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# Determining the Relationship Between 11<sup>th</sup> Students' Attitude Towards Mathematics and Their Achievement in Mathematics

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**Abstract.** The aim of this study was to determine the relationship between high school students' attitudes and their mathematics learning achievement. This study uses a survey method. The population in this study includes is grade 11<sup>th</sup> student at public senior high schools in Pandeglang Regency and Serang City, Indonesia. Sample of this study is 12 schools that determined by stratified proportional random sampling. Data was collected using a questionnaire and students' mathematics reports. Analysis of the data used is Spearman rank correlation analysis and chi-square test. The results showed that there was a weak but significant positive relationship between students' attitudes towards mathematics and mathematics learning achievement. This can indicate that there are some students who have high learning achievement in mathematics tend to have attitudes towards mathematics in the medium or low category.

**Keywords.** Attitude towards mathematics, mathematics achievement, student 11<sup>th</sup> grade.

## 1. Introduction

School mathematics learning has received important attention by educators. One of the reasons is that by learning mathematics students can enhance the ability to think logically, systematically, critically, creatively, and analytically which is good for students needed in their daily lives. The National Council of Teachers of Mathematics stated that school mathematics experiences must involve students in reasoning and sense making (NCTM, 2009). Learning mathematics can assist individuals in solving various problems that require mathematical skills.

However, mathematics is regarded as a subject that is scary, difficult, and has other negative impressions. This can cause students to be less interested in learning mathematics. Therefore, it is not surprising that the results of students' mathematics learning show unfavorable results. Meanwhile, the mathematics achievement of students in Indonesia in international assessments is low, as found in the Program for International Student Assessment (PISA) (Fenanlampir et al., 2019; OECD, 2019) and The Trends in International Mathematics and Science Study (TIMSS).

The attitude of Indonesian students towards mathematics is quite positive, as shown in the research results (Yuniar et al., 2021). This phenomenon is an interesting discussion among educators, and various assumptions have been put forward (Ulumudin, Aisha & Widiputera,

2020). Even though international assessments are carried out for elementary and junior high school students, this phenomenon may occur among students in senior high schools because attitudes are more stable and are formed from previous student learning experiences (Isharyadi & Deswita, 2017). Based on the explanation above, this study aims to determine and describe the relationship between students' attitudes towards mathematics and their learning achievement in students in Pandeglang Regency and Serang City, Indonesia.

## **2. Literature Review**

Learning mathematics requires a positive attitude towards mathematics. Students' attitudes towards mathematics are an accumulation of their various experiences with mathematics (Davadas & Lay, 2017). The accumulation of these students' experience of mathematics material certainly greatly influences student attitudes. They will respond and develop a positive or negative attitude towards the learning experience that has been carried out. Students who have a positive attitude towards mathematics tend to like learning mathematics and are passionate about learning mathematics (Mullis et al., 2020). However, students who have a negative attitude towards mathematics tend to dislike mathematics, they even consider it a useless subject and tend to avoid studying mathematics (Cho & Hwang, 2019). Therefore, teachers need to know their students' attitudes towards mathematics.

Attitude as a concept relates to the way of thinking, acting, and behaving in an individual. This has very serious implications for students, teachers, closest social groups, and the entire school system (Mensah et al., 2013). Alibraheim (2021) reveals that attitude is an essential part of human life; whether people love, hate, like, or dislike something is a response to their surroundings. Attitude plays a crucial role in learning mathematics and a positive attitude toward mathematics is thought to play an important role in causing students to learn mathematics and defines mathematical attitudes 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.

Adapted from Attitudes Toward Mathematics Inventory (ATMI) research conducted by Majeed et al (2013), there are four indicators of attitudes towards mathematics that are used, namely self-confidence which is used to determine a person's belief in good or bad mathematics, value is used to determine one's beliefs about mathematics is useful or not useful, enjoyment is used to find out the likes or dislikes of mathematics, and motivation is used to determine involvement or avoidance of mathematics activities.

Student attitudes are developed over a long period of time and have a strong influence on their effective engagement, participation, and achievement in mathematics. In the school environment, a common problem for many students from every level of school concerns their weak ability in mathematics (Buzzai et al., 2020). The literature shows that factors that can affect math skills and affect math achievement include affective factors, such as math anxiety and attitudes toward math (Barroso et al., 2020). Attitudes are acquired over a long period of time and are difficult to change. Therefore, Çelik (2018) argues that a student who develops a positive or negative attitude towards mathematics can reflect it in their future life.

