

The Effect of Mathematics Learning With Improve Method to the Mathematical Representation Ability of Junior High School Students

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Abstract: Mathematical representation ability is one of the important components in an effort to develop students' thinking ability. However, in TIMSS' report, it said that students' ability in representing idea or concept is still low. One of the alternative ways to use is IMPROVE method in mathematics learning. Based on the problem, this study will compare the mathematical representation ability between students who take mathematics learning with IMPROVE method and students who take mathematics learning with conventional method. This study applied quasi-experimental method with Nonequivalent Control Group Pretest-posttest Design. Based on the results and discussions of this study, it can be concluded that the mathematical representation ability of students who learn mathematics with IMPROVE method is better than students who take mathematics learning with conventional method.

1. Introduction

Along with the development of era and education in general, mathematics education has also developed. Mathematics is considered to play an important role in human daily life because in the learning process, mathematics trains a person to think logically, critically and creatively. As stated by Kline [1] mathematics is not a solitary knowledge that can be perfect because of itself, but the existence of mathematics is mainly to help humans in understanding and mastering social, economic, and natural problems. In addition, mathematics is often referred to as the queen of science, the science that functions to serve the needs of science in its development and operations.

Although it plays an important role in the field of education, until now the community still has a negative response to mathematics which can be seen from the low learning achievement in mathematics. According to Russefendi [2] "Mathematics for children in general is a subject that is not liked, so the results of learning mathematics are less successful". The same thing was expressed [1] that mathematical concepts are arranged in a hierarchical, structured, logical and systematic manner starting from the simplest concepts to the most complex concepts.

Ruseffendi [4] revealed that one of the important roles in studying mathematics is to understand direct mathematical objects which are abstract, such as facts, concepts and principles. To achieve this, concrete problems are needed in understanding abstract mathematical ideas, so that the learning process requires a good representation ability. In [5] Jones also revealed that there are several reasons for the need of representation, namely giving students fluency in developing concepts and mathematical thinking and to have strong and flexible abilities and understanding of concepts built by teachers through mathematical representation.



The ability of mathematical representation used in learning, besides having a role as an aid in understanding, representation also supports the ability to solve problems in mathematics. A problem that is considered complicated can be more easily understood if it can utilize the representation in accordance with the problem. Conversely the problem will become more complicated if the problem is represented incorrectly. This shows that representation is not only a process and a product, but also an inseparable part of mathematics as a formal science.

In reality, the Trends in International Mathematics and Science Study (TIMSS) report in 2011 showed that students' ability to represent mathematical ideas or concepts was low. The same thing was expressed by [5] in his dissertation that a small number of students could answer correctly in working on mathematical problems related to the ability of representation, while the majority of others were weak in utilizing the ability of their representation, especially in visual representation.

Based on the explanation above, we need a learning strategy that can create an active learning environment, where it is a curriculum requirement, so learning is no longer teacher-centered. The meta cognitive approach is an effort to improve the quality of mathematics learning in schools that support active student learning in building the ability of representation. Mathematics learning with a meta cognitive approach is the learning that focuses on student activities. The teacher is assigned as a facilitator who helps and guides students if they encounter difficulties in learning.

The process of meta cognition according to Elawar [6] is a strategy of self-regulation of students in choosing, remembering, re-recognizing, organizing the information they face and solving problems. Meta cognition can also be interpreted as a theory that compiles an individual's awareness of his own thought process. By training students to develop meta cognitive awareness, students are expected to have skills that will help them to solve problems related to other disciplines, as well as problems related to daily life.

Based on the description above, the IMPROVE method is one of the innovative methods designed to help students develop optimal mathematical skills and improve student learning activities. IMPROVE is an acronym for the steps of learning, namely Introducing the new concepts, Meta cognitive questioning, Practicing, Reviewing and reducing difficulties, Obtaining mastery, Verification and Enrichment [7].

In learning with the IMPROVE method students are adapted to solve the problems given by working in groups. The group consists of students with heterogeneous abilities. This heterogeneous group situation can develop interactions within groups, such as question and answer and exchange of opinions. In addition, group learning is able to make students accept other students with different background abilities [1]. Based on the background description above, the authors are interested in conducting research on the effect of learning mathematics with the IMPROVE method on students' mathematical representation abilities.

