

Pair Check and Mathematics Representation

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Abstrak

Penelitian ini dilatarbelakangi oleh pentingnya meningkatkan kemampuan representasi matematis siswa. Karena itu penelitian bertujuan untuk mengetahui peningkatan kemampuan representasi siswa yang menggunakan pembelajaran Pair Check dengan pembelajaran konvensional berdasarkan PAM. Penelitian menggunakan metode kuasi eksperimen, sampel terdiri dari satu kelas eksperimen dan satu kelas control di salah satu MTs Negeri Kota Bandung. Instrumen dalam penelitian ini adalah tes dan nontes, tes berupa tes pemahaman awal, pretest dan posttest sementara nontes berupa lembar observasi dan kuesioner skala sikap. Analisis kuantitatif dilakukan dengan menggunakan uji ANOVA dua jalur dengan bantuan SPSS. Hasilnya menunjukkan terdapat peningkatan gambaran aktivitas guru menggunakan model pembelajaran tipe pair check pada pertemuan kedua dan gambaran aktivitas siswa meningkat setiap pertemuan, kemampuan representasi matematis siswa yang menggunakan pembelajaran pair check mengalami peningkatan dengan tingkat interpretasi sedang sementara kemampuan representasi matematis siswa yang menggunakan pembelajaran konvensional mengalami peningkatan dengan tingkat interpretasi rendah, peningkatan kemampuan representasi matematis siswa di kelas eksperimen tidak lebih baik daripada kelas konvensional berdasarkan tingkat PAM, siswa memberikan sikap positif terhadap pembelajaran matematika dengan menggunakan model pembelajaran pair check.

Kata Kunci: Pembelajaran Kooperatif, Kemampuan Representasi Matematis

Abstract

This research is motivated by the importance of increasing students' mathematical representation abilities. Therefore, the study aims to determine the increase in the representation ability of students who use Pair Check learning with conventional learning based on EMK. The study used a quasi-experimental method, the sample consisted of one experimental class and one control class in Islamic Junior High Schools Bandung. The instruments in this study were tests and non-tests, tests in the form of initial comprehension tests, pretests and posttests while non-tests were in the form of observation sheets and attitude scales. Quantitative analysis was conducted using the two-way ANOVA test with the help of SPSS. The results showed an increase in the picture of teacher activity using a Pair Check type learning model at the second meeting and an overview of student activity increased at each meeting, the mathematical representation ability of students using Pair Check learning increased with a moderate level of interpretation while the mathematical representation ability of students using conventional learning increased with a low level of interpretation.

The increase in students' mathematical enhancement abilities in the experimental class is no better than the conventional class based on the level of EMK. Students give a positive attitude towards learning mathematics by using the Pair Check learning model.

Keywords: *Cooperative Learning, Mathematical Representation Abilities.*

1. INTRODUCTION

A Study is a change in the activity of the environment, according to E.R Hilgard (Susanto, 2013: 3). The change in activity referred to is that in the form of knowledge, conduct, skill, and this is acquired through exercise (experience). This experience can be gained either by engaging in learning activities. Learning is a process of modification in a manageable capacity and a rise in human level, which is suggested by Gagne as quoted by (Huda, 2014:3). According to the defined opinion, it is likely that students have a capacity which can be enhanced primarily in mathematical learning. Learning should instill good mathematical concepts so that students can gain ease in the primary learning process of expressing their ideas for an increased process of learning.

Mathematics as one of the subjects studied at every level of education has a very important role in various aspects of life. While Maulidah et al. (2020), said that mathematics is one of the sciences that is close to everyday life, where everyone and every day math is used as a support in activities for humans, so that mathematics has an important role in life. NCTM (J. A. Dahlan, 2014) argued that representation is the translation of a problem or ideas into new forms, including in the inside of the drawing or physical model in the form of symbols, words, or sentences. The National Council of Teachers of Mathematics (NCTM, 2000) stated the reasons for the importance of studying mathematics, namely: 1) Mathematics is useful for life; 2) Mathematics as part of cultural heritage; 3) Mathematics is needed to solve problems in the world of work; 4) Mathematics as a tool for scientists and statisticians.

