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The Influence of Mathematical Beliefs on Mathematical Representation Ability of Students in Class VII at SMP Negeri 2 Sumbang, Banyumas

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Abstract: Mathematical representation ability refers to students' capacity to articulate mathematical concepts through tables, diagrams, pictures, equations/words, and symbols. This ability is believed to be influenced by students' mathematical beliefs, which encompass their attitudes towards mathematics based on personal experiences. This quantitative survey study investigates the impact of mathematical beliefs on the mathematical representation skills of seventh-grade students at SMP Negeri 2 Sumbang, Banyumas Regency. The research population comprised 216 seventh-grade students, with a sample size of 141 students. Mathematical beliefs were examined as the independent variable, while mathematical representation ability served as the dependent variable. Data collection methods included questionnaires to assess mathematical beliefs and tests to evaluate mathematical representation skills. The findings, analyzed using simple linear regression, showed that mathematical beliefs significantly influenced students' mathematical representation ability, accounting for 42.6% variance.

Keywords: mathematical ability; mathematical beliefs; mathematical representation ability

A. Introduction

Education is one of the benchmarks of the quality of a nation. A nation that has a high quality of education can be said to have high quality, and vice versa. Therefore, efforts to improve the quality of the nation are through improving the quality of education. The results of improving the quality of education will be seen in how students' knowledge, skills and attitudes have been formed through learning activities. Learning activities provide a set of provisions to students through various subjects according to the applicable curriculum. One of them is mathematics. Mathematics is one of the lessons given at all levels of education. Mathematics learning at school has an important role in developing students' mathematical abilities.

Mathematics is a science in which there is a collection of concepts in the form of operations, numbers, symbols and definite patterns. Mathematics also supports the science of symbols, rules and operations that are partly applicable to solving scientific and other problems in the real world (Rahmah, 2020). Indirectly, this shows that students' understanding of a collection of concepts and operations is more objective than developing their skills in calculation. Therefore, it is not only good at calculating or can be referred to as cognitive abilities but in learning mathematics can also develop both cognitive, affective, willing aspects (Sitanggang, 2018). The understand of mathematics concepts is not only can calculate the

number but also to solve the problem, make a planning, and give solutions (Riyanti & Zitouni, 2023).

As human resources, students must have mathematical skills. This ability is very important to learn so that students can understand a concept to be able to apply it in various real lives. According to the National Council of Teachers of Mathematics (NCTM), one of the mathematical abilities that students must master in learning mathematics is the ability of mathematical representation (NCTM, 2020). But many students think that math lessons are difficult and difficult. The reason is that most of these students have difficulty in digesting the material taught by the teacher. the results of the 2011 The Third International Mathematics and Science Study (TIMSS) survey report which states that the low mathematical representation skills of students in Indonesia. The survey was conducted in class VIII junior high school with problem modeling in algebraic form problems. It was stated that about 62.7% of students answered correctly, while the average correct answer from international students was 71.8% (Setiadi, 2011).

Mathematical representation ability plays a very important role during learning at school and is closely related to understanding learning in students, so it is very important for students to master. Representations are classified into three categories, namely visual representations (diagrams, graphs, images, or tables), symbolic representations (mathematical statements, algebraic symbols), and verbal representations (words/text) (Kartini, 2009:36). The representations raised by students are expressions of mathematical ideas that students display in their efforts to find solutions to the problems they are facing. Building a new idea from students does not necessarily suddenly arise, but there needs to be a stimulus or stimulus that can develop. With the stimulus provided by the teacher for students during learning, it will affect affective aspects. To increase students' mathematical representation abilities can be used by realistic mathematical approach (Hidayat & Novikasari, 2023).

