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The Influence of Mathematical Anxiety and Self-Concept on Students' Mathematics Learning Outcomes

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Abstract

Mathematical anxiety and self-concept are factors that influence students' mathematics learning outcomes. Therefore, this research aims to determine the influence of mathematical anxiety and self-concept on the mathematics learning outcomes of class VIII students at MTs Miftahul Ula partially and simultaneously—a type of ex post facto research with a quantitative approach. The population in this study consisted of all VIII class students at MTs Miftahul Ula for the 2023/2024 academic year, totaling 70 students consisting of 2 classes. The sampling technique is carried out using a saturated sampling technique, namely a sampling technique where all members of the population are used as samples without giving each element or member of the population the same opportunity to become a sample. Based on the results of data analysis, it was found that the significant value for mathematical anxiety was $0.000 < 0.005$ and the significant value for self-concept was $0.107 > 0.005$. The mathematical anxiety factor only partially influences students' mathematics learning outcomes. Meanwhile, based on the F test, the $F_{Calculated}$ value was $23.047 > F_{Table}$ was 3.1 three, and the significant value was $0.000 < 0.05$. So, there is an influence between mathematical anxiety and self-concept on students' mathematics learning outcomes.

INTRODUCTION

Mathematics must be studied at all levels, from elementary school (SD) to college. Article 37 of the Republic of Indonesia Law Number 20 of 2003, which stipulates that every student must study mathematics from elementary to high school, supports this statement at school and in everyday life: mathematics has a very significant position [1], [2], [3], [4]. Mathematics is one of the most important subjects at all stages of formal education, and it is a primary subject. Mathematics is a tool that can clarify and simplify a situation by using abstraction, idealization, or generalization for research purposes or problem-solving [5], [6], [7], [8]. Mathematics develops along with the needs of the times and encourages society to develop or apply mathematics more creatively as an essential educational science [9], [10], [11], [12]. One of the problems that exists today is that students think mathematics is complicated. A lot of people consider mathematics to be a disaster that must be avoided. Mathematics is considered difficult to learn because it is

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abstract, logically systematic, and has many symbols and formulas that are difficult to understand [3], [12], [13], [14].

Students' dislike of mathematics can cause negative impacts in the form of anxiety when they study mathematics. Students who experience mathematics anxiety are usually said to have mathematics anxiety [15], [16], [17], [18], [19], [20], [21], [22]. Mathematics anxiety is an unpleasant emotion caused by changing feelings, known as feelings of anxiety, stiffness, fear, and worry about unwanted activities in mathematics learning. Anxiety is a feeling that is very visible and felt by someone in connection with learning mathematics [23], [24], [25]. When someone faces activities related to learning mathematics that they do not want, they will feel anxious, tense, afraid, and anxious. This is known as math anxiety. Therefore, mathematics anxiety is a feeling of panic, worry, insecurity, and fear caused by emotional instability when faced with something undesirable about learning mathematics.

Mathematics anxiety makes students avoid activities that cause them to be forced into things they do not want and make them think unfavorably about themselves. If students can handle or manage their anxiety, it means that mathematical anxiety has a positive impact on them [22], [26]. Meanwhile, [15] continued that the negative effect of anxiety is that it disrupts focus on learning, which results in low learning outcomes. Students who cannot regulate their level of anxiety, especially in mathematics lessons, will face difficulties and fear, which will cause poor mathematics learning outcomes [23], [27], [28].

There are factors, namely factors within the student (internal) and factors related to outside the student (external). This factor influences student learning outcomes. Internal factors include interest, talent, motivation, self-concept, and others; external factors, for example, factors from inside the house or the surrounding environment. Self-concept is a synthesis of people's beliefs about their characteristics: physical, mental, emotional, social, aspirations, and achievements. Self-concept can be defined as the beliefs, opinions, and views of other people about themselves. If a person has a bad (negative) self-concept, he believes and considers himself weak, helpless, incompetent, a failure, and unattractive, resulting in insecurity and low self-esteem. On the other hand, people who have a good (positive) self-concept appear to be more grateful, optimistic, and confident in themselves and always have a positive attitude toward all things [1].