2. Research method

This research is a quasi-experimental research. Quasi-experimental research is part of quantitative approach [8]. In this quasi experiment the subjects are not randomly grouped, but researchers accept the state of the subject as it is [3]. The research design used was Nonequivalent Control Group Pretest-posttest Design. The purpose of the study is to determine differences in mathematical representation abilities of students who received mathematics learning using the IMPROVE method and students who received conventional learning.

The population in this study were all students of class VII in one of the Junior High School in West Bandung regency academic year 2013/2014. While the samples in this study were students in class VII-G as an experimental class who got mathematics learning using the IMPROVE method and students in class VII-H as a control class who got conventional mathematics learning. The instrument used in this study consisted of a test instrument that is a test of mathematical representation ability, and a non-test instrument consisting of student questionnaires and observation sheets.

3. Result and discussion

Data obtained from the results of this study are quantitative data and qualitative data. Quantitative data were obtained from the pretest and posttest results of each class. Quantitative data processing used the help of IBM SPSS Statistics 20. Qualitative data obtained from the observation sheet and student attitude scale questionnaire. The data is processed and analyzed descriptively to obtain conclusions from the results of the study.

3.1 Difference in Mathematical Representation Ability

Students' mathematical representation ability was measured using a mathematical representation ability test instrument before and after learning (pretest and posttest). Pretest was done at the 1st meeting. The learning was carried out at the 2nd to 4th meeting, and posttest was done at the 5th meeting. Pretest was carried out to obtain data on students' mathematical representation ability before the learning treatment, while the posttest was conducted to obtain data on students' mathematical representation ability after the learning treatment. These pretest and posttest were given both to students in the experimental class and to students in the control class.

3.1.1 Data Analysis of Pretest

Descriptive analysis of pretest data was performed using the help of IBM SPSS Statistics 20. The descriptive statistics of pretest data are presented through Table 1 as follow.

Table 1. Descriptive statistics of pretest data

Class	N	Mean	Std. Dev.	Min	Max
Experiment	38	13.58	7.727	2	36
Control	36	11.28	3.177	6	22

From table 1 it appears that the average pretest score of the experimental class is 13.58 with a maximum score of 36 and a minimum score of 2. The average score of the control class pretest is not too much different from the average score of the experimental class pretest which is 11.28 with a maximum score of 22 and a minimum score of 6. To conclude whether the average mathematical representation ability of the experimental class differs significantly from the control class, Inferential statistical tests were carried out using the following steps.

3.1.1.1 Distribution of Normality Test

Distribution normality test is used to determine whether the data obtained are normally distributed or not. Testing of data normality used the help of IBM SPSS Statistics 20 software with Shapiro-Wilk statistical tests using a significance level of 5%. The test results are presented in Table 2 below.

Table 2. Normality test result of pretest data

Class	Shapiro-Wilk		
	Statistics	df	Sig.
Pretest Experimental	0,779	36	0,000
Pretest Control	0,912	36	0,008

H_0 : Pretest data of mathematical representation in the control class and experimental class were normally distributed

From Table 2, it can be seen that the Shapiro-Wilk test for the experimental class and the control class obtained Sig. = 0,000 and 0.008. Because both classes have Sig. which is less than 0.05, meaning that H_0 is rejected. This means that the sample data of the pretest score of the mathematical representation of the experimental class and the control class is not normally distributed. Therefore, there will be no

variance homogeneity test. The test that will be carried out next is to test the similarity of the ability of the initial mathematical representation using the non-parametric Mann-Whitney statistical test.

3.1.1.2 Two-Mean Equality Test

Using the help of the IBM SPSS Statistics 20 software to test the similarity of the two non-parametric Mann-Whitney averages, the results are summarized in the following Table 3.

Table 3 Average similarity test results

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<i>Mann-Whitney U</i>	607,000
Asymp. Sig. (2-tailed)	0,397

H_0 : There is no difference in the level 4 mathematical literacy pretest scores of the control class and the experimental class

With the Mann-Whitney U test the Sig. that is 0.397 where 0.397 is more than 0.05. So it can be concluded that H_0 is accepted at the significance level of 5% ($\alpha = 0.05$). Thus, it can be said that there is no significant difference between the initial mathematical representation ability of students in the experimental class and students in the control class.

Since there is no significant difference between the initial mathematical representation ability of the experimental class and the control class students, the next step is to test the average difference in the scores of the mathematical representation between the experimental class and the control class.

3.1.2 Data Analysis of Posttest

Descriptive analysis of posttest data was performed using IBM SPSS Statistics 20 software. The statistical description of posttest data is presented through Table 4 as follow.

