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REPRESENTATION MATHEMATICS THROUGH THE POWER OF TWO

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ABSTRACT
Mathematical representation is one of the abilities that support students in understanding mathematical concepts. However, some students have difficulty in developing mathematical representation skills so that it needs good handling so that the objectives of learning mathematics are achieved. The purpose of this study was to describe the improvement of students' mathematical representation abilities in mathematics learning using "The Power of Two" model. Researchers used a quantitative approach with the method of Quasi Experiment and Pretest-Posttest Control Group Design. The population in this study were students of class X one of the high schools in Bandung Regency, the sample was taken by simple random sampling technique. The selected sample was class X MIPA-4 as the experimental class and X MIPA-5 as the control class. The instruments used were in the form of description questions to obtain N-Gain data and student responses to obtain response data regarding mathematics learning through the Power of Two model. The data analysis technique used is the Independent t-Test. The results showed that the average increase in the mathematical representation ability of students who received mathematics learning using The Power of Two model was 0.88 in the high category, while the average increase in the mathematical representation ability of students who received conventional learning was 0.67 in the moderate category. That is, there are differences in the increase in the mathematical representation ability of students who learn using The Power of Two model with students who learn using conventional models. In general, 87.5% of students gave positive responses to learning mathematics using the Power of Two model. Thus, learning mathematics through The Power of Two model can improve students' mathematical representation abilities.
Keywords: representation mathematics, The Power of Two, Quasi Experiment

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INTRODUCTION

Mathematics is one of the sciences that has a significant role in life. Mathematics is a universal science that underlies the development of modern technology, has an essential role in various disciplines, and helps develop human thinking (Nasution, 2019). It shows that

mathematics will always be inherent in human life and necessary to study mathematics because it can make students think systematically and logically. Thus, the government has established mathematics as one of the subjects in education, from elementary school to university, to gain knowledge of mathematics even more for those who study it in depth. The purpose of learning mathematics includes learning to communicate, reasoning, solving problems, connecting ideas, and forming positive attitudes towards mathematics (Hasbulla & Wirantomo, 2015). The main goal in learning mathematics is to build the students' character so that when they face life after graduating from school, they already have sufficient knowledge.

Mathematics communicates through symbols that specifically have a clear meaning. Creating a mathematical model of a known problem needs mathematical symbols. When students are asked to solve a mathematical problem, they can find other alternatives to determine the solution to get the same answer. Students can express their ideas to develop because saying ideas or determining settlement strategies is one of the students' abilities to learn mathematics, namely, students' mathematical representation abilities. According to Vergnaud (1987), representation is an essential part of mathematics because it makes the concept of reality and its helpful structure.

Students face difficulties non-visually, namely difficulties presenting problem information, making new mathematical models, and not compiling completion steps. Due to limitations in understanding the concepts of the material discussed, many student answers do not match or deviate from the idea. If visually, students have not been able to present information in tables and even graphs because they cannot find new information in the questions. Similar to the research conducted by Sulastri, Marwan, and Duskri (2017), students have difficulty with the questions given by the teacher. This problem needs to be overcome because it dramatically affects students who do not achieve learning goals.

According to Syafri (2017), mathematical representation ability is one of the abilities to express mathematical ideas or ideas in many ways. Mathematics, through mathematical representation, will make it easier to understand the relationship of each supporting element. Students' mathematical representation abilities will develop well if they meet the indicators. According to Mudzakir (2006), there are three indicators of mathematical representation ability: visual representation in diagrams, graphs, tables, or pictures to solve mathematical problems, representation of mathematical equations or expressions, and representation of words. or written text.

To develop students' mathematical representation skills, mathematics]needs to be appropriately managed, especially regarding the convenience of students in learning and students' activeness in solving problems. In this case, students need good support from teachers, friends, and the class atmosphere to develop mathematical representation abilities to the fullest. Based on the current curriculum, learning is not teacher-centered, but students must explore knowledge based on their findings to be active in learning and achieve their satisfaction. Especially in learning mathematics, teachers are directed to develop students' cognitive and affective abilities (Pamungkas et al., 2019). The goal is to improve their understanding, reasoning, analysis, and mathematical problems systematically and logically. Students need to solve some math problems. Thus, students will try to work with their problem-solving schemes. The procedure for solving mathematical problems includes finding the required data and

planning what to do so that students will use their thinking style in processing the information obtained from the questions to affect the strategies used in solving problems. A method or technique that can make students more active in learning is necessary because conventional teacher-centered learning has not optimally improved students' mathematical representation abilities (Muhamad, 2016).