Mathematics learning is often seen as abstract learning with tiered concepts and principles (Rachmawati et al., 2021). In the process of learning mathematics, students are expected to be able to put their ideas into writing and be able to apply mathematical concepts in everyday life or known as mathematical representation ability. According to Hutagaol (2013) representational ability in Mathematics is the ability to Communicate the math ideas learned in a Certain way. According to Dahlan (2011), representation is the basis or foundation for how a student can understand and use mathematical ideas. With those abilities, a person is able to solve the mathematics and problems of daily life that involve mathematics. Good management is needed in developing students' mathematical representation abilities and other mathematics skills, such as student comfort in learning and students' ability to solve problems (Pangestuti et al., 2021) . A number of forms of mathematical representation, such as verbal, Figures, numerals, algebraic symbols, tables, diagrams, and graphs are an integral part of can be separated from learning mathematics.

To improve the ability of a student's mathematical representation, there needs to be a change in the way a teacher teaches a class. Teaching methods applied in the class should keep students actively involved in learning with learning activities that give students the opportunity to discuss in pairs so that students can be able to develop mathematical ideas or ideas that students have to explain, provide opportunities to describe the situation in the problem and state solutions in the form of charts, tables, and algebra, Provide opportunities to express in a mathematical form and describe the problem solution opportunities that are presented with mathematics and the correct symbols to other students or by presenting them in class (Dwiani & Dkk, 2018).

The importance of mathematical representation ability can be seen from the process standard set by NCTM which stipulates that learning programs from pre-kindergarten until twelfth grade must enable students to: 1) Create and use representational ability for organizing; record and communicate mathematical ideas. 2) Select, apply and translate mathematical representations to

solve problems. 3) Using representations to solve problems by modeling and interpreting physical, social, and mathematical phenomena. Thus, the ability of mathematical representation is needed by students to find and create a tool or way of thinking in communicating mathematical ideas from the abstract to the concrete, so that is easier to understand (NCTM, 2000).

The results of a TIMSS survey (TIMSS, 2011: 56) revealed that Indonesia's high school (junior high) students (junior high) was an attendance of 38 from 42 countries with an average score of 386. Whereas the average standard of score that the team was using was 500, with the ability of mathematical representation as one of the aspects that were assessed on the survey. The survey showed that the capacity for mathematical representation of students, especially in middle schools in Indonesia, was still low. There are several factors that affect the low ability of students' mathematical representation. According to Safitri et. al. (2015) one of the factors that causes the low ability of representation is technological. Use mathematics in solving problems, namely the lack of understanding of students' mathematical concepts. Conventional learning conducted by schools is procedural, causing the students' mathematical representation ability to be low. Based on the research results of Khoerunnisa & Maryati (2022), it is known that students' mathematical representation abilities in solving quadrilateral math problems in class VIII SMP, the indicator of students' mathematical representation ability is the representation of equations or mathematical expressions, which is only mastered by one student, while the other students do not master these indicators. This is because the students do not understand how to work on the material contained in the problem with equation representation indicators or mathematical expressions.

The results of a preliminary study conducted by researchers in two classes of the State Islamic Junior High School in Bandung showed unsatisfactory results. A teacher's innovative learning model is required to address the problem of a student's lack of mathematical representation capability at school. The learning model used should be able to require a student to be active in understanding the materials being taught and thus be capable of presenting a student's ability to represent a well-developed mathematical concept. A student has good mathematical ability if the student is able to understand a math concept and has the ability to communicate it. As the ikashaum (Handayani, 2017) states, understanding concepts and communication capabilities is the basis of mathematical representation. One alternative that can be used to improve representational abilities is to use a learning model that supports and familiarizes students with representational thinking, one of which is the *Pair Check* learning model.

The *Pair Check* learning model, which was first popularized by Spencer Kagan, is a group or paired learning model. Huda (2013) states that the *Pair Check* learning model requires students to work together to solve the problems given. The purpose of this learning model is to gain a deep understanding or practice the material that has been studied (Sutarto et al., 2020).