In mathematics, a student's attitude towards mathematics has been identified as one of the factors that play a role in increasing mathematics learning achievement (Cerbito, 2020). For example, Langat (2015) conducted research in Kenya and found that most students have positive attitudes towards mathematics. Likewise, Peteros et al (2019) concluded that students' attitudes toward mathematics have a more significant impact on student academic achievement. In another study conducted by Simegn & Asfaw (2017) in Ethiopia involving 10<sup>th</sup> and 12<sup>th</sup> grade

students. They determined that at both grade levels, there was not a significant difference between the sexes as shown in their attitude towards mathematics, however, female students showed a greater decrease in attitudes in terms of grade level. They concluded that by increasing students' positive attitudes, they could improve student achievement in mathematics, especially female students.

With the successes and failures students experience, attitudes towards the subject must be developed. Attitudes towards mathematics can be positive or negative. Zan & Di Martino (2008) define a positive attitude as a positive emotional disposition towards the subject while a negative attitude is a negative emotional disposition towards the subject. In addition, positive attitudes towards subjects were more frequently associated with success in mathematics whereas negative attitudes were seen as an indicator of low-level performance, leading to suggestions about interventions to enhance learning and replacing negative attitudes with positive ones. There are many allegations that there is a positive relationship or correlation between students' attitudes and their learning achievement.

This means that students who have a positive attitude towards certain subjects will be more active in learning so that they get better results. And vice versa, students who have a negative attitude towards learning, they will not be eager to learn so that the results are not satisfactory. So that attitudes, self-confidence, and students' views of mathematics play an important role and influence student achievement in learning mathematics.

### **3. Method**

The type of research used in this research is quantitative research. The quantitative approach used consisted of quantitative descriptive to describe students' attitudes towards mathematics and correlational analysis which was intended to analyze the category of relationship between students' attitudes towards mathematics and mathematics achievement.

Attitudes towards mathematics were obtained through an attitude questionnaire towards mathematics, while data on mathematics learning achievement was obtained from students' scores on mathematics in the previous semester contained in report cards.

The attitude questionnaire towards mathematics was adapted from an abbreviated version of the Attitudes Toward Mathematics Inventory (ATMI) Majeed et al (2013) which measures students' self-confidence, value, enjoyment, and motivation in learning mathematics. The total statements included in this questionnaire were 32 statements, 7 of which were negative.

Quantitative research data analysis in this study used the help of statistical programs. Then categorize the value of each indicator. From these values, it is divided into 3 categories (high, medium, low) based on the mean (M) and standard deviation (SD). Data analysis was performed using Spearman's correlation and chi-square test. Because the two variables of this study, namely attitudes towards mathematics and mathematics learning achievement variables are not normally distributed.

Attitude towards mathematics data was obtained from a questionnaire distributed to respondents with 20 statement items. The questionnaire was prepared using a modified Likert Scale with 5 alternative answer scores. The data were analyzed and grouped into 3 categories: high, medium, low categories. For data on attitudes towards mathematics, if the score is more than 81, then it is categorized as high, scores 65-81 are categorized as medium, and scores below 65 are categorized as low.

Data of mathematics achievement obtained from student report in the previous semester. The data were analyzed and grouped into 3 categories: high, medium, low categories. For this

data, if the score is more than 85, then it is categorized as high, scores 75-85 are categorized as medium, and scores below 75 are categorized as low.

#### 4. Results and Discussion

Descriptive analysis in this study includes range, minimum, maximum, mean, standard deviation, frequency table, based on categories which are determined using the help of statistical programs. The table below displays descriptive statistical indicators of attitudes towards mathematics and students' mathematics learning achievements. The four indicators of attitudes towards mathematics are converted into percentages so that comparisons with mathematics learning achievement variables can be more easily described.

**Table 1** Descriptive data

Variable	Number of students	Range	Minimum	Maximum	M	SD
Attitudes towards mathematics	461	46,00	52,00	98,00	72,58	8,05
Mathematics achievement	461	29,00	65,00	94,00	79,90	5,08

Table 1 shows that the score of the attitude variable towards mathematics has a larger data range and standard deviation than the score of the mathematics achievement variable. Student achievement data which is the value of mathematics subject in report cards ranges from 65-94. The minimum score is the lower cut mark or standard setting among the schools involved in this study. Meanwhile, the descriptive statistics for each indicator of attitudes towards mathematics are presented in the table below.

