



The Influence of Realistic Mathematics Education on the Mathematical Problem-Solving Ability and Learning Independence of Class V Students at Jarakan State Elementary Schools

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ABSTRACT

This research aims to describe the influence of the realistic mathematic education approach model on students' mathematical problem-solving abilities and define the impact of the realistic mathematic education approach on students' learning independence. The sample used in this research was the VA and VB classes of Jarakan State Elementary School, with 35 students in each class. This type of research is quasi-experimental research. The instruments used in this research were test questions on students' mathematical problem-solving abilities and learning independence questionnaires. The research test carried out by the researcher used a significance level of 5% so that if the significance value is less than 0.05, it can be concluded that the realistic mathematic education approach positively affects students' mathematical problem-solving abilities. The learning independence test can be seen by comparing the total score, mean value, and percentage of the level of student response contained in the descriptive statistical analysis. If the score, mean, and percentage of student response level percentage of the experimental class are higher than the control class, it can be concluded that the realistic mathematic education approach has a positive influence on student learning independence.

Keywords: problem-solving ability, independent learning, realistic mathematic education, Scientific

ABSTRAK

Penelitian ini bertujuan untuk mendeskripsikan pengaruh model pendekatan realistic mathematic education terhadap kemampuan pemecahan masalah matematis siswa dan mendefinisikan pengaruh pendekatan realistic mathematic education terhadap kemandirian belajar siswa. Sampel yang digunakan pada penelitian ini yaitu kelas VA dan VB SD Negeri Jarakan, dengan jumlah siswa disetiap kelas 35 siswa. Jenis penelitian ini merupakan penelitian eksperimen semu. Instrumen yang digunakan dalam penelitian ini yaitu soal tes kemampuan pemecahan masalah matematis siswa dan angket kemandiriann belajar. uji penelitian yang dilakukan peneliti menggunakan taraf signifikansi 5% (0.05), sehingga apabila nilai signifikansi kurang dari 0.05 maka dapat disimpulakn bahwa: pendekatan realistic mathematic education berpengaruh positif terhadap kemampuan pemecahan masalah matematis siswa. Uji kemandirian belajar dilihat dari perbandingan total skor, nilai mean, dan persentasi nilai tingkat rrespon siswa yang terdapat pada analisis deskriptif statistik. Jika nilai skor, mean, dan persentase tingkat respon siswa kelas eksperimen lebih tinggi dibandingkan dengan kelas kontrol maka dapat diambil kesimpulan bahwa: penekatan realistic mathematic education memiliki pengaruh positif terhadap kemandirian belajar siswa.

Kata Kunci: kemampuan pemecahan masalah, kemandirian belajar, realistic mathematic education, saintifik



INTRODUCTION

In mathematics learning, some goals must be achieved in its implementation. The objectives of learning mathematics according to the decision of the Head Agency of Standard, Curriculum and Educational assessment (Badan Standar, Kurikulum, dan Asesmen Pendidikan), Ministry Of Education, Culture, Research and Technology number 032/H/KR/2024 are 1) being able to understand any material related to concepts, principles, operations, relationships, and facts in mathematics; 2) able to use the concept of reasoning and patterns in a property, mathematical tricks, compiling evidence, explaining mathematical ideas; 3) have expertise in understanding problems, designing mathematical models, analyzing models, and providing solutions that have been obtained; 4) connecting an idea in symbols, diagrams, tables, and media; 5) solidifying mathematics lessons with a craft, a field of study, a science aspect, and a life path; 5) have an attitude of appreciating the usefulness of mathematics. Through the various objectives outlined above, it is hoped that the mathematics learning learned by students will not only be understood academically or theoretically but can also be applied in real, everyday life.