Huda (2013) said that *Pair Check* is one type of cooperative learning model that demands the ability and independence of students in solving problems. In addition, this model also trains cooperation, social responsibility, and the ability to give judgment. The syntax of applying the *Pair Check* type cooperative learning model are: 1) The teacher explains the concept. 2) Grouping students, each group consists of four students consisting of two pairs. One student from each pair acts as a tutor, the other student acts as a partner. 3) The teacher gives questions to students who act as partner. 4) The partner answer questions, students who act as tutors are in charge of checking the answers, partners who answer questions correctly get coupons from tutors. 5) The tutor and partner swap roles. 6) The teacher distributes questions to partner. 7) The partner answer questions, students who act as tutors are in charge of checking the answers, partners who answer questions correctly get coupons from tutors. 8) Each pair returns to the initial group and matches each other's answers. 9) The teacher guides and gives clear directions for each question. 10) Each group checks their answers. 11) The group that gets the most coupons gets a gift from the teacher.

The Pair Check learning model has advantages and disadvantages. According to Huda (2013) the advantages of this learning model are: 1) increasing cooperation between students. 2) Enhance comprehension of the concept and/or learning process. 3) Teach students how to communicate effectively with one another. Meanwhile, the disadvantages of this learning model are: 1) it takes a lot of time. 2) Requires students' readiness to become tutors and partners who are honest and understand the questions well (Lestari et al., 2018). The adaptive advantage of a pair of check models (Aris, 2016) includes 1) training students to be patient, which is giving a partner time to think and not give answers to problems that are not his or her job, 2) training students to give and absorb their spouse's proper and effective motivation, 3) training students to be open to criticism or constructive advice from a partner or other partners in his or her group, 4) providing opportunities for students to mentor others (including their spouses), 5) to teach students how to ask and ask others for help (his or her partner) in a positive way, rather than immediately asking for answers but rather problem-solving). 6) to give students an opportunity to offer help or guidance to others in a good way, 7) giving students the opportunity to learn to maintain class order (avoid the commotion that interferes with the learning atmosphere), 8) being a coach with his or her partner, 9) to create mutual cooperation among students, and 10) to practice communication (Aris, 2016).

Application of a pair of systems of learning models checks accordingly with a student's less than equal ability, for which conceptual learning can conceptually contribute to manusua by developing and using a variety of learning resources, including human resources, nature and environment, resource opportunities or opportunities, and by improving the effectiveness and efficiency of educational resources (Miarso, 2004).

The cooperative learning Pair Check model can be used to help passive students in group activities because, in this learning model, students are required to cooperate in groups and apply the arrangement of checking in pairs (Huda, 2013). Students will practice understanding the reading in the problem through the Pair Check model (Ermavianti & Sulistyorini, 2016). Therefore, this study aims to determine whether the Pair Check learning model can improve students' mathematical representation abilities.

The application of this pair of studying models' checks is one way to improve the quality of learning. Hence, it enhances students' social skills, enables them to become accustomed to communicating between friends and apply theories acquired during the teacher's giving material (Ermavianti & Sulistyorini, 2016).

The hypothesis in this study is that the Pair Check learning model is better than the conventional learning model in order to improve mathematical representation abilities based on the EMK categories, namely high, medium, and low categories. The research method used is a quasi-experimental design that has a control group but does not function fully to control external variables that affect the implementation of the experiment (Sugiyono, 2012).

This study's sample consisted of two classes: class VII-A, which was an experimental class that received a pair-check learning model, and class VII-D, which received conventional learning. The instruments used in the study were tests and non-tests. The tests are the *EMK* test, pretest, and posttest. The *EMK* test consists of ten multiple-choice questions. The pretest and posttest consist of four essays (description questions) that have been prepared based on representation indicators. Meanwhile, the non-test instruments were observation and attitude scale questionnaires. sources of data obtained from teachers and students. The resulting data sets were analyzed using the homogeneity test of the N-Gain data and then tested the two-way hypothesis along with the *EMK* data.

