DO PRIMARY SCHOOL STUDENTS LIKE MATHEMATICS?

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Abstract. Importance of mathematics as a school subject is evident in a fact that it is a constituent part of core curriculum for basic education in all education systems in the world. First few years of education are of crucial importance to the formation of attitudes towards mathematics. Attitudes are important because they navigate our actions and by doing so, influence our reality and our future as well. Research on attitudes towards mathematics has considerably increased over the past few years, since the importance of mathematics is getting continuously more accentuated. In the context of schools and education, it is emphasized how positive attitude towards mathematics influences students’ relationship with school-work, studying, confidence and behaviour. The aim of the study was to determine primary school students’ attitudes towards mathematics. One hundred and seventy-one students from 3rd to 8th grade from III Primary School Varaždin, Croatia participated in the research. The data were analyzed with t-test and one-way ANOVA for independent samples. The research has shown that there is no statistically significant gender difference in attitudes towards mathematics; however, age difference was confirmed. It was also found that younger students in primary education had a more positive attitude towards mathematics than older students. Practical implications of acquired results could be in providing additional support to 5th and 6th grade students when the change from positive to negative attitude happens.

Keywords: age, attitude, gender, mathematics, primary education, students.

Introduction

Rapid development of science and technology is impossible without mathematics. Mathematical skills and competence are recognized as vital to personal and economic success (Lipnevich et al., 2011). Importance of mathematics as a school subject is evident in a fact that it is a constituent part of core curriculum for basic and also secondary education in all education systems in the world. Zhou et al. (2019) emphasize that primary education is an essential stage and has an important impact on students’ learning attitudes throughout the coming school years.

Throughout history, attitudes have been defined in different ways. Krech and Crutchfield (1976) define attitude as permanent organization of perceptual,
instinctive, emotional and adaptable processes tied to a certain aspect of human life. McLeod (1994) defines them as positive and negative emotional dispositions. Pennington (2001) describes attitude as a construct that is used as a guide to certain mental processes of a person. Aydin defines attitude as “a cognitive, affective and behavioral reaction the individual organizes toward himself/herself or any object, subject or fact around him/her based on information, feelings, and motivation” (2012, p. 334). Attitudes are not inherent; they can change as a result of an experience (Capuno et al., 2019).

Attitudes towards mathematics have been a topic of numerous research projects that have begun in the second half of 20th century. In the last 20 years, these research projects have become even more frequent. Today there is more and more talk about the development of STEM area (Science, Technology, Engineering and Mathematics) and with that, more interest in influences on evolution of mathematics.

**Review of the Literature**

Zan and Di Martino (2007) point out that an attitude towards mathematics is a construct which plays an important role in mathematics education. Students' attitudes play a vital role in the learning of mathematics (Kele & Sharma, 2014), therefore attitude is a fundamental factor that cannot be ignored (Mazana, Montero, & Casmir, 2019).

Early research about attitudes towards mathematics has shown that positive attitudes toward mathematics play a big role in mathematics education (Neale, 1969). The author classifies attitudes towards mathematics as liking or disliking, diligence or avoidance, good and bad attitudes towards mathematics and also classification by usefulness of mathematics. Students’ attitudes towards mathematics are highly associated with their achievement in mathematics (Chagwiza et al., 2013; Tuncer & Yilmaz, 2020). Research also shows that parents have a big role in forming of positive and negative attitudes towards mathematics (Arambašić & Vlahović-Štetić, 2003; Mohr-Schroeder et al., 2017). Prior to formal education, mostly parents influence the formation of attitude towards mathematics, but in school, there are also other factors and influences. Teachers as role models can have a big impact on attitudes of students towards mathematics (Fržop, 2019). Oyedeji (2017) in his research confirms that parents, teachers and peers influence the formation of attitudes of students. Influence of peers on attitudes can also be positive or negative.

Research has so far shown that when children start going to school, they have a positive attitude towards mathematics; however, these attitudes change throughout their education and become more negative (Ma & Kishor, 1997). Throughout education, negative attitude towards mathematics tends to become
more and more negative, while at the same time the importance of mathematics in education and in life after education becomes more emphasized (Arambašić, Vlahović-Štetić, & Severinac, 2005). Failing at grasping mathematical concepts very often generates the feeling of insecurity and students create a negative self-image and feel incompetent (Sherman & Christian, 1999).