One of the affective aspects that can build mathematical ideas is the beliefs that students have about mathematics. Beliefs are one important factor of the many factors that must be considered in mathematics education, because this can have a major impact on students' interest, pleasure, and motivation in mathematics (Kloosterman, 2002:247). Psychologically, beliefs are said to be understandings or propositions about the world that are considered true or in other words considered to have an influence on a person's view of some aspects of the world (Philipp, 2007:259). While lexically, in the Oxford dictionary, belief is defined as a strong feeling about the truth or existence of something or believing something is good or true (Fauzi dkk, 2011:1).

The formation of students' beliefs about mathematics is obtained from the first experience when the students concerned learn mathematics (Handal, 2003:47). Students who think that math is difficult because during the first experience of the student working on problems either in the form of assignments or math tests cannot be done properly and end up getting poor grades. Conversely, for some students who think that math is easy because the first experience of the student does not face difficulties in doing math problems. And there are also neutral students who think that math is sometimes easy, sometimes difficult because they do not have a memorable experience.

According to Fadhila's research, there is a positive relationship between beliefs and mathematical ability (Liviananda, 2019). This shows that the belief factor can affect the mathematical abilities of students. The higher the confidence, the higher the mathematical ability. The same thing with mathematical beliefs, it is suspected that mathematical beliefs can affect students' mathematical representation abilities. If students' mathematical beliefs are high, then students will be easy and confident in expressing their mathematical ideas both when doing assignments or tests.

Based on the explanation above, the researcher is interested in examining more deeply the influence of students' mathematical beliefs on students' mathematical representation skills. The research was conducted in class VII SMP Negeri 2 Sumbang after previous interviews with mathematics teachers and observations by following the learning activities.

B. Methods

This research in its implementation uses a quantitative approach with the aim of knowing the effect of mathematical beliefs on students' mathematical representation skills. Specifically, this research will use inferential statistical analysis, namely statistical techniques related to sample data analysis or analyzing sample data and the results are applied to the population. The research method that will be used in this research is survey research. Survey research is research that uses a questionnaire as a data collection tool. Data were obtained using a mathematical confidence instrument in the form of a questionnaire and mathematical representation ability using a test.

The population of this study were all seventh grade students of SMP Negeri 2 Sumbang in the 2022/2023 academic year. The sampling technique of this study used simple random sampling, namely taking sample members from the population taken randomly so that each student from six classes at the VII level, namely VII A, VII B, VII C, VII D, VII E, and VII F, which all had the opportunity to be used as research samples. The number of samples was calculated using the Slovin formula. The total population and sample in this study were 216 and 141 students.

The research instruments used were a questionnaire in the form of a questionnaire and a test consisting of several questions. Before the research instruments were given to respondents, the questionnaires and tests were tested in class VIII to test their validity and reliability. In this study, respondents were given 15 statements and 3 written test questions each. The statements in the questionnaire consisted of 12 positive statements and 3 negative statements. The questionnaire was made using a Likert scale and was arranged by presenting four types of answers, namely Strongly Agree (SS), Agree (S), Disagree (TS), and Strongly Disagree (STS). In positive statements, the value of SS (4), S (3), TS (2), and STS (1), and vice versa for negative statements, the value of SS (1), S (2), TS (3), and STS (4). While the score given to each test question is a minimum score of 0 and a maximum score of 2. In filling out the questionnaire and test, it was guided by the researcher so that it was done honestly and there was no misunderstanding in answering statements that were in accordance with one's own beliefs and abilities.

This study used SPSS 26 to conduct three statistical calculation tests, namely descriptive tests, prerequisite analysis tests, and hypothesis testing. Descriptive tests are used to determine mean, median, mode, standard deviation and others based on each variable. The analysis prerequisite tests used are normality test, linearity test, and regression significance test where

the test is carried out based on the results in the questionnaires and tests that have been distributed. While the hypothesis test used is a simple linear regression test to analyze the data which aims to determine the presence and absence of influence and how much influence students' mathematical beliefs have on students' mathematical representation skills.

