EFFECTIVENESS OF MATHEMATICS LEARNING WITH INDONESIA'S REALISTIC MATHEMATICS EDUCATION APPROACH TO SOLVING SKILLS

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ABSTRAK

Tujuan utama dari penelitian ini adalah untuk mengetahui pendekatan PMRI efektiv digunakan dalam pembelajaran matematika pada kemampuan pemecahan masalah pada pokok materi bangun ruang sisi datar siswa kelas VIII SMP Islam YPI Buaran. Jenis penelitian yang digunakan adalah penelitian eksperimen dengan desain penelitian *Quasi Experimental Design* yang berbentuk *Pretest-Post test Control Group Design.* Penelitian dilakukan pada dua kelas yaitu kelas kontrol dan kelas eksperimen, dengan jumlah sampel 73 siswa. Uji hipotesis yang digunakan adalah *Independent Sample T-Test*, dan memberikan kesimpulan bahwa dengan perolehan hasil signifikansi (2-tailed) sebesar 0,000< 0,05 maka H_a diterima yang artinya pendekatan PMRI efektif untuk meningkatkan kemampuan pemecahan masalah pada pokok materi bangun ruang sisi datar siswa kelas VIII SMP Islam YPI Buaran.

***Kata kunci**: pendekatan PMRI, kemampuan pemecahan masalah.*

ABSTRACT

The main objective of this study was to determine the effective PMRI approach used in mathematics learning on problem-solving abilities on the subject matter of building flat-sided room for grade VIII students of SMP Islam YPI Buaran. This type of research is experimental research with a Quasi-Experimental Design research design in the form of a Pretest-Posttest Control Group Design. The research was conducted in two classes, namely the control class and the experimental class, with a total sample of 73 students. The hypothesis test used is the Independent Sample T-Test, and concludes that by obtaining a significance result (2-tailed) of 0.000 <0.05, $\boldsymbol{H_a}$ is accepted, which means that the PMRI approach is effective in improving problem-solving abilities on the subject matter of flat-sided shapes VIII grade students of SMP Islam YPI Buaran.

***Keywords:** PMRI approach, problem solving skills.*

INTRODUCTION

Education in other words is also seen as having a big role in achieving success in child development (Tihuri, 2018). Education problems are closely related to learning problems, the learning process does not have to be centered on teachers, but rather

students involved in the learning process both emotionally and socially (Tihuri, 2018).

One of the efforts to improve the quality of education is to make innovations or new breakthroughs in the world of education, especially in learning activities that can touch aspects of one's self so that he is able to develop the potential that he has optimally, especially in mathematics learning that is considered abstract, meaning that mathematical objects are in the human mind, while the realization by using objects that are around us.

An example of abstract mathematics is a rectangle, the realization of which is a rectangular build. This abstract nature causes students to have difficulty in mathematics. In the world of education, especially in mathematics education, problem solving is a learning approach to solving various mathematical problems (Runtukahu, 2014). Problem solving is one part of the expected standard of competence or mathematics skills, after learning students are required to demonstrate the ability to create or formulate, interpret, and complete mathematical models in problem solving (Yani, 2014).

Teaching mathematics is generally still dominated by the introduction of formulas and concepts verbally, without sufficient attention to the understanding of students. Textbooks used in learning still have little to do with developing students' mathematical problem solving skills (Muchlis, 2012). This causes students to be less motivated to learn math and because the dominance of teachers in teaching and learning activities leads to less active students. In mathematics teaching activities, teachers tend to transfer their math knowledge into students' minds without giving students the opportunity to develop their own knowledge. Students do not have the opportunity to think and determine their own strategies to solve problems. As a result, students consider teachers to be the source of their work.

The learning approach that can be applied by teachers as a new innovation in teaching mathematics is the Indonesian Realistic Mathematics Learning approach, because this learning approach can encourage activeness, arouse students' interest

and creativity in order to improve their learning outcomes (Marta, 2018). According to Freudhental, mathematics must be associated with realistity, close to the student's mind and relevant to society in order to have human values.

Learning with PMRI approach students are encouraged to actively work even expected to construct or build their own mathematical concepts and improve students' ability in problem solving, this learning uses real world context as a learning topic. In connection with the statement, the realistic mathematical approach must have something to do with the real situation, which is easy to understand and imagine by students so as to improve the structure of students' mathematical understanding (Isrok'atun, 2019).

Thus, PMRI has the potential to improve the math problem solving skills of YPI Buaran Islamic Junior High School students. Based on the above problem, the author conducted a class action study titled "Effectiveness of Mathematics Learning with Realistic Mathematics Education Approach of Indonesia on Problem Solving Ability of Materials To Build Flat Side Room of Grade VIII Students of SMP Islam YPI Buaran".