Table 4 Descriptive statistics of posttest data

Class	N	Mean	Std. Dev.	Min	Max
Experimental	38	75,82	10,389	59	100
Control	36	54,36	11,890	25	97

From table 4 it appears that the average post-test score of the experimental class is 75.82 with a maximum score of 100 and a minimum score of 59; while the average posttest score of the control class was 54.36 with a maximum score of 97 and a minimum score of 25. Thus, it was seen that the average posttest score of the experimental class was relatively greater than the average posttest score of the control class. However, to conclude whether the mathematical representation capabilities of the experimental class differ significantly from the control class an inferential statistical test will be carried out using the following steps.

3.1.2.1 Normality Test of Distribution

Distribution normality test is used to determine whether the data obtained are normally distributed or not. Testing data normality using the help of IBM SPSS Statistics 20 software with Shapiro-Wilk statistical tests using a significance level of 5%.

With the Shapiro-Wilk test for the experimental class the Sig. = 0.112 while for the control class the Sig value is obtained. = 0.004. This means that the experimental class posttest data came from the normal distribution population while the control class posttest data came from the abnormally distributed population. Because the posttest data of one of the research classes comes from an abnormally distributed population, there will be no variance homogeneity test. The test that will be carried out next is to test the difference in mathematical representation ability using non-parametric Mann-Whitney statistical tests.

3.1.2.2 Test Difference of Two Averages

Using the help of IBM SPSS Statistics 20 software to test the similarity of the two non-parametric Mann-Whitney averages. the results are summarized in the following table.

With the Mann-Whitney test the Sig. (2-tailed), that is 0,000. Because the test uses an average difference test of one party, the Sig. (2-tailed) must be divided in half. So the value of Sig. to 0,000 where the value is less than 0.05. Based on the previous testing criteria, it can be concluded that H_0 is rejected at the 5% significance level ($\alpha = 0.05$). Thus, it can be said that there is a significant difference between the mathematical representation ability of students in the experimental class and students in the control class.

3.1.3 Discussion

It has been explained previously that the ability of students' initial mathematical representation in the experimental class and the control class there is not significantly different. The students in the experimental class and the control class have the same initial mathematical representation ability. Because students in both research classes have the same initial mathematical representation ability, then to find out the difference in mathematical representation ability between the experimental class and the control class is sufficient through the final test data analysis. Based on the results of the analysis of the posttest data obtained that the mathematical representation ability of the experimental class students is better than the control class students. Thus, students who learn by the IMPROVE method have better mathematical representation abilities than students who learn conventionally.

In this study, one of the things that support the mathematical representation ability of experimental class students better than the control class students is the activity of students in solving problems given in the learning process. In learning with the IMPROVE method, students are guided to solve problems through metacognitive questions. In the problem solving process the experimental class students are also trained to express the answers in their minds. This can help students to develop their representational abilities. In the experimental class, students work in groups and there is class discussion. This makes the students in the experimental class used to discuss both with other students and with the teacher.

3.2 Description of Student's Attitude

The results of the qualitative data analysis are supported by the results of the qualitative data analysis, which is the questionnaire data analysis. Questionnaires are given to students at the end of learning after the test. The statements in this questionnaire are divided into three categories, namely students' attitudes towards mathematics, students' attitudes toward learning using the IMPROVE method, and students' attitudes toward worksheets and students' mathematical representation questions. Questionnaire data is processed according to the measured categories. Based on the results of calculations, for each category given, students gives a positive attitude. This can be seen from the average overall attitude of students towards mathematics with indicators showing interest in learning mathematics and showing perceptions of mathematics lessons, which is 4.05. For students' attitudes towards learning using the IMPROVE method with indicators showing the benefits of participating in learning with the IMPROVE method and showing the perception of using the IMPROVE method has an average value of 3.93. While the average value of overall student attitudes towards worksheets and mathematical representation problems with indicators showing the perception of the use of worksheets and the perception of mathematical representation problems is 3.94.

4. Conclusion

Based on the results of research and discussion about the ability of mathematical representation between students who get mathematics learning using the IMPROVE method and students who get conventional mathematics learning, the following conclusions are obtained: 1) The mathematical representation ability of students who get learning using the IMPROVE method is better than students who get conventional learning; 2) Students show a positive attitude towards mathematics lessons, towards learning mathematics using the IMPROVE method, towards the use of worksheets and mathematical representation problems.

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