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The Effect of the Application of the Make-a-Match Model on the Ability to Understand Mathematical Concepts and Student Learning Activity

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Keywords

Effect, Application, Make-A-Match Model, Mathematical Concepts, Active Learning.

ABSTRACT

This study aims to evaluate the impact of the Make a Match learning model on the ability to understand mathematical concepts, student learning activity, and their response to mathematics learning. The research method used is a quantitative approach with a quasi-experimental design using the nonequivalent group posttest only design method. Data collection techniques involve tests, questionnaires, and documentation. The research sample consisted of class VIII E students as the experimental group and class VIII B as the control group, with a total of 34 students. Research findings show that: 1) the application of the Make a Match learning model has a significant positive impact on the ability to understand mathematical concepts, with an influence of 53.7%, 2) there is a significant influence on student learning activity with the application of the Make a Match learning model, with an influence of 23.4%, and 3) student response to learning using the Make a Match model reaches 87.50%, with good category. These results contribute positively to the understanding of mathematical concepts, learning activity, and student responses to the Make a Match learning model.

INTRODUCTION

One process that is so important in improving the quality of education is learning activities. Obedience learning is an activity that has been planned to achieve a goal that involves several interrelated elements. Learning that aims to improve students' abilities optimally must be done through structured and measurable steps (Mirnawati et al., 2022; Hanafy, 2014; Maisari et al., 2013).

Mathematics is among the subjects that students at various levels of education must learn. Mathematics is the most important hierarchy for education because it is fundamental to other subjects. Based on NCTM (National Council of Teacher Mathematics), five abilities must be mastered in learning mathematics, including: 1) solving a problem; 2) proof, & reasoning; 3) relationships; 4) communicating; 5) representing. If the student's concept understanding ability is good, then the five abilities above will experience development. Understanding concepts is a basic and important aspect that students must have when learning mathematics (Haser et al., 2022; Held & Hascher, 2023; Ningrum et al., 2023). So, if the students' concept understanding skills are good, then they will be easy to learn and solve math problems.

In fact, the ability to understand concepts, which is the most important aspect in learning mathematics, still needs to improve (Boye & Agyei, 2023; Maruyama, 2022). This fact is in line with

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research by Zulfahrani (2018) that students often face a problem when learning mathematics is the low ability to understand concepts. In line with the results of a 2015 survey conducted by TIMSS (Trends in International Mathematics and Science Study), Indonesia occupies the 44th position out of 49 countries. The average score achieved by the Indonesian state is 397 out of 500. Based on the assessment criteria set by TIMSS, the value of 400 is included in the low category; this means that Indonesia's position can be categorized as low and still far from the level of proficiency (Hadi & Novaliyosi, 2019).

Based on test scores conducted by TIMSS, Indonesia has yet to be able to solve questions related to the application of an object, explain the relationship between concepts, and choose and use certain operations to solve questions (Kusumawati, 2023). The components above are closely related to the understanding of mathematical concepts, meaning that the ability of junior high school students in Indonesia to understand mathematical concepts still needs to improve. This situation is also in line with the results of the PISA (The Programme for International Student Assessment) survey 2018 with the category of mathematical ability, which shows that Indonesia is ranked 73 out of 79 countries with an average score of 379, while the international average score is 500. The TIMSS and PISA surveys mean that there is still low mathematics achievement in Indonesia. One of the reasons is the student's understanding of mathematical concepts is still minimal (Hardianti et al., 2015; Hewi & Saleh, 2020; Pamungkas & Afriansyah, 2017)

The lack of understanding of mathematical concepts experienced by students can be seen from the provision of exercises that vary slightly from the examples taught. Many of them have difficulty answering and completing the exercise, they have not been able to apply the concept if the problem is different from the example that has been taught (Koparan et al., 2023; Lindström et al., 2023; Sadak, 2023). In addition, they also find it difficult to write the data on the question. This is because most of them only remember formulas and do not understand the concepts, so many of the students have not been able to apply the concepts to different problems (Fajri et al., 2018; Lahdenperä et al., 2022)

According to research conducted, there are several reasons why students do not understand mathematical concepts, such as incomplete knowledge related to prerequisite material, the delivery of material about understanding basic mathematical concepts is less than optimal, and lack of ability to get information on math problems. Understanding a mathematical concept greatly impacts the understanding of the next concept (Ndori, 2019).

