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CHANGES OF ATTITUDES TOWARDS MATHEMATICS

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Abstract. Mathematical competence is the ability to develop and use mathematical thinking for solving various problems in everyday situations. The process of acquiring mathematical competence is strongly determined by attitudes to mathematics. In this contribution, we examine the attitudes of students towards mathematics during their transition to post-secondary institutions.

1. Introduction

Mathematics is a part of human culture. Its pieces of knowledge, methods and procedures are transferred to all parts of human activity. One of those parts is, obviously, education. Mathematical education is not an independent part of education. Mathematics undoubtedly develops cognition of every student, and with its methods and devices it is predetermined to become an instrument for the development of ability for constructing knowledge.

Attitudes are the variables that play an important role in teaching mathematics. They represent an assumption about an educational and learning process, about students and their knowledge. Thus attitudes function as cognitive and emotional filters through which we are able to explain and judge our knowledge and experience. For this reason we consider attitudes and their development as a key variable in the continuing education process. It should be taken into consideration that students of the mathematics teaching programme are coming with attitudes towards mathematics and its teaching. However, many studies have confirmed the fact that teachers eventually use

the teaching methods which have been used in their own educational process. Attitudes of students are continuously changing and developing. This change of attitudes and the way of thinking are reflected in the way they learn.

2. Survey of students' attitudes towards mathematics

In the process of grant project realization we carried out the survey of students' attitudes towards mathematics during an initial phase of their studying. For the survey, the students of three among the seven faculties of the University of Žilina were selected. The faculties differ not only in their field of study and practical orientation but also in entrance exam requirements.

- ◇ The first faculty orientation is technical, and students are accepted without maths entrance test.

- ◇ The second faculty focuses on economic sectors, and students have to write an entrance test with relatively low math requirements.

- ◇ Specialized areas of study of the third faculty are economics of transport and communications, and students have to write an entrance test with higher math requirements in comparison with the second faculty.

Among the two hundred survey respondents, seventy were from the first faculty, seventy from the second faculty and sixty respondents from the third faculty. Multidimensional conception of attitudes, which recognizes 3 components – emotional reactions, confidence connected with an object and behaviour towards an object, had been used as a theoretical basis of a questionnaire [2]. The test consisted of 15 questions and students could choose one from five or six answers. The offered answers were scaled so that it could be possible to sort out positive and negative attitudes towards teaching mathematics, self-evaluation of individual mathematical abilities, student's ideas of a good way of teaching secondary school mathematics and changes in attitudes towards mathematics after entering the university.

In this paper we present some of the results of our survey. One of them is the answer to the question concerning students applying for entry to particular faculties and their secondary school results. It is reasonable to assume that the faculties which require entrance exams in the form of tests (also tests from mathematics) accept more students with higher preconditions for study success, i.e. with better results. The results of our survey, which confirm this fact, are presented in Table 1 and Figure 1.

Evaluation of results from secondary school mathematics	**Faculty I**	**Faculty II**	**Faculty III**
a) excellent	10.00%	10.00%	15.00%
b) excellent or very good	15.71%	42.86%	33.33%
c) very good or good	37.14%	20.00%	36.67%
d) good	28.57%	20.00%	13.33%
e) fair/sufficient	8.57%	7.14%	1.67%

