD = 21.71) have more positive attitude towards mathematics then the students who finished their education on secondary level (M = 57.68, SD =9.40), $t(44.48) = 6.03$, $p<.001$. The Levene test for equality of variances is important $F(44.481) = 19.073$, $p< 0,01$, that means that the assumption for equal variances of the groups is impaired, according the degrees of freedom are moved from 185 to 159,904 (table 5).

TABLE V. INDEPENDENT SAMPLES TEST

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Attitude towards mathematics	Equal variances assumed	19.073	.000	3.267	185	.001	16.47055	5.04193	6.52348	26.41762
	Equal variances not assumed			6.030	44.481	.000	16.47055	2.73127	10.96773	21.97338

For determination of the relationship between attitude towards mathematics and grade in mathematics from the previous year among students of secondary school, non-parametric test was applied (Spearman's rho coefficient), because the variable-grade in mathematics from the previous year is measured on ordinal level. According to the data of a statistical correlation analysis it can be concluded that there is distinct difference between attitude toward mathematics and mathematics assessment of the previous year ($r = 0.64$; $p <0.001$). Students who had higher grade in mathematics in previous year, have a more positive attitude towards mathematics, i.e. with increasing success in mathematics, attitude of positivity in mathematics is increased (table 6).

TABLE VI. CORRELATIONS

			Mathematics' grade from previous year	Attitude towards mathematics
Spearman's rho	Mathematics' grade from previous year	Correlation Coefficient	1.000	.636**
		Sig. (2-tailed)	.	.000
		N	187	187
	Attitude for mathematics	Correlation Coefficient	.636**	1.000
		Sig. (2-tailed)	.000	.
		N	187	187

**. Correlation is significant at the 0.01 level (2-tailed).

According to the results of the statistical correlation analysis there is significant relationship between attitude towards mathematics and grade in mathematics on a half year ($r = 0.68$; $p<0.01$). The students who had better grade in mathematics at half year, have positive attitude towards mathematics, i.e. with increasing success in mathematics, positivity of attitude in mathematics is increased (Table 7).

Table VII. CORRELATIONS

			Assessment in mathematics from half year	Attitude towards mathematics
Spearman's rho	Assessment in mathematics from half year	Correlation Coefficient	1.000	.679**
		Sig. (2-tailed)	.	.000
		N	187	187
	Attitude towards mathematics	Correlation Coefficient	.679**	1.000
		Sig. (2-tailed)	.000	.
		N	187	187

**. Correlation is significant at the 0.01 level (2-tailed).

There are many studies which have explored the role of the environment on learning. Students get maximum learning and develop positive attitude toward a subject in a climate where student get higher involvement, teacher-student relationship, and creative teaching methodology. In order to provide maximum learning, there should be an environment, where student feel comfort, motivation, and experimentation in the classroom. Attitude has positive impact on student motivation, it eventually generates fruitful results. Even 42.2% surveyed students said that they have performance anxiety in mathematics always and 18.2% are always afraid to answer the question that is posed by the teacher. When they face up with a problem related to mathematics, even 53.5% of the surveyed students always ask their parents to hire a private teacher, 25.7% always retreat hoping to get lucky, and only 10.7% always seek help from a mathematics teacher at the school. On the other side, only 4.8% of the students said that the mathematics teacher always says what is important on the class and even 23% said that the teacher never emphasizes the important things during the class. 12.3% of the surveyed students said that the teacher does not encourage discussion and 63.6% said that teacher always leaves them to solve the problems alone while he does something else. Only 7.5% said that teacher compares what they learn on the class with the real problems in their lives. Also the results from the survey show that the mathematics teachers always use the books-3.2%, but only 12.3% always use computer software.

IV. CONCLUSION

It could be concluded that the students' attitude towards mathematics does not depend on the student' gender. In addition, positive attitude towards mathematics does not depend on the choice for next education. However, the attitudes towards mathematics depend on their achievement in mathematics. The teachers should focus to increase the level of achievements in order to foster optimistic attitude.

These data indicate that mathematics teachers should seriously think about introducing changes in the process of teaching mathematics. Teachers should make changes in their approach to the students, in order to eliminate fear among the students and to provide a pleasant climate for working.

We will give a recommendation for the teachers for greater use of the computers in teaching mathematics, in order to allow visualization for the students, and connecting mathematics with real situations.

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