

## Ability to Understand Mathematical Concepts of Students through Mind Mapping Method

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### Abstract

*The ability to understand students' mathematical concepts is the ability to absorb and understand mathematical ideas. Good concept understanding skills can help students in solving or providing solutions to a problem. This study aims to determine the ability to understand students' mathematical concepts with the mind mapping learning method and students who are not taught with the mind mapping method. The research method used is quantitative research with a quasi-experimental model designed in the form of non-equivalent control group design. The population in this study was all grade VIII students of SMP Negeri Liman and the research sample was taken in 2 classes with simple random sampling technique. The data collection technique and instrument used is a test in the form of a description question consisting of pre-test and post-test questions. The data analysis technique in this study used an independent t-sample test with prerequisite tests, namely the normality test and homogeneity test then continued with the gain score. Based on the results of the analysis, it was concluded that the ability to understand mathematical concepts of students who learn using the mind mapping learning method is better than students who learn without using the mind mapping learning method. The results showed that there was an increase in the ability to understand mathematical concepts of students in classes who received the mind mapping learning method in the high category with an average gain score of 0,74. Meanwhile, the ability to understand mathematical concepts of students in the control class is 0,29 which is a low category so that the improvement in the experimental class is better than the control class.*

*mind mapping method, understanding mathematical concepts*

**Keywords:** Accuracy, SmashForehand, Badminton, Accuracy Analysis

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## INTRODUCTION

Mathematics is one of the important sciences in the world of education and in the development of technology that is chosen to be taught at every level of education in schools. Mathematics learning needs to be made as interesting as possible so that it can stimulate thoughts, ideas, principles, and material concepts that can develop students' skills in thinking and designing things (Astuti, 2021). The goals of learning mathematics with its core competencies consist of the ability to: 1) understand mathematical concepts, 2) use patterns as conjectures in problem-solving, 3) use reasoning on properties, 4) communicate ideas, 5) have an attitude of respecting the usefulness of mathematics, 6) have attitudes and behaviors that are following values in mathematics, 7) carry out motor activities that use knowledge, 8) use simple visual aids (Permendikbud No 58 of 2014). In mathematics, one of the abilities that students must have is the ability to understand concepts.

Understanding concepts is a very important aspect of learning mathematics. By understanding concepts, students can develop the ability to solve mathematical problems (Effendi, 2017). The ability to understand mathematical concepts is the ability to absorb and understand mathematical ideas (Lestari and Yudhanegara 2015:81). Understanding concepts is an ability to master the material in understanding, absorbing, mastering, and applying it in mathematics learning (Yuliani, Zulfah and Zulhendri, 2018). Indicators of the ability to understand mathematical concepts are (1) restating the concepts that have been studied (2) classifying objects based on mathematical concepts, (3) applying concepts algorithmically, (4) providing examples or counter-examples of mathematical concepts, (5)

present concepts in various representations, (6) associate various mathematical concepts internally and externally.

Based on the results of the survey conducted by Trends in International Mathematics and Science Study (TIMSS) is an international study in the field of mathematics and science conducted to find out and get information about the achievement of mathematics and science achievements in countries. TIMSS results show that in Indonesia many students have difficulty in understanding mathematical concepts. To be precise, Indonesia is ranked 45th out of 50 countries (Diana, Marethi and Pamungkas, 2020). The results of this survey showed that the understanding of the concept of students in Indonesia is still very low. Low understanding of mathematical concepts students also occurs in SMP Negeri Liman. Based on the observation of students in grade SMP Negeri Liman shows that in the process of learning mathematics students find it difficult to re-reveal the material they have learned when given questions related to existing concepts or materials. Students also find it difficult to determine what procedures they use to solve an existing problem. In addition, students do not dare to solve the problem in front of the class so impressed the teacher is more dominant in learning, students have difficulty in providing other examples related to the concept of material, and students have not been able to give the right example. This is also supported by the results of student work in Figure 1.

1. Buatlah 3 contoh PLSV.

2. Tentukan penyelesaian dari  $2x - 5 = 10$   
Jawaban.

1. a.  $2x - 5 = 12$   
b.  $4 - 5x > 8$   
c.  $2x^2 + 5 = x + 2$

2.  $2x - 5 = 10$   
 $(2-1) x = 10$   
 $x = 15$

Figure 1. Student Work

Figure 1 shows that students are able to make an example but in making the next example still does not understand the concept of PLSV seen from the use of inequality signs and quadratic equations. Students also incorrectly use basic concepts to solve one-variable linear equations. This means that students have not been able to understand the concepts that have been learned well so students have difficulty working on problems.

Understanding concepts is the basis of Understanding Principles and theories, so to understand principles and theories, students must first understand the concepts that make up the principles and theories, because if students do not understand mathematical concepts, students will have difficulty solving problems and re-expressing mathematical ideas (as well as in learning) (Diana, Marethi, and Pamungkas, 2020). This is the reason that requires teachers to be able to innovate and design learning that is tailored to the conditions or circumstances of students by providing opportunities for students to be active in constructing their understanding (Utami, Asnawati, and Gunowibowo, 2016). Learning innovations are designed by teachers based on encouragement or new ideas to take steps in mastering learning with new methods or techniques so that ways or methods are obtained that can make students enthusiastic about learning (Harmita, Sofiana, and Amin, 2022). Therefore, there is a need for improvement in teaching in the form of models, media, or learning methods to improve the ability to understand mathematical concepts. One of them is by applying the learning method of mind mapping.

Mind mapping is a learning method that learns concepts or techniques to remember something with the help of mind maps so that both parts of the human brain can be used optimally (Lestari and Yudhanegara 2015:81). Pertiwi (2021) stated that mind mapping is a concept of learning activities that help teachers in carrying out mathematics learning activities that are taught by trying to make the active role of students, especially the knowledge they have and how it is applied in life. In this case, students are allowed to actively construct their understanding through freedom of imagination which will improve students' understanding of concepts. The results of Fitriyani, Syaodih, and Annisa (2017) showed that the application of mind mapping methods can improve students' ability to understand mathematical concepts.

The steps of mind mapping learning are as follows: 1) the teacher conveys the competencies to be achieved, 2) forming a group whose members are 2-3 people, 3) the teacher conveys the subject matter, 4) each group inventories/records the important points of the material presented, 5) each group restates the material that has been submitted teacher in the form of a concept map in the form of a chart or diagram, 6) representatives of several groups presented the concept map made (Lestari and Yudhanegara 2015: 76). Mind mapping will help a person in various ways such as planning, communicating, remembering things well, making a person more creative in solving problems, focusing attention, structuring and explaining thoughts, and learning everything more quickly and efficiently (Aprinawati, 2018).

This study aims to produce a study of the ability to understand mathematical concepts of students in classes that get the mind mapping learning method and classes that do not get the mind mapping learning method.

## RESEARCH METHODS

This research uses a quantitative approach with a quasi-experimental method of non-equivalent control group design. This design involves 2 classes of research, namely experimental class, and control class. The experimental class is a class that gets the mind mapping learning method and the control class is a class that does not get the mind mapping learning method. The research design is presented in Table 1.

**Table 1. Research Design**

<b>Kelas</b>	<b>Pre-Test</b>	<b>Treatment</b>	<b>Post-Test</b>
Experiment	$O_1$	X	$O_2$
Control	$O_3$		$O_4$

Source: Sugiyono, 2017:116.

The experimental class and control class are given a pre-test to determine the ability to the initial understanding of mathematical concepts of students and a post-test is given after learning to determine the ability of the final understanding of mathematical concepts of students.

The population in this study was all grade VIII students of SMP Negeri Liman odd semester of the 2022/2023 academic year consisting of five classes while the research sample was taken in two classes randomly using the simple random sampling technique. The research samples used were Class VIII-2 students as many as 30 people as an experimental class and Class VIII-3 students as many as 30 people as a control class.

The data collection technique used in this study was a test to obtain data on students' ability to understand mathematical concepts. The instruments used were descriptive questions, namely pre-test and post-test questions in the form of description questions which were arranged based on indicators of students' ability to understand mathematical concepts. These

questions were tested before being used to determine validity, reliability, distinguishing power, and level of difficulty. The data analysis technique in this study was an independent sample t-test to find out the average difference in the ability to understand students' mathematical concepts between the experimental class and the control class. Prior of that Pre -test and post-test students' ability to understand mathematical concepts in both classes must normally distributed and come from a homogeneous population. Furthermore, the calculation of the gain score was carried out to find out the magnitude of the increase in the ability to understand students' mathematical concepts in the experimental class and the control class

## RESULT AND DISCUSSION

Before the learning process is carried out in both classes, a pre-test is carried out at the first meeting with the set material to obtain data on the initial ability to understand mathematical concepts and a post-test at the last meeting with the material on relations and functions to obtain data on the final ability to understand mathematical concepts. Based on the results of the test of understanding the concepts of students in these two classes, can be calculated maximum, minimum, average, and standard deviation, as in Table 2.

**Tabel 2. Student's Ability To Understand Mathematical Concepts**

Class		N	Maximum	Minimum	Average	Standard Deviation
Experiment	<i>Pre-test</i>	30	76,00	41	78,87	11,68
	<i>Post-test</i>		97,00	85	89,10	5,07
Control	<i>Pre-test</i>	30	70,00	30	63,33	10,23
	<i>Post-test</i>		85,00	70	73,46	3,74

Table 2 shows that the average value of the ability to understand mathematical concepts of students in the experimental class is 89.10 higher means that there is an increase in the ability to understand mathematical concepts of students in the experimental class than the average value of the ability to understand mathematical concepts of students in the control class is 73.64. Based on the standard deviation data the ability to understand mathematical concepts of students in the experimental class is 5.07 more uniform than the standard deviation data of students in the control class is 3.74. The maximum value of the ability to understand mathematical concepts of students for the experimental class is 97.00 higher than the control class is 85.00, while the minimum value for the experimental class is 89.10 higher than the control class is 73.64.

Before analyzing the results of the test the ability to understand the concept of the test prerequisites are the normality test and homogeneity test.

### 1. Normality test

Normality test is used to determine two samples from a population of normally distributed data. The normality test of the pre-test values the ability to understand mathematical concepts students in the experimental class and control class was conducted with Kolmogorov smirnov test at a significant level  $\alpha = 0.05$  the results can be seen in Table 3.

**Tabel 3. Normality Test of Pre-Test Values in Experimental Class and Control Class**

Pre-Test	Sig
Experiment	0.631
Control	0.786

Based on the normality test results obtained that the sig value of the second class of samples is greater than the value  $\alpha = 0.05$  so it can be concluded that the ability to understand mathematical concepts of students in the experimental class and the controlling class of normal distribution.

## 2. Homogeneity test

The homogeneity test is used in pre-test data to see whether the experimental and control classes are derived from homogenous populations or not. The homogeneity test using SPSS with the test of homogeneity of variances with the significance level of the results can be seen in Table 4.

**Table 4. Homogeneity Test of Experimental Class and Control Class.**

Pre-Test	Sig
Experiment and Control	0.289

Based on the homogeneity test results obtained that the Sig value of both classes of samples is greater than the value of value  $\alpha = 0.05$  so it can be concluded that the ability to understand mathematical concepts of students in the experimental class and the control Class comes from a homogeneous population.

Further analysis with an independent t-sample test but before the first prerequisite test of normality test of post-test data is done. Normality test results obtained that the experimental class' sig of 0.968 and the control class' sig of 0.680, because the value of both classes' sig is greater than  $\alpha = 0.05$ , it can be concluded that the two classes of normal distribution.

Based on the results of the independent t-sample test, the  $t_{\text{count}} = 14.433$  and the  $t_{\text{table}} = 12.546$ . The  $t_{\text{table}}$  value is obtained from the student distribution table with  $dk=58$  and significant value of 0.05. The t-test is used to test the research hypothesis by stating the hypothesis  $H_0 : \mu_1 = \mu_2$  (The average mathematical concept understanding ability of students in the experimental class is the same as the control class) and  $H_1 : \mu_1 > \mu_2$  (The average mathematical concept understanding ability of students in the experimental class is better than the control class) then the calculation is if  $t_{\text{count}}$  and the  $\leq t_{\text{table}}$  then  $H_0$  is accepted otherwise if then  $H_0$  is rejected and accept  $H_1$ .

The results of the analysis show that  $t_{\text{count}} > t_{\text{value}}$  then  $H_1$  is accepted or the average mathematical concept understanding ability of the experimental class students is better than the control class. This is following the results of research conducted by (Utami, Asnawati, and Gunowibowo (2016); Sucianti, Noviyanti, and Sholeh (2018)) which concluded that the ability to understand mathematical concepts of students who learn to use mind mapping learning method is better than students who study without using the mind mapping learning method.

The understanding of mathematical concepts in the experimental class is better because learning using the mind mapping method or concept maps can help students in compiling the core material that is important in learning so that it makes it easier for students to understand mathematical concepts and students can also work together with other friends. Whereas in the control class, the students were enthusiastic about participating in learning but when the learning process was finished when the teacher gave questions related to the material being studied, students still had difficulty connecting concepts with other concepts and when students were asked to work on questions, students still had difficulty working on and felt slower time worked.

Sucianti, Noviyanti, and Sholeh, (2018) state that the understanding of mathematical concepts in the experimental class is better than in the control class because the mind mapping learning method helps students understand the mathematical concepts being studied so that it helps students solve mathematical problem solving by using mathematical concepts. right

concept. Bruner in his theory states that mathematics will be more successful if the teaching process is directed to the concepts and structures of mathematics that are made in the subject being taught, in addition to the related relationships between concepts and structures. In getting to know the concepts and structures included in the material being discussed, the child will understand the material that he must master (Suherman et al, 2003).

The results of the normalized gain score analysis also show that there is an increase in the ability to understand students' mathematical concepts in the experimental class with an average gain score of 0.74 in the high category. Meanwhile, the gain score data for the ability to understand mathematical concepts of students in the control class was 0.29 which was in the low category so the increase in the experimental class was better than the control class. Mind mapping makes learning more interesting so that it makes students feel that mathematics is no longer a difficult subject but a fun lesson so that students are more enthusiastic about working on problems and students is easy to relate to one another. This can be seen when the learning process takes place so that in the mind mapping learning system students can take creative notes through a basic keyword which is then connected to other related keywords which are connected with arrows where each keyword can be an image, word, number or color (Wulan, Marzuki, and Suhardi, 2022). The results of research conducted by Fitriyani, Syaodih, and Annisa (2017) also stated that there were differences in increasing students' understanding of mathematical concepts between the experimental class and the control class.

## CONCLUSION

Based on the results of the study, it can be concluded that the ability to understand mathematical concepts of students in classes who received the mind mapping learning method was better than students who did not receive the mind mapping learning method. Improving the ability to understand students' mathematical concepts in the mind mapping learning method is in the high category with an average gain score of 0.74. While the ability to understand mathematical concepts of students in the control class was 0.29 which was in the low category so that the increase in the experimental class was better than the control class.

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