Learning outcomes are often used as a benchmark for how much someone understands and masters their lessons. Mathematics learning outcomes is a term used to describe students' results during the mathematics learning process. Mathematics learning outcomes are beneficial for measuring the success of mathematics learning [23]. Students' mathematics learning outcomes can be measured by checking whether they can achieve the set learning objectives. If the majority of students cannot achieve the goals, it means that the learning outcomes have not been achieved.

Many previous studies have examined the influence of mathematical anxiety and self-concept on student learning outcomes. Previous research by [16] stated a significant influence between mathematical anxiety and student learning outcomes and no significant influence between self-concept and student learning outcomes. However, the difference between this research and previous research lies in the high and low levels of learning outcomes related to mathematical anxiety and students' partial self-concept.

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In this study, researchers researched the influence of mathematics anxiety and self-concept on students' mathematics learning outcomes. This research is essential in improving students' mathematics learning outcomes, and this research is based on the author's desire to explore further information on mathematical anxiety on student learning outcomes by using objects or populations at the class VIII middle school level. According to the author's interview with one of the mathematics teachers who teaches in class VIII, Mts Miftahul Ula, the information obtained is that there are students with mathematics learning results below the KKM limit, namely below 70. Apart from that, it can be seen that some students are not confident in answering mathematics questions and are in a hurry. They are solving problems, doing a lot of movements or activities when working on math problems, feelings of fear, tension, anxiety, and even heart palpitations. Although it has not been confirmed that this situation is caused by anxiety and self-concept that occurs when they study mathematics, this condition has already occurred in students. Therefore, researchers are interested in conducting this research to prove this is true. Thus, it is hoped that the results of this research can build the self-concept of students who are not enthusiastic about learning mathematics to become enthusiastic.

Through this explanation related to mathematical anxiety, self-concept, and students' mathematics learning outcomes, researchers want to determine whether mathematical anxiety and self-concept influence the mathematics learning outcomes of class VIII students at MTs Miftahul Ula.

METHODS

In this research, a quantitative approach is used, and the ex post facto type is used, meaning it only reveals the actual situation obtained by measuring events within the respondent without manipulating variables. The population in this study were all class VIII students at MTs Miftahul Ula, consisting of 70 respondents. In this study, the population was less than 100 respondents, so the author used a non-probability sampling method with a saturated sampling technique. According to Sugiyono, non-probability sampling is a sampling technique that does not give each element or member of the population a similar chance or opportunity to be sampled.

The quantitative data used in this research includes mathematical anxiety, self-concept, and student mathematics learning outcomes. Researchers collected this data through two methods, namely documentation, questionnaires, and learning results test sheets. Data about students' mathematics learning outcomes were collected through test sheets, and data on mathematical anxiety and self-concept were collected using questionnaires. The Self Concept Questionnaire consists of four aspects: physical, moral, mental, and social. The Mathematical Anxiety Questionnaire consists of four aspects: cognitive, psychological, affective, and behavioral. Mathematical anxiety data is categorized into the categories Always (SL), Often (S), Sometimes (K), and Never (TP). Self-concept is categorized based on the categories very suitable (SS), suitable (S), not suitable (TS), and wildly inappropriate (STS). The mathematical anxiety measurement scale used is the Likert scale. Data processing and analysis aims to find the strength of the influence between variables using multiple linear regression analysis. Before starting the analysis, it is necessary to test the prerequisites for regression analysis, such as the normality, linearity, and multicollinearity tests.

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In this research, multiple regression analysis is an analytical tool used to determine whether there is an influence of the independent variables, namely mathematical anxiety $(X_1)$and self-concept (X_2), on the dependent variable, namely students' mathematics learning outcomes (Y) which were tested using the t-test. Apart from that, multiple linear regression analysis was also used to determine whether there was an influence between anxiety and self-concept simultaneously (simultaneously) on students' mathematics learning outcomes tested using the F test.