This research was conducted to know the learning process with the approach of Indonesian Realistic Mathematics Education on the subject of building a flat side room, knowing problem solving skills with conventional methods on the subject of building a flat side room, knowing problem solving skills with PMRI approach on the subject of building a flat side room, as well as knowing the effectiveness of learning with the approach of Indonesian Realistic Mathematics Education (PMRI) on the ability to solve the subject matter of building a flat side room.

This type of research is experimental research that aims to test or assess a model on a particular variable (Emzir, 2014). The types of research include Quasi-Experiment Desigh research (Pseudo experiment research design), in this study using control class and experimental class whose data is compared, data retrieval from pretest and posttest to find out the results of both classes after the use of PMRI approach.

This study is an experimental study with quantitative research model, arguing that in this study using numbers in collecting data such as test results, with a strongitative approach, the researchers will examine certain populations or sempel, data collection using research instruments, quantitative or statistical data analysis, with the aim to test the hypothesis that has been established (Sugiyono, 2012) that is caused by the effectiveness of PMRI approach on the ability to solve the main problem building materials of grade VIII SMP Islam YPI Buaran. Tempat pelaksanaan penelitian ini yaitu di SMP Islam YPI Buaran Kota Pekalongan, denganalamat Jl. Gatot Subroto No.21a, Kradenan, Kec. Pekalongan Selatan, Kota Pekalongan.

Data retrieval techniques use test and observation techniques, test techniques are used to measure students' problem solving skills on the subject of building flat side rooms, while observation techniques are used to know and measure the success of researchers as implementers of PMRI approach in mathematics learning. The population in this study is all grade VIII SMP Islam YPI Buaran which amounts to 90 students. The sampling technique was conducted using Slovin formula and resulted in 73 students.

The sampling technique used was the Cluster Technique or Area Sampling which was chosen as the sampling technique in this study, this technique was simple random sampling where each unit was collected as a collection (Muri, 2014). In this study, there were 73 samples obtained using the Slovin formula, then the 73 respondents were divided into two classes, namely the control class as many as 36 students and the experimental class as many as 37 students. The determination of the number of students is based on the cluster technique, which means grouping where the elements in one cluster are homogeneous.

DISCUSSION

(Abdullah, 2017) The approach of learning as a descriptor to make it easier for teachers to give lessons so that students are easier to understand the teaching materials delivered by teachers with a pleasant learning atmosphere.

Pribadi in the journal Putri Fadilla stated that the approach of learning can also be interpreted as a procedure used by teachers to create effective and efficient learning.

In the early 1970s Realistic Mathematics Education (RME) was successfully implemented in the Netherlands and several other countries such as the United States. RME is one of the approaches that use problems as a learning intermediary. Inspired by the RME, a group of mathematics educators in Indonesia initiated an approach called Indonesian Realistic Mathematics Education (PMRI). (Arina, 2018) Based on Hadi in Wulida journal PMRI adopted the principles and characteristics in RME but still adapted to Indonesian culture

Indonesian Realistic Mathematics has the characteristics of making students think more actively, context and teaching materials are directly related to the school environment and students, and the role of teachers is more active in designing teaching materials and class activities (Septiana and Mujib, 2018)

The approach of PMRI according to Treffers in Fahrurrozi (Fahrurrozi, 2017) has 5 indicators, namely: (1) The use of context, context or realistic problems is used as the starting point of mathematics learning. The context used in this study is real-world problems and assisted by props, namely the framework of building a flat side room. (2) The use of progressive matematization model, model is used in conducting progressive matematization. Models in realistic mathematics are the connecting bridge of situations/contexts to the formal stages of mathematics through the mathematical process. In this study, it transformed from real-world problems into mathematical models. (3) Utilization of student construction results, a large contribution to the teaching and learning process is expected from the construction of the students themselves directing them from their informal methods in a more formal or standard direction. Students are not objects of learning but subjects of learning. (4) Interactivity, In clear learning it is necessary to carry out interactions between students and

students as well as between students and teachers who act as facilitators. Students can ask each other questions and answers with educators. (5) Interrelationship, Concepts in mathematics are not partial, but many mathematical concepts are related. In material problems building flat side spaces can be associated with Pythagoras theorem material and flat wake material.

The advantages of learning mathematics using the PMRI or RME approach are (Fahrurrozi, 2017): (1) Learning becomes quite enjoyable for students and a tense atmosphere appears. (2) The material can be understood by most students. (3) The teacher becomes creative in developing learning resources. (4) Students who have high enough intelligence appear to be smarter.