The process of learning mathematics at school certainly has various problems in its application. Problems that often occur in mathematics learning are 1) students' lack of ability to master the material; 2) students' lack of mathematical thinking ability; 3) students' little interest in learning mathematics; 4) students' limitations in understanding mathematical concepts; 5) students' lack of interest in learning mathematics; 6) the impression is embedded in students that mathematics is a complex subject; 7) students' lack of self-confidence to express opinions in mathematics learning (Maryanto et al., 2019). Based on the problems described above, it can be seen that the problems in mathematics learning in Indonesia are very complex. Therefore, there needs to be an appropriate strategy to minimize existing problems.

The National Council of Teachers Mathematics (NCTM) in 2000 stated that it had found several skills in mathematics learning that were the objectives of mathematics learning, one of which was mathematical problem solving (Purnomo et al., 2024; Suryaprani et al., 2016; Widodo et al., 2021). This can be interpreted as one of the abilities that must be possessed after studying mathematics, namely having the ability to solve problems mathematically. This problem-solving ability is an ability that students have to be able to solve problems carefully and by solving procedures (Kusuma et al., 2024; Özreçberoğlu & Çağanağa, 2018; Utami et al., 2024). Besides that, mathematics is a science used in society and the economy, so this is necessary and understood by students and is of concern to teachers (Maass et al., 2019; Scheiner et al., 2019).

Experts have studied a lot regarding the meaning of mathematical problem-solving abilities. Cahyadi et al. (2023) stated that problem-solving ability is an ability possessed by an individual or group to find a solution to a problem. Problem-solving ability is an effort to find a solution to a problem or difficulty being faced (Hendriana et al., 2018; Murtafiah et al., 2024; Syaodih et al., 2018). Problem-solving ability is a learning process or the process of applying knowledge and knowledge to solve a problem (Hasanah et al., 2023; Septian et al., 2022). Based on the understanding of experts, it can be concluded that problem-solving ability is a skill that a person has when solving a problem according to the problem-solving strategy. Problem-solving ability is one of the problems found in the

student learning process. Apart from problem-solving abilities, other issues are related to student learning independence. Besides that, Damayanti & Anando (2021) that student learning independence is one of the obstacles found in learning at school. Besides that, Indonesia is a vulnerable country lacking awareness of independent learning. Therefore, independent learning has become an educational problem in Indonesia.

Learning independence is when a person has skill in controlling and managing his/herself within the scope of learning or the learning process (Hariyadi et al., 2023). This learning independence is considered a psychosocial ability related to the freedom to behave, independence from other people, and freedom to regulate oneself (Nurhayati, 2016; Sobri, 2020). Learning independence is also defined as a person's growing and growing skills to learn, seek knowledge, and set goals, methods, and evaluations in the learning process. A person's awareness of wanting to seek knowledge or learn and being able to determine learning goals, strategies, and evaluation is the definition of learning independence (Juniyansyah et al., 2023). From several opinions, according to the experts above, it can be concluded that learning independence is a psychosocial ability that a person has to regulate themselves in the learning process, seek knowledge, and determine goals, learning design, and evaluation.

To overcome problems, as in the previous explanation, appropriate learning innovations are needed. One learning innovation that teachers can implement to minimize these problems is using a Realistic Mathematical Education approach in the learning process. The realistic mathematic education approach is a learning approach that uses concrete objects that exist in students' daily lives (Pangestu & Ruqoyyah, 2023). An approach that can include students' skills and knowledge in learning activities carried out in the classroom is the realistic mathematic education approach (Hidayat et al., 2020). According to Rajab (2023), the realistic mathematic education approach is a learning approach that focuses the majority of activities on students, and mathematics learning must contain human activities related to real, everyday life so that it is hoped that it can provide students with learning experiences. The conclusion is that the Realistic Mathematical Education approach is a learning approach that actively involves students in learning activities, and the learning process carried out is concrete, realistic, or accurate in everyday life so that it can provide experience to students. Other researchers have researched using the realistic mathematical education approach several times. Still, in my study, the realistic mathematic education approach is not only used to test mathematical problem-solving abilities or mathematical problems but also by student learning independence.