RESULTS AND DISCUSSION

Descriptive Statistical Analysis

The researcher will describe the research results for each variable and carry them out with the help of IBM SPSS Statistics 25. Each variable is discussed using quantitative methods in the form of numbers or scores and then interpreted qualitatively. The following will be explained in detail regarding the description of the research data for each variable:

Table 1. Descriptive Statistics Test Results

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Mathematical Anxiety	70	72	90	84.31	3,233
Self-concept	70	65	87	79.91	4,860
Learning outcomes	70	15	85	49.86	15,533
Valid N (listwise)	70				

Based on the results of the Descriptive Test above, we can describe the distribution of data obtained by researchers as follows;

1. Mathematical Anxiety (X_1)

Mathematical anxiety data was obtained through a questionnaire consisting of 24 items with four alternative answers. Based on Table 1 above, it can be seen that the average math anxiety score is 84.31. The minimum score obtained is 72, and the maximum score is 90.

This mathematical anxiety questionnaire is structured based on four aspects, the results of which are presented in the following figure:

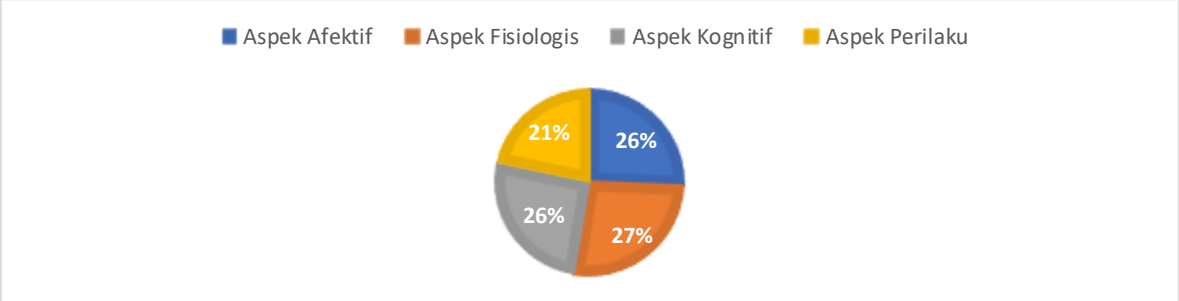

Figure 1. Mathematics Anxiety Questionnaire Results

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Following Figure 1 above, it can be seen that the mathematical anxiety experienced by students is more expressed through physiological aspects, with the highest presentation, namely 27%, characterized by headaches, cold sweat, heart palpitations/anxiety, and shaking during mathematics lessons.

2. Self-Concept (X_2)

Self-concept data was obtained through a questionnaire consisting of 24 items with four alternative answers. Based on Table 1 above, it can be seen that the average self-concept score is 79.91. The minimum score obtained is 65, and the maximum score is 87. This self-concept questionnaire is prepared based on four aspects, the results of which are presented in the following figure:

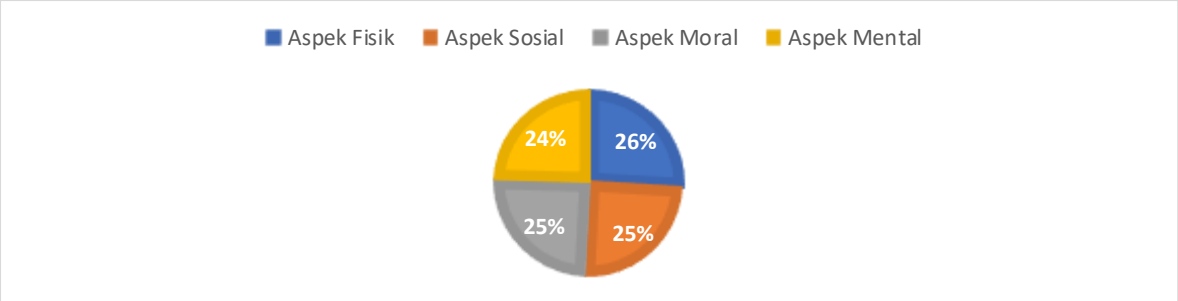

Figure 2. Self-Concept Questionnaire Results

Following Figure 2 above, it can be seen that the self-concept experienced by students is shown more through physical aspects, with the highest presentation, namely 26%. The physical aspect in question is an individual's assessment of his or her physique.

