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EFFECTIVENESS OF REALISTIC MATHEMATHIC EDUCATION (RME) MODEL ASSISTED WITH JARIMATICS ON STUDENT PROBLEM SOLVING

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ABSTRACT

The objectives of this study are (1) to test the mathematical problem solving ability with RME learning model assisted by Jarimatika better than the mathematical problem solving ability with conventional learning, (2) to test the mathematical problem solving ability with RME model assisted by Jarimatika better than the mathematical problem solving ability with conventional learning, (3) to test the improvement of mathematical problem solving ability with RME model assisted by Jarimatika better than the improvement of mathematical problem solving ability with conventional learning. This research is a pure experimental research. The design was pre test post test control group design. The population was fifth grade students at Jatilawang 1 State Elementary School and Kemantran 1 and 2 State Elementary School. While the sample was first grade Jatilawang 1 State Elementary School as the experimental class and Kemantran 1 State Elementary School as the control class. Data collection techniques in this study were documentation and tests. The data analysis used in this research (1) mathematical problem solving ability completeness test (one sample t test) and classical completeness test, (2) mathematical problem solving ability average difference test (independent t test), and two proportion difference test, (3) mathematical problem solving ability improvement test. The results of this study are (1) The problem solving ability of students with the RME model assisted by teaching materials exceeds 70, and the proportion of students with the RME model assisted by teaching materials reaches the completion of problem solving ability exceeds 80%. (2) The problem solving ability of students with RME model assisted by teaching materials is better than the problem solving ability of students with conventional learning, and the proportion of students with RME model assisted by teaching materials achieving completeness of problem solving ability is more than or equal to students with conventional learning, (3) the improvement of students' problem solving ability with RME assisted by teaching materials is better than the improvement of students' problem solving ability with conventional learning, (4) the influence of curiousity on problem solving ability is 90%. The implication of this research is that the use of the RME model assisted by Jarimatics can develop problem solving abilities, problem solving abilities with the RME model assisted by Jarimatics are better than conventional models.

Keywords: Problem Solving, Realistic Mathematic Education, Model Assisted of Jarimatics

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PRELIMINARY

Mathematics learning is the interaction of teachers, students, and the environment in developing thinking patterns designed by a teacher using various effective and efficient learning models (Chisara et al., 2018). The purpose of learning mathematics at school is so that students can master mathematical abilities and solve everyday problems (Fauzan, 2013). Therefore, learning mathematics is important to develop students' ability to solve problems.

The importance of mathematics is not in line with the abilities of Indonesian students. In the 2018 Program for International Student Assessment (PISA) evaluation results showed a lack of mathematical ability (Widodo & Amalia, 2020). Therefore, mathematical skills need to be developed in schools.

According to National Council of Teachers of Mathematics (NCTM), the standards of mathematics learning process are reasoning and proof, communication, problem solving, representation, and connection (NCTM, 2000). Mathematical problem solving ability is one of the standards that students must master. Problem solving ability is an effort to find solutions to difficulties to achieve goals (Maulyda, 2020).

However, based on several studies, it shows a lack of problem solving skills. Students have not been able to develop problem solving skills, and have not been able to solve everyday problems (Rosneli & Hidayat, 2019a). In addition, students have difficulty when working on problems that require analysis and are not routine (Noviyana & Fitriani, 2017). Students' problem solving skills are below the KKM (Mulyati, 2017).

These problems are in accordance with the reality at SD Negeri Jatilawang. The observation results show that students still cannot understand the problems given by the teacher so that students cannot plan strategies that can be used to solve problems. This causes students to not be able to solve the problem. Then some students who can solve the problem only write the calculation results. Students do not conclude the results obtained in accordance with the existing problems. Some students can also understand the problem and determine the strategy, but not yet correct in solving the problem. Students are wrong in using formulas and calculating them.

Field observations show that in learning students are passive, students tend to be bored and not interested in the material provided. The reason is that students do not like math because it is considered difficult. Another factor is that the learning model is not appropriate to develop problem solving skills.

Many teachers have tried various ways to overcome these problems. According to the results of research by Gee (2019); Rahman & Setyaningsih (2022), Realistic

Mathematics Education (RME) based learning improves problem solving skills. Another study mentioned that problem solving ability through Realistic Mathematics Education model is better than through conventional learning (Mulyati, 2017). According to Susanti & Nurfitriyanti (2018); Widana (2021) there is an effect of the RME model on problem solving ability. Based on some research results, it shows that the application of the RME model can improve mathematical problem solving skills.

RME considers mathematics to come from human activities so that it can be connected to the context of students' daily lives to develop mathematical concepts and apply them (Ismail & Jamil, 2019). According to Ahmad et al. (2018), in RME learning students are required to think about a problem that is close to the real world of students and find their own way of solving it. The application of Realistic Mathematics Education (PMR) is able to improve students' mathematical abilities, namely intuition, mathematical problem solving, connection (Afsari et al., 2021). With the RME model, students will be brought into real problems in everyday life, students will find solutions and solve problems themselves.

