

The Effect of Mathematical Disposition on Students' Mathematical Creative Thinking Abilities in Class XI

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Abstract: Mathematics is a lesson that is useful for the development of thinking. Then, thinking becomes an important process in it, where students are expected to be able to think deductively. Students are asked to understand the concept of the material that has been delivered with an active and conscious attitude, referred to as a disposition. The purpose of this research was to find out the effectiveness of mathematical disposition on students' mathematical creative thinking abilities in the eleventh grade of MIPA MAN 2 Banyumas. The population in this research were all students of XI MIPA consisting of 243 students, 153 students were taken as samples using a simple random sampling technique. This research was conducted using quantitative research methods where data was obtained by distributing research instruments in the form of questionnaires and tests. The analysis technique used a simple linear regression analysis technique. Before the analysis test was carried out, the data went through analysis prerequisite tests, namely the normality test, regression significance test, and linearity test. The results of this study indicated that there was an influence of mathematical disposition on students' mathematical creative thinking abilities of 12,6%. When the regression equation was obtained, $\hat{Y}=8.325+0.730X$ showed that the regression coefficient value was positive. Therefore, if the mathematical disposition (X) was increased by 1 unit, the student's mathematical creative thinking ability (Y) could be increased by 0.730 units.

Keywords: Creative Thinking; Disposition; Mathematical Abilities; Mathematical Disposition; Mathematics.

A. Introduction

In simple terms, education is defined as an effort made by humans to foster human personality so that it can be in accordance with the values in society and culture. According to J.J. Rousseau, education is to give us provision that does not exist in childhood, but we need it in adulthood. The educational process that we know is a process of interaction that involves at least two people, namely between students and teachers. This is in line with Macmud's opinion which says that the educational process is carried out by educators who are conscious, intentional, and full of responsibility in guiding students to become physically and spiritually mature as well as socially mature. So that in the future they can become human beings who are able to carry out physical tasks as well as think, behave, have an adult will, and can live normally and have the courage to be responsible for their attitudes and actions towards others.

The process of interaction carried out between the teacher and students is referred to as the teaching and learning process. Teaching as an activity to create an environment that

allows the learning process to occur. Self-study is a process carried out by someone to be able to produce changes in behavior that are carried out intentionally in order to gain knowledge, skills, and new experiences in a better direction. As we know, in the world of education, so many learning materials are delivered by teachers to students, especially in our beloved country. Such as Indonesian, Physics, Religious Education, Arts, Sociology, Mathematics, and many more.

Mathematics as a subject that is considered difficult by most students because mathematics is abstract, logical, systematic, and full of confusing symbols and formulas. However, mathematics actually has an important role in various scientific disciplines and promotes human thought. One reason is because mathematics is a science that can cover all aspects of life and education. It can be said that mathematics is also a subject that is closely related to everyday life. Parts of mathematics such as calculating, measuring, processing data, and others play a role in the process of forming something new, whether in science, problem solving, development, or technology. Through learning mathematics it is hoped that it can make students flexible in explaining the interrelationships between mathematical concepts, explaining mathematical ideas and statements, interpreting the solutions obtained, communicating ideas with symbols, tables, diagrams, or other media to clarify problems. This ability is an aspect of the ability to think creatively mathematically. Mathematics as a lesson that is useful for the development of thoughts such as ideas, processes, and reasoning related to opinions or facts. In learning mathematics, thinking becomes an important process in it, where students are expected to be able to think deductively. However, in reality, there are still many students whose abilities are still low. For example, they still have difficulties in performing mathematical calculations and operations, and they are even still fixated on the examples given. When they are given different types of questions with examples, they will face difficulties.

Creative thinking is a learning process that is carried out with several methods and various strategies to be able to provide motivation and bring out students' creativity during learning. Creative thinking is the ability to provide various possible answers or problem solving based on the information provided, and being able to generate many ideas related to a problem. This creative thinking ability provides opportunities for students to be creative and imaginative in solving a mathematical problem. With trained creative thinking skills, the ability to relate students' mathematical ideas is formed, then their mathematical understanding skills will be better, students can also understand the relationships between topics in mathematics. Creative thinking in mathematics is the ability to understand patterns and relationships using complex thinking. According to Tall in La Moma, creative thinking is thinking in an effort to solve problems and/or develop thinking in structures by paying attention to the rules of deductive reasoning and generating relationships from concepts to unify important points in mathematics. Thinking creatively in learning mathematics can make it easier for students to solve math problems, because students can express answers to problems with various solutions. Mathematical creative thinking has several indicators, according to Munandar there are four indicator components, namely: Fluency, providing many answers, ideas, and problem solving. Flexibility, generate various ideas or answers. Originality, creating unique ideas or original ideas. Elaboration, adding or detailing the details of an object, idea, or situation so that it becomes more interesting.