One of the learning methods considered capable of improving students' mathematical representation skills is the cooperative learning method. In cooperative learning, the learning process occurs in groups; students learn together to contribute ideas and are responsible for achieving individual and group learning outcomes that can train students to learn to exchange thoughts, ideas, and opinions (Anitra, 2021). From this learning model, it is expected that students will develop social skills, both communicating in groups, sharing information, and arriving at problem-solving and drawing conclusions. Even if there are only two people in a group, this aims to reduce the student gap. Students can increase their self-confidence and believe that students can solve a mathematical problem uniquely based on their concepts in class. Cooperative learning methods can improve students' learning outcomes and mathematical understanding. Yusup (2017) reinforces by his research that shows the application of cooperative learning methods has a significant effect on students' mathematics learning results.

One type of cooperative learning method used in learning mathematics is The Power of Two model. The Power of Two model is active learning that forms groups by strengthening synergistic relationships, namely thinking with two heads is better than thinking alone (Hosnan, 2014). On the other hand, Razi (2019) states that the Power of Two model can improve student learning outcomes. Learning mathematics through The Power of Two model provides opportunities for students to be creative and correct each other's work. If there are differences, students will work together to find new answers based on the results of the discussions that have been agreed upon. Students will exchange their understanding of the mathematical concepts being studied during the discussion process between two students. This is an advantage for students in learning in the form of deeper knowledge. As a student facilitator in the classroom, the teacher supervises and directs learning so that mathematics learning objectives are achieved and students are monitored in learning activities. If there are differences, students will work together to find new answers. Through learning using The Power of Two, students will also become learning resources for their friends who can make students active in the learning process (Putri & Ghufron, 2019). This model will also help students to improve students' mathematical representation skills because active learning will develop students' mathematical abilities (Effendi, 2012).

Regarding the stages of learning mathematics using The Power of Two model, several experts argue. In this study, the researcher chose the stages of The Power of Two learning model according to Djamarah dan Zain (2010), which began with giving questions by the teacher. Students were directed to find solutions to mathematical problems independently. Students were grouped in pairs to discuss answers to the questions that have been given. After the discussion each team writes answers based on the results of the discussion, and at the end of the lesson, the teacher asks students to present the solutions from the results of the discussion. The Power of Two Model's advantages increase students' self-confidence, develop

students' verbal argumentation skills against their peers, and help students find problem-solving by working together and realizing their limitations (Djamarah dan Zain (2010). Students can also foster a sense of responsibility in completing their assignments, and The Power of Two model can also increase the spirit of learning and stimulate students' mindsets. The disadvantages of The Power of Two Model, namely the teacher needs to prepare to learn to the maximum. Otherwise, it will waste a lot of energy, thought, and time. In addition, when the two students discuss, one student will likely dominate the other student so that one student becomes passive. Based on this explanation, cooperative learning method can improve students' understanding and learning outcomes of mathematics. One of the cooperative types is The Power of Two model, which researchers suspect can improve students' mathematical representation skills. In this study, researchers will compare mathematics learning using The Power of Two model of mathematics learning with conventional learning to determine the increase in students' mathematical representation abilities in learning mathematics utilizing The Power of Two model and assess student responses to The Power of Two model.

METHODS

The research conduct in one of the high schools in Bandung Regency for the 2020/2021 academic year. Through a quantitative approach, the research method chosen is Quasi Experiment with Pretest-Posttest Control Group Design. The data analysis technique used is descriptive. The population in this study were students of class X, the sample in this study was selected by simple random sampling technique. The sample in this study was class X MIPA-4 as an experimental class with The Power of Two learning model and X MIPA-5 as a control class with a conventional learning model. The research design used can be seen in Table 1.

Table 1. Research design

Group	Pretest	Treatment	Posttest
Experiment	O	X	O
Control	O	-	O

Keterangan:
O : Pretest and posttest with the same test instrument
X: Learning mathematics with The Power of Two learning model

The instrument used to obtain data on the results of students' mathematical representation abilities from the pretest and posttest calculated using N-Gain is a test instrument in the form of essay questions (the pretest and posttest are the same). The test given has indicators of mathematical representation ability adapted from Mudzakir (2006), namely presenting data in graphs, tables, or images; creating an equation, mathematical model, or representation of a given mathematical problem; and solve math problems using words or written text. The validity with categories can be seen in Table 2, according to Susilawati (2013).