In addition to the low understanding of mathematical concepts, the problem often experienced is the lack of student activity when learning. This fact is based on research that currently classroom learning is still teacher centred (Dyer et al., 2023; Murphy et al., 2021; Szczepański & Marciniak, 2023). With a learning system like this, students will depend on teachers, so they tend to be less active in class. According to research, most learners are less active when learning mathematics. Generally, the learning model used by teachers is conventional. Teachers play an active role compared to students who passively receive material and practice questions, so teachers dominate learning in class more than students. In line with the results of the study stated from the results of questionnaires that have been filled out by grade VII students, in fact, there are still many students who are less active when learning mathematics (Alipour et al., 2023; Rueda-Gómez et al., 2023; Rutherford et al., 2023; Smit et al., 2023). Most of the students are passive when learning activities take place, they hesitate to ask questions about material that they think they have not understood. In addition, most of the students are embarrassed to present the results of the answers that have been obtained they lack confidence in the results they have (Farida, 2017; Handoko, 2017)

In line with research that in class VIII the problems that are often experienced when learning mathematics are low mathematics learning outcomes and the lack of student activity in learning. This can be seen when teachers ask them questions and then they are reluctant to express their opinions, there are only a few students who answer the questions. In addition, student learning activity can be seen from homework or other assignments (Kim et al., 2022; Tong et al., 2021). Many students are

reluctant to do it, and most of them neglect their duties. Many also do homework, but the results of cheating from friends (Herlikano & Sujadi, 2017).

Low learning activity and the ability to understand mathematical concepts are so important to follow up. Related to this issue, the role of teachers is very important to facilitate and motivate students so that they learn effectively and efficiently based on the goals to be achieved (Cortez et al., 2023; Hwang et al., 2021; Laurent et al., 2022; Molnár & Hermann, 2023). Based on the above problems, teachers should use more innovative and varied learning models (Simon, 2022). The learning model used should make students active when learning mathematics and be able to increase their understanding of concepts. One of the learning models that can increase students' understanding of concepts and activeness in learning mathematics is the make-a-match type cooperative model.

Cooperatives is an effective way of learning in the learning process by forming several groups to interact, work together, and exchange opinions (Yang & Kaiser, 2022). Lorna Curran developed the make-a-match learning model in 1994. This model is a method of learning by finding a partner. In this model, two cards are provided containing questions and answers. Each student pairs question cards and answer keys while studying independently to help understand math concepts. Students can share opinions as well as review answers that are considered correct (Susanty, 2014; Zakiah et al., 2017).

The make-a-match model is one of several learning models that can be used to increase understanding of concepts and learning activities. This model requires students to find pairs of cards containing questions or answers before a set deadline. If they can pair it correctly, they are entitled to earn points. Conversely, they won't get points if they can't match the cards correctly. This model can make the learning atmosphere fun because they can match answers to friends through cards containing questions and answers (Saparwadi, 2016).

The benefit of using this model is that it can increase students' understanding of concepts and active learning of mathematics on the material they have learned based on discussions with groups. The most prominent advantage of this model is that learners can learn concepts or topics while finding pairs of questions and answers within set deadlines. This learning model can make him trained to express ideas to his friends (Pratiwi et al., 2018; Zakiah et al., 2017)

Therefore, this study aims to determine (1) the influence of the make-a-match learning model on the ability to understand mathematical concepts, (2) the influence of the make-a-match learning model on student learning activity, (3) student responses to mathematics learning using the make a matching model.