In addition to the advantages of Indonesian Realistic Mathematics Education (PMRI), this learning approach also has several disadvantages, including (Fahrurrozi, 2017): (1) Difficult to apply in a large class (40-45 people). (2) It takes a long time for the subject matter. (3) Students with intelligence need a longer time to understand the subject matter.

According to Polya in Wahyudi's book, problem solving is an attempt to find a way out of a difficulty and achieve goals that cannot be achieved immediately. Or in other words, problem solving is a process of how to solve a problem or a challenging question that cannot be resolved with a routine procedure that is commonly used / known (Wahyudi, 2017).

Polya also argued that there are four main stages in the problem-solving process, namely: (1) Understanding the problem (understanding the problem) Activities that can be carried out in this step are: what (data) is known, what is not known (asked), whether information sufficient, what conditions (conditions) must be met, restating the original problem in a more operational (solvable) form. (2) Devising a plan Activities that can be done in this step are: trying to find or remember problems that have been solved that have similarities to the problem to be solved, looking for patterns or rules, drawing up a settlement procedure (creating

conjecture). (3) Carrying out the plan of carrying out the plan, the activities that can be done in this step are: carrying out the procedures that have been made in the previous step to obtain completion. (5) Re-examining the results of the completion (looking back) Activities that can be done in this step are: analyzing and evaluating whether the procedures applied and the results obtained are correct, or whether the procedure can be generalized.

The framework of thinking in a study reveals the problem being studied and then solved from various problems. The frame of mind can be in the form of a theoretical framework and it can also be in the form of a logical reasoning framework. The frame of mind is a brief description of the theory used and how to use the theory in answering research. The thinking framework is operational in nature derived from one or several logical theories or statements (Bisri, 2011) and the thinking framework is how one theory relates to various factors that have been identified as important to the research problem (Noor, 2011).

Based on the above theoretical framework, it can be made a frame of mind that the application of PMRI approach has an important role in the learning process that is interesting and fun and can improve problem solving skills by associating learning with real life in order to be better understood by students.

So, the problem is the high low problem solving skills in math lessons To achieve such success, it takes the right learning approach and can stimulate and develop the competence and creativity of students in problem solving. So that the material delivered will be easy to understand by students. By using PMRI approach students are trained to think critically in solving problems in mathematics both individually and with group discussions. Research variables are the object of research. The variables in this study are: (1) Free variables (Independent Variables) which is the approach of Indonesian Realistic Mathematics Learning (PMRI). The data needed to determine whether or not the application of mathematics learning with PMRI approach is to use observations on the performance

of researchers in applying PMRI approach conducted by all students of the experiment class. (2) The dependent variable (Dependent Variable) is problem solving. The data collection used to measure students' problem-solving abilities was to use tests, namely pre-test and post-test that would be given to students. Before the pre-test and post-test are carried out, the test instruments that have been compiled are tested beforehand on a population outside the sample with the aim of ensuring that the questions are valid and reliable and have a sufficient level of difficulty and distinction in the category.

Before the research was carried out, the test instrument was tested through validity testing of 10 items carried out on 17 students with df = n-1 obtained r table 0.632 and resulted in 2 invalid items, namely numbers 4 and 9 so that the numbers were discarded or not used. in research. In addition, the reliability test of the test instrument was also carried out and it resulted in an r count of 0.88 which is based on the decision rule if 0.70 > r_count > 0.90 then the instrument is said to be reliable and reaches high criteria. The test instrument difficulty level is all in the moderate category because the resulting numbers are between 0.30-0.70 and the difference power test concludes that all valid items are at a different power with a sufficient category because the resulting numbers range from 0, 20-0.40.

After that, research was carried out and obtained student grade data which were summarized in Table 1, The following:

Table 1. Descriptive Statistics

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Pre-Test Eksperimen	37	48	81	67.38	7.624
Post-Test Eksperimen	37	80	100	87.51	5.226
Pre-Test Kontrol	36	55	84	67.17	7.311
Post-Test Kontrol	36	64	98	78.22	6.949
Valid N (listwise)	36				

Table 1 above shows that the average value of the Post-Test questions in the experimental class, namely the class with the application of learning with the PMRI approach, is higher than the control class using the conventional learning model.

Data analysis was carried out by various types of testing, but before that the results of observations or observations on teacher performance were needed to support a testing decision. Because the value obtained by students is the influence of the success or failure of the teacher in delivering the material, which in this case is delivered by applying a learning model with the PMRI approach.

