

The Effectiveness of Mind Mapping Learning Models Based on Contextual Learning on Mathematical Problem Solving Ability

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Abstract. This research is an experimental research with the aim to find out: (1) mathematical problem solving abilities of SMP Negeri 3 Kolaka students taught by using contextual based mind mapping learning; (2) mathematical problem solving abilities of students of SMP Negeri 3 Kolaka who are taught using conventional methods; and (3) the effectiveness of context-based mind mapping learning on mathematical problem solving abilities. The data analysis technique uses descriptive statistics and inferential statistics. The conclusion in this study is the mathematical problem solving abilities of students taught using mind mapping learning model based on contextual learning consisting of 20 students showing a mean value of 60.71. While students taught with conventional learning consisting of 17 students showed a mean value of 50.14. Furthermore, the results of inferential statistical analysis of hypothesis testing using the t-test have obtained a value of $t_{\text{count}} (2.889) > t_{\text{table}} (1.68957)$. From the results of the research, it can be concluded that the mathematical problem solving abilities of students taught by mind mapping learning model based on contextual learning are more effective than the mathematical problem solving abilities of students taught with conventional learning in class VIII of SMP 3 Kolaka.

1. Introduction

In government act No. 20, 2003 year about National Education System, stated that national education aims to develop the potential of students to become human beings who believe and fear God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independent and become citizens democratic and responsible. The formulation of the above objectives is the main reference for the implementation of learning in any field of study, including in the field of study of secondary school mathematics [1]. As for one of the mathematics learning objectives listed in KTSP [2006] which was refined in the 2013 curriculum is the problem solving ability which is one formulation of mathematics learning goals as stated in point 3. However, in reality the conditions of problem solving abilities of students in Indonesia are still relatively low, this is indicated by the low Indonesian mathematical achievements in the international arena. Such an international study was followed by the Indonesia Program for International Student Assessment (PISA) organized by the Organization for Economic Cooperation and Development (OECD), a UN body based in Paris. A study conducted on 15-year-olds in 2015, placed the mathematical abilities of Indonesian students ranked 62nd out of 70 countries [2].

The low mathematical problem solving ability of students was also shown based on the results of mathematics teacher interview of class VIII at SMPN 3 Kolaka, obtained information about the lack of students' ability to use their knowledge. This is shown based on the test of mathematical problem solving abilities of the students who conducted the research on 26-28 April 2017 in all class VIII with quadrilateral material obtained results that the mean of mathematical problem solving ability of 62 students who took the test was 21,21. In the results of the analysis of answers to the ability to solve mathematical problems, most of them have not been able to identify the problem correctly and not yet in providing solutions to the solution and have not been smooth in the calculation process. This indicates the low mathematical problem solving abilities of students, because the learning process is conventional where the teacher is more active and becomes the center of information during the teaching and learning process, while students only passively listen. According to [3] mind mapping helps students overcome difficulties, find out what they want to write, and how to organize ideas so students can understand the main problems that occur, and overcome problems. To make it easier for students to make mind maps, learning is needed that can stimulate student ideas optimally. Mind mapping is a way to put information into the brain and take it back out of the brain. Mind mapping is called mind mapping or mind maps is one way to record subject matter that makes it easy for students to learn, [4]. Contextual learning can be used as an alternative in applying mind map models and making it easier to understand mathematical problems. Contextual teaching is teaching that enables learning in which student employ their academic understanding and abilities in a variety of in-and out of school context to solve simulated or real world problems, both alone and with others, [5]. The combination of mind mapping and contextual teaching and learning is expected to be able to improve students' mathematical problem solving abilities.

The purpose of this study is to find out: (1). students' mathematical problem solving abilities after being taught with mind mapping learning model based on contextual learning; (2). mathematical problem solving abilities of students after being taught using conventional learning; and (3). the effectiveness of mind mapping learning models based on contextual versus conventional learning on mathematical problem solving abilities of class VIII students of SMP Negeri 3 Kolaka.

2. Methods

This type of research was experimental research where there are two classes involved, namely the experimental class and the control class. The experimental class is treated by using mind mapping learning model based on contextual learning and in the control class using conventional learning as usual. This research was conducted in SMPN 3 Kolaka in the even semester of the 2016/2017 academic year on 11 April-19 May 2017 in class VIII. The population in this study were all students of class VIII of SMPN 3 Kolaka, even semester in the 2016/2017 school year as many as 86 people consisting of VIIIA 20 people, VIIIB 22 people, VIIC 22 people, and VIID 22 people. The research sample was selected by simple cluster sampling. According [6] states a simple cluster sampling, namely simple group sampling by randomizing groups. The classes chosen as samples are class VIIIB and VIID. Class VIIIB as the experimental class and class VIID as the control class. The instruments used in this study were tests and observation sheets. This test is done to obtain the value of students' mathematical problem solving abilities. The test was carried out at the end of learning in a class that uses contextual and class mind mapping learning models that use conventional learning. The observation sheet is used to find out how the activities of students during learning take place and the activities of the teacher in managing the class both in the class using mind mapping learning model based on contextual learning as well as those using conventional learning. Data retrieval is done when the learning process takes place with the help of observers. The design of this study was posttest-only control group design where at the end of the learning the two classes were given a test. The data in the study were analyzed in two stages, namely (1) descriptive analysis to describe or describe research data relating to the mean, variance and standard deviation; and (2) inferential analysis, including: (a). the normality test of the data using the Kolmogorov-Smirnov formula, this aims to determine whether the results of the problem-solving ability test data in the control and experimental classes come from

populations that are normally distributed; (b) test the variance homogeneity to find out whether or not the two groups of data studied have homogeneous variances. The homogeneity test of variance consisting of two classes using Levene statistics; and (c) hypothesis testing.