C. Results and Discussion

Based on the data collection, each variable is divided into five categories to see the frequency of each individual. The following are the results of the questionnaire and test calculations of each variable.

Table 1. Categorization of Mathematics Confidence Questionnaire Results

No.	Range	Category
1.	15 - 23	Very Low
2.	24 - 32	Low
3.	33 - 41	Medium
4.	42 - 51	High
5.	52 - 61	Very High

Based on the table above, the results show that out of 141 students who have a low level of mathematical confidence as many as 28 students with a percentage of 19.9%, students who have a moderate level of mathematical confidence as many as 52 students with a percentage of 36.9%, and students who have a high level of mathematical confidence as many as 61 students with a percentage of 43.2%. While the categorization of mathematical representation ability is as follows.

Table 2. Categorization of Mathematical Representation Ability Test Results

No.	Range	Category
1.	0 - 3	Very Low
2.	4 - 7	Low
3.	8 - 11	Medium
4.	12 - 15	High
5.	16 - 20	Very High

Based on the table above, the results show that out of 141 students who have a low level of mathematical representation ability as many as 9 students with a percentage of 6.3%, students who have a moderate level of mathematical representation ability as many as 30 students with a percentage of 21.3%, students who have a high level of mathematical representation ability as many as 53 students with a percentage of 37.6%, and students who have a very high level of mathematical representation ability as many as 49 students with a percentage of 34.8%.

Furthermore, descriptive tests, prerequisite analysis tests, and hypothesis testing will be carried out. First, the test carried out is a descriptive test used to determine the statistical description of the data obtained from the results of the mathematical belief questionnaire and the mathematical representation ability test is as follows.

Table 3. Descriptive test

		Mathematical Beliefs	Mathematical Representation Ability
N	Valid	141	141
	Missing	0	0
Mean		39.11	13.21
Std. Error of Mean		.545	.304
Median		40.00	13.00
Std. Deviation		6.473	3.605
Minimum		27	6
Maximum		49	19

The test that will be carried out next is the prerequisite test of analysis. The first prerequisite test is the normality test. The normality test is carried out on the data taken to determine whether the data is normally distributed or not. The decision-making criteria are if the sig value. ≥ 0.05 then the data is normally distributed and vice versa, if the sig value. < 0.05 then the data is not normally distributed. The normality test in this study was carried out using the *Kolmogorov-Smirnov* method using residuals with the following output.

Table 4. Normality Test

	Tests of Normality					
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Unstandardized Residual	.074	141	.058	.980	141	.033

a. Lilliefors Significance Correction

Based on the table in the *Kolmogorov-Smirnov* test column, it can be seen that the normality test results with a sig. value of 0.058. Because 0.058 ≥ 0.05 or sig value. ≥ 0.05, it can be concluded that the data is normally distributed. The second prerequisite test is the linearity test. The linearity test is carried out with the aim of knowing whether or not the relationship between the dependent variable and the independent variable is linear. The relationship between variables can be known to be linear or not by paying attention to the significance value, namely if the sig value. deviation from linearity > 0.05 then the relationship between variables is linear and if the sig value. deviation from linearity <0.05 then the relationship between variables is not linear. The results of the linearity test can be seen as follows.

Table 5. Linearity Test

			ANOVA Table				
			Sum of Squares	df	Mean Square	F	Sig.
Mathematical Representation Ability * Mathematical Belief	Between Groups	(Combined)	919.181	22	41.781	5.475	.000
		Linearity	774.816	1	774.816	101.538	.000
		Deviation from Linearity	144.365	21	6.875	.901	.590
	Within Groups		900.437	118	7.631		
	Total		1819.617	140			

Based on the table, it can be seen that the linearity test results with a sig. deviation from linearity value of 0.590. Because 0.590> 0.05 or sig. deviation from linearity> 0.05, it can be concluded that the relationship between variables is linear. Furthermore, the third prerequisite test is the regression significance test. The regression significance test is carried out with the aim of knowing whether the regression coefficient obtained provides a meaningful relationship or not. The decision-making criteria are if the sig value. > 0.05 then the regression does not mean and if the sig value. ≤ 0.05 then regression means. The results of the regression significance test are as follows.

