

APPLICATION OF BRAINSTORMING LEARNING METHODS TO STUDENTS' CRITICAL THINKING ABILITY

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Abstract

The purpose of this research is to find out the differences between the Brainstorming learning method on students' critical thinking skills in mathematics. The method used in this study is a quasi-experimental method with a Nonequivalent Control Group Design. The sample in this study were 66 students of class VII SMP Negeri 20 Kota Tangerang, consisting of 33 students for the experimental class and 33 students for the control class. The research instrument used as a test result of mathematical critical thinking skills is in the form of descriptive questions. The data analysis technique in this study is the t-test to test the proposed hypothesis. From the results of the calculations that have been carried out, it turns out that the value obtained is tcount of 2,454 at a significant level of $\alpha = 5\%$ which is then compared with a ttable value of 2,035. because tcount > ttable (2.454 > 2.035) then H₀ is rejected so it can be concluded that the Brainstorming learning method has an effect on the ability to think critically mathematically in class VII students of junior high school.

Keywords: Brainstorming Method, Critical thinking ability

INTRODUCTION

Education is an effort to develop the potential in a person. Education holds an important element in forming a person's mindset, morals and behavior so that it is in accordance with applicable norms, such as religious norms, moral norms, politeness norms, and legal norms in accordance with Law - Law no. 20 of 2003 concerning the National Education System which states that "Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have spiritual religious strength, self-control, personality, intelligence, noble character, and skills what is needed by himself, the people of the nation and the State."

The goal of education in general is to provide an environment that allows students to optimally develop their talents and abilities in an active learning environment. Using strategies or teaching methods quickly is one way to realize the expected educational goals. The achievement of educational goals in accordance with applicable laws can create a good learning process.

Learning is a process of interaction between students and educators and learningresources in a learning environment (Law No. 20 of 2003, Article 1 paragraph 20). The learning objectives are for students to have the ability to: (1) use reasoning on patterns and properties, perform mathematical manipulations in making generalizations, compiling evidence, or explaining mathematical ideas and statements, (2) solving problems which

include the ability to understand problems, design mathematical models, completing models and mathematics, completing models and interpreting the solutions obtained. (3) communicating ideas with symbols, tables, diagrams or other media to clarify situations or problems, (4) having an attitude of appreciating the usefulness of mathematics in life, namely having curiosity, concern, and interest in learning mathematics, and tenacity and confidence in problem solving. (Rizal, Tayeb, Latuconsina, 2016: 176).

Mathematics is often seen as a language or an accurate tool for solving social, economic, chemical, physical and biological problems. As language or mathematics serving other sciences, this role is used as the reason why people call mathematics the queen of science (the queen of science) (Dede Roswati, 2015, h, 2). Mathematics with its nature as a structured and systematic science, as a human activity through active, dynamic and generative processes as well as a science that develops critical, objective and open thinking attitudes is very important for students to have in dealing with the development of science and human resources which continues to grow.

Mathematics functions to develop the ability to count, measure, use formulas, develop the ability to communicate ideas and information through the language of mathematics. Communicating ideas with the language of mathematics is actually more practical, systematic and efficient. (Suci & Fitriani 2021: 8). So that in the future there will be no misunderstandings during the learning process of mathematics, and no additional students will experience this which will have an impact on weakening students' understanding of learning. In carrying out the process of increasing learning understanding, the thinking ability developed in mathematics is the ability to think critically. Critical thinking is the ability to think at a complex level using a process of analysis and evaluation. Critical attitudes and ways of thinking are able to form people who want to do and seek all possibilities that might occur. So that he is able to select, produce, organize, and use the information that comes to be utilized in everyday life.

Critical thinking according to Glaser contains "ability and position combined with prior knowledge, mathematical reasoning abilities, and cognitive strategies, to be able to generalize, prove, access mathematical situations reflectively (Sumarno, 2017, p.96). Critical thinking in mathematics defined by Ennis in Fisher is reasonable thinking to decide what to believe and do (Fisher, 2008, p.4).