Results of studies on gender differences mostly imply that mathematics is either a male-dominated area or that no gender differences were identified, but some studies show that females have a more positive attitude to mathematics than males (Kaldo & Õun 2020, p. 597). Some authors explain that negative attitude towards mathematics in girls is formed in their upbringing through which an idea that mathematics is only for boys is imposed (Hyde, Fennema, Ryan, Frost, & Hopp, 1990). After meta-analysis, Frost, Hyde and Fennema (1994) prove that gender differences in levels of success in mathematics are getting smaller. Despite that, many researchers have shown since that girls have a more negative attitude towards mathematics than boys do (Keller, 2001; Leedy, LaLonde, & Runk, 2003; Arambašić et al., 2005; Else-Quest, Hyde, & Linn, 2010; Markovits, &Forgasz, 2017). Furthermore, most studies show that older students have a more negative attitude towards mathematics than younger ones (Hyde et al., 1990; Mata, Monteiro, & Peixoto, 2012; Mazana, Montero, & Casmir, 2019).

By looking into this issue, it was observed that in Croatia, the development of attitudes towards mathematics was monitored by gender, age, success and motivation and also that in the last 20 years, many studies have been conducted on this topic (Arambašić et al., 2005; Bušac, 2006; Pavlin–Bernardić, Ravić, & Borović, 2012; Novak & Brođanac, 2019). Concerning gender, most studies indicate that females generally have a more negative attitude towards mathematics than male examinees. With that, Vidić (2016) implies that boys have a more positive attitude towards mathematics than girls. It should be noted that not every research has shown the gender difference, for example in a study conducted by Cezner (2016), there was no difference in attitude towards mathematics between female and male students. Concerning age, younger students have a more positive attitude than older students (Pavlin-Bernardić et. al., 2010; Cezner, 2016; Vidić, 2016).

Primary education in Republic of Croatia lasts 8 years and is obligatory for all children from 6 to 15 years of age. During first 4 years of primary education students are taught by only one teacher (excluding foreign languages, religion and computer science). Generally, in grades 5 to 8, every subject is taught by a different teacher (specialized for that subject).

The aim of the study was to determine primary school students’ attitudes towards mathematics.
In the study the following research questions are determined:
1) Is there a significant gender difference in the primary school students’ attitudes towards mathematics?
2) Is there a significant grade level difference in the primary school students’ attitudes towards mathematics?

**Methodology**

Following hypotheses were set:
H1: There is no significant gender difference in the primary school students’ attitudes towards mathematics.
H2: There is no significant grade level difference in the primary school students’ attitudes towards mathematics.

**Sample of the study**
Students (ages 9-15) from 3rd to 8th grade from III Primary School Varaždin, Croatia participated in this study. Research population were students of III Primary School Varaždin (N=292) and from that, non-representative probability sample (N=171) was defined. Students were split in three different age groups:
1. Group - 3rd and 4th grade students (n=57)
2. Group - 5th and 6th grade students (n=58)
3. Group - 7th and 8th grade students (n=56).

The probability sample consisted of 81 girls (47%) and 90 boys (53%).

**Procedure of the study**
Before conducting the research, an approval from the school principal was received. The participation was voluntary and anonymous. Also, a signed approval was received from every student’s parent. The research was conducted in accordance with Ethical Standards for Research with Children. The data were collected through a survey carried out in April during school year 2019/20. The survey took place at the school during agreed classes and in the presence of teachers. The length of the survey was around 10-15 minutes and it was done using pen and paper.

**Instrument and Data Analysis**
Original instrument *Attitudes Toward Mathematics Inventory* (ATMI) consists of 49 item and the ATMI psychometric analysis revealed sound properties and therefore can be used by researchers and practitioners to measure students' attitudes toward mathematics (Tapia, 1996). An adapted version of the survey ATMI was used and it consists of 40 statements and measures 4 aspects: confidence, importance/usefulness, enjoyment and motivation. Students were asked to choose one of 5 offered levels of agreement on the Likert scale, where smaller values represented smaller levels of agreement with a statement.
The data were collected were analysed in *SPSS 22* Statistics software. For comparative analysis, t-test and one-way ANOVA was used in order to examine the changes depending on gender and age variables.