In the learning process, students are asked to understand the concept of the material that has been delivered with an active and conscious attitude, or referred to as a disposition. When students are learning mathematics, student behavior tends to be conscious, organized, and voluntary to build traits, attitudes, and skills in mathematics, this is explicitly called the students' mathematical disposition. Sumarmo defines a mathematical disposition as a strong desire, awareness, inclination, and dedication for students to think and act mathematically. Kilpatrick defines a mathematical disposition as a productive disposition, or a view of mathematics as being logical and producing something useful. Mathematical disposition is an awareness that exists in students to be able to play an active role in the learning process. Where students play an active role in class such as asking if the material that has been delivered by the teacher is not well understood. Mathematical disposition can also be interpreted as students' interest and appreciation of mathematics, in the form of a tendency to think and act positively, including self-confidence, curiosity, perseverance, enthusiasm for learning, persistent in facing problems, flexible, willing to share with others, and reflective in math activities.

In learning, teachers should be able to cultivate a conscious, organized, and voluntary disposition in students for the implementation of good learning. Disposition plays an important role in supporting the proper course of learning mathematics, so that students can enjoy learning mathematics, experience the benefits, and can apply mathematics in everyday life. Polking states that the existence of a mathematical disposition can be demonstrated by the existence; confidence in using mathematics, solving problems, giving reasons, and communicating ideas; flexibility in investigating mathematical ideas and trying to find alternative methods in solving problems; diligently doing math assignments; interest, curiosity, and inventiveness in solving mathematical tasks; tend to monitor, reflect on their own performance and reasoning; assess the application of mathematics to other situations in mathematics and everyday experience; and appreciate the role of mathematics. According to the NCTM (National Council of Teachers Mathematics), there are seven indicators of mathematical disposition, namely; confidence in solving math problems, communicating ideas, and giving reasons; flexibility in exploring mathematical ideas and trying various alternative methods to solve problems; strong determination to complete math tasks; interest, curiosity, and the ability to discover in doing mathematics; tendency to monitor and reflect on one's own thought processes and performance; assess the application of mathematics in other fields in everyday life; and appreciate the role of mathematics in culture and its values, both mathematics as a tool, and mathematics as a language. The benefits of this disposition include, the transfer of knowledge to students can run as expected, the atmosphere in the learning process becomes more enjoyable so that it will provide maximum results, and the teacher will be more enthusiastic about teaching in class.

Based on the results of an interview that was conducted with Ms. Devi Rakhmawaty, a Class XI math teacher at MAN 2 Banyumas, on Thursday, November 17 2022, said that in learning mathematics the teacher gives students the opportunity to learn from various references, with the hope that students can develop their way of thinking, especially how to think creatively in solving mathematical problems with various alternative solutions. But in fact there are still some obstacles, such as the habit of students writing answers to questions the same as the examples given by the teacher. This can be an obstacle for students in

developing mathematical creative thinking processes, there are even some students who don't want to do the practice questions given from the teacher.

Based on this explanation, students' ability to think creatively cannot be maximized. This is in line with the results of Suparman and Zanthi's research which shows that the low ability to think creatively mathematically is because there are still students' mistakes in solving mathematical creative thinking ability questions in the process of making mathematical models, identifying the adequacy of elements and concepts contained, as well as errors in arithmetic operations. The ability to think creatively mathematically is important because by understanding the flow of thinking in solving mathematical problems, it will be easier for students to determine the best way to solve the problem, or in other words students can answer questions with not only one way of solving. In addition to the ability to think creatively mathematically, In learning mathematics, students can also develop other abilities, such as being critical and careful, objective and open, appreciating the beauty of mathematics, curiosity, thinking and acting creatively, and enjoying learning mathematics. These attitudes and thinking habits will shape students' mathematical dispositions. Mathematical disposition is a strong desire, awareness and dedication in students to learn mathematics and carry out various mathematical activities. From this explanation, there is a relationship between mathematical creative thinking abilities and mathematical dispositions such as the results of Reynaldi, Sugiatno, and Astuti's research which shows a relationship between mathematical creative thinking ability and mathematical disposition. Where students who have a high mathematical disposition will also have good creative thinking abilities. In addition, in developing the level of creative thinking, students need a mathematical disposition at each level of creative thinking experienced by students. It is hoped that in each learning process with the aim of developing students' creative thinking levels, accompanied by strong awareness and dedication within students.