Scoring and assessment criteria in analyzing teacher performance observation sheets using a scale of 4 with the following percentages:

$<$ 60% : Learning Is Not Good

60% - 69% : Good Enough Learning

70% - 84% : Good Learning

85% - 100% : Learning Very Good

Data from observations of teacher performance were analyzed in percentage form with the formula:

$$NP = \frac{R}{SM} \times 100$$

Information:

NP = Percent value sought

R = The raw score obtained by the teacher

SM = Maximum score

100 = Fixed number (Purwanto, 2010)

The observation data acquisition carried out by researchers and assisted by students during the learning process by applying the PMRI approach is summarized in Table 2 below:

Table 2. Learning Success

Criteria	**Students**	**Average Percentage**
Very good	6	90,91 %
Good	8	80,11 %
Enough	23	71,78 %
Less	-	0 %
Very Less	-	0 %

Based on Table 2 the results of observations on the performance of

researchers conducted by the students above, the average student produced a percentage of 76.60%. This figure lies in the 76% - 85% interval, which means that the success of PMRI learning reaches good criteria. So, it can be concluded that the use of the PMRI approach in mathematics learning at SMP YPI Buaran class VIII, the subject matter of flat-sided building, achieves good criteria. The results of observations or observations described above are used to support decision making after going through several tests as follows:

Normality test

Normality test is one of the requirements for the –t test. This normality test aims to find out if the test scores obtained in the study are normally distributed or not. The calculation in this normality test is done for each class that becomes a research sample and taken from the post test result value. For normality test using Kolmogrov-Smirnov test with the help of SPSS with the following criteria:

The significance value or probability value <0.05, then Ha is rejected so that the data is not normally distributed.

The significance value or probability value> 0.05, then Ha is accepted so that the data is normally distributed.

The results of the normality test calculation are presented in Table.3:

Table 3. Normality Test Results

		Kolmogorov-Smirnov[a]		
	Kelas	Statistic	df	Sig.
Hasil Belajar Siswa	Pre-Tes Eksperimen (PMRI)	.079	37	.200*
	Post-Test Eksperimen (PMRI)	.128	37	.132
	Pre-Test Kontrol (Konvensional)	.088	36	.200*
	Post-Test Kontrol (Konvensional)	.178	36	.006

Based on the normality test table, the One Sample Kolmogorov-Smirnov Test, the significance value shows that the post-test experimental

class is 0.132 and the control class is 0.06. Based on the criteria in the normality test, it shows that 0.132> 0.05 and 0.06. > 0.05 then Ha is accepted. So the two Post-test value data are normally distributed.Based on the normality test table, the One Sample Kolmogorov-Smirnov Test, the significance value shows that the post-test experimental class is 0.132 and the control class is 0.06. Based on the criteria in the normality test, it shows that 0.132> 0.05 and 0.06. > 0.05 then Ha is accepted. So the two Post-test value data are normally distributed.

Homogeneity test

The homogeneity test is used to determine whether the two samples, namely the experimental class and the control class, have the same variance or not. If this homogeneity is fulfilled, the researcher can test the hypothesis using the t-test. To test the homogeneity of the variants of the two classes of researchers using SPSS.

The homogeneity test was carried out by using the One Way Anova test, with the following criteria:

The significance value or probability value> 0.05 (5%) then Ha is accepted, the data has the same or homogeneous variants.

The significance value or probability <0.05 (5%) then Ha is rejected, so that the data has unequal or homogeneous variants.

The results of the homogeneity test are presented in Table 4:

Table 4. Homogeneity Test Results

		Levene Statistic	df1	df2	Sig.
Hasil Belajar Siswa	Based on Mean	.845	1	71	.361
	Based on Median	.849	1	71	.360
	Based on Median and with adjusted df	.849	1	63.321	.360
	Based on trimmed mean	.818	1	71	.369

Based on the homogeneity analysis table, it turns out that the significance value is 0.361. So it can be concluded that the data used is homogeneous because it has a significance value of 0.361> 0.05.

Thus, it means that the sample of the experimental class and control class are homogeneous and have the same variance.

Hypothesis test

Based on the description above, it can be said that the prerequisite test has been fulfilled. So that we can move on to hypothesis testing. Hypothesis testing in this study used the t-test to determine learning with the PMRI approach is effective in learning mathematics and can improve students' problem solving abilities.

The t-test is done by taking the students' post-test value data. Hypothesis testing is carried out using the Independent Sample t-Test which aims to answer the problem formulation in this study and to find out whether there is a difference between the mean data of the experimental class and the control class. The calculation results use SPSS. The hypothesis to be tested is as follows:

Ho: The PMRI approach is not effective for improving problem-solving skills on the subject matter of building class VIII students at SMP Islam YPI Buaran

Ha: PMRI's approach is effective for improving problem-solving skills on the subject matter of building class VIII students at SMP Islam YPI Buaran.