**Results**

Statements that were not answered or had multiple different answers were omitted from the analysis. Before the analysis, statements from the questionnaire where the smallest possible number was the most positive answer were redefined, so that the smallest number also implied the most negative answer. Altogether there were 11 such questions, namely the questions 9, 10, 11, 12, 13, 14, 15, 20, 21, 25 and 28. After that, a composite variable which included all the other variables that measured students’ attitude towards mathematics was defined. Afterwards, a descriptive statistic for individual statements from the questionnaire and for the composite variable “Attitudes of primary school students towards mathematics” was calculated. The data are presented in Table 1. Skewness is −0.685 which means that the data follow a normal distribution with a negative kurtosis of −0.263.

**Table 1 Descriptive Statistics of Students’ Statements Attitudes Towards Mathematics**

<table>
<thead>
<tr>
<th>Statement</th>
<th>M</th>
<th>SD</th>
<th>Skewness</th>
<th>S. St Err</th>
<th>Kurtosis</th>
<th>K. St Err</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mathematics is a very worthwhile and necessary subject.</td>
<td>4.67</td>
<td>.680</td>
<td>-2.569</td>
<td>.186</td>
<td>7.864</td>
<td>.370</td>
</tr>
<tr>
<td>2. I want to develop my mathematical skills.</td>
<td>4.33</td>
<td>.992</td>
<td>-1.668</td>
<td>.187</td>
<td>2.439</td>
<td>.371</td>
</tr>
<tr>
<td>3. I get a great deal of satisfaction out of solving a mathematics problem.</td>
<td>3.57</td>
<td>1.127</td>
<td>-.843</td>
<td>.187</td>
<td>.117</td>
<td>.371</td>
</tr>
<tr>
<td>4. Mathematics helps develop the mind and teaches a person to think.</td>
<td>4.59</td>
<td>.832</td>
<td>-2.549</td>
<td>.186</td>
<td>7.061</td>
<td>.370</td>
</tr>
<tr>
<td>5. Mathematics is important in everyday life.</td>
<td>4.62</td>
<td>.761</td>
<td>-2.666</td>
<td>.186</td>
<td>8.412</td>
<td>.370</td>
</tr>
<tr>
<td>6. Mathematics is one of the most important subjects for people to study.</td>
<td>4.36</td>
<td>.907</td>
<td>-1.689</td>
<td>.186</td>
<td>3.072</td>
<td>.370</td>
</tr>
<tr>
<td>7. High school math courses would be very helpful no matter what I decide to study.</td>
<td>4.64</td>
<td>.760</td>
<td>-2.851</td>
<td>.187</td>
<td>9.379</td>
<td>.373</td>
</tr>
<tr>
<td>8. I can think of many ways that I use math outside of school.</td>
<td>4.21</td>
<td>1.014</td>
<td>-1.406</td>
<td>.187</td>
<td>1.593</td>
<td>.373</td>
</tr>
<tr>
<td>9. Mathematics is one of my most dreaded subjects.</td>
<td>3.44</td>
<td>1.511</td>
<td>-.327</td>
<td>.187</td>
<td>-1.408</td>
<td>.373</td>
</tr>
<tr>
<td>10. My mind goes blank and I am unable to think clearly when working with mathematics.</td>
<td>3.68</td>
<td>1.433</td>
<td>-.602</td>
<td>.187</td>
<td>-1.039</td>
<td>.371</td>
</tr>
<tr>
<td>11. Studying mathematics makes me feel nervous.</td>
<td>3.72</td>
<td>1.427</td>
<td>-0.631</td>
<td>.187</td>
<td>-1.105</td>
<td>.371</td>
</tr>
<tr>
<td>12. Mathematics makes me feel uncomfortable.</td>
<td>3.95</td>
<td>1.389</td>
<td>-.954</td>
<td>.187</td>
<td>-1.573</td>
<td>.371</td>
</tr>
<tr>
<td>13. I am always under a terrible strain in a math class.</td>
<td>3.79</td>
<td>1.440</td>
<td>-.750</td>
<td>.187</td>
<td>-0.939</td>
<td>.373</td>
</tr>
<tr>
<td>14. When I hear the word mathematics, I have a feeling of dislike.</td>
<td>4.17</td>
<td>1.260</td>
<td>-1.281</td>
<td>.187</td>
<td>.348</td>
<td>.373</td>
</tr>
<tr>
<td>15. It makes me nervous to even think about having to do a mathematics problem.</td>
<td>3.91</td>
<td>1.394</td>
<td>-.856</td>
<td>.187</td>
<td>-1.727</td>
<td>.371</td>
</tr>
<tr>
<td>16. Mathematics does not scare me at all.</td>
<td>3.53</td>
<td>1.508</td>
<td>-.558</td>
<td>.187</td>
<td>-1.180</td>
<td>.371</td>
</tr>
<tr>
<td>17. I have a lot of self-confidence when it comes to mathematics.</td>
<td>3.53</td>
<td>1.370</td>
<td>-.690</td>
<td>.188</td>
<td>-1.724</td>
<td>.374</td>
</tr>
</tbody>
</table>
Since further statistical analysis was on the composite variable *Attitudes of students towards mathematics*, the normality of the distribution was verified with the Kolmogorov-Smirnov test (D(148) = 0.120 p > 0.01). Results show that the variable follows normal distribution and that parametric statistical tests were used for testing the hypotheses.