3. Learning Outcomes (Y)

The learning outcome data in this research was obtained through a test with five questions on flat-sided geometric shapes. Based on Table 1 above, it can be seen that the average student score is 49.86. The minimum score obtained is 15, and the maximum score is 85. Apart from that, it is also presented whether or not the students' mathematics learning results have been completed, which are summarized in the following picture:

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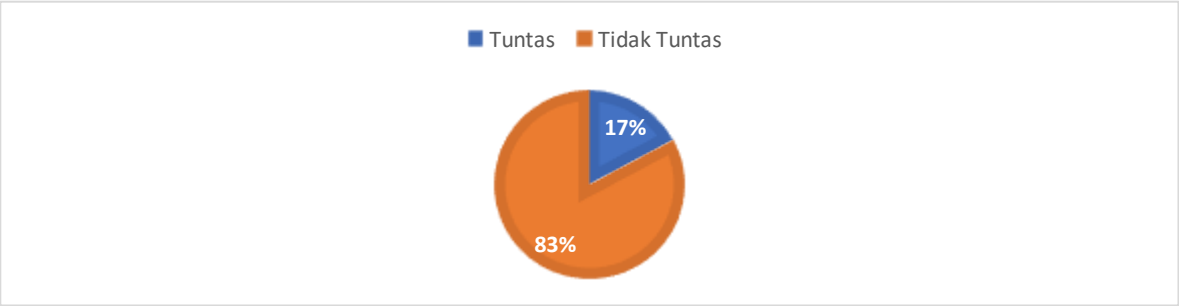

Figure 3. Mathematics Learning Results Test

Following Figure 3 above, it can be seen that 17% of students completed and 83% of students did not complete the mathematics learning outcomes test related to flat-sided shapes. This is said to be complete because the results obtained are more significant than the Minimum Completeness Criteria (KKM), which is 70.

Inferential Statistical Analysis

Prerequisite Test

1. Normality test

The test results using *Kolmogorov-Smirnov* with the help of *SPSS 25* obtained the following results:

Table 2. Normality Test Results

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residuals
N		70
Normal Parameters [a, b]	Mean	.0000000
	Std. Deviation	11.9559049 8
Most Extreme Differences	Absolute	,059
	Positive	,048
	Negative	-.059
Statistical Tests		,059
Asymp. Sig. (2-tailed)		,200 [c,d]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance.

Based on Table 2 above, it is known that the significance value of the normality test is $0{,}200 > 0{,}05$, so it can be interpreted that the data is normally distributed.

2. Linearity Test

The results of the linearity test using *SPSS 25* are as follows:

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Table 3. Linearity Test Results

Statistics	X_1 with Y	X_2 with Y
F_{Hitung}	0,881	0,665
F_{Tabel}	3,13	3,13
Sig	0,570	0,828
Conclusion	Linear	Linear

Based on Table 3 above, it is known that the significance value of the linearity test is 0.828 and 0.570 > 0.05, so it can be interpreted that the data is linear and can be continued with multiple regression analysis.

3. Multicollinearity Test

The results of the multicollinearity test using SPSS 25 are as follows:

Table 4. Multicollinearity Test Results

Statistics	Multicollinearity X_1 *dan* X_2
VIF	0,965 > 0,10
Tolerance	1,036 < 10.00
Conclusion	Multicollinearity does not occur.

Based on Table 4 above, it is known that there is no multicollinearity between the mathematical anxiety variable and the self-concept variable in mathematics, so that it can be continued with multiple linear regression analysis.

The Effect of Mathematical Anxiety and Self-Concept on Partial Student Mathematics Learning Outcomes

The results of data analysis using SPSS 25 are as follows:

Table 5. T-Test Data Results

Coefficients [a]

Model	Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	Q	Sig.
1 (Constant)	329,000	41,821		7,867	,000
Mathematical Anxiety	-2,836	,460	-.590	-6,167	,000
Self-concept	-.500	,306	-.157	-1,635	.107

a. Dependent Variable: Learning Outcomes

Before analyzing Table 5 in the SPSS calculations above, researchers must search. T_{tabel} first, in this study, the researcher used a predetermined distribution table to find T_{tabel}. It is known that if the value. T_{hitung} is as large as $6{,}167 > T_{tabel}$ 1,668,, and the sig value is as significant as $0{,}000 < 0{,}005$. It can be concluded that there is a partially significant negative influence between the X_1 mathematical anxiety variable and Y students' mathematics learning outcomes. Thus, students must suppress or control anxiety to get high student mathematics learning outcomes.