From the results of the observations and explanations that have been presented, the researcher is interested in examining more deeply related to “the Effect of Mathematical Disposition on Students' Mathematical Creative Thinking Abilities in Class XI”. Referring to the formulation of the problem that has been described, the purpose of this study is to find out whether there is an influence of mathematical disposition on the mathematical creative thinking abilities of class XI MIPA MAN 2 Banyumas.

B. Methods

The type of research used in this study is a quantitative research method. Quantitative research is a research method that is based on the philosophy of positivism, where this method is used in researching a population or sample. Data are obtained with research instruments and analyzed using quantitative/statistical methods, and aim to test hypotheses that have been set before. This research also belongs to causative research which is a type of research with problem characteristics in the form of a causal relationship between two or more variables. Based on the formulation of the research problem, there are two variables used, namely the independent variable and the dependent variable. the independent variable in this study is the mathematical disposition while the dependent variable is the mathematical creative thinking ability. Data collection was carried out by distributing questionnaires related

to mathematical disposition and tests of mathematical creative thinking skills to students of class XI MIPA MAN 2 Banyumas. The data collection process starts from content validity and item validity. Content validity is the validity that is tested through testing the feasibility of the content through rational analysis by a competent panel or through expert judgment. While item validity is used to determine the validity/accuracy/accuracy of the question items in measuring the variables studied. The validity test that the researcher will use is the Product Moment Correlation developed by Pearson in testing the validity of the items. Research data collection was carried out in the even semester of the 2022/2023 school year, in the period from May 26 to June 10, 2023. The data obtained was then analyzed with prerequisite tests, namely normality tests, regression significance, and linearity tests which had previously been tested for validity and reliability. Then a hypothesis test was carried out to obtain research results related to students' mathematical dispositions and creative thinking abilities.

C. Results and Discussion

1. Result

Data processing as a whole is assisted by the SPSS Version 25.0 application. Before the data collection process is carried out, the mathematical disposition questionnaire instrument and the mathematical creative thinking ability test will go through validity and reliability tests first. The questionnaire instrument was compiled based on indicators of mathematical disposition with a total of 27 statement items, while the test instrument was compiled based on indicators of the mathematical creative thinking ability with 6 points of items. From the results of validity and reliability testing, obtained 20 questionnaire instruments and 5 points of item test instruments which were declared valid. This instrument will be used in the process of collecting data in research. After the data related to mathematical disposition and mathematical creative thinking ability is obtained, then an analysis prerequisite test is carried out.

The first step is to do a normality test. The normality test is used to prove whether a sample from a population is normally distributed, it can also be used to prove that the population has a normal distribution. This normality test is carried out by comparing the data owned with distribution data that has the same mean and standard deviation. Data that is normally distributed is a requirement of parametric statistics. Based on the results of data processing that has been done, the results show that the data is normally distributed. This is based on the results of the Kolmogorov-Smirnov test, the results of the analysis obtained a significance value of 0.54 greater than 0.05, it can be concluded that the data is normally distributed. The results of this normality test are based on the results of the following table analysis:

Table 1. Normality Test Result

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Unstandardized Residual	,072	153	,054	,976	153	,008

a. Lilliefors Significance Correction

Then a linearity test was carried out between mathematical dispositions and mathematical creative thinking abilities. The linearity test was conducted to determine the relationship between the independent variables and the dependent variable whether it was linear or not, or whether it could be interpreted as a straight line or not. This linearity test uses decision-making criteria if the value of Sig. ≥ 0.05 indicates that the relationship between the research variables is linear. Otherwise, if the significance value < 0.05 indicates that the relationship between research variables is not linear. The following table shows the results of the data linearity test:

Table 2. Linearity Test Results

			Sum of Squares	df	Mean Square	F	Sig.
Creativ * Disposition	Between Groups	(Combined)	10317,749	32	322,430	1,796	,013
		Linearity	4008,975	1	4008,975	22,337	,000
		Deviation from Linearity	6308,773	31	203,509	1,134	,308
	Within Groups		21537,480	120	179,479		
	Total		31855,229	152			

From Table 2 it is found that there is a linear relationship between mathematical disposition and the mathematical creative thinking ability. This is indicated by the significance value of the Deviation from Linearity, which is 0.308, which is greater than the value of 0.05.