The first goal was to test if a statistically significant gender difference in attitudes towards mathematics exists. The difference was verified with the t-test for independent samples. It was shown that no statistically significant gender difference in attitudes towards mathematics exists (t = 0.989, df = 147, p = 0.324) and therefore, the first hypothesis is confirmed.

Furthermore, existence of statistically significant age/grade difference in attitudes towards mathematics was tested. The results shown in Table 2 indicate that students in 5th and 6th grade (M = 148.292, SD = 35.106) and students in 7th and 8th grade (M = 141.300, SD = 33.597) have more negative attitude towards mathematics than students in grades 3 and 4 (M = 172.137, SD = 22.189).
### Table 2 Attitudes of Students Towards Mathematics by Age/Grade

<table>
<thead>
<tr>
<th>Age/Grade</th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Std. Error</th>
<th>95% Confidence Interval</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Bound</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd and 4th grade students</td>
<td>51</td>
<td>172.1373</td>
<td>22.18920</td>
<td>3.10711</td>
<td>165.8964</td>
<td>103.00</td>
<td>198.00</td>
</tr>
<tr>
<td>5th and 6th grade students</td>
<td>48</td>
<td>148.2917</td>
<td>35.10589</td>
<td>5.06710</td>
<td>138.0980</td>
<td>49.00</td>
<td>200.00</td>
</tr>
<tr>
<td>7th and 8th grade students</td>
<td>50</td>
<td>141.3000</td>
<td>33.59741</td>
<td>4.75139</td>
<td>131.7517</td>
<td>62.00</td>
<td>196.00</td>
</tr>
<tr>
<td>Total</td>
<td>149</td>
<td>154.1074</td>
<td>33.31426</td>
<td>2.72921</td>
<td>148.7141</td>
<td>49.00</td>
<td>200.00</td>
</tr>
</tbody>
</table>

In statistical analysis, a one-way ANOVA for independent samples was also calculated. It was shown that there is a statistically significant age/grade difference in attitudes towards mathematics (F2,146 = 13.982, p < 0.01). From this data, we can conclude that the second hypothesis can be rejected. In order to determine the difference, the Turkey post hoc test was used (Table 3). Among students in grades 5, 6, 7 and 8 no difference in attitudes towards mathematics was found (p = 0.05).