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Then, it is known that the value. T_{hitung} is equal to $1{,}635 < T_{tabel}\ 1{,}668$, and the sig value is equal to $0{,}107 > 0{,}005$, so it can be concluded that there is no significant negative partial influence between the X_2self-concept variables on Ystudents' mathematics learning outcomes. Thus, getting high student mathematics learning outcomes is not influenced by the high or low level of students' self-concept. This means that only the mathematical anxiety factor partially influences students' mathematics learning outcomes.

The Simultaneous Influence of Mathematical Anxiety and Self-concept on Students' Mathematics Learning Outcomes

The results of data analysis using SPSS 25 are as follows:

Table 6. F-Test Data Results

ANOVA [a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6785.459	2	3392.729	23,047	,000 b
	Residual	9863.113	67	147.211		
	Total	16648.571	69			

a. Dependent Variable: Learning Outcomes
b. Predictors: (Constant), Self-Concept, Mathematical Anxiety

From Table 6 above, where $F_{Tabel}$to get the value of $3{,}13$and F_{Hitung} is $23{,}047$. If analyzed, the value F_{Hitung} is $23{,}047 > F_{Tabel}$as large as $3{,}13$ the value is significant $0{,}000 < 0{,}05$. So it can be concluded that this research where X_1 and X_2simultaneously (simultaneously) affects Y because F_{Hitung} It is more significant than F_{Tabel} Moreover, the significant value is smaller than $0{,}05$. This means that the high and low levels of students' mathematics learning outcomes influence the levels of mathematical anxiety and self-concept. To get high learning outcomes, students must have a high self-concept accompanied by controlled anxiety.

This aligns with research by [23]that there is a significant and sufficient influence between self-concept and mathematical anxiety simultaneously on students' mathematics learning outcomes. A value indicates this. F_{Hitung} That is $3{,}785$significantly $0{,}044$ smaller than $0{,}05$. This means that high and low student mathematics learning outcomes are related to high and low levels of mathematical anxiety and self-concept. This is also confirmed by research conducted by [26], namely that mathematics anxiety and self-concept significantly influence students' mathematics learning outcomes, as shown by the value. $F_{Hitung} = 35{,}869$ and level of significance $0{,}000 < 0{,}05$.

The influence of mathematical anxiety on mathematics learning outcomes in this research is in line with research conducted [1] in that there is a partially significant negative influence between the X_1mathematical anxiety variable and Ystudents' mathematics learning outcomes. The research results align with Fitrianingsih [4], shown by values. $T_{Hitung}$of $2{,}340 > T_{Tabel}$0 $2{,}002$ and sig of $0{,}023 < 0{,}05$. This means that the increasing mathematical anxiety in students can cause a decrease in students' mathematics learning outcomes.

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The influence of self-concept on mathematics learning outcomes in this research is in line with research conducted [29], [30], [31], [32], that self-concept does not affect students' mathematics learning outcomes, meaning that getting high learning outcomes is not influenced by the high or low level of student's self-concept. This is proven by obtaining a sig value $0{,}230 > 0{,}05$. Apart from that, research [33] also states that there is no influence of students' self-concept on mathematics learning outcomes at SMPN 2 Pacitan, which is indicated by a significant value of $0{,}996 > 0{,}05$.

According to [34] in previous research, teachers can reduce students' anxiety by creating a comfortable and enjoyable learning environment by actively involving students in every learning process. One method that can be applied to lesson study is research conducted [35], [36], [37], [38], which states that lesson study can improve student learning outcomes. This certainly has a good impact on students' ability to learn mathematics and obtain good results.

CONCLUSION

Based on the results and discussion of the research described above, it can be concluded that mathematical anxiety partially influences the mathematics learning outcomes of class VIII students at MTs Miftahul Ula. Meanwhile, partially, self-concept does not influence the mathematics learning outcomes of class VIII students at MTs Miftahul Ula. Then, there is a simultaneous influence between mathematical anxiety and self-concept on the mathematics learning outcomes of class VIII students at MTs Miftahul Ula. This means that the high and low levels of students' mathematics learning outcomes influence the levels of mathematical anxiety and self-concept. To get high learning outcomes, students must have a high self-concept accompanied by controlled anxiety. The suggestions for future researchers are to do further research on mathematical anxiety and self-concept, considering the importance of this in improving student learning outcomes.

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