Using the realistic mathematical education approach in the learning process is considered quite effective in overcoming problems related to students' problem-solving abilities and learning independence. This is relevant to the opinion of one expert who stated that the mathematics learning process is recommended to be able to apply a concept of understanding about the design of thought and teachings in mathematics that need to be linked to everyday life so that later students can solve various mathematical problems in the fields of science and technology. Everyday problems (Hidayat et al., 2020). Therefore, researchers are interested in researching the influence of the realistic mathematic education approach on the mathematical problem-solving abilities and learning

independence of fifth-grade students at Jarakan State Elementary School. The researchers' research aimed to determine the effect of the realistic mathematic education approach on students' mathematical problem-solving abilities and learning independence at Jarakan State Elementary School.

METHOD

This research is a quantitative research type of quasi-experimental research. Data collection techniques in this research are tests and questionnaires. The test consists of pre-test and post-test questions to test students' problem-solving abilities, while questionnaires test students' learning independence. The researcher used two sample groups with many similarities and the same number in each class. Therefore, the data analysis technique used to test the effect of realistic mathematic education on problem-solving abilities is hypothesis testing with a paired sample t-test, while to test learning independence, the researcher used a descriptive analysis test with a Likert scale. In hypothesis testing with a paired sample t-test, prerequisite tests are carried out as a balance, normality, and homogeneity test before testing the hypothesis.

The stages carried out in this research are: 1) making observations; 2) making proposals, instruments, instrument validation sheets, and instrument trials; 3) coordinating with schools and teachers; 4) carrying out a pre-test; 5) giving experimental class treatment using the RME approach and control class using a scientific approach; 6) provide post-test questions and learning independence questionnaires in each research class group; 7) process and analyze data; 8) preparation of reports on the results of research that has been carried out.

The population used in this research was class V students at SD Negeri Negeri Kuncikan. The collection technique is a saturated sample. This saturated sample is a sampling technique that uses the entire population as a sample (Nugraha, 2022). Therefore, the sample used in this research was students in classes VA and VB, consisting of 35 students in each class. The researcher chose this class sample because there was equality in basic mathematics abilities in classes VA and VB.

This research uses mathematical problem-solving ability test instruments and learning independence questionnaires. The validity and reliability tests of the questions come from the results of expert validity tests and unused instrument tests. This unused instrument test means that the instrument was tested first on other students. Researchers conducted instrument trials first on class VB students at Jurugentong State Elementary School, one of the elementary schools in the research area. After testing the instrument and obtaining results, the researcher tested the validity and reliability of the questions and found that the questions tested were valid and reliable. The question will be said to be valid and reliable if the significance value is less than 0.05. Questions and questionnaires whose significance value is less than 0.05 are said to be valid and trustworthy and will be given to experimental and control students.

The learning independence questionnaire used in this research comes from modifying the development of the learning independence questionnaire by Hidayati & Listyani (2010) and has been validated by experts. Apart from that, the questions and questionnaires given to the experimental

and control classes were the same type of questions and were not differentiated. This is to determine whether there are differences in abilities between the experimental and control classes.

In this study, the one-way ANOVA test was used to test for equality. Test the normality of the research using the Kolmogorov-Smirnov normality test and homogeneity test. The hypothesis of this research, namely, whether there is a positive influence of the realistic mathematic education approach on the mathematical problem-solving abilities of fifth-grade students at Jarakan State Elementary School, Bantul, and whether there is a positive influence of the realistic mathematic education approach on the learning independence of fifth-grade students at Jarakan State Elementary School.

RESULTS AND DISCUSSION

Student Problem-Solving Ability

The initial data for the experimental and control classes describes students' mathematical problem-solving abilities before being treated using the realistic mathematic education approach. Meanwhile, the final data describes students' mathematical problem-solving skills after being treated using the realistic mathematic education approach. The following is initial data on students' mathematical problem-solving abilities presented in Table 1.