3. Results and Discussions

The data in this study were analyzed descriptively and inferentially. Descriptive analysis includes analysis of the implementation of learning, analysis of mathematical problem solving abilities based on indicators, and analysis of the ability to solve mathematical problems as a whole, as well as inferential analysis of mathematical problem solving ability.

3.1. Analysis of the implementation of learning

Through the observation sheet, the implementation of learning activities can be measured. This is done to find out how much learning activity are carried out by the teacher in applying mind mapping learning model based on contextual learning and conventional learning. The results of the analysis are presented in table 1 below.

Table 1. Percentage of Learning Activity Observation Results

Teacher Activity	Meeting			Mean
	1	2	3	
Mind mapping learning model based on contextual learning	70,00%	85,00%	90,00%	81,67%
Conventional	78,57%	78,57%	92,86%	83,33%
Students Activity	Meeting			Mean
	1	2	3	
Mind mapping learning model based on contextual learning	95,71%	94,92%	97,78%	96,15%
Conventional	89,91%	90,92%	92,3%	91.04%

At each meeting, the experimental class and the control class were observed by observers in charge of observing that the researcher carried out learning in accordance with the lesson plan. The average percentage of the results of observation of teacher activities in the experimental class, namely the class using Mind mapping learning model based on contextual learning reached 81,67%, while in the control class using conventional learning reached 83,33%. This shows that teachers are more active when teaching using conventional learning than mind mapping learning model based on contextual learning. This is because the teacher is not accustomed to using mind mapping learning model based on contextual learning. Nevertheless, based on the percentage of the results of observations of student activities, the activeness of students taught using mind mapping learning model based on contextual learning is better than the activity of students who are taught using conventional learning. The mean percentage of students' activeness in the class using mind mapping learning model based on contextual learning reached 96,15% while in the class using conventional learning reached 91.04%. With the mind mapping learning model based on contextual students are encouraged to be more active and creative in learning.

3.2. Descriptive Analysis of mathematical problem solving ability

Descriptive analysis of mathematical problem solving ability includes two things, namely the analysis of mathematical problem solving abilities based on the indicators, and analysis of the ability to solve mathematical problems as a whole.

Table 2. Description of Posttest Data Mathematical Problem Solving Ability

Indicator of Mathematical Problem Solving Ability	Mean of Mathematical Problem Solving Ability of Students		
	Experimental Class	Control Class	Difference
Ability to identify problems. (writing down what is known and asked from a math problem)	65,55	50,00	15,55
Ability to plan problem solving (Writing sketches / drawings / models / formulas / algorithms to solve problems)	69,58	47,75	21,83
Ability to solve problems according to plan. (Solve problems from math problems correctly, complete, systematic)	64,17	43,75	20,42
Ability to interpret the solution	40,55	28,33	12,22

The results of descriptive analysis of data can be seen in table 3 below:

Table 3. Results of Descriptive Analysis of Posttest Data

Descriptive Data	Experimental Class	Control Class
Amount of value	1214,28	852,40
The number of students	20	17
Mean	60,714	50,1412
Maximum	76,19	73,81
Minimum	47,62	30,95
Standard deviation	8,26	13,715
Variance	68,339	188,115

In the class taught using mind mapping learning model based on contextual the number of posttest scores obtained was 1214,28 with a total of 20 students, a class mean of 60,714 with a maximum value of 76,19 and a minimum value of 47,62 and a standard deviation and the variance is 8,26 and 68,339, respectively. Whereas in the class that uses conventional learning models the number of posttest results obtained is 852,4 with a total of 17 students, the class average is 50,1412 with a maximum value of 73,81 and a minimum value of 30,95 and a standard deviation and variance respectively 13,715 and 188,115. From these data show that the mind mapping learning model based on contextual is more effective than conventional learning on mathematical problem solving abilities. This is supported by research conducted by [7] that there is an effect of mind mapping methods on students' mathematical problem solving abilities.

Based on the results of normality tests and test data homogeneity of mathematical problem solving abilities, obtained data that are normally distributed and homogeneous. Then carried out hypothesis testing using the independent t-test, obtained $t_{count} (2.889) > t_{table} (1.689)$ with $dk = 35$ at the significance level $\alpha = 0,05$. The results of this study meet the effective criteria that have been determined namely mathematical problem solving abilities of students taught using mind mapping learning model based on contextual better than students' problem solving abilities taught using conventional learning, and the implementation of mathematics learning processes using mind mapping learning model based on contextual 93.89%, it can be concluded that learning by using mind mapping learning model based on contextual is effective against students' mathematical problem solving abilities. This is in accordance with the results of a study conducted by [8] that students' ability to solve mathematical problems in groups of students using contextual learning is better than students who learn with conventional learning.

4. Conclusion

The mathematical problem solving abilities of students taught by mind mapping learning model based on contextual with a value of 1214,28 consisting of 20 students with the lowest score of 47,62 and the highest score of 76,79, the mean of value obtained is 60,714, the standard deviation of 8,26 and variance of 68,339. Mathematical problem solving abilities of students taught with conventional learning with a total value of 852,4 consisting of 17 students with the lowest value of 30,95 and the highest value of 73,81, the mean of value obtained 50,1412, the standard deviation of 13,715 and variance of 188,115. Learning mind mapping learning model based on contextual is more effective than conventional learning on mathematical problem solving ability of class VIII students of SMP Negeri 3 Kolaka.

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