Based on this understanding, it means that students are required to have the ability to think critically to understand and assess the truth of information. Based on the results of research observations conducted on Wednesday 10 May 2023 at SMP Negeri 20 Tangerang City class VII, especially in mathematics, the researchers did this by providing comparative questions to measure students' critical thinking skills, where there were 24 students or 68.6% who have not reached the criteria for critical thinking skills. The low critical thinking skills of students are shown in the following figure:

Nilai rata-rata dari 8 orang siswa adalah 6,5. Satu siswa yang mempunyai nilai 10 keluar dari kelompok tersebut. Nilai rata-rata 7 orang siswa adalah...?

$$8 - 7 = 1$$

$$10 - 6,5 = 3,5$$

$$\text{Nilai rata-rata} = 1 + 3,5$$

$$= 4,5$$

Figure 1. The initial observation test answer sheet is wrong

Based on Figure 1.1, students' critical thinking skills in solving problems are still lacking. Seen in the results of the question sheets that have been done, it proves that there is no critical thinking ability such as solving, analyzing and evaluating a problem in answering the questions given. This problem illustrates that students' critical thinking skills are still low, students are able to answer questions only to the extent of their memory. This problem is caused by several factors which include various things such as student activity, the scope of learning, and the learning methods used.

Students' critical thinking skills can be increased by applying teacher-dominated learning methods into a student-centered learning process, where students are given the opportunity to build knowledge with their own minds, so that students are able to develop their critical thinking skills to solve mathematical problems. tika. For this reason, we need a learning method that can be used to develop critical thinking skills.

One method to improve students' critical thinking skills is to apply the Brainstorming method. Brainstorming is a learning method that is carried out in groups where students have different backgrounds of knowledge and experience. This method is used in activities to collect as many statements about needs, ideas, opinions, and answers about various alternative ideas for dealing with problems. This method is very appropriate to use because

in a short time innovative ideas, opinions and answers can be gathered, as long as there is no criticism that hinders the spontaneous delivery of statements by students (Sudjana 2001: 88).

It should be noted that the use of this method will be appropriate if there is a situation of getting to know each other among students.

METHODS

This research is an experimental research on critical thinking skills by applying the Brainstorming learning method. The type of research used is quantitative research with quasi-experimental or quasi-experimental methods, namely the type of experiment that has a control group, but does not fully function to control other variables that affect the implementation of the experiment (Sugiyono, 2017, p.77)

This study used the Non Equivalent Pretest-Posttest Control Group Design, however, the selection and placement of groups was not done randomly (Sugiyono, 2017, p.79). Two groups were selected, namely the experimental group which was given treatment in the form of the Brainstorming learning method, and the control group using conventional learning (lectures). Then the class is given an initial test (pretest) with the aim of knowing the initial state whether there are differences between the experimental class and the control class. After being given treatment in both the experimental class and the control class, then the two groups were given a final test (posttest) to find out the differences in students' critical thinking skills from the two groups. (Sugiyono, 2017, p.81) said that the sample is part of the number and characteristics possessed by the population. Sampling in this study was carried out by Simple Random Sampling. The population in this study were all class VII students of SMP Negeri 20 Tangerang City for the 2022-2023 academic year. The total population of class VII consists of eight classes. Then it is taken at random. In taking the sample, the researcher took class VII H which was used as the experimental class.

The instrument used in this study was a test to obtain data on students' conceptual understanding. Before the instrument is used, an assessment is first carried out by an expert validator, after the instrument meets certain criteria then it will be tested on the instrument. This test was conducted to determine the validity and reliability of each test item. After testing, then an analysis of the test items was carried out.

Before testing the hypothesis, a calculation is carried out first, namely the calculation of the normality test and homogeneity test along with the results of the calculations.

Table 1. Calculation Results of the Chi-Square Normality Test One-Sample Kolmogorov-Smirnov Test

		Kelas Eksperimen	Kelas Kontrol
N		33	33
Normal Parameters ^{a,b}	Mean	59,39	51,21
	Std. Deviation	11,776	11,182
Most Extreme Differences	Absolute	,127	,135
	Positive	,116	,135
	Negative	-,127	-,087
Test Statistic		,127	,135
Asymp.Sig. (2-tailed)		,197 ^c	,134 ^c

a. Test distribution is Normal.

b. Calculated from data

Based on table 1 it can be seen that the experimental class has a sign value of 0.197 > 0.05 and a sign value. For the control class is 0.134 > 0.05. it can be concluded that the data for the experimental class and the control class are normally distributed.