Table 1. Pre and Post-Test on Students' Mathematical Problem-Solving Abilities

Description	Pre-test		Post-test	
	Experimental	Control	Experimental	Control
Mean	53.04	52.08	84.36	81.18
Std. Deviation	12.58	3.57	4.90	6.19
Minimum	33.75	43.75	76.25	70.00
Maksimum	76.25	58.75	92.50	91.25
N	35	35	35	35

Prerequisite analysis tests include the results of equality tests, normality tests, and data homogeneity tests. The equality test is used to determine the diversity of groups in the experimental class and control class. This research uses an equality test (one-way ANOVA). The equality test (Way ANOVA) is used to test the average of an experiment using 1 factor, and from that 1 factor contains three groups. The equality test (one-way ANOVA) uses a significance value level of more than 0.05, meaning that if the significance value obtained is more than 0.05, then the experimental and control classes have homogeneous diversity. The equality test (one-way ANOVA) in the experimental and control classes can be seen in Table 2.

Table 2. Equality Test (one-way ANOVA)

Groups	Sum of Squares	df	Mean	F	Sig.
Between Groups	16.272	1	16.272	.190	.664
Within Groups	5819.464	68	85..580		
Total	5835.737	69			

The normality test is used to see whether data comes from a population with a normal distribution. This normality test is carried out before and after treatment. In this study, the normality test used was the Kolmogorov Smirnov-test formula with a significance value of 0.05. significance is

0.05, meaning that the data is normally distributed if the normality test results are more than 0.05. If the resulting data is less than 0.05, then the data can be said to be not normally distributed. In this study, the normality test was assisted using SPSS 24. The results of the normality test can be seen in Table 3.

Table 3. Normality Test with Kolmogorov Smirnov-test

Groups	Statistic	df	Sig.	Result
Pre-test Experiment	.088	35	.200	Normal
Post-Test Experiment	.124	35	.195	Normal
Pre-Test Control	.138	35	.089	Normal
Post-Test Control	.108	35	.200	Normal

The homogeneity test aims to test whether the sample variations used in a study are homogeneous. The data used in the homogeneity test are pre-test and post-test data. The level of significance used in the homogeneity test in this research is 5% or significance more than 0.05. This means that the sample is said to be homogeneous if the resulting significance value is more than 0.05. The output results from the resulting homogeneity test can be seen in Table 4.

Table 4. Homogeneity Test Results

	Levene Statistic	df1	df2	Sig.
Based on Mean	1.361	1	68	.247
Based on Median	1.511	1	68	.223
Based on the Median and with adjusted df	1.511	1	63.673	.224
Based on trimmed mean	1.323	1	68	.254

Hypothesis testing in this study uses a paired sample t-test using SPSS 24. This hypothesis test can be carried out if the normality and homogeneity tests have been fulfilled with normal and homogeneous results. The qualification of the decision results from the hypothesis test is that if the significance value is less than 0.05, H_a is accepted, while H_0 is rejected. H_a reads that the realistic mathematic education approach positively influences the mathematical problem-solving abilities of fifth-grade students at Jarakan State Elementary School. Apart from that, H_0 states that the realistic mathematic education approach does not affect the mathematical problem-solving skills of fifth-grade students at Jarakan State Elementary School. Table 5 summarizes the results of hypothesis testing using the paired t-test.

Table 5. Hypothesis Test Results paired sample t-test

Group of Pre and post-test	Mean	Std. deviation	Std. error mean	Lower	upper	t	df	Sig.
Experiment	-31.321	12.866	2.175	-35.741	-26.902	-14.403	34	0.000
control	-29.107	7.2860	1.232	-31.610	-26.604	-23.634	34	0.000

Based on the hypothesis test results, which were carried out using the paired sample t-test, a significance value of 0.000 was obtained. These results found that the significance result was 0.000 less than 0.05, so H_a was accepted, and H_0 was rejected. Therefore, it can be concluded that the realistic mathematic education approach positively influences the mathematical problem-solving abilities of fifth-grade students at Jarakan State Elementary School.