Table 6. Regression Significance Test

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	774.816	1	774.816	103.081	.000[b]
	Residual	1044.801	139	7.517		
	Total	1819.617	140			

a. Dependent Variable: Mathematical Representation Ability
b. Predictors: (Constant), Mathematical Beliefs

Based on the table, it can be seen that the regression significance test results with a sig. value of 0.000. Because 0.000 <0.05 or sig value. <0.05, it means that the regression is meaningful. Thus, it can be concluded that the math belief variable can be used to predict students' mathematical representation ability. The last stage is hypothesis testing using simple linear regression test. The hypothesis test results are as follows.

Table 7. Hypothesis Test

Coefficients [a]						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	-1.001	1.419		-.705	.482
	Mathematical Beliefs	.363	.036	.653	10.153	.000

a. Dependent Variable: Mathematical Representation Ability

Based on the table above, in the row of mathematical beliefs, it can be seen that the hypothesis test results are a significance value of 0.000. Because the significance value <0.05, it can be concluded that there is a significant influence between students' mathematical beliefs on the representation ability of seventh grade students of SMP Negeri 2 Sumbang. As for the regression equation, it can be found in the std. error column which can be written as $\hat{Y}$=1.419+0.036X. The constant of 1.419 states that if there is a value of X (X=0) then the value of $\hat{Y}$=1.419. The X regression coefficient of 0.036 states that every discussion of one unit of X, the value of $\hat{Y}$ increases by 0.036. Furthermore, the calculation of the coefficient of determination is as follows.

Table 8. Coefficient of Determination

Model Summary [b]				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.653[a]	.426	.422	2.742

a. Predictors: (Constant), Mathematical Beliefs
b. Dependent Variable: Mathematical Representation Ability

The table above shows the correlation / relationship value (R) which is 0.653 and shows the percentage of the influence of the independent variable on the dependent variable called the coefficient of determination which is the result of multiplying R. From the table also obtained a coefficient of determination of 0.426 or 0.426 × 100% = 42.6% which means that the influence of the student's mathematical belief variable on the student's mathematical representation ability variable is 42.6%.

Based on the results of data analysis conducted by researchers on the results of the study, it gets an overview of the issues discussed in this study. In accordance with the theory that discusses that students' mathematical beliefs are one of the factors that can affect students' mathematical representation abilities. This is also in line with Guven who states that students' beliefs have a strong influence on students' mindsets and habits. Positive mathematical beliefs motivate students to solve problems, make students think of many solutions to solve problems, and make students successful in solving problems. Negative math beliefs will make students lazy to solve their problems they tend to avoid problems so they cannot solve the problems given.

Research on students' mathematical beliefs can be measured from indicators such as the assumption that math is not boring, math is not difficult, and others. Students will have positive beliefs and so they do math happily and enthusiastically in understanding mathematics without any coercion so that students have the opportunity to get satisfactory mathematical representation ability test results. So the more positive or higher the student's mathematical beliefs, the higher the mathematical representation ability. Conversely, the more negative or low the student's mathematical beliefs, the lower the mathematical representation ability.

D. Conclusion

Based on the research and the results of the analysis and discussion that has been done, it can be concluded that there is an influence of mathematical beliefs on mathematical representation ability. This can be proven by the value of R^2 or the coefficient of determination of 42.6%, which means that the influence of mathematical beliefs on mathematical representation ability is large enough to be influential or significant with a correlation value (R) of 0.653. While the remaining 57.4% is influenced by other factors both internal and external factors. Based on the results of data calculations obtained that the higher the mathematical beliefs of students, the higher the mathematical representation ability of students and vice versa.

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