**Tabel 1** Indicator of attitudes towards mathematics

Indicator	Number of students	Range	Minimum	Maximum	M	SD
Self-confidence	461	16	9	25	17,17	2,84
Value	461	23	7	30	24,88	2,83
Enjoyment	461	23	12	35	24,16	3,90
Motivation	461	8	2	10	6,38	1,16

The students' attitude towards mathematics of high school students in Pandeglang Regency and Serang City is generally in the medium category. In more detail it is obtained that 67.7% (312 students) in the medium category, 17.4% (80 students) are in the high category, and 15% (69 students) in the low category.

In addition, the students' mathematics achievement is generally in the medium category. In more detail it is obtained that 315 students or 68.3% in the medium category, 84 students or 18.2% are in the high category, and 62 students or 13.4% are in the low category.

#### 4.1 The relationship between attitudes towards mathematics and learning achievement

The relationship between the variables of attitudes toward mathematics and mathematics learning achievement in this study was analyzed using Spearman's rank correlation analysis. If the calculated value is less than the significance level of 5% or 0.05 then the data is correlated. The results of Spearman's rank correlation analysis for each indicator of attitudes towards mathematics with mathematics learning achievement tend to vary. Self-confidence ( $\rho=0.007$ ,  $p\text{-value}=0.886$ ) has a very weak but not significant positive correlation, value ( $\rho=0.158$ ,  $p\text{-value}=0.001$ ) very weak but significant positive correlation, enjoyment ( $\rho=0.099$ ,  $p\text{-value}=0.033$ ) very positive correlation weak but significant, motivation ( $\rho=-0.006$ ,  $p\text{-value}=0.901$ ), has a very weak and insignificant negative correlation.

The contingency table of attitude and achievement category variables below shows that students are more likely to have positive attitudes in the moderate category in each achievement category. Nearly 59.5% of high achieving students have a moderate positive attitude, the rest are more likely to have a low positive attitude (11.9%) and (28.6%) have a high positive attitude. This is quite different from students who have medium and low achievement. Among students with low achievement, 71% showed moderate positive attitude, the rest had high positive attitude (17.7%) which was slightly more than students who had low positive attitude (11.3%).

**Table 3** Contingency table between attitude toward mathematics and mathematics-achievement

		Attitude Toward Mathematics			Total
		Low	Medium	High	
Mathematics Achievement	Low	7 (11,3%)	44 (71,0%)	11 (17,7%)	62 (100,0%)
	Medium	52 (16,5%)	218 (69,2%)	45 (14,3%)	315 (100,0%)
	High	10 (11,9%)	50 (59,5%)	24 (28,6%)	84 (100,0%)
Total		69 (15,0%)	312 (67,7%)	80 (17,4%)	461 (100,0%)

Attitudes towards mathematics and student achievement in this study show a weak but significant positive correlation which is also in line with research (Cerbito, 2020). In addition, if the achievement and attitude variables are categorized into three categories (high, medium, and low), this positive relationship can be identified. In the form of categorical variables, it was found that low achieving students tended to have moderate and high positive attitudes. This is also the case for high achieving students tend to have moderate and high positive attitudes. While students who achieve moderately have moderate and low positive attitudes.

The results regarding the small proportion of low achieving students who tend to have high positive attitudes are in line with the results of PISA (Schleicher, 2014) and TIMSS (Mullis et al., 2012), even though they involved students of different educational levels. Attitudes towards mathematics and their learning achievement have a significance level of ( $0.023 < 0.005$ ), which means that there is a significant relationship between high school

students' attitudes toward mathematics and their learning achievement. It can be interpreted that if students' attitudes toward mathematics are more positive, their learning achievement will also increase.

These results are also in line with research (Alpacion et al., 2014) which found that attitudes towards mathematics have a significant effect on learning achievement. Students who show a positive attitude towards mathematics tend to do well. Therefore, achievement in mathematics can be increased by developing a positive attitude towards the subject. Unfavorable negative attitudes must be reduced professionally and early enough before students give up learning mathematics.

Although the correlation is very weak ( $\rho=0.106$ ,  $p\text{-value}=0.023$ ), it is positive and significant because of differences in the learning materials studied between high achieving students and low achieving students. A small proportion of high achieving students, who may come from superior schools or classes, have studied mathematics material more broadly with a higher level of difficulty of the questions discussed.

## 5. Conclusion

Based on the results, this study concluded that there is a weak relationship between students' attitudes towards mathematics and mathematics learning achievement, but the relationship is significant. It means that there are some students who have high learning achievement in mathematics who tend to have attitudes towards mathematics in the medium or low category.

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