### Table 3 Age/Grade Differences in Attitudes Towards Mathematics

<table>
<thead>
<tr>
<th>(I) Age/grade</th>
<th>(J) Age/grade</th>
<th>Mean difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>3rd and 4th grade students</td>
<td>5th and 6th grade students</td>
<td>23.84559</td>
<td>6.17935</td>
<td>.000</td>
<td>9.2138</td>
<td>38.4774</td>
<td></td>
</tr>
<tr>
<td>5th and 6th grade students</td>
<td>3rd and 4th grade students</td>
<td>-23.84559</td>
<td>6.17935</td>
<td>.000</td>
<td>-38.4774</td>
<td>-9.2138</td>
<td></td>
</tr>
<tr>
<td>7th and 8th grade students</td>
<td>5th and 6th grade students</td>
<td>6.99167</td>
<td>6.20924</td>
<td>.500</td>
<td>-7.7109</td>
<td>21.6943</td>
<td></td>
</tr>
<tr>
<td>7th and 8th grade students</td>
<td>3rd and 4th grade students</td>
<td>-30.83725</td>
<td>6.11535</td>
<td>.000</td>
<td>-45.3175</td>
<td>-16.3570</td>
<td></td>
</tr>
<tr>
<td>5th and 6th grade students</td>
<td>7th and 8th grade students</td>
<td>-6.99167</td>
<td>6.20924</td>
<td>.500</td>
<td>-21.6943</td>
<td>7.7109</td>
<td></td>
</tr>
</tbody>
</table>

* The mean difference is significant at the 0.05 level.

**Discussion**

With this research we wanted to test if there are gender or age differences in primary school students’ attitudes towards mathematics.

According to acquired results, there is no statistically significant difference in attitudes towards mathematics between boys and girls, so first hypothesis was confirmed. Many studies have focused on gender differences in attitudes towards mathematics and according to some of them boys have a more positive attitude...
than girls (Keller, 2001; Leedy et. al., 2003; Arambašić et. al., 2005; Else-Quest, Hyde, & Linn, 2010; Markovits, & Forgasz, 2017). Results from other studies have shown that there is no statistically significant gender difference in attitudes (Nicolaidou & Philippou, 2003). Possible explanation of our results is that the current primary education system provides adequate support for boys and girls, along with many mathematical activities that are offered and popularize mathematics (e.g. Math Night events, mathematics festivals, Eratosthenes Experiment, international mathematics competition Mathematical Kangaroo, centre for advanced/further mathematics). In all of these projects and activities, boys and girls are equally included and their attitudes towards mathematics are not much different.

Present study does not confirm the hypothesis about no existing age/grade level difference in the primary school students’ attitudes towards mathematics. This finding is consistent with past research projects, older students tend to have a more negative attitude towards mathematics than younger students (Hyde et. al., 1990; Pavlin-Bernardić et al., 2012; Vidić, 2016). Our research has shown that students in 3rd and 4th have a more positive attitude towards mathematics than students in grades 5-8. Furthermore, we can see from the data that attitudes of students became considerably more negative in grades 5 and 6. There could be several reasons for that change. Fifth grade students experience many changes in ways that classes are organised and taught. In grades 3 and 4 they still have a single-class-teacher who knows them well and there is a mutual understanding and connection. In grade 5, they get a different teacher for every subject and every teacher works and teaches in a different way. They also have four new subjects and consequently more classes which means they spend more time in school and have more things to learn. Apart from that, it seems that parents expect their children to be more independent and responsible at that age. The acquired result could also be a consequence of peer pressure, students of that age (12-13) are often characterized by dislike for teachers’ and parental authority and for schoolwork in general.

This research was conducted on a probability sample of students in III. Primary School Varaždin and because of that, we cannot generalize our results to all primary schools in Croatia, but it would be useful to do the same study in other primary schools in Varaždin and Varaždin County, so that a comparative analysis could be done.

Practical implications of acquired results could be in providing additional support to 5th and 6th grade students when the change from positive to negative attitude happens.
Conclusions

Attitudes are important because they navigate our actions and in doing so, influence our reality and also our future. Positive or negative attitude towards mathematics is probably going to determine the future education path, career and life of our students. Even though students realise the potential and value of mathematics and rate it very high in terms of importance, it is evident that there is a certain anxiety towards it and a low level of satisfaction students get from it.

This research has not confirmed any gender differences in attitudes towards mathematics, while the age difference was confirmed. Younger students tend to have a more positive attitude towards mathematics than older students. That result should be understood as a “pointer” so that students’ attitudes could be guided to a more positive direction. Mathematics classes should build bridges between mathematics as a subject and science, not break them. According to our results, it seems that the most negative change happens around the age of 12 and therefore, we should concentrate our efforts on that age group.

References