Next, a regression significance test was carried out to see how much influence mathematical disposition had on students' mathematical creative thinking abilities with the test results presented as follows:

Table 3. Regression Significance Test

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4008,975	1	4008,975	21,739	,000 ^b
	Residual	27846,253	151	184,412		
	Total	31855,229	152			

a. Dependent Variable: Kreatif

b. Predictors: (Constant), Disposisi

Based on Table 3, the value of significance is 0.000. So it can be concluded that Sig. $0.000 < 0.05$ means that the regression is significant. So that the mathematical disposition variable can be used to determine students' mathematical creative thinking abilities. Then will look for the value of the coefficient of determination. where the coefficient of this

determinant shows the extent to which the contribution of the independent variables in the linear regression model is able to explain the variation of the dependent variable. The coefficient of this determinant can be seen from the table, namely the value of R-Square (R^2). The R-Square value can be obtained from the following table:

Table 4. Output R-Square Value

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,355 ^a	,126	,120	13,580

a. Predictors: (Constant), Disposisi

b. Dependent Variable: Kreatif

The table above shows the magnitude of the correlation value which is equal to 0.355 and shows the large percentage of influence of the independent variable on the dependent variable which is referred to as the determinant coefficient as a result of squaring R. From the table the determinant coefficient value of 0.126 is obtained, which means that the magnitude of the influence of the mathematical disposition variable on mathematical creative thinking ability is 12.6%.

Table 5. Hypothesis Test Results

		Unstandardized Coefficients		Standardized Coefficients	
Model		B	Std. Error	Beta	t
1	(Constant)	8,325	8,456		,985
	Disposisi	,730	,156	,355	4,663

a. Dependent Variable: Kreatif

Based on the results of the hypothesis test table above, the regression equation obtained from this research is:

$$\hat{Y} = 8,325 + 0,730X$$

The results of the regression equation show that if the students' mathematical disposition is zero, then the value of students' mathematical creative thinking ability is 8.325. The value of the regression coefficient is positive, which means that if the mathematical disposition (X) increases by 1 unit, the student's mathematical creative thinking ability (Y) will increase by 0.730 units. This shows that the students' mathematical disposition and creative thinking ability are directly proportional, in other words, the higher the student's mathematical disposition, the higher the student's ability to think creatively.

2. Discussion

In the discussion will be explained related to the results of research that has been conducted by researchers. This research was conducted to determine the effect of mathematical disposition on the students' mathematical creative thinking abilities in class XI

MIPA MAN 2 Banyumas. The population used in this study were all students of class XI MIPA MAN 2 Banyumas totaling 243 students, with a sample of 153 students based on Simple Random Sampling or Probability Sampling technique calculations and utilizing the Research Randomizer website.

To obtain the required data, the researcher used a questionnaire instrument to obtain mathematical disposition data and tests for mathematical creative thinking skills. Disposition questionnaires and test questions were distributed to class XI MIPA students who had previously carried out content validity and item validity. Content validity is carried out to determine the feasibility of the content through rational analysis by a competent panel or through expert judgment. Item validity is carried out to obtain valid or invalid results related to each item and statement.

The reliability test results of the mathematical disposition questionnaire instrument were 0.745 and the students' mathematical creative thinking ability test instrument was 0.714. Decision making is by comparing the value of Cronbach's Alpha reliability with 0.6. If the reliability Cronbach's Alpha value is > 0.6 , then the instrument is declared reliable. Otherwise, the instrument is declared unreliable. The results obtained from the reliability of the mathematical disposition questionnaire trial and the test questions related to the ability to think creatively mathematically with a total of 42 students with a significance level of 5% were declared reliable. So that this research instrument can be used as a data collection tool in the research that will be carried out.

The mathematical disposition questionnaire instruments and mathematical creative thinking ability tests that have been declared valid and reliable, are then distributed to students who are used as research samples. After the data has been obtained, then the prerequisite test and hypothesis test are carried out. From the results of the research that the researchers have done, the results show that there is an influence between mathematical dispositions on students' mathematical creative thinking abilities. These results were obtained from the results of a simple linear regression test which showed a significance level of 0.000. The value of $0.000 < 0.05$ so that H_0 is rejected and H_1 is accepted, which means that there is an influence of mathematical disposition on the students' mathematical creative thinking abilities in class XI MIPA MAN 2 Banyumas.