Table 1: Secondary school study results

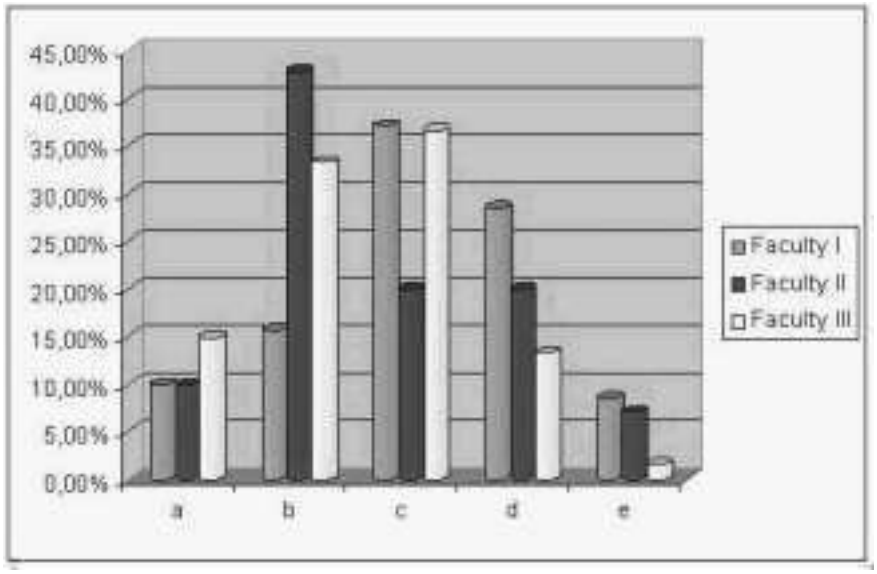

Figure 1:

Positive and negative self-evaluation of attitudes of students is analyzed by another test item, results of which are presented in Table 2 and Figure 2. It can be seen from the results that regardless of the entrance exams, mathematics is a difficult subject for applicants and they are not able to learn it with ease.

Mathematics is among	**Faculty I**	**Faculty II**	**Faculty III**
a) the most difficult subjects	25.71%	27.14%	30.00%
b) difficult subjects	42.86%	48.57%	43.33%
c) semi-difficult subjects	28.57%	20.00%	23.33%
d) easy subjects	0.00%	4.29%	3.33%
e) the easiest subjects	2.86%	0.00%	0.00%

Table 2: Difficultness of mathematics learning

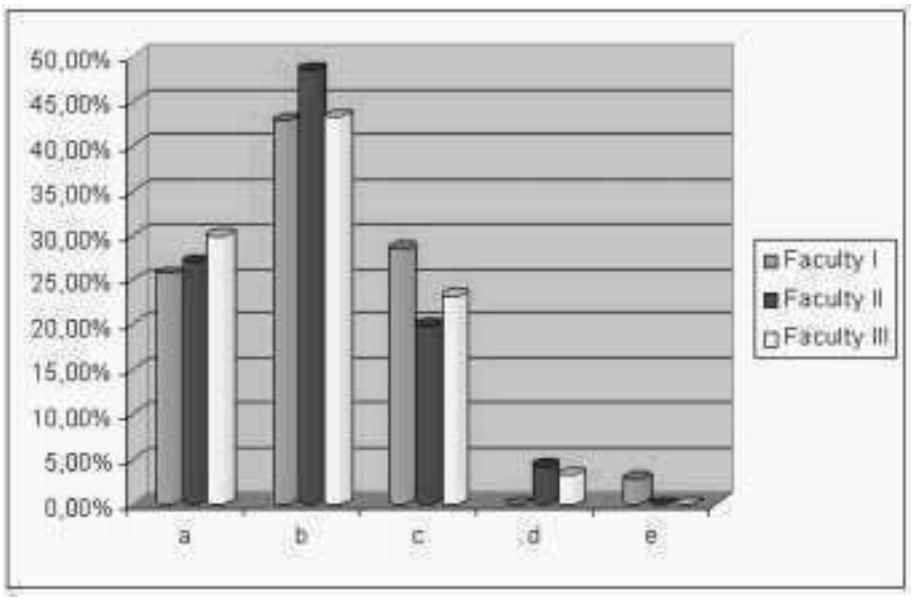

Figure 2:

The problems in learning mathematics are closely related to its popularity. For this reason we included question in the survey designed to analyze the popularity of mathematics among students. The results are summarized in Table 3 and Figure 3.