Table 2. Validity Category

Correlation Coefficient	Classification
$0{,}80 < x_{pbi} \leq 1{,}00$	Very High
$0{,}60 < x_{pbi} \leq 0{,}80$	High
$0{,}40 < x_{pbi} \leq 0{,}60$	Moderate
$0{,}20 < x_{pbi} \leq 0{,}40$	Low
$0{,}00 < x_{pbi} \leq 0{,}20$	Very Low
$x_{pbi} \leq 0{,}00$	Not Valid

After going through the validity stage, the reliability test was continued with the categories in Table 3 according to Sundayana (2014).

Table 3. Reliability Category

Reliability	Classification
$0{,}90 < r_{11} \leq 1{,}00$	Very High
$0{,}70 < r_{11} \leq 0{,}90$	High
$0{,}40 < r_{11} \leq 0{,}70$	Moderate
$0{,}20 < r_{11} \leq 0{,}40$	Low
$r_{11} \leq 0{,}20$	Very Low

Four items were selected regarding the Absolute Linear Value of One Variable. The questions have moderate category validity and high category reliability. The four selected questions are shown in Figure 1.

PROBLEM

1. Using the definition of absolute value, determine $|x + 5|$ for x real numbers
2. Find the value of x that satisfies $2|3x - 8| = 10$
3. Find the value of x that satisfies $|2x - 1| = |x + 3|$
4. Draw a graph $y = |x + 2|$ for each $x \in R$

Figure 1. Instrument Test Questions

In addition, the non-test instrument used to obtain data on student responses to mathematics learning uses The Power of Two model in the form of an attitude scale whose assessment uses a Likert scale. The attitude scale consists of 14 statements related to learning mathematics utilizing The Power of Two model. Each statement is validated through expert judgment from mathematics learning experts.

To improve students' mathematical representation skills using The Power of Two learning model with conventional learning models, the researcher analyzed the N-Gain data obtained from the pretest and posttest data of students in each group. The formula used to determine N-Gain is like Equation (1), according to Sundayana (2014).

$$N - Gain = \frac{posttest\ score - pretest\ score}{maximum\ score - pretest\ score} \qquad (1)$$

The N-Gain value obtained from each student in each group was then averaged to determine the increase in mathematical representation ability based on the classification of N-Gain score, which can be seen in Table 4.

Table 4. Criteria of N-Gain Score

N-Gain Score	Criteria
$-1,00 \leq g < 0,00$	Decrease
$g = 0,00$	Stable
$0,00 < g < 0,30$	Low
$0,30 \leq g < 0,70$	Moderate
$0,70 \leq g \leq 1,00$	High

After getting the N-Gain data from the two groups, the researcher will examine the data to find out the differences in the improvement of students' mathematical representation abilities in the experimental class (The Power of Two learning model) and the control class (conventional learning model). An Independent T-test is using to analyze the data to determine which one is better. Researchers need students' responses to mathematics learning through The Power of Two model to support the results of increasing students' mathematical representation abilities. The data is analyzed to determine student responses to the statements given using the formula according to Juariah (Atoillah, 2017) in Equations 2 and Table 5.

$$\bar{x} = \frac{Total\ student\ attitudes\ for\ each\ item}{Total\ student\ attitude\ score\ for\ each\ item} \qquad (2)$$

Table 5. Classification of the Average Score of Student Response

Rata-rata skor	Classification
$\bar{x} > 2,50$	Positive
$\bar{x} = 2,50$	Neutral
$\bar{x} < 2,50$	Negative

The percentage of subjects who have a positive response to learning mathematics using The Power of Two model can be calculated using the formula according to Juariah (Atoillah, 2017) in Equation 3 and Table 6.

$$percentage = \frac{frequency\ response}{number\ of\ respondents} \times 100\% \qquad (3)$$

Table 6. Interpretation of Student Response Answers

Percentage of Answers	Interpretation
0%	Not a single student respond
1% - 25%	A small number of students respond
26% - 49%	Almost half of the students who responded
50%	Half of all students who respond
51% - 75%	Most of the students who respond
76% - 99%	In general, students who respond
100%	All students who respond

Student response data is needed for consideration and to ensure that The Power of Two learning model can be used in learning mathematics.

