The Effect of Realistic Mathematics Approach on Mathematical Problem Solving Ability of Elementary School Students

Pengaruh Pendekatan Matematika Realistik terhadap Kemampuan Pemecahan Masalah Matematis Siswa Sekolah Dasar

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Abstract

This study aims to determine the effect of a realistic mathematical approach on the mathematical problem-solving ability of elementary school students. This study uses quantitative research with a non-equivalent control group design. The population in this study were all fifth-grade elementary school students from various schools in Tanete Rilau District, Barru Regency and the sample was drawn using simple random sampling. Instruments Data collection was carried out through a mathematical problem-solving ability test instrument. The data analysis technique used is descriptive and inferential analysis. The results based on descriptive analysis showed that the results of the problem-solving ability test of students who were given treatment with a realistic mathematical approach in the experimental class had a more significant effect than the control class with the average posttest results in the experimental class = 61.85 while in the control class = 46.40. The study's results based on inferential analysis using the independent sample t-test hypothesis test and the Manova test showed that learning with a realistic mathematics approach significantly affected the results obtained by the sig value. 0.000<0.05.

Keywords: realistic mathematics; mathematical problem solving; math learning

Abstrak

Penelitian ini bertujuan untuk mengetahui pengaruh pendekatan Pembelajaran Matematika Realistik terhadap kemampuan pemecahan masalah matematis siswa sekolah dasar. Penelitian ini menggunakan penelitian kuantitatif dengan desain Noneequivalent Control Group Design. Populasi pada penelitian ini adalah semua siswa kelas V sekolah dasar dari berbagai sekolah yang ada di Kecamatan Tanete Rilau Kabupaten Barru dan penarikan sampel menggunakan simple random sampling. Instrumen Pengumpulan data dilakukan melalui instrumen tes kemampuan pemecahan masalah matematis. Teknik analisis data yang digunakan adalah analisis deskriptif dan inferensial. Hasil penelitian berdasarkan analisis deskriptif menunjukkan bahwa hasil tes kemampuan pemecahan masalah siswa yang diberikan perlakuan dengan

pendekatan pembelajaran matematika realistik pada kelas eksperimen berpengaruh lebih signifikan dibanding kelas kontrol dengan rata-rata hasil posttest pada kelas eksperimen = 61,85 sedangkan pada kelas kontrol = 46,40. Hasil penelitian berdasarkan analisis inferensial dengan menggunakan uji hipotesis independent sample t-test dan uji manova menunjukkan bahwa pembelajaran dengan pendekatan PMR berpengaruh lebih signifikan dengan hasil yang diperoleh nilai sig. 0,000<0,05.

Kata Kunci: *pendekatan matematika realistik; pemecahan masalah matematis; pembelajaran matematika*

Introduction

Students' difficulties are usually in understanding or analyzing story problems. The story problem in question is a form of issue that contains a mathematical problem that must be solved. Based on observations in the field, students' mathematical problem-solving abilities are still low. From the daily test results, 100% of students only immediately wrote answers without writing down the proper steps or strategies for finding solutions to story questions.

As interpreted by (Amam, 2017), problem-solving is a process of an activity that prioritizes the importance of procedures, steps, strategies, or ways that students will solve problems to find answers. The cause of students' difficulties in solving story problems is generally due to students' difficulties in understanding mathematical story problems. Hence, students struggle to formulate what is known and asked and cannot determine the appropriate completion steps for story problems. This is following the results of research by (Jodi, Fera Yuliana Subekti, 2020), which states that students' difficulties in solving problems are, among others, due to: (1) difficulties in the language aspect, namely, students are less precise in reading the questions, resulting in misinterpretation and difficulty understanding mathematical language. ; (2) the problem of prerequisite aspects, namely, students cannot identify what is known and what is sought.