The regression equation obtained from this study is $\hat{Y} = 8.325 + 0.730X$. The results of the regression equation show that the value of b is positive, which means that if the mathematical disposition (X) increases by 1 unit, the students' mathematical creative thinking ability (Y) will increase by 0.730 units. To find out the influence of students' mathematical dispositions on students' mathematical creative thinking abilities, it can be seen through the value of the R-Square determinant coefficient of 0.126. Where mathematical disposition influences students' mathematical creative thinking ability by 12.6% and 87.4% is influenced by other variables outside the mathematical disposition variable.

The results of this study indicate that there is an influence of mathematical disposition on students' mathematical creative thinking abilities. This is in line with the results of research by Reynaldi et al. which shows a relationship between mathematical creative thinking abilities and mathematical dispositions where students who have high mathematical dispositions will have good creative thinking abilities. Suparman and Zanthi also suggested

that there is a relationship between mathematical creative thinking ability and mathematical disposition.

This mathematical disposition is able to help students view mathematics positively. This positive attitude will make students like mathematics so they will be more assiduous, persistent and confident. This good disposition will enable students to be able to come up with creative ideas in the process of solving mathematical problems or creating new innovations. The existence of an association between mathematical dispositions and mathematical creative thinking abilities was demonstrated by Sugilar, where the results of his research showed that the association between students' mathematical creative thinking abilities and dispositions was relatively high.

This research obtained results in the form of a positive influence of mathematical disposition on students' mathematical creative thinking abilities. So that students are able to do mathematical tasks well, a mathematical disposition is necessary which will later provide encouragement to students to participate in the entire learning process, never give up, take responsibility for each task, and continue trying to find solutions to solve problems. With this, students' creative mathematical thinking abilities will be improved so that they can achieve maximum results. Based on these reasons, it is important to train and improve students' mathematical dispositions so that students can have good mathematical creative thinking skills.

From the results of this study, it will be explained regarding the description of the data based on the category table that has been compiled based on the calculation of the mean and the standard deviation obtained by the students score.

Table 6. Category Calculation Formula

Category	Formula
Low	$X \leq \text{mean} - \text{std. deviation}$
	$X \leq 53,58 - 7,039$
	$X \leq 46,541$
Medium	$\text{mean} - \text{std. deviation} < X \leq \text{mean} + \text{std. deviation}$
	$53,58 - 7,039 < X \leq 53,58 + 7,039$
	$46,541 < X \leq 60,619$
Hight	$X > \text{mean} + \text{std. deviation}$
	$X > 53,58 + 7,039$
	$X > 60,619$

Data on students' mathematical dispositions obtained by distributing questionnaires related to mathematical dispositions, the maximum score given for each statement item is 4 and the minimum score is 1.

Table 7. Category Results Instrument Mathematical Disposition Questionnaire

No.	Category	Frequency
1.	Low	19
2.	Medium	106
3.	Height	28
	Total	153

Based on the Table 7, the results obtained, from the 153 students who were used as research samples, there were 19 students who had a low level of mathematical disposition, 106 students had a medium level of mathematical disposition, and 28 students had a high level of mathematical disposition.

Then a table of categories of mathematical creative thinking ability will be made, with the highest score being 4 and the lowest score is 0 for each question.

Table 8. Category Results Instrument Mathematical Creative Thinking Ability Test

No.	Category	Frequency
1.	Low	29
2.	Medium	96
3.	Height	28
	Total	153

Based on the Table 8, from the 153 students sampled in the research, there were 29 students who had a low level of mathematical creative thinking ability, 96 students had a medium level of mathematical creative thinking ability, and 28 students who had high mathematical creative thinking ability.

D. Conclusion

Based on the results of the analysis and discussion of the research that the researchers have done regarding the effect of mathematical disposition on the students' mathematical creative thinking abilities in class XI MIPA MAN 2 Banyumas, it can be concluded that there is an influence of mathematical disposition on the students' mathematical creative thinking abilities in class XI MIPA MAN 2 Banyumas. The magnitude of the influence of mathematical disposition on the students' mathematical creative thinking abilities is 12.6% and the remaining 87.4% is influenced by variables other than mathematical disposition.

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