RESULTS AND DISCUSSION

The improvement of students' mathematical representation skills given mathematics learning using The Power of Two model and conventional models. Before entering the lesson, students in each group were given a pretest with the same questions. The following are the average results obtained by students in each group which can be seen in Figure 2.

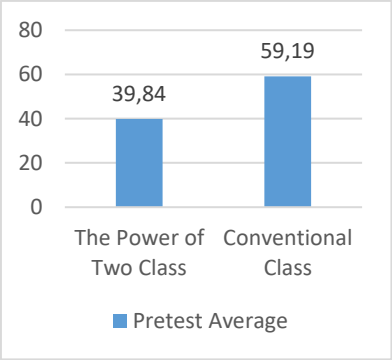

Figure 2. Pretest Average

Figure 2 shows that the average pretest for The Power of Two class is 39.84, smaller than the average pretest for the conventional class (59.19). It means that students before being given treatment are low, so it needs serious handling. After being given a pretest, the researcher gave mathematics learning using The Power of Two model to the experimental class students and the conventional model to the control class students. At the end of the lesson, students are given a posttest with the same questions as the pretest to determine student progress.

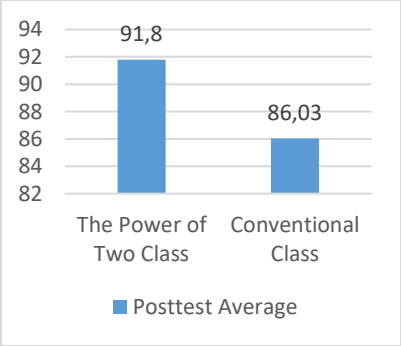

Figure 3. Posttest Average

Figure 3 shows that the experimental class students of The Power of Two model with an average of 91.8 are superior to conventional class students with an average of 86.03. Based on the pretest and posttest results, the N-Gain data from each student group can be searched and then averaged, which can be seen in Figure 4.

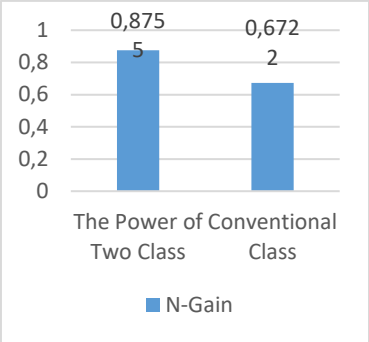

Figure 4. Average N-Gain

Figure 4 shows that the average N-Gain of the group using The Power of Two model is 0.8755 in the high category. At the same time, the group that uses conventional learning is 0.6722 in the medium category. The N-Gain data needs to pass statistical tests. Before that, the data was tested for normality test. The N-Gain data for the experimental group (The Power of Two learning model) and the control group (conventional learning model) is normally distributed. The following are the N-Gain data normality test results for The Power of Two class and the Conventional class.

Table 7. Normality Test

Group	Kolmogorov-Smirnov		
	Statistic	Df	Sig.
The Power of Two	.906	16	.384
Konvensional	.576	17	.895

Based on Table 7, the value of Sig. The value of Power of Two Class (0.384) $\geq \alpha$ (0.05) means that the Power of Two Class -N-Gain data is normally distributed. Likewise with the value of Sig. conventional class (0.895) $\geq \alpha$ (0.05) which means the conventional class N-Gain data is normally distributed. Then, both the N-Gain experimental class data (The Power of Two learning model) and the control class (conventional learning model) are ensured to have homogeneity of variance. The results of the homogeneity test of data variance are in Table 8.

Table 8. Variance Homogeneity Test

Levene Statistic	Df1	Df2	Sig.
3.802	1	31	.060

Based on Table 8, the value of Sig. (0.060) $\geq \alpha$ (0.05) means that both N-Gain data have homogeneous variances. The N-Gain data of both groups proved to be normally distributed and have homogeneous variance, so that the assumption will be continued with the Independent T-test. The test results can be seen in Table 9.

Table 9. N-Gain Data Independent T-Test

t-test For Equality of Means			
T	dF	Sig. (2-tailed)	Mean Difference
2.891	31	.007	2.0331

Based on Table 9, the value of Sig. (0.007) < α (0.05) mean differences in improving students' mathematical representation abilities whose learning uses The Power of Two model with students whose learning uses conventional models. It shows that the mathematical representation ability of students whose learning uses The Power of Two model is better than students who use the conventional model. The following are the stages of learning mathematics through The Power of Two model.