Problem-solving ability in Indonesia is still weak (Novita et al., 2012; Sari et al., 2017; Wulandari et al., 2020). The mathematical knowledge of Indonesian students has been tested in various international competitions, one of which is the TIMSS (Trend International Mathematics and Science Study). TIMSS is a global study of trends, directions, and mathematics and science developments. This study was conducted by the International Association for the Evaluation of Educational Achievement (IEA). TIMSS 2015 Indonesia is ranked 44th out of 49 countries. Agree with this (Wulandari et al., 2020) stated that the average score in the national final exam is consistently below 5, in line with international competencies such as IMO (International Mathematics Olympiad). Indonesian students offer low performance. Thus, the problem-solving ability is not optimal. Mathematics learning in schools focuses more on achieving the target material. As a result, students do not understand the material. Students do not build their knowledge of mathematical concepts but tend to memorize formulas and

concepts in mathematics without knowing the real meaning. This follows what was stated by (Jontarnababan, 2020), that the dominant learning is to memorize the formulas used for practice solving problems so that they do not understand the meaning and application in everyday life. Because education tends to be in rote learning, students have difficulty understanding mathematics in class.

To develop students' mathematical problem-solving abilities, the researchers chose the Realistic Mathematics Learning Approach, which will be applied in fifth-grade class to the material for solving story problems related to fractions. The realistic mathematics learning approach was chosen because it will guide students to find their concepts according to the actual situation (Gravemeijer & Doorman, 1999; Widjaja & Heck, 2003). The context presented is related to other ideas, so students are expected to understand the concept, including its application. This is in line with research (Liani, 2021), which states that in developing students' ability to understand mathematical concepts, one of the learning processes that can be applied in meaningful learning where students who directly play an active role in the learning process, students can find their learning concepts. So education is needed that can link learning materials with real and fundamental problems in everyday life. So practical mathematics learning is an option for solving real issues in the learning process. Therefore, researchers are increasingly convinced that the realistic mathematics learning approach can be oriented to problem-solving activities because the learning process clearly shows the problem-solving stage at the Realistic Mathematics Learning Approach stage.

This study aims to determine the effect of applying a realistic mathematics learning approach to the problem-solving abilities of fifth-grade elementary school students in Tanete Rilau District, Barru Regency. The benefits of this research are (1) The results of this study can be used as a reference in further research; (2) The results of this study can be used as reference material to improve the quality of learning in elementary schools and other educational institutions in general; (3) The results of this study can be used as a new learning experience, learning more meaningfully, and obtaining behavioural changes, excellent mathematical problem-solving abilities, which ultimately affect student learning outcomes.

This realistic mathematics learning approach must be student-oriented. In a Realistic Mathematics Approach, the teacher is a facilitator, and students can freely express and exchange ideas. The teacher helps students compare ideas and guides them to make correct and understandable decisions. The theory emphasizes process skills (Of Doing Mathematics), discussion and collaboration, and arguing with classmates so they can find out for themselves (Student Inventing). In the end, students use mathematics to solve problems individually and in groups (Handayani, 2019).

The main characteristic of this approach is learning in students, and mathematics is a human activity that must be done in real life. Therefore, the main principle of the realistic mathematics learning approach is that students must actively participate in the learning process. In this kind of learning, students have the opportunity to develop knowledge. Understand and express their ideas. Abstract concepts require teachers to transform students into real and imaginable things because they are related to the surrounding environment or students' daily lives. Several research findings are relevant to the principles of realistic mathematics learning (Liani, 2021). The realistic mathematics learning approach provides opportunities for students to find mathematical concepts in solving mathematics-related problems. Education can lead students to understand mathematical concepts by constructing themselves through prior knowledge about everyday life and finding the ideas to make learning more meaningful.

Based on theoretical studies and previous research on Realistic Mathematics Approach, it can be concluded that this study hypothesizes that applying a realistic mathematics education approach to students' problem-solving abilities is an effect of using a realistic mathematics education approach.