What is your relationship to mathematics?	**Faculty I**	**Faculty II**	**Faculty III**
a) I really do not like mathematics	12.86%	2.86%	3.33%
b) I do not like mathematics because I often do not understand it	14.29%	14.29%	16.67%
c) It depends on a current topic	40.00%	45.71%	35.00%
d) I enjoy mathematics if I understand the current topic	28.57%	34.29%	45.00%
e) Mathematics lessons belong to my most favourite ones	4.29%	2.86%	0.00%

Table 3: Popularity of mathematics

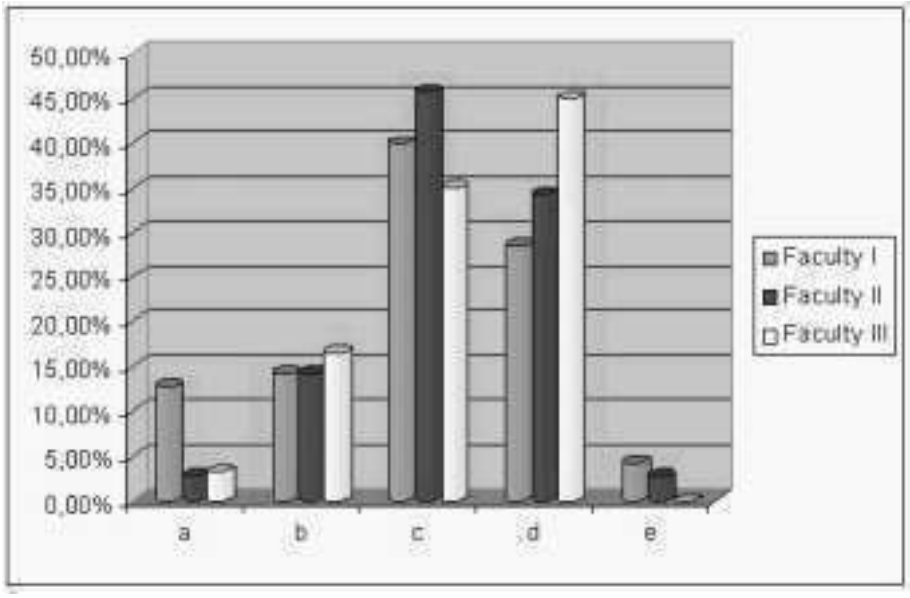

Figure 3:

It has been shown by our survey that the negative attitudes are predominantly observed among the students who did not have to deal intensively with mathematics during their senior year at a secondary school. Very surprising is the fact that also positive attitudes towards mathematics prevail among students of this group.

Views of importance of mathematics in future career	**Faculty I**	**Faculty II**	**Faculty III**
a) Mathematics is very important for my future career	12.86%	2.86%	3.33%
b) I will certainly need mathematics from time to time	14.29%	14.29%	16.67%
c) I will use mathematics only marginally	40.00%	45.71%	35.00%
d) I do not think I will need mathematics in my future career	28.57%	34.29%	45.00%
e) I hope I will not need mathematics in my future career	4.29%	2.86%	0.00%

Table 4: The necessity of mathematics

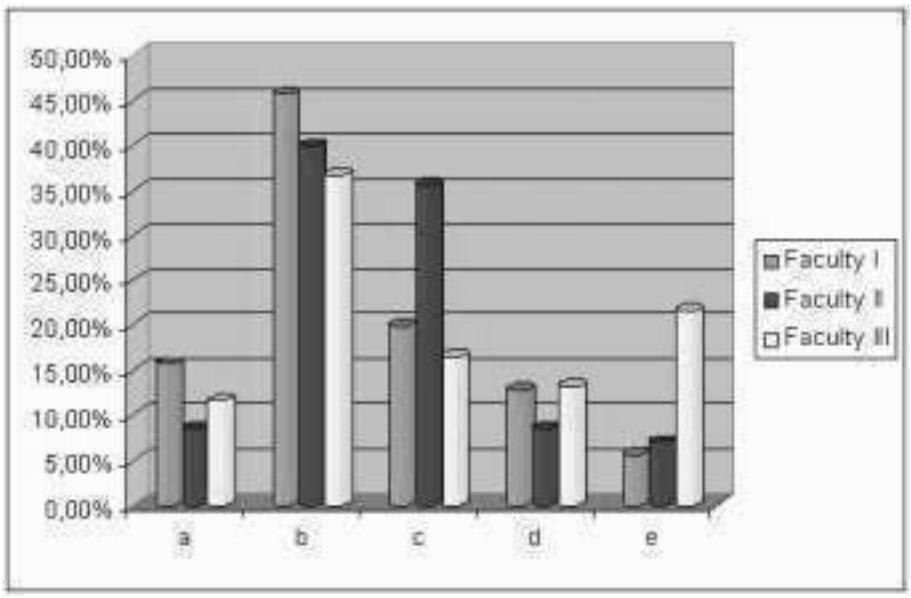

Figure 4:

The question of importance of mathematics in student's perspective job is presented by Table 4 and Figure 4. According to the presented results, positive attitudes of Faculty I and Faculty II students and negatives attitudes of students of Faculty III prevail in the survey. We did not expect this conclusion.

In Introduction we have mentioned that the attitudes of students are in the continuing development and change during their study. Thus we also analyzed which period of their studies they consider to be the point when their attitudes changed. This is presented in Table 5 and subsequently by Figure 5.

When did the change happen?	**Faculty I**	**Faculty II**	**Faculty III**
a) During the first four years of basic school	1.43%	1.43%	1.67%
b) During the second four/five years of basic school	12.86%	4.29%	3.33%
c) At secondary school	50.00%	45.71%	41.67%
d) It did not happen	24.29%	25.71%	41.67%
e) I am not able to decide when it happened	11.43%	22.86%	11.67%

Table 5: The period of changes of attitudes towards mathematics

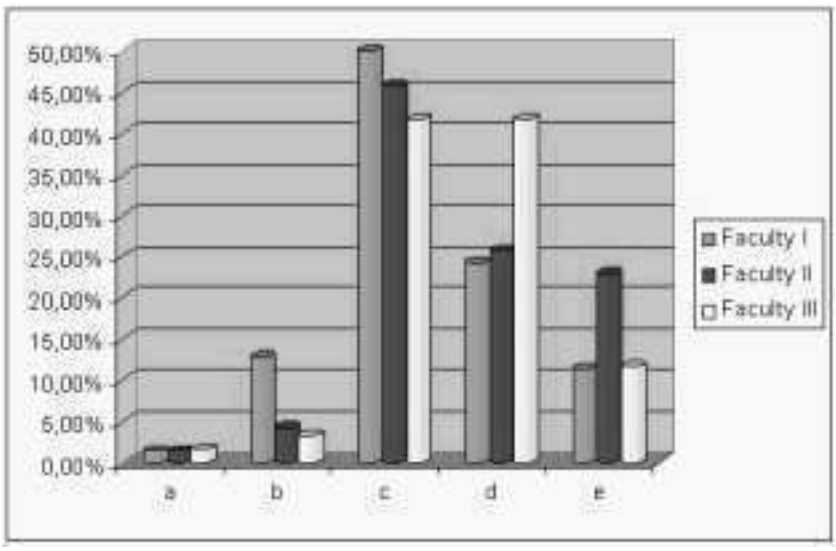

Figure 5:

As we tested the opinions of students at the very beginning of their university studies, only the periods of primary and secondary schools were included. The survey shows that the changes of attitudes towards mathematics (or no changes) are characteristic for students of all three types of faculties.

3. Conclusion

In this paper not all the results and conclusions of all tested items are presented. In spite of this fact, the presented selection indicates that study results of university students are strongly determined by their prior schooling, during which their attitudes towards mathematics usually worsen. It has been shown that too demanding tasks, incorrectly-chosen rate of teaching, the choice of inadequate language and negative attitudes of mathematics teachers have a bad impact on students. At the same time, the periods of primary and secondary school are key periods for the formation of students' attitudes towards mathematics.

We note that the results presented in this paper are, to some degree, influenced by the comparatively small number of respondents of the survey. But in spite of this fact, they represent an incentive for further study of students' attitudes towards mathematics and its teaching during the secondary-tertiary transition, and for the research of methods positively influencing these attitudes. This includes, for instance, activating methods developing motivation and creativity of students during the process of mathematical education [1] and positive attitudes of mathematics teachers at universities.

Acknowledgements

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