2. METHODS

In connection with the disclosure of the problems that have been stated above, the research conducted by the researcher is quasi-experimental research conducted in two categories, namely experimental and control.

At the time of giving treatment (cooperative learning Pair Check model and conventional types), students were first grouped based on the *EMK* test, and it was found that the experimental class was treated with a Pair Check cooperative learning model, while the control group was treated with conventional learning.

Based on the treatment method given, the effect can be seen from the difference in the results of the pre-test and post-test of the experimental group and the control group.

The following Table 1 describes the experimental research design used in this study namely *the nonequivalent pretest – posttest control group design*.

Table 1. Research Design Table

Class	Pretest	Treatment	Posttest
A	O_1	×	O_2
B	O_3		O_4

This study was carried out in class VII of one of the Islamic Junior High Schools in Bandung City during the academic year 2016/2017, which included ten classes: VII-A, VII-B, VII-C, VII-D, VII-E, VII-F, VII-G, VII-H, VII-I, and VII-J. The sampling technique used in this study is probability sampling, a simple random sampling technique. After selecting the sample, category VII-A was obtained as the experimental category, and category VII-D as the control category. The test used is a test related to rectangular shaped material.

This study's data collection technique was a test conducted in the form of a descriptive or descriptive. There are two tests in this study, namely a test of students' prior mathematical knowledge and a test of students' mathematical representation abilities. The indicators of student representation ability used by researchers are visual representations in the form of pictures, mathematical equations or expressions, and words or written text. This test is used to assess students' mathematical representation skills. Based on the calculation results, the reliability value of the items $r_{11} = 0.55$, so that the instrument is included in the category of medium reliability, so that the instrument can be used in the experimental class and control class. Data analysis using Two Path Analysis of Variance. In addition, the researchers also provided a questionnaire on students' attitudes towards the Pair Check learning model. Researchers distinguish between the positive and negative attitudes of students.

The following is an indicator of the mathematical representation used in this research.

Table 2 Description of Mathematical Representation Indicators

Aspect	Indicator
Visual representation	a. Represents data or information from a representation to a diagram, graph, or table representation. b. Using visual representations to solve problems

Image representation	<ul style="list-style-type: none"> a. Draw geometric patterns. b. Create geometrical figures to clarify problems and facilitate resolution
Representation of a mathematical equation or expression	<ul style="list-style-type: none"> a. Create an equation or mathematical model from another given representation. b. Create a conjecture from a number pattern. c. Problem solving involving mathematical expressions.
Representation of words or written text	<ul style="list-style-type: none"> a. Create problem situations based on the data or representations given. b. Write an interpretation of a representation. c. Write troubleshooting steps. d. Answer questions using words or written text.

(Lestari and Yudhanegara, 2015: 84)

3. RESULT AND DISCUSSION

The results of processing data on the description of teacher activities with a Pair Check learning model increased to 91% at the first meeting, to 100% at the second meeting, and the description of student activities increased at each meeting can be seen on the Figure 1. Figure 1 shows the percentage of student activity at each meeting in learning using the Pair Check learning model.

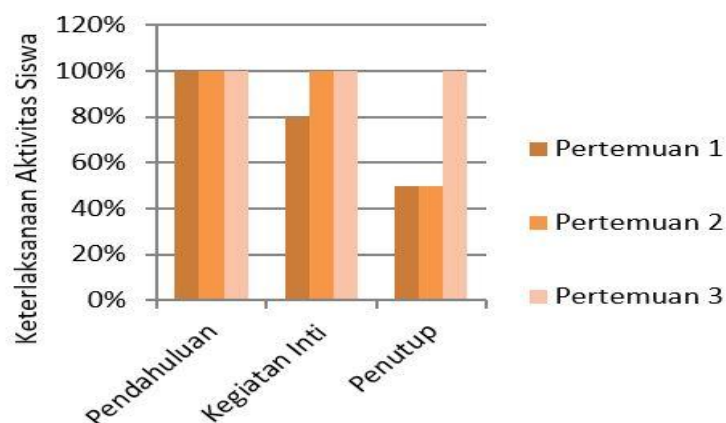


Figure 1. Percentage Diagram of Student Activity Implementation

Based on the analysis of N-Gain of Early Mathematical Knowledge (EMK) in the high, medium, and low categories, the mathematical representation ability of students using the Pair-Check learning model has increased, with an average N-Gain value of medium category or moderate level of interpretation reaching 0.51. And the ability to use mathematical representations of students in conventional learning has increased, but the level of interpretation is low, with an average N gain of 0.30.