**Table 2. Homogeneity Test Test oh Homogeneity
of Variances**

Levene Statistic	df1	df2	sig.
,000	1	64	,991

Based on table 2 above, it is known that the sign value. For the posttest data for the experimental class and the control class is 0.991, it can be concluded that the pretest data for the experimental and control classes come from groups that have a homogeneous variance.

RESULTS AND DISCUSSION

Based on table 1 and table 2, it shows that the data is normally distributed and comes from a homogeneous population. So that it can be tested the hypothesis using the t-test as follows.

Table 3. Paired Sample Test Results of the t-test

	Paired Differences					T	Df	Sig.(2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Paired Samples 1 Kelas Eksperimen - Kelas Kontrol	1,212	7,398	1,288	-1,411	3,835	0,941	32	0,354

obtained in the form of a significant value (2 tailed) 0.020. it means that the probability is less than 0.05. so that H0 and H1 are accepted. So thus it can be said that "There are differences in students' critical thinking abilities in classes that use the Brainstorming learning method with classes that use conventional teaching".

The results of tcount are in the area of rejection of H0, so it can be concluded that there is a significant difference in critical thinking skills that are not given the Brainstorming learning method and those who are given the Brainstorming learning method.

In addition to using the normality, homogeneity and t-test calculations in this study, the calculations were carried out using the N-Gain test for the results as follows:

Table 4. N-Gain Normality Test

Kelas	Kolmogorov-Smirnov ^a			Shapiro-Wilk			Df	Sig.
	Statistic	Df	Sig.	Statistic	Df	Sig.		
N_Gain_ kelas Eksperimen			.083	33	.200*	.984	33	.899
Kelas Kontrol			.104	33	.200*	.967	33	.411

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Based on table 4.10 it can be seen that the n-Gain result data has a significant value in the experimental class, namely 0.104 and in the control class, namely 0.084. The results of calculations in the experimental class and control class obtained that the sig value > 0.05. This shows that the data is normally distributed.

Table 5. Results of Homogeneity Test Calculations

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	24.242	1	24.242	.430	.514
Within Groups	3607.576	64	56.368		
Total	3631.818	65			

Based on table 5 it can be seen that the n-Gain result data has a significant value in the experimental class and in the control class, namely 0.514. The results of calculations in the experimental class and the control class obtain that the sig value > 0.05 . This shows that the data is normally distributed.

Based on the table above, from the results of calculations using SPSS 22, data can be obtained in the form of a significant value (2 tailed) 0.009. it means that the probability is less than 0.05. so that H_0 and H_1 are accepted. So thus it can be said that "There are differences in students' critical thinking abilities in classes that use the Brainstorming learning method with classes that use conventional teaching".

The results of tcount are in the area of rejection of H_0 , so it can be concluded that there is a significant difference in critical thinking skills that are not given the Brainstorming learning method and those who are given the Brainstorming learning method.

After the calculations were carried out by the researcher, there were steps that were carried out. In the initial conditions of the meeting, the experimental group students who were given the Brainstorming learning method still seemed to lack interaction and were shy about contributing suggestions in answering questions, students felt afraid that the giving of the wrong vote and responded negatively by their friends because they are used to being given conventional learning methods. At the second meeting students slowly started to look confident to contribute their thoughts and explain in front of their friends, but there were some students who still behaved insecure about the opinions they gave. At the third meeting all students were very self-confident and able to contribute their thoughts as quickly as possible and explain them in front of their friends, at the third meeting it could be seen that students experienced development of confidence and thinking skills so that in the learning process students became more active.

CONCLUSION

1. Based on data processing and the results of the analysis and discussion, it can be concluded that there are differences in the ability to think critically in mathematics between students who are given the Brainstorming learning method and students who are given conventional learning methods at SMP Negeri 20 Kota Tangerang. With a tcount value of 2,454 at a significant level $\alpha = 5\%$ which is then compared with a ttable of 2,035 so that it rejects H_0 and accepts H_1 . From these results it can be concluded that there are
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- differences in students' critical thinking skills in mathematics between the control class and the experimental class. This shows that the Brainstorming learning method has an effect on the mathematical critical thinking skills of grade VII junior high school students.
2. Based on the table above, from the results of calculations using SPSS 22, data can be obtained in the form of a significant value (2 tailed) 0.009. it means that the probability is less than 0.05. so that H0 and H1 are accepted. So thus it can be said that "There is an increase in students' critical thinking skills in classes that use the Brainstorming learning method with classes that use conventional teaching".

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