Based on the first formulation and the results of the initial hypothesis obtained, the realistic mathematic education approach positively influences the mathematical problem-solving abilities of fifth-grade students at Jarakan State Elementary School. Because of the Realistic Mathematical Education approach, students are given a treatment often found in their daily lives. These activities did not occur in the control class, which used a scientific approach in the learning process. In this scientific approach, students are more concerned with critical thinking to observe, ask questions, analyze, and communicate what they have understood from what they hear, see, and read.

These results are also relevant to research conducted by Mutia et al. (2023) that the realistic mathematic education approach influences problem-solving abilities, supported by the hypothesis test results, which show a significance value of 0.000 less than 0.05. Therefore, the Realistic Mathematical Education approach significantly influences students' problem-solving abilities. In the opinion of Yetri et al. (2019), the realistic mathematic education approach can make it easier for students to understand learning using this approach. Besides that, the material the teacher presents is contextual and based on the student's previous experiences (Reinke & Castro, 2022).

Based on research conducted by Chisara et al. (2019), realistic learning can give students the freedom to discover and construct mathematical concepts based on reality in everyday life so that each student can build their experiences. This will later become a learning experience so students do not easily forget the material. Apart from that, realistic-based learning appropriate to students' daily lives will create a pleasant learning atmosphere because the assumption that mathematics is complex learning will be minimized.

According to the concept issued by Freudenthal, mathematics is a human activity and must be connected to reality (Van den Heuvel-Panhuizen & Drijvers, 2020). This concept means that a mathematics learning process must be related to actualization in everyday life and be significant to the world of children (Dorrier & Maass, 2020; Radford, 2014). Such a learning process needs to be supported by a learning concept created by the teacher, where the learning concept created needs to provide freedom for students to build their understanding. Therefore, the Realistic mathematics education approach is very much in line with the concept expressed by Hans Freudenthal, where in this approach, students can learn about understanding mathematics, the process of teaching mathematics to students, and how students can learn mathematics.

The learning process using the realistic mathematic education approach means that learning activities will be linked to everyday life, which can help students understand the benefits of studying mathematics in life. Moreover, in the learning process using the Realistic Mathematical Education approach, students are given contextual problems where they are allowed to define, interpret, and solve a problem using their knowledge and experience. In the learning process using the realistic mathematical education approach, students are trained to discuss, organize, and express opinions with their peers to get the most appropriate solution later. Therefore, learning activities that apply the Realistic Mathematic Education approach positively affect students' mathematical problem-solving abilities.

In this study, researchers used pudding as a learning medium. Before carrying out the lesson, the researcher reminded the students about fractions. The students were divided into several

groups, and worksheets and learning media were distributed to each group. After the worksheet and media have been distributed, students can discuss and follow the steps on the worksheet, solve problems, and work on the practice questions provided on the worksheet. After students complete the worksheet and discuss it, they are asked to present the results of the discussion in front of the class. The learning activity ends with questions, answers, and conclusions.

Student Learning Independence

This data on student learning independence provides a picture of student learning independence for students taught using the Realistic Mathematical Education approach and classes taught using a scientific approach. Table 6 is the result of data analysis of student learning independence.

Table 6. Results of Data Analysis of Learning Independence

Aspect	Experimental class				Control Class			
	Score	Mean	SRL	Category	Score	Mean	SRL	Category
Dependence on others	94.5	2.7	90.00	Very good	94.5	2.7	90.00	Very good
Have Self-confidence	89	2.5	84.80	good	85	2.4	81.30	good
Discipline	98	2.8	93.30	Very good	94	2.6	89.80	good
Have a sense of responsibility	98	2.8	93.30	Very good	95	2.7	90.50	Very good
Initiative	76.3	2.2	72.70	Pretty good	78	2.2	74.30	Pretty good
Trained self-control	94.7	2.7	90.10	Very good	91	2.6	86.70	good
Total average	91.75	2.62	87.37	good	89.6	2.53	85.40	good

Table 6 shows the descriptive statistical analysis results of the student learning independence questionnaire in the experimental and control classes. The table contains each aspect's total score, mean, and percentage of student response level (SRL). The total score comes from all respondents' scores in each element. Next, the mean value is obtained from the total score of respondents divided by the total number of respondents. The percentage of student response level is obtained from the mean value divided by the total score multiplied by one hundred.