Method

This type of research is quasi-experimental, so in its implementation, the experimental and control group students are used. The subjects of this study were the fifth-grade students of 64 Barru elementary schools, amounting to 26 students as the experimental class and the fifth-grade students of 44 Barru elementary schools totalling 25 students as the research control class. The variables of this study consisted of the independent variable, namely the Realistic Mathematics Approach, and the dependent variable, namely the problem-solving ability. In this study, there are two types of data

used, namely (1) quantitative data, namely the type of data taken from the results of students' mathematical problem-solving ability tests that can be measured or calculated directly in the form of numbers; (2) Qualitative data, namely descriptive data types in the form of explanations of the observation of the teaching and learning process using a Realistic Mathematics Approach. The data sources in this study also consist of 2: (1) Primary data, data obtained through research in the field. For example, the data from the pretest and posttest results of students' mathematical problem-solving abilities, data from observations and research documentation of test instruments in the form of story questions related to multiplication and division of fractions. (2) Secondary data is obtained from reading results from books, journals, theses, and other reading sources related to the problems faced. For example, literature review data, references to relevant research results, etc. Data collection techniques through test techniques, observation, and documentation. The data analysis technique used is descriptive and inferential data analysis. Descriptive data analysis in the form of data on the average score of the problem-solving ability test results for the experimental class and the control class with the categorization of the problem-solving results as follows:

Table 1 *Interval Category Problem Solving Ability Score* (Fanny Fatmawati, 2018)

Interval	Category
65 – 100	High
55 – 64	Medium
0 – 54	Low

Meanwhile, inferential data analysis consists of normality and homogeneity tests as prerequisites for hypothesis testing.

Results

The following is the percentage of the criteria for achieving the initial results of the problem-solving ability of the experimental class and the control class obtained through the SPSS version 15.0 application:

Table 2 *Percentage of Problem-Solving Ability Pretest Results*

Value Range	Frequency	Percentage (%)	Category
Experiment Class			
65-100	0	0	High
55 - 64	0	0	Medium
0 - 54	26	100	Low
Total	**26**	**100**	
Control Class			
65-100	0	0	High
55 – 64	0	0	Medium
0 – 54	25	100	Low
Total	**25**	**100**	

Table 2 shows the percentage of the results of the pretest problem-solving ability of students in the experimental and control classes. All students are in a low category. These results indicate that students' problem-solving ability in experimental and control classes is still relatively low, so treatment or guidance is needed.

Table 3: Percentage of Posttest Results of Problem-Solving Ability Experiment Class and Control Class

Value Range	Frequency	Percentage (%)	Category
Experiment Class			
65-100	10	38,5	High
55 – 64	8	30,8	Medium
0 – 54	8	30,8	Low
Total	**26**	**100,1**	
Control Class			
65-100	2	8	High
55 – 64	5	20	Medium
0 – 54	18	72	Low
Total	**25**	**100**	

Table 3 shows the percentage of the post-test results of the experimental class students' problem-solving abilities. There are eight students, or 30.8%, in the low category, eight students or 30.8%, in the medium category and ten students or 38.5%, in the middle category. High category. As for the control class, there were 18 students or 72%, in the low sort, five students or 20%, in the medium category and two students or 8%, in the high category. This indicates that the percentage of high and medium categories of students' problem-solving ability results in the experimental class is higher than in the control class.