METHODS

This research uses a quantitative approach with true experimental methods. The design used is a nonequivalent group posttest-only design. The following is a table of research designs that will be used:

Table 1. Nonquivalent group posttest only design

Class	Action	Posttest
Experiment	X	O
Control	-	O

With:

O: Posttest administration for experimental and control classes
X: Application of make a match models in experimental classes

The research was conducted from January to March 2023 at SMP Negeri 1 Beber. The population of this study is class VIII of the 2022/2023 school year consisting of 9 classes with a total of 308 students. The technique used in this sampling is purposive sampling. This technique is a determination of samples

with certain considerations . This sample was taken by selecting two classes that have relatively the same ability to understand mathematical concepts based on the average score of the odd semester final exam of class VIII for the 2022/2023 academic year and based on their learning activity, the classes to be sampled are VIII E as an experimental class and VIII B as a control class consisting of 34 students each (Sugiyono, 2013).

The instruments and data collection techniques used are tests, questionnaire sheets, and documentation. The data analysis techniques used are prerequisite tests and hypothesis tests. The prerequisite tests carried out were normality & homogeneity tests, while the hypothesis test used simple linear regression tests, linearity, correlation coefficients, and determination coefficients using SPSS Version 20 software.

RESULTS

The Effect of the Application of the Make a Match Learning Model on the Ability to Understand Student Mathematical Concepts

The data collection stage that will be used to analyze the effect of the make a match model on the ability to understand students' mathematical concepts is from the experimental class posttest and the control class that applies conventional models. The result is as follows:

Table 2. Data Prerequisite Test Results Ability to Understand Mathematical Concepts

Class	Kolmogorov-Smirnov	Shapiro-Wilk	Based On Mean
	Sig.	Sig.	Sig.
Experiment	0,095	0,251	0,257
Control	0,200	0,139	

Based on the output above, it is known that the normality test value of the experimental class posttest data can be seen from Kolmogorov Smirnov and Shapiro Wilk whose significance values are 0.095 and 0.251, while for the control class posttest data a significance value of 0.200 and 0.139 is obtained where both significance results are ≥ 0.05. It can be concluded that all test research data are normally distributed. In addition, for the homogeneity test, it can be seen from the significant value in the column based on mean 0.257 ≥ 0.05, the test data is homogeneous. Furthermore, the results of the hypothesis test are as follows:

1. Simple Linear Regression Test

Table 3. Simple Linear Regression Test Results

Type	Sum of Squares	Df	Mean Square	F	Sig.
Reg	1928,163	1	1928,163	37,107	0,000
Res	1662,778	32	51,962		
Total	3590,941	33			

From the table above, a significant value of 0.000 is obtained. If viewed from the interpretation of 0.000 ≤ 0.05 then H_0 rejected, this means that there is an influence of the application of the make a match learning model on the ability to understand students' mathematical concepts.

2. Linearity Test

Table 4. Linearity Test

		Sum of Squares	Df	Sig.
Between Groups	(Combined)	3028,441	23	0,082
	Linearity	1928,163	1	0,000
	Deviation from Linearity	1100,278	22	0,612

From the table above, the significance value is seen from the deviation from linearity which is 0.612. When viewed from the interpretation, that 0.612 ≥ 0.05 means that the variable data of the application of the make a match learning model and the data on the ability to understand students' mathematical concepts have a significant linear relationship.

3. Correlation Coefficient Test

The correlation coefficient test is used to see the relationship and prove the hypothesis between the influence of the make a match learning model and the understanding of students' mathematical concepts. The result is as follows:

Table 5. Correlation Coefficient Test Results

		Model MaM	Understanding of Mathematical Concepts
Model MaM	Pearson Correlation	1	0,713
	Sig. (2-tailed)		0,000
	N	34	34
Understanding of Mathematical Concepts	Pearson Correlation	0,713	1
	Sig. (2-tailed)	0,000	
	N	34	34

From the table above, we get a significance value of 0.000. Based on the interpretation, if the significance value ≤ 0.05 or 0.000 ≤ 0.05 then H0 rejected or both variables correlated. This means that there is an influence of the make a match learning model on the ability to understand students' mathematical concepts. The pearson correlation value of the two variables is positive at 0.733, this means that the relationship between the two variables is positively correlated with high criteria.