Based on this table, the total average for the control class and experimental class is obtained. In the experimental class, the total average student score was 91.75, the total average score was 2.62, and the total average percentage was 87.37%, which was in the good category. In the control class, the total average score for student learning independence was 89.6, the total average score was 2.53, and the total average percentage of student response level was 85.4% in the good category. If you look at these results, the percentage of student response level in the experimental class is higher than the control class, with a difference of 1.97%, even though both are in the good category.

A very slight difference in value was obtained based on the percentage of student response level. Therefore, to find out the difference in influence, researchers carried out a different test (t-test). A difference test (t-test) is carried out to compare the mean values along with certain confidence intervals from two populations. The level of significance used in this different test (t-test) is that if the significance value obtained is less than 0.05, then there is a significant difference in learning

independence between the control and experimental classes. Still, if the significance value is more than 0.05, there is no significant difference in learning independence in the experimental and control classes. Table 7 shows the results of various tests that have been carried out.

Table 7. Data from Different Test Results (t-Test) of Student Learning Independence

Groups	Mean	Std. deviation	Std. error mean	Lower	upper	t	df	Sig.
Control	48.857	4.564	.77149	-2.9173	.91728	-1.041	68	0.302
Experimental	49.857	3.388	.57269	-2.920	.92019	-1.041	62.743	0.302

Based on the results of the different tests (t-test), which were carried out using the independent sample t-test, a significance value of 0.302 was obtained. With these results, it was found that the significance result was 0.302, more than 0.05. Therefore, it can be concluded that there is no significant difference in the learning independence of the experimental class and the control class. These results show that realistic mathematical education and scientific approaches have the same effect on increasing student learning independence.

In the opinion of Warsito and Saleh (2021), mathematical abilities that come from learning using the realistic mathematic education approach affect learning independence, such as self-control, formulating strategies for solving problems, and planning goals. Relevant to the opinion of Leon et al. (2015), Warsito & Saleh (2021), and Yıldızlı & Saban (2016) that someone who has learning independence has characteristics such as being able to plan a goal, having an appropriate strategy, being able to schedule time, being able to choose priorities for the information that has been obtained, paying attention to feedback from what has been implemented, able to evaluate and make adjustments to improve the results obtained.

The learning process found in the realistic mathematic education approach teaches students to develop strategies in the form of mathematics that suit the problem and are based on their knowledge. This learning process will free students to experiment individually and in groups. Through this freedom to experiment, students will understand the usefulness of learning mathematics in everyday life and experiment to study the material they have obtained. The explanation regarding this matter is in line with the opinion of Rajab et al. (2023) that the realistic mathematic education approach can provide students with an understanding regarding the relevance of the mathematics they have learned, its usefulness in life, and how students are trained to be able to complete all studies independently. by constructing and developing. Therefore, the Realistic Mathematical Education approach and the Scientific approach positively affect student learning independence.

CONCLUSION

Based on the results of the research that has been carried out as well as the results of data analysis tests, it can be concluded that the realistic mathematic education approach has a positive effect on the mathematical problem-solving abilities of fifth-grade students at the Jarakan State Elementary School. Besides that, it is also concluded the realistic mathematic education approach and the Scientific approach have the same influence on the learning independence of fifth-grade

students at Jarakan State Elementary School. It can also be interpreted that problem-solving abilities have a more significant influence if taught using the realistic mathematic education approach than a scientific one. In contrast, independent learning has the same influence as realistic mathematical education and the scientific approach.

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