For more details, it can be seen in the comparison graph between the results of the following problem-solving ability post-test:
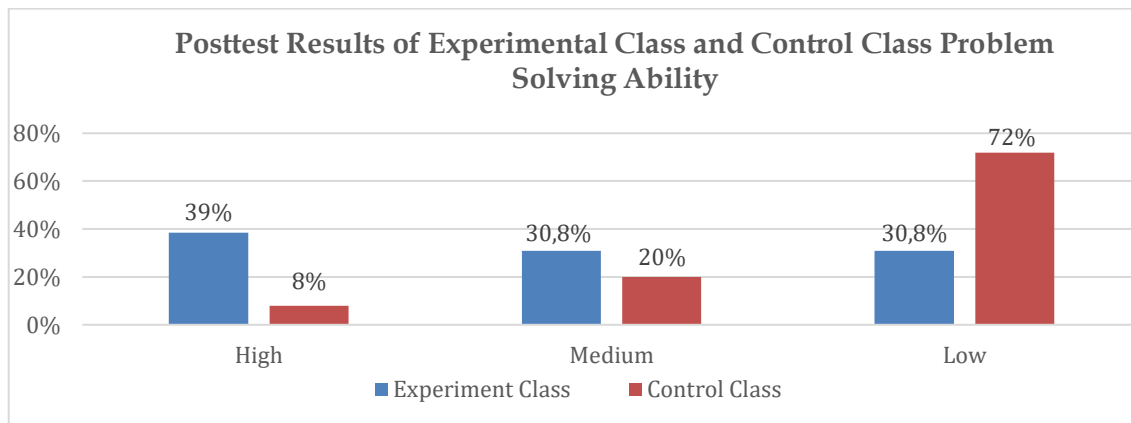

Figure 1 *Graph of Problem-Solving Ability Posttest Results*

The following is a recapitulation of research results obtained through the SPSS version 15.0 application.

Table 4 *Recapitulation of Pretest and Posttest Results of Students' Problem-Solving Ability*

	Experiment Class		Control Class	
	Pretest	*Posttest*	*Pretest*	*Posttest*
Mean	28	61,85	26,40	46,40
Median	30	59	24	46
Mode	30	58	20	30
Standard Deviation	12,52	12,87	10,65	14,42
Variance	156,80	165,74	113,33	208
Minimum	10	42	10	24
Maximum	54	84	54	78
Sum	728	1608	660	1160

As for the inferential statistical analysis of this study, which consists of a normality test and homogeneity test as prerequisites for the independent sample T-test test, carried out with the SPSS version 15.0 application with sig. Results for the pretest and posttest problem-solving abilities of the experimental class and control class are normally distributed because the value obtained is greater than the significant level =0.05 (sig. > 0.05). For testing the hypothesis, namely the independent sample T-test, the value of sig. (2-tailed) is 0.000. This significance value is smaller than 0.05, so it can be concluded that a realistic mathematics approach affects problem-solving ability.

Discussion

The stages carried out in the realistic mathematics approach follow previous research (Pangestu & Santi, 2016). The steps in this study's core activities of the realistic mathematics approach process begin with the presentation of contextual problems and provide opportunities for students to understand contextual issues. Individually or in groups. The teacher offers instructions/directions about the steps for solving the problem. Then students are asked to solve contextual issues presented in their way/strategy according to the problem-solving steps described previously in groups. This is done to compare and discuss the answers to the story questions. In group discussions, students discuss problems with each other and try to solve story problems using the knowledge that has been obtained. After that, students were asked to present on the blackboard.

The learning steps in the realistic mathematics approach significantly affect students' mathematical problem-solving abilities. This can be seen in the steps of mathematical problem-solving skills stated in (Rahmayani, 2019), namely: 1) understanding the problem, 2) developing a plan/completion strategy, 3) implementing a problem-solving plan and 4) re-examining the process and results later. Write the conclusion of the answer according to what was asked.

Characteristics in education, especially in realistic mathematics learning, is learning that requires students to play an active role or as the main character in a lesson and the teacher acts as a facilitator and mentor for students (Phuong Uyen et al., 2021; Rusdi et al., 2020; Wiratman et al., 2019). This is in line with the research conducted by (Fitriani & Maulana, 2016), with the results of the study stating that there are differences in the effect of the realistic and conventional approaches on students' mathematical understanding and problem-solving abilities. The average value obtained by the experimental class is greater than the control class, namely 70.03 and 60.06. His research results show that the experimental class's average score = 10.15 is higher than the control class = 8.85. This indicates a positive attitude of students towards problem-solving abilities and a realistic mathematical approach. The similarity of previous research with the author's research lies in the main principle of the realistic mathematics approach. Namely, students must actively participate in the learning process. In this kind of learning, students are allowed to build knowledge, understand

and express their ideas. Abstract mathematical concepts require teachers to