To find out the comparison of students' mathematical representation abilities using the Pair Check learning model with increasing students' mathematical representation abilities using conventional learning, it was carried out based on the level of Early Mathematics Knowledge (EMK) with high, medium, and low categories. Completing the research is through a Two-Way Analysis of Variance. The following are the results of the Two-Way Analysis of Variance Test on EMK, which are presented in Table 2.

Table 3. EMK Two Path ANOVA Test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.108a	5	.222	2.936	.020
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	7.250	1	7.250	96.038	.000
Model	.325	1	.325	4.309	.043
EMK	.359	2	.179	2.376	.102
Model * EMK	.127	2	.063	.841	.437
Error	4.152	55	.075		
Total	15.629	61			
Corrected Total	5.260	60			

Based on table 2. Two-way ANOVA test of EMK obtained (a) N-Gain data based on EMK, students have a Sig value. $0.102 > 0.05$, then H_0 received. This means that there is no difference in the increase in students' mathematical representation abilities according to the EMK level of students in the high, medium and low categories. (b) The N-Gain data based on the learning model has a Sig value. $0.043 > 0.05$, then H_0 rejected.

That is, there is a difference in the improvement of mathematical representation skills between students who use the Pair Check learning model and those who use conventional learning. This is in line with the opinion of Rahmadani et al (2019) who stated that the increase in the ability to understand concepts of students who take part in learning with the Pair Check model is better than the understanding of concepts of students who take part in learning with conventional models. Then, the average N-Gain value of students using the Pair Check learning model is 0.5052, which is greater than the average N-Gain value of students using conventional learning, which is 0.3029. Thus, it can be concluded that the increase in the ability of mathematical representation of students who use the Pair-Check learning model is better than the improvement in the ability. Mathematical representation of students who use conventional learning methods. This is also in accordance with the results of research by A'yun et al. (2021) in their research concluded that the Pair Check learning model is better than conventional learning models for students' mathematical communication skills. Suprpto (Arnidha, 2016) also stated that students who receive STAD type cooperative learning have better representational abilities than students who receive conventional learning.

Based on the two-way ANOVA test, it can be concluded that it was H_0 rejected. This means that there are differences in the improvement of students' mathematical representation abilities using the Pair Check learning model compared with students using conventional models based on the level of Early Mathematics Knowledge (EMK), which is categorized as high, medium, and low. In addition, the researchers also looked at students' attitudes towards the Pair Check learning model. The following is a chart of the results of students' attitudes towards the Pair Check learning model in Figure 2.



Figure 2. Percentage of Students' Attitudes to the Pair Check Model

Based on the diagram of the percentage of students' attitudes towards the Pair Check model, most of the students gave a positive response to the Pair Check learning model. This shows that most students are happy with learning mathematics with the Pair Check model, students are serious and active in participating in the learning process carried out, and students feel the benefits of the learning process. In Supriatna's research (2018), it was stated that the response of students to the Pair Check type of cooperative learning model resulted in a good response. In addition, the pair check type cooperative learning model in terms of mathematical reasoning and students' critical thinking got a positive response from students (Hujemiati, 2018)

4. CONCLUSION

Based on the results of data analysis, it can be concluded that there is an increase in the mathematical representation ability of students who use Pair Check, but it is not better than an increase in the mathematical representation ability of students who use conventional learning based on the level of Early Mathematical Knowledge (EMK). In general, students' attitudes towards learning using the Pair Check type of learning model reveal a positive attitude.

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