

Effect of The Learning Approach of Realistic Mathematics Education on Problem Solving and Mathematics Communications Effectivity

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Abstract. Realistics mathematics educations (RME) has succeeded in shifting behavioristic mathematics learning to more constructive. RME deals with the process of learning, which helps the students to think and communicate mathematically. Therefore, RME is helpful in promoting student's problem-solving skills and mathematics communications in learning. The instructional with RME approach will be more effective if the performance of students' achievement in problem-solving and mathematics communications better than not use MRE approach or conventional approach. The purpose of this research was to examine the effect of the realistic mathematics approach on problem-solving and mathematics communications effectivity in learning. The results of quasi-experimental indicated that the MRE approach fulfilled the direct effect on problem-solving and mathematics communications effectivity. This data provide support for the claim that RME approach is superior in comparison to conventional teaching. Students in the experimental group showed an overall favorable view towards the implementation of MRE approach. They viewed that the RME approach provides an opportunity for students to be more active in learning and have a positive attitude towards mathematics subjects.

Keywords: *Realistic mathematics education, problem-solving, mathematics communication.*

INTRODUCTION

National Counseling of Teachers of Mathematics (NCTM) describes five standards of mathematical ability must students possess, such as; reasoning abilities, communication skills, connection ability, problem-solving ability, and representation. Problem solving and communication skills are standard abilities must be owned and are essential for students to develop [1].

A study found that students' problem-solving skills at the elementary school (SD) and junior high school (SMP) levels were still low [2]. This is linear with Fakhurudin that the mathematical problem-solving abilities of elementary and junior high school students are also not satisfactory, only 30.67% of the ideal score.

Mathematical learning must be able to change the paradigm that can activate students during in the learning process and can minimize teacher dominations, so that there is a change in mathematics learning, that is, from learning with an approach of teacher-centered to be student-centered [3]. Learning is no longer behavioristic but changes in a constructive direction. So that knowledge is no longer obtained through transfer but through construction.

In order for this to be done, a learning model needs to be developed that can improve mathematics learning. Realistic Mathematics Education Learning (RME) is considered able to improve mathematics learning.

The RME in its activities relates to reality as the students experience. This learning approach is suitable to be used in mathematical learning because learning mathematics is not only enough to know and memorize, but also requires an understanding and ability to good mathematics problems solving and true through everyday objects in everyday life as students experience [4].

The special feature of MRE is the use of existing real situations developed in accordance with the context and circumstances of Indonesia, this indicates that the activity must be close to the student and relevant to the everyday situation.

Gravemeijer [5] describes three main principles of PMR, guided reinvention, progressive mathematizing, didactical phenomenology, and self-developed models. There are 5 characteristics of PMR Gravemeijer, (1) Using contextual problems, (2) Using models, (3) Using the results and contributions of students, (3) Interacting between teachers and students with interactive learning activities, allowing communication and negotiation between students and teachers, students with other students, and (4) the interrelationship between the part of the learning material, the structure and the mathematical concepts related to each other, so that engagement must be explored in order to support more meaningful learning.

While problem-solving is a directional thought to find solutions or solutions to a specific problem. Siswono stated that problem-solving as an individual business activity towards the response to overcome obstacles and control when one answer or method of answer has not been clearly seen. Whereas there are four problem-solving abilities, as follows: (1) understanding the problem, (2)

making a problem-solving plan, (3) implementing problem-solving planning, and (4) self-checking

To measure mathematical problem solving skills, indicators are needed (1) Identifying known elements, asking questions and adequacy of elements, (2) making models, (3) implementing strategies or ways to solve mathematical problems, (4) Explaining results, (5) completing mathematical models and real problems, and (6) using mathematics meaningfully [6].

Communication skills are the ability to communicate; the activity is using the ability to listen, studying, writing, evaluating and interpreting of idea, terms, symbols and mathematical information that is ideal when listening, discussing and presenting. When students get information in the form of mathematical concepts given by the teacher or what they get from reading material, at that time there is a transformation of mathematical information from the student's source. Mathematical communication skills are important skills in mathematics, in this ability can express mathematically different ideas to teachers, accompany and others through written writing and written writing [6].

Through mathematical communication, students can develop mathematical understanding using the correct language of mathematics, writing mathematical representations, grouping ideas and learning to make arguments symbolically, image and verbally.

Mathematical communication can be developed in two ways, writing and physical or verbal. Indicators of the mathematical communication ability be developed in activities (1) connect real objects, diagrams, into mathematical ideas, (2) explain situations, relations, mathematical ideas illusively, writing with real objects, graphs, picture and algebra, (3) the daily events of language or mathematics symbol, (4) be able to discuss, listen to, and write about mathematics, (5) be able to read written mathematical presentations and compile relevant questions, and (6) make an argument, summarize definitions and generalizations [1].