4. Coefficient of Determination Test

The coefficient of determination test was carried out to see how much influence the make a match learning model and the ability to understand students' mathematical concepts. This test is performed using SPSS Version 20.

Table 6. Coefficient of Determination Test Results

Type	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0,733	0,537	0,522	7,128

From the table above, the effect of applying the make a match type cooperative learning model on the ability to understand students' mathematical concepts in the R Square column was 0.537 or 53.7% with a strong category.

Thus, it can be concluded that the application of the make a match type cooperative learning model has a significant effect on the ability to understand mathematical concepts of students in

Class VIII SMP Negeri 1 Beber. This is in line with research conducted by that after the use of the make a match learning model, the understanding of mathematical concepts and learning outcomes of PGSD students is said to increase as seen from the 1st and 2nd cycles. Judging from the concept understanding indicator, students who can repeat a concept have increased from 62.50% to 76.38% (Juliani Et Al. , 2021).

The Effect of the Make a Match Learning Model on Student Learning Activity

The data collection stage needed to analyze the effect of the make a match model on student learning activity based on the results of student learning activity questionnaires in experimental and control classes. The result is as follows:

Table 7. Prerequisite Test Results Student Learning Activity Data

Class	Kolmogorov-Smirnov	Shapiro-Wilk	Based on Mean
	Sig.	Sig.	Sig.
Experiment	0,159	0,431	0,977
Control	0,200	0,459	

Based on the table above, the significance value for the normality test can be seen from the value of sig. in the Kolmogorov-Smirnov and Shapiro-Wilk columns. The significance values for the learning activeness posttest in the experimental class were 0.159 and 0.431, while for the learning activeness posttest in the control class were 0.200 and 0.459. Based on the interpretation, if the significance value is ≥ 0.05 then the data is normally distributed. This means that both data are normally distributed.

In addition, the homogeneity test can be seen from the significant value in the based on mean column of 0.977. Based on the interpretation, if the significant value ≥ 0.05 or 0.977 ≥ 0.05 then the data is homogeneous. Furthermore, the results of the hypothesis test are as follows:

1. Simple Linear Regression Test

   A simple linear regression test is performed to determine the effect of the independent variable on the dependent variable. Here is a simple linear regression test calculation using SPSS Version 20:

Table 8. Simple Linear Regression Test Results

C	Sum of Squares	Df	Mean Square	F	Sig.
Regression	498,402	1	498,402	9,766	0,004
Residuals	1633,039	32	51,032		
Total	2131,441	33			

From the table above, a significant value of 0.004 ≤ 0.05 was H_0 rejected, meaning that there is an influence of the application of the make a match learning model on student learning activity.

2. Linearity Test

   An inearity test is carried out to determine whether the two variables have a linear relationship or vice versa. This test uses SPSS Version 20. The results and criteria are:

Table 9. Linearity Test Results

		Sum of Squares	Df	Sig.
Between Groups	(Combined)	1562,908	17	0,032
	Linearity	498,402	1	0,002
	Deviation from Linearity	1064,506	16	0,110

From the table above, the significance value seen from deviation from linearity is 0.110. When viewed from the interpretation, that 0.110 ≥ 0.05 means that the variable data on the application of the learning model make a match and the variable data on student learning activity have a significant linear relationship.