One of the factors that can make students better understand learning material is by connecting it to everyday life. Students are more enthusiastic and interested in problems related to their lives.

In RME learning combined with jarimatika calculation. The jarimatika method involves students' own organs directly, so as to increase the efficiency of students' counting speed (Syaharuddin & Mandailina, 2018). In addition, in learning with jarimatika students exceed KKM and there is an increase in ability after learning (Himmah et al., 2021). Using the jarimatika method will make students faster and more precise in completing arithmetic operations (addition, subtraction, multiplication, and subtraction) (Hidayah & Islamiah, 2022). The application of the RME model assisted by jarimatika improves student learning outcomes (Marfuah et al., 2019). It aims to help students in calculations when solving problems. By using RME assisted with jarimatika, it is hoped that it can improve problem solving skills.

The objectives of this study are:

1. to test the ability of mathematical problem solving with RME model assisted by jarimatika beyond KKM,

2. to test the ability of mathematical problem solving with RME model assisted with jarimatika better than the ability of mathematical problem solving ability with conventional learning.

3. testing the improvement of mathematical problem solving ability with RME model assisted by jarimatika is better than the improvement of mathematical problem solving ability with conventional learning.

METHODS

This research is a true experimental with a pre test post test control group design. (Rukminingsih et al., 2020). The population is grade II students of Jatilawang 1 State Elementary School, Kemantran 1 and 2 State Elementary School in the 2021/2022 academic year. The sampling technique is simple random sampling. The sample used class II SD Negeri Jatilawang 1 as an experimental class of 26 students and class II SD Negeri Kemantran 1 as a control class of 28 students. The data collection methods are tests, and documentation. Tests to obtain data on problem solving skills. While documentation to obtain student data, and photos. The research instrument tests used were reliability, validity, difficulty level and differentiability. The data analysis is (1) test the completeness of mathematical problem solving ability with one sample t test, classical completeness test, (2) test the difference in mathematical problem solving ability with independent t test, two proportions difference test, (3) test the improvement of problem solving ability with independent t test.

RESULTS AND DISCUSSION

The instrument trial analysis has been carried out, the results are.

Table 1. Instrument Test Analysis

No	Rxy	R table	Interpretation	r_{11}	Interpre tation	Difficulty level	Interpretation	D	Interpretation
1.	0.970	0.368	Valid	0.982	Reliable	0.60	Currently	0.420	Good
2.	0.940		Valid			0.56	Currently	0.320	Enough
3.	0.949		Valid			0.45	Currently	0.440	Good
4.	0.936		Valid			0.56	Currently	0.350	Enough
5.	0.932		Valid			0.42	Currently	0.300	Enough
6.	0.943		Valid			0.42	Easy	0.330	Enough
7.	0.885		Valid			0.71	Currently	0.290	Enough
8.	0.965		Valid			0.36	Currently	0.310	Enough

No	Rxy	R table	Interpretation	r_{11}	Interpre tation	Difficulty level	Interpretation	D	Interpretation
9.	0.843		Valid			0.24	Hard	0.300	Enough
10.	0.965		Valid			0.56	Currently	0.310	Enough

In Table 1, it can be seen that the validity test results show that all questions have $R_{xy} > 0{,}368$ value. So it can be concluded that there are 10 questions that are said to be valid. While the reliability test results that the question is a reliable question. The results of the level of difficulty test obtained by the easy category question, namely question number 6. While the questions in the medium category are questions 1,2,3,4,5,7,8, and 10. While the question with the difficult category is number 9. The results of the analysis of the differentiating power of questions with sufficient categories are 8 questions while the good category is 2 questions. The conclusion is that the questions that can be used in research are 10 questions.

The results of data analysis are as follows.

1. Hypothesis 1
   a. Completeness Test Average Mathematical Problem Solving Ability

      The test carried out was *the one sample t test.* The data used is posttest data on problem solving abilities with KKM = 70 . The hypothesis is as follows.

      H_0: μ ≤ 70 , the average problem solving ability of students with RME model assisted by jarimatiks does not exceed 70.

      H_1 : μ > 70, the average problem solving ability of students with RME model assisted by jarimatiks exceeds 70.