The purpose of this research to determine the effectiveness of the mathematics realistic educations (MRE) approach (RME) on students' problem solving and mathematical communication skills.

METHOD

This quasi-experiment research uses a quantitative approach, designed with the pretest-posttest nonequivalent control group design as shown in Table 1 below:

Table 1. Design of Research: Pretest-posttest non-equivalent Control Group

Group	Pretest	Treatment	Post-test
<i>Experiment (MRE)</i>	O_1	X	O_2
<i>Control (Conventional)</i>	O_1	-	O_2

The independent variable of this study is the approach to mathematics learning (MRE and CT) and the dependent

variable is the ability to and mathematical problems solving and communications.

The population of this study is all Madrasah Ibtidaiyah Negeri (MIN) in South Banjarmasin, MIN 1, MIN 3 and MIN 5. The sample study is randomly selected from the whole class, and selected 5-A classes at MIN 1 and Class 5-B MIN 3 respectively as an experimental class that using a mathematics realistic educations earning (MRE) approach and as a control, class that using a conventional teaching approach (CT).

Data collection techniques in this study were tests, and non-tests (questionnaires and observations). The test instrument is 5 questions describing problem-solving abilities, while the no test in the form of teacher observation sheets at the time of the learning process to measure mathematical communication ability and questionnaires is used to determine the response of students' interest in classroom learning. The data collecting procedure is the pre-test stage, the learning process stage and the test post-stage. Furthermore, the data obtained were analyzed using a *t*-test with independent samples to measure the average difference with the effect size of Cohen's calculated with SPSS Ver.23 program.

RESULT

Data analysis in this study starts from the analysis of pretest mathematics problem solving to see the homogeneity of selected research samples. *t*-test Independent Samples be used for two selected classes of samples were used. The homogeneity test results are presented in Table 2 as follows:

Table 2. Homogeneity Test for Pretest Mathematics Problem Solving ability

Group	n	Mean	Sign. (p)
Experiment	57	43,19	
Control	56	37,71	.130 > .05

Table 2 shows the sample data from the pretest mathematical problem-solving ability for both experimental and control classes with a significance level $\alpha = .05$ can be said that the mean difference is not significant, $p = .130 > .05$, so it can be concluded that the two classes (experiment and control) homogeneous for data mathematical problem-solving abilities.

Furthermore, *t*-test Independent Samples to test homogeneity of mathematical communication ability of the two classes of selected samples. The test results are presented in Table 3.

Table 3. Homogeneity Test for Pretest Mathematics Communication Ability

Group	n	Mean	Sign. (p)
Experiment	57	43,19	
Control	56	37,71	.682 > .05

Table 3 shows data pretest of mathematical communication for both experimental and control classes with a significance level of $\alpha = .05$ can be said the difference of mean is not significant, $p = .682 > .05$, so it can be concluded that the two classes (experiment and control) homogeneous for mathematical communication ability.

To analyze the effectiveness of the MRE approach for students' mathematical problem-solving abilities, it was started by conducting the normality test of the distribution of students' posttest data both problem-solving ability and mathematical communication for both experimental and control groups.

The Kolmogorov-Smirnov One-Sample Test has been used to determine the normality of the distribution of data on the ability for mathematical problems solving ability. The results of the normality test are presented in the following Table 4:

Table 4. Normality Tes Posttest Data for Problem Solving Ability

Group	n	Sign. (p)	Interpretation
Experiment	57	0,004	
Control	56	0,003	Normal ($p < .05$)

Table 4 shows that the distribution of data can be assumed normally distributed at a level of significance $\alpha = 0.05$, $p < .05$.

Furthermore, the Kolmogorov-Smirnov One-Sample Test was also used to determine the normality of the distribution of mathematical communication data. The results of the normality test are presented in the following Table 5:

Table 5. Normality Test Posttest Data Mathematical Communications

Group	n	Sign. (p)	Interpretation
Experiment	57	0,005	
Control	56	0,007	Normal ($p < .05$)

Table 5 shows that the distribution of data can be assumed normally distributed at a level of significance $\alpha = 0.05$, $p < .05$.

Furthermore is the null hypothesis test (H_0): There is no significant difference between the average problem-solving ability and students' mathematical communication in the experimental and control groups.

The t-test difference test with Independent Samples was conducted to test the mean differences of mathematical problem-solving abilities of the two sample Classes (Experiment and Control). The results of the t-test are presented in Table 6 as follows:

Table 6. Test the Mean Difference of Problem Solving Ability of Posttest Data

Groups	n	Mean	d	p
Experiment	57	85,64	.29.024	.000 < .05
Control	56	56,62		

Table 6 shows that from posttest data for both experimental and control classes with a significance level of $\alpha = 0.05$, it can be said that H_0 was significantly rejected ($p = .000 < .05$) so it can be concluded that there is a difference in average mathematical problem-solving abilities between experimental groups and control, namely $p = .000 > .05$.

