

# Realistic mathematics education learning model to improve junior high students' problem-solving ability in social arithmetics

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**Abstract.** This study was focused on how to improve junior high students' problem-solving ability through the Realistic Mathematics Education (RME) learning model. Through problem-solving, students are required to make their own efforts to find solutions and built their own knowledge. One of the mathematical learning models that allow students to build their own knowledge is the RME learning model. RME learning model giving contextual problems that related to students' real life and they will be motivated to learn and gained by their experience. This study is quantitative research with the experimental method. The data of this study were collected using the test method. Before the instrument is used, the instrument of the test must fulfill as good item criteria to retrieve data on the study include the level of difficulty, discriminating power, and reliability. The data analysis technique used in this study was the t-test with a significance level of 5%. Before testing the hypothesis, the first step is to conduct a prerequisite test i.e. normality and homogeneity test. The results show that the students' problem-solving abilities in social arithmetics taught using the RME learning model are better than the students' problem-solving abilities who are taught using conventional learning models.

## 1. Introduction

One way to increase human potential from backwardness is through education [1]. Through education, people can increase their resources, especially in mathematics education [2]. In line with Fahrudin, Rakhmawati argued that mathematics is one of the sciences that has a crucial position withinside the schooling field [3].

Through mathematics learning, students are expected to improve their abilities e.g. reasoning, communication, connections, representation, and problem-solving. In this modern era, students not only require to master the mathematical concepts learned, but also be able to solve problems. Besides that, Alifia and Rakhmawati argued that one of the skills that closely related to characteristics of mathematics is the problem-solving ability [4]. Problem-solving ability is needed to deal with problems precisely, accurately, systematically, logically, and effectively from various points of view.

One of the abilities that students must have is the problem-solving ability [5]. The importance of problem-solving ability is due to problem-solving ability as a basic personal ability to solve problems that involve critical, logical, and systematic thinking. In general, it can be transferred to be used in solving other problems in daily life. Problem-solving is defined as a process carried out by students to find answers to questions (problems) encountered in solving a problem.



Through problem-solving, students are required to make their own efforts to find solutions and built their own knowledge. Through problem-solving exercises, students will learn to organize their abilities in developing appropriate strategies to solve problems. Problem solving also encourages students to solve problems systematically.

One of the mathematical competence aspects that gained from mathematics learning is the problem-solving ability [6]. Mathematics learning focuses on the learning process requiring students to think so they can build knowledge in the form of concepts and procedures that will develop into a skill under the guidance of the teacher [7]. Mathematical problem solving refers to the ideas and methods that a person produces when solving a problem and is very important for successful problem solving [8].

But in fact, Indonesian students' mathematics problem-solving ability is low. It can be seen from the results of the PISA survey in 2018 regarding students' ability in the field of mathematics stated that Indonesia ranked 75<sup>th</sup> with an average score of 379 out of 80 participating countries [9]. Besides that, Indonesian students' average score is lower than the average score of students in Singapore, Malaysia, and Thailand.

The low of students' problem-solving ability is caused by the selection of learning models used by teachers is less effective so it does not develop students' problem-solving abilities. Another factor causing the low of students' problem-solving ability is the teacher's lack of linking lessons with students' daily life, so students have difficulty applying mathematics to real-life situations. One of the mathematical learning models that allow students to build their own knowledge through problem-solving is the Realistic Mathematics Education (RME) learning model.

Through contextual problems, the RME learning model changes mathematics learning to be more fun and meaningful for students [10]. The RME learning model uses a starting point from students' reality and real experiences in daily life [11]. Through the RME learning model, the students are motivated to solve questions in the problem-solving process [12]. Besides that, Mustofa argued that the RME learning model could direct students to solve mathematical problems, so it is expected that students' mathematical abilities can be increased by increasing students' problem-solving abilities [13]. Thus, the RME learning model giving contextual problems that are related to students' real life, and they will be motivated to learn and gained by their experience.

RME begins by taking on problems relevant to students' experience and knowledge [14]. RME learning model contains things that support logical thinking to be able to conclude the problem [15]. Through the RME learning model, students will be more focused on thinking where they not only know the basic theories but also students will relate these problems to their daily life. Thus, this study was focused on how to improve junior high students' problem-solving ability through the RME learning model.

## 2. Methods

This study is quantitative research with experimental methods. This study included as quasi-experimental with the design uses is the two-group comparison design. In this study, experimentation was carried out by comparing the two groups as research subjects, viz. experiment and control group. An experiment group is a group where students are taught using the RME learning model and a control group is a group where students are taught using a conventional learning model.

The instrument of this study used a problem-solving ability test. The problem-solving ability test was consisting of 5 essay questions. Before the instrument is used, the instrument of the test must fulfill as good item criteria to retrieve data on the study include the level of difficulty, discriminating power, and reliability [16]. From the trial results, three items fulfill the good criteria. The reliability coefficient of the test using the Cronbach alpha was 0.708.