The criteria for testing the hypothesis are as follows:

If the significance value <0.05 then Ha is accepted and Ho is rejected.

If the significance value ≥0.05 then Ha is rejected and Ho is accepted.

The results of hypothesis testing are presented in Table 5:

Table 5. Test Results Independent sample t-test

	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Equal variances assumed	.845	.361	6.468	71	.000	9.291	1.437

Based on the results of hypothesis testing carried out on students' Post-Test scores in both the control and experimental classes which have been summarized in the table above, it can be concluded that with the 2-tailed significance acquisition of 0.000 <0.05, H_a is accepted, which means the PMRI approach effective to improve problem-solving skills in the subject matter of building class VIII students of SMP Islam YPI Buaran,

Table 6. Average Test of the Independent sample t-test

Group Statistics

	Kelas	N	Mean	Std. Deviation	Std. Error Mean
Hasil Belajar Siswa	Post-Test Kelas Eksperimen (PMRI)	37	87.51	5.226	.859
	Post-Test Kelas Kontrol (Konvensional)	36	78.22	6.949	1.158

Based on the table above, it can be seen that Mean 87.52> 78.22, so it can be concluded that the average value of students' problem solving abilities in the experimental class is higher than the average score in the control class. This means that the problem-solving ability of the experimental class using the PMRI approach increases.

After the results of the research analysis are found, the next step is to describe the results of the analysis that has been done above, the results of the research are in the form of words that interpret the results of the analysis above. Based on the results in the study using two classes, namely the experimental class as many as 37 students and the control class as many as 36 students of class VIII at SMP Islam YPI Buaran who then tested the post-test results of the two classes to determine the problem solving ability, the average value was obtained. The post-test experimental class was 87.52, while the post-test mean score of the control class was 78.22. So it can be concluded that using the PMRI approach can effectively improve students' problem-solving abilities on the subject matter of building a flat side room.

The results of post-test scores in the experimental class were better than the post-test scores in the control class certainly could not be separated from the performance of researchers as implementers of PMRI approach in mathematics learning, based on observations made by 37 students who were given actions in the form of PMRI approach showed a percentage of 60% to 94% percent, which means that the performance of researchers as implementers of learning by using PMRI approach achieved sufficient criteria , good and very good.

In addition to the observation results, the data in this study was also tested with an independent t-test, but previously conducted a prerequisite test, namely normality test and homogeneity test. In the normality test of the experiment class and the control class with one sample Kolmogorov-Smirnov Test obtained significance value showed that in the post-test experimental class was 0.132 and the control class was 0.06. Based on the criteria in the normality test shows that 0.132 > 0.05 and 0.06. > 0.05 then Ha accepted. So both post-test value data are normally distributed.

After the normality test, the data were analyzed using the homogeneity test, based on the data that had been analyzed using SPSS, a significance value of 0.361 was obtained. So it can be concluded that the data used is homogeneous because it has a significance value of 0.361> 0.05. Thus, it means that the sample of the experimental class and control class are homogeneous and have the same variance.

Independent Sample t-Test can be carried out if the normality test and homogeneity test have been carried out, based on the data that has been analyzed using SPSS, the results of the t-test are the results of hypothesis testing carried out on the Post-Test scores of students in both the control and experimental classes. summarized in the table above, it can be concluded that with the acquisition of a significance (2-tailed) of 0.000 <0.05, H_a is accepted, which means that the PMRI approach is effective for improving problem-solving abilities on the subject matter of building class VIII students of SMP Islam YPI Buaran Kota. Pekalongan.

CONCLUSION

Based on the data analysis and hypothesis testing that has been carried out by the researcher, it can be concluded as follows: (1) The process of learning mathematics using the PMRI approach to the flat-sided building material at SMP Islam YPI Buaran can be implemented well and reaches a percentage of 77%. (2) The problem-solving ability of students in conventional learning has increased on average, with the previous average of 67.17 being 78.22. The pre-test and post-test scores reached the sufficient category. (3) The problem-solving ability of students in learning using the PMRI approach has increased on average, with the previous average of 65.40 to 91.81. The pre-test score reached the sufficient category while the post-test reached the good category, so there was an increase in categories in learning using the PMRI approach. (4) The PMRI approach is effective in the problem-solving ability of students in the subject matter of building a flat side room in class VIII students of SMP Islam YPI Buaran.

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