The effectiveness of the realistic mathematics educations (MRE) approach for students' problem-solving abilities between the experimental and control groups was carried out by the Cohen effect size test as follows:

$$d = \frac{\bar{x}_t - \bar{x}_c}{S_{pooled}}$$

$$= \frac{85,64 - 56,62}{19,717}$$

$$= \frac{29,024}{19,717}$$

$$= 1,47$$

Based on Cohen's criteria, $d = 1.47$ is a high influence category. It means that the realistic mathematical learning approach (MRE) has high effectiveness on problem-solving abilities of Class V MIN students in South Banjarmasin.

Furthermore, the t-test mean difference test with Independent Samples was also carried out to test the mean differences of mathematical communications ability data of both samples Class (Experiment and Control). The homogeneity test results are presented in Table 7 as follows:

Table 7. Test the Mean Difference of mathematical communications ability of Posttest Data

Groups	n	Mean	d	p
Experiment	57	85,06		
Control	56	56,96	28.13	.000

Table 6 shows that from post-test data for both experimental and control classes with a significance level of $\alpha = 0.05$, it can be said that H_0 is significantly rejected ($p = .000 < .05$) so that it can be concluded that there are differences in the average mathematical communications ability between experimental and control groups, namely $p = .000 > .05$.

The effectiveness of the realistic mathematical learning approach (MRE) on students' problem solving abilities between the experimental and control groups was carried out by the Cohen effect size test as follows:

$$d = \frac{\bar{x}_t - \bar{x}_c}{S_{pooled}}$$

$$= \frac{85,06 - 56,96}{28,13}$$

$$= \frac{15,960}{28,13}$$

$$= 1,76$$

Based on Cohen's criteria, $d = 1.76$ belongs to the category of high influence. This means that the realistic mathematical learning approach (MRE) has high effectiveness on the mathematical communication ability students of Class V MIN in the South Banjarmasin.

DISCUSSION

Effendi's research explained that the old man in the process of learning mathematics in the classroom, which is generally students learning mathematics by being told by their rules, indicates that students are not active in learning through the process of learning like this, the possibility of students' ability to develop [2].

Based on the results of the questionnaire response students who use realistic mathematical approaches, there are significant differences. The percentage of positive responses of students in the experimental class was class V A MIN 1 Banjarmasin and students of class V A MIN 3 Banjarmasin amounting to 85.96%, much higher than the control class, which meant that the positive response of students in the experimental class was better than the control class. Thus, in line with Mulbar's study of learning using a realistic mathematical approach to make students more active, have energy and motivation to learn, so that there is a good impact on improving student achievement [7].

In his research, Wubbels et al explained that the use of realistic mathematics learning approaches by teachers succeeded in changing students' perceptions of mathematics, awareness built by teachers that students had different preferences for learning and students had various solutions to mathematical problems making realistic mathematics appropriate to use [8].

Effendi in his research also said that with realistic mathematics give a good contribution to students through achievement and attitudes shown by high student motivation [2].

In the class of problem-solving ability control students in understanding problems, planning solutions, implementing planning and checking back tend to be less and ordinary. This statement is evidenced by the percentage of classical average values in the control class $51.43\% \leq 65\%$ minimum classical completeness criteria this is due to the mathematics learning process only refers to student worksheets and books using lectures so as to make students' thinking and reasoning skills less honed.

This is consistent with the research of Setiawati, Syahputera and Rajagukguk [9] that the answer to the student's resolution process in solving students' problem-solving in conventional learning is still low. Other studies that agree, according to Witri, that conventional learning has not been able to significantly influence students' problem-solving abilities [4].

Problem-solving ability is a skill of thinking more than memorizing, reasoning, predicting and finding solutions to problems given. The process of problem-solving will be more meaningful if the problem that is given is problems that are often found in everyday life that can be described through reading problems (understanding), understanding

(comprehension), transformation or problem transfer (transformation), process skills (process skills) and encoding [10].

According to Yoe [11], it is clear that the problem solving ability is one between high-level abilities that require good reasoning in reading the information provided by understanding the terms, words and sentences in the problem, determining what is known and asked with right, planning a problem solving that is relevant to the problem given, can solve the problem in accordance with the steps of solving problems that have been planned appropriately and check and provide conclusions on the problem that has been solved.

CONCLUSION

The research results showed that problem-solving ability and mathematical communication skills using the realistic mathematics educations (MRE) approach for students grade V MIN in South Banjarmasin significantly differed in average problem-solving ability and mathematical communication abilities compared to the conventional approach and showed that the MRE approach was higher average.

Effectiveness of the mathematics realistic educations (MRE) approach to problem-solving and mathematical communication skills of class V MIN students in South Banjarmasin. This proves that the mathematics realistic educations (MRE) approach has a high influence on the problem solving and mathematical communication skills of V MIN class students South Banjarmasin Kalimantan.

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