In this study, the data analysis technique used the t-test with a statistical significance of 5%. Before testing the hypothesis, the first step is to conduct a prerequisite test i.e. normality and homogeneity test. A normality test is performed to determine whether the population of the experiment and control tests is normally distributed using the Lilliefors method. The homogeneity variance test is used to determine

whether the variance of the population of the two groups are the same or not. The homogeneity test uses the Bartlett test with a significance level of 5%.

### 3. Results and discussion

In this study, the hypothesis test aims to test the impact of the RME learning model on junior high students' problem-solving ability in social arithmetics. Hypothesis testing is done to compare the problem-solving abilities of students who are taught using the RME learning model with students who are taught using conventional learning models. Before testing the hypothesis to compare the students' problem-solving ability, the prerequisite test, normality and homogeneity test, are carried out first.

A normality test is conducted to determine whether the population of the experiment and control group on the problem-solving ability test is normally distributed. The summary of the normality test results is presented in table 1.

**Table 1.** The summary of the normality test.

Group	$L_{obs}$	Critical Region	Result
Experiment	0.148	$\{L > 0.156\}$	Normal
Control	0.110	$\{L > 0.156\}$	Normal

Based on table 1 of line 2 and 3,  $L_{obs}$  of both the experiment and the control group is less than the critical region. It means both  $H_0$  of the experiment and the control group were not rejected. Furthermore, it can be concluded that the problem-solving ability of experiment and control group students were taken from the normally distributed population.

The data used in the calculation is sample data, then  $\sigma_1^2$  and  $\sigma_2^2$  are considered unknown, so the homogeneity variance test is needed to determine whether the variances of the populations of the two groups are the same or not. Homogeneity variance test performed using the Bartlett test. The variance homogeneity test' results of the problem-solving ability of experiment and control group that have been done obtained the results of  $\chi_{obs}^2 = 0.754$  with  $DK = \{\chi^2 > 3.841\}$  and  $H_0$  was not rejected. So, it can be concluded that the variance of students' problem-solving ability from the experiment and control group is homogeneous. The descriptive statistical calculations are presented in table 2.

**Table 2.** Descriptive statistics of problem-solving ability test.

	Experiment Group	Control Group
$n$	32	32
$\bar{X}$	8.875	7
$s$	9.274	12.709

Based on the prerequisite tests, samples were obtained from populations that were normally distributed and both populations were homogeneous. Then, hypothesis testing using a t-test is conducted by comparing the students' problem-solving ability to experiment and control group. Hypothesis testing aims to determine whether the students' problem-solving abilities taught using the RME learning model are better than the students' problem-solving abilities who are taught using conventional learning models. The table of hypothesis testing with the  $t$ -test is in table 3.

**Table 3.** Hypothesis Testing with t-test.

	Experiment Group	Control Group
Mean	8.875	7
Variance	9.274193548	12.70967742
$t$ Stat	2.262164476	
$t$ Critical one-tail	1.669804163	

Based on table 3, the results of calculations that have been done, the average of the experiment group's problem-solving ability test is 8.875. Meanwhile, the average of the control group's problem-solving ability test is 7. The hypothesis test used a significance level of 5% and the results obtained  $t_{obs} = 2.62$  with  $DK = \{t > 1.669\}$ . So, it can be concluded that the problem-solving abilities of students who are taught using the RME learning model are better than students' problem-solving abilities who are taught using conventional learning models.

This study result is in line with the research conducted by Susanti and Nurfitriyanti [17] states that students' problem-solving ability who obtain learning with the RME model is more improved than the students' problem-solving ability who use expository learning. Furthermore, there is also a significant influence on student motivation in learning who were treated with the application of learning with the RME model. Based on the results of this study and previous relevant studies, it is evident that the RME learning model can influence the students' problem-solving abilities. Students' problem-solving ability taught using the RME learning model is better than students' problem-solving ability who are taught using the conventional learning model.

RME learning model is not only expected to improve students' problem-solving abilities but also can improve motivation in learning mathematics and provide new solutions in the learning process that are different from conventional learning models. Thus, this RME learning model in the presentation of learning materials and learning atmosphere is better and more effective in learning mathematics and improves students' problem-solving abilities [18][19].

#### 4. Conclusion

The results show that the average score of students' problem-solving ability in social arithmetics of the experiment group is higher than the control group. It can be seen from the average score of students' problem-solving ability using the RME learning model in mathematics learning is better than students' problem-solving ability that being taught using the conventional learning model.

RME learning model is not only expected to improve students' problem-solving ability in social arithmetics but also can improve motivation in learning mathematics and provide new solutions in the learning process that are different from conventional learning models. Thus, this RME learning model in the presentation of learning materials and learning atmosphere is better and more effective in learning mathematics and improves students' problem-solving abilities.

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