1. The teacher gives some questions to the students. Students are less enthusiastic when asked to work independently.
2. Students solve math problems independently. Some students answer, and some students answer based on the correct concept.
3. The teacher makes a group of students in pairs based on the results of previous student work. It becomes the basis for teachers to classify students who are considered capable and unable to solve mathematical problems in pairs.
4. The teacher asks students to discuss. At the discussion stage about the answers found by each student, the student's enthusiasm for learning began to increase. Communication between students who present the answer resulted in an agreement agreed upon by both of them. The answer was considered appropriate and corrected if the solution from each student was wrong.
5. The teacher asks students to present the answers they find. When one group presents solutions, the other group listens and responds with approval and rebuttal if errors are found.

The five stages of learning mathematics using The Power of Two model show good learning outcomes. The research is conducted in the Covid-19 pandemic situation requiring researchers to shorten face-to-face meetings to adjust the available learning time with learning syntax to be more effective. All stages can be carried out correctly. Good mathematics learning outcomes using The Power of Two model are in line with research conducted by Julianti dan Danaryanti (2014) that student learning outcomes using The Power of Two model are in good qualification. Mardiah (2020) also stated in his research that the application of The Power of Two model in mathematics learning was proven to improve student learning outcomes. Likewise, the research results conducted by Ardi, Latuconsina, dan Angriani (2020) showed that The Power of Two types' cooperative learning model effectively improved mathematics learning outcomes for class VIII students.

Furthermore, the student's response to learning mathematics uses The Power of Two model. At the end of the lesson, the researcher analyzed the data from the answers on the attitude scale sheet given to the experimental class students (the class whose mathematics learning uses The Power of Two model). The average score of students' attitudes towards learning mathematics using The Power of Two model can be seen in Table 10.

Table 10. Average Statement Score on the Student Attitude Scale

Aspect	Average Score	
	Neutral Student	Student scores
Students' attitudes towards learning mathematics using The Power of Two model	2,50	3,05

The average score of students' attitudes on aspects of learning mathematics using The Power of Two model (3.05) is greater than the average student neutral score (2.5). It shows that students give a positive response to learning mathematics by using The Power of Two model.

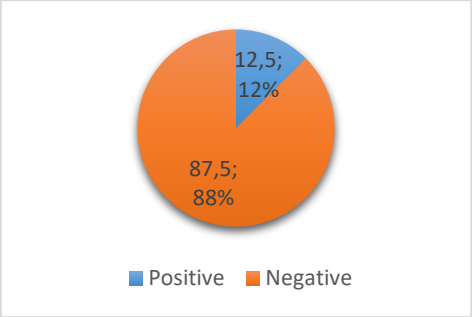

Figure 5. Student Responses Using the Power of Two Model

Based on Figure 5, the aspect of learning mathematics using The Power of Two model received positive responses from experimental class students (classes whose learning uses The Power of Two model) of 87.5% and negative responses of 12.5%. In general, students give a good response to learning mathematics by using The Power of Two model. The stages of learning mathematics use The Power of Two model, which students prefer during paired discussions. Students who are considered unable to solve problems correctly find it helpful in understanding the concepts used to solve the given mathematical problems. This makes students feel motivated and their interest in learning increases. This is in line with research conducted by Yaniwati & Husna (2017) that The Power of Two learning model can stimulate students to learn actively in collaboration and discussion. Likewise with research conducted by Bintaro (2018) that The Power of Two learning model can increase students' interest in learning mathematics in terms of increasing the average score of student interest in the first cycle of 2.50 and the second cycle of 3.08. It is also reinforced by the results of research conducted by Bella, Suhendri, & Ningsih (2019) which shows that The Power Of Two learning model affects mathematical problem-solving abilities.

CONCLUSION

The result showed differences in students' mathematical representation abilities whose learning uses The Power of Two model with conventional models. The average N-Gain pretest-posttest of mathematical representation ability through The Power of Two model is 0.88 in the high category, higher than students who use conventional learning of 0.67 in the medium category. So it can be concluded that increasing students' mathematical representation skills through cooperative learning model type The Power of Two is better than conventional learning. It is supported by 87.5% of students who responded positively to learning mathematics through The Power of Two model. As a suggestion, The Power of Two model can be applied to improve mathematical representation skills, such as the ability to understand, relate, and solve mathematical problems.

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