      Criteria :H_0 accepted If $t \leq t_{n-1,\alpha}$. The results of the one sample t test are as follows

Table 2. Average Completeness Test

	Test Value = 70					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference Lower	Upper
K_problem_solving_ex	7.655	25	.000	9.769	7.14	12.40

The average completeness test results show a value of t-count = 5,716. While the value $t\,tabel = t_{n-1,\alpha} = t_{25;\,0{,}05} = 2{,}0595$can be seen to be $t - count = 7{,}655 > t_{25;\,0{,}05} = 2{,}0595$, then Ho is rejected. This means that the problem solving

ability of students with the RME model assisted by jarimatiks exceeds 70.

b. Classical Due Diligence

This test uses posttest data on problem solving abilities. hypothesis :

H_0 : π ≤80% (proportion of students taught using RME model assisted by jarimatiks who achieve complete problem-solving abilities has not exceeded 80%)

H_1: π >80% (the proportion of students taught with model assisted by jarimatiks who achieve complete problem solving abilities has exceeded 80%)

Test statistics used(Putri & Suryati, 2016)are as follows.

$$z = \frac{\frac{x}{n} - \pi_o}{\sqrt{\frac{\pi_o(1-\pi_o)}{n}}} = 2{,}059$$

The criteria are H_0 ditolak if $z_{hitung} > z_\alpha$ where $z_\alpha = z_{0,05} = 1{,}64$. It can be seen that $z\ hitung = 2{,}059 > z_{0,05} = 1{,}64$, then Ho is rejected. It means proportion student taught with RME model assisted by jarimatiks completeness problem solving abilities have exceed 80%.

2. Hypothesis 2

a. Test the average difference in problem solving ability

The data analysis used is the independent t test. What was used in the analysis was the posttest value of the problem solving ability of the class with the RME model assisted by jarimatics and the class with the conventional learning model.

The hypothesis used is as follows.

H_0: $\mu_1 \leq \mu_2$ (the problem solving ability of students with RME model assisted by jarimatiks is less than the problem solving ability of students with conventional learning)

H_1: $\mu_1 > \mu_2$ (students' problem solving ability with RME model assisted with jarimatiks is better than problem solving ability with conventional learning)

Acceptance criteria H_0 is Accept H_0if $t \leq t_{(\alpha,n1+n2-2)}$.

The result of data analysis is :

Table 3. Independent Samples Test Results

		t-test for Equality of Means		
		t	df	Sig. (2-tailed)
posttest_ ability	Equal variances assumed	2.212	52	0.031
	Equal variances not assumed	2.218	51.218	0.031

The independent t test analysis results in a calculated t value in the Equal variances assumed (homogeneous) section.

The calculated t value = 2.212. While $t\ tabel = t_{(\alpha,n1+n2-2)} = t_{(0,05,26+28-2)} = t_{(0,05,52)} = 2.0066$. T count = $2.212 > t_{(0,05,38)} = 2.0066$, then Ho is rejected. This means that students' problem solving ability with RME model assisted by jarimatiks is better than students' problem solving ability with conventional learning.

b. Two Proportion Difference Test

This test uses posttest data on problem solving abilities.

The hypothesis is:

H_0: $\pi_1 \leq \pi_2$ (proportion of students who completed the RME model assisted by Jarimatics than or equal to students who with conventional learning model)

H_1: $\pi_1 > \pi_2$ (proportion of students who completed the RME model assisted by Jarimatics more than students who with conventional learning model)

Criteria for this test: Accept Ho if $z_{\ hitung} < z_{tabel}$. The z value is as follows.

$$z = \frac{\frac{x}{m} - \frac{y}{n}}{\sqrt{p \times q \times (\frac{1}{m} + \frac{1}{n})}} = 1.9129$$

Based on calculations, it is obtained $Z\ hitung = 1.9121$. Meanwhile $z_\alpha = 1.64$. It can be seen that $Z\ hitung = 1.9121 > z_\alpha = 1.64$, then Ho is rejected. proportion of students who completed the RME model assisted by Jarimatics more than students who with conventional learning model.

3. Hypothesis 3

The test used is the independent t test. Previously, data was searched for the difference between the pretest and posttest of the class using the RME model assisted by mathematics and the conventional model.

The independent test results are as follows.

Table 4. Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Improved_experimentcontrol	Equal variances assumed	5.400	0.024	3.959	52	.000
	Equal variances not assumed			4.036	43.385	.000

The prerequisite test is the homogeneity test.The hypothesis:

$H_0: \sigma_1^2 = \sigma_2^2$(both sample groups have the same variance)

$H_0: \sigma_1^2 \neq \sigma_2^2$(both sample groups have different variants)

From the *Levene's Test for Equality of Variances column* , it can be seen that the significance is 0.024. It can be seen that it is significant = 0.024 <0.05, so accept H. This means that the two groups have unequal variances. So the output seen is the *equal variances not assumed section.*

After that, the *independent t test analysis. The independent t test* hypothesis is:

H_o: $\mu_1 \leq \mu_2$(The average increase in students' problem solving abilities with RME assisted by Jarimatics is less than the increase in students' problem solving abilities with conventional models)

H_1: $\mu_1 > \mu_2$(The average increase in students' problem solving abilities with RME assisted by Jarimatics is better than the increase in students' problem solving abilities with conventional models)

The criteria: $H_o$accepted if $t \leq t_{(\alpha,n1+n2-2)}$. The t value seen in the *independent t test output* is equal variance assumed. This is because of the homogeneity test results. The calculated t value is 3,959. mean while $t\ tabel = t_{(\alpha,n1+n2-2)} = t_{(0,05,26+28-2)} = t_{(0,05,52)} = 2.066$. If the value is $t\ hitung = 3.959 > t_{(0,05,38)} = 2.066$, then rejected Ho. It means that The average increase in students' problem solving abilities

with RME assisted by Jarimatics is better than the increase in students' problem solving abilities with conventional models.

Based on the analysis, the research results are (1)The average problem solving ability of students using RME assisted by Jarimatics exceeds 70,the proportion of students with RME assisted by Jarimatics who have complete problem solving abilities exceeds 80%. This is in accordance with the results of other research showing that students' problem solving abilities reach the KKM with an average of 76.32 and classical learning completeness is 88.24% (Asih, 2020).

Conditions in the field show that RME assisted by Jarimatics encourages students to solve realistic problems that are close to everyday life. In learning activities, students are more active in exploring information to understand their own problems. Students use their concepts to transform problems into mathematical symbols and plan appropriate solutions. The RME model is supported by calculations using mathematics so that students can calculate quickly and solve problems effectively, quickly and precisely. The RME assisted by Jarimatics can improve problem solving abilities.

This is in accordance with several research results, namely research resultsimplementation of RME in elementary schools can improve learning outcomes and mathematics problem solving (Elwijaya. et.al., 2021). RME can improve students' learning outcomes and mathematical abilities. Starting from intuition abilities, mathematical problem solving abilities, students' connection and communication abilities (Afsari, et. al., 2021). Other research states that students' problem solving abilities using the RME model assisted by Hapiz media reached KKM with an average of 78.50 and a completion percentage of 90.9% (Kristanti et al., 2017).

Meanwhile, the second hypothesis isStudents' problem solving abilities using the RME model assisted by Jarimatika are better than students' problem solving abilities using conventional models. Proportionstudents using the RME model assisted by Jarimatika achieved completionmore than or equal to students with the conventional model. The third hypothesis isaverageIncreasing students' problem solving abilities with RME assisted by Jarimatika is better than increasing students' problem solving abilities with conventional models.

The mathematics-assisted RME model has several phases in learning. In the first phase, understanding contextual problems, students are given problems related to daily life. Students try to understand the problem given. Students are encouraged to relate mathematical problems to everyday life.

The second phase is solving problems related to daily life. In this phase, students are expected to solve their own problems. Students use the knowledge they already have to obtain solutions to solve problems. After finding the right solution, the problem is solved with the help of a graph. Mathematical calculations using mathematics make solutions faster and more precise.

The third phase is comparing and discussing students' answers. Students compare answers to problems in small groups. Then the results of the work are presented in front of the class. Other groups can provide feedback on the results of each group's work. This allows students to determine the most appropriate solution to solve the problem.

The fourth phase is drawing conclusions. At this stage the teacher and students together draw conclusions based on the theories, concepts and mathematical procedures they have related to the problem given. Students play an active role in solving problems so that students understand the material better. Student learning using RME assisted by Jarimatics is more meaningful and can improve problem solving abilities.

Meanwhile, in the conventional learning model students are passive. Students only listen to lectures from the teacher. Many students feel bored and do not focus on learning. Students' ability to solve problems on their own is not honed. Students only know the directions given by the teacher without finding the right solution themselves.

This is in accordance with research results, namely that learning Mathematics with RME learning can improve students' problem solving abilities(Rosneli & Hidayat, 2019b). Apart from that, other results show that problem solving abilities in mixed arithmetic operations material using RME learning are better than those following conventional learning (Mulyati, 2017); (Oftiana & Saefudin, 2017). Other research states that there is a higher increase before learning and after learning (Asih, 2020). The limitation in this research is that implementing the PBL model requires a longer time to get better results.

CONCLUSION

The conclusions of this research are:

1. (a) The average problem solving ability of students using RME assisted by Jarimatics exceeds 70. (b) The proportion of students using RME assisted by Jarimatics achieving completion exceeds 80%.
2. (a) The average problem solving ability with the RME model assisted by mathematics is better than the problem solving ability of conventional learning students. (b) The proportion of students using RME assisted by Jarimatics achieves completionmore than

or equal to students with conventional learning models.

3. AverageIncreasing students' problem solving abilities with RME assisted by Jarimatics is better than increasing problem solving abilities with conventional learning.

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