3. Correlation Coefficient

The correlation coefficient test was conducted to determine the relationship between the two variables, and prove the hypothesis between the application of the make a match learning model and student learning activity. This test is performed using SPSS Version 20. The results are:

Table 10. Correlation Coefficient Test Results

		Learning Activity	Model MaM
8E Learning Activity	Pearson Correlation	1	0.484**
	Sig. (2-tailed)		0,004
	N	34	34
Learning Activity 8B	Pearson Correlation	0.484**	1
	Sig. (2-tailed)	0,004	
	N	34	34

From the table above, the significance value is 0.004. Based on the interpretation, if the significance value ≤ 0.05 or 0.004 ≤ 0.05 then H_0 rejected or both variables correlated. This means that there is an influence on the application of the make a match learning model to student learning activity. The pearson correlation value of the two variables is positive at 0.484, this means that the relationship between the two variables is positively correlated with the medium criterion.

4. Coefficient of Determination Test

The coefficient of determination test was carried out to see how much influence the application of the make a match type cooperative learning model and student learning activity. This test is performed using SPSS Version 20.

Table 11. Coefficient of Determination Test Results

Type	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0,484	0,234	0,210	7,144

From the table above, the effect of applying the make a match type cooperative learning model on student learning activity in the R Square column was 0.234 or 23.4%. Meanwhile, 76.6% is another factor in student learning activity. If interpreted, 0.234 belongs to the medium category.

Thus, it can be concluded that the application of the make a match type cooperative learning model has a significant effect on student learning activity in Class VIII SMP Negeri 1 Beber. This is in line with research conducted by Setyawati et al., 2018there is an increase in student learning activity after the application of the make a match model with the help of image media, this is in accordance with the results of the 1st and 2nd cycles, namely 76.3% to 92% which is classified as a very good category.

Description of Student Response Questionnaire Data to the Application of the Make a Match Model in Mathematics Learning

This description aims to determine student responses to the application of the make a match model in mathematics learning. The student response questionnaire consists of 20 statements with 4 indicators, namely the ease of students in understanding the material through the application of the make a match learning model, students feel happy and not burdened in learning mathematics using the make a match model, showing interest when learning mathematics using the make a match model, students are motivated to learn mathematics using the make a match model. The following is the data from the recapitulation of the student response questionnaire for each indicator.

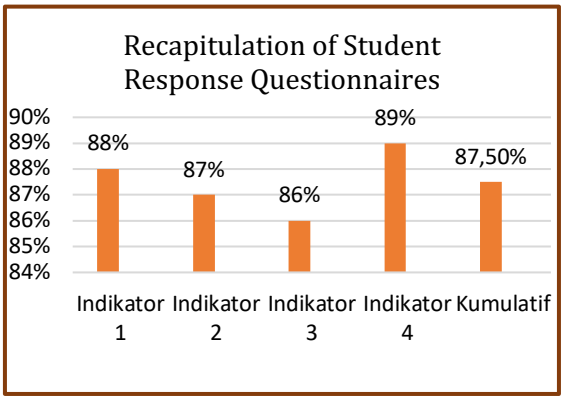

Figure 1. Questionnaire Recapitulation

Based on the bar chart image above, the cumulative percentage of student response questionnaires to the application of the make-a-match model in mathematics learning from each indicator is 87.50% with good categories.

CONCLUSION

Based on research on the influence of the Make a Match learning model on grade VIII students at SMP Negeri 1 Beber, it was concluded that the model had a positive influence on the ability to understand mathematical concepts and learning activities. Statistical analysis rejected the null hypothesis with a significance of 0.000 ≤ 0.05, showing a strong influence on the understanding of mathematical concepts by 53.7%, while other factors influenced 46.3%. Meanwhile, there was a positive influence on learning activity by 23.4%, with the remaining 76.6% influenced by other factors. The positive response of students to the Make a Match learning model reflected in the average response of 87.50%, indicates that its use is considered good by grade VIII students at SMP Negeri 1 Beber. Thus, this study provides a comprehensive picture of the benefits of such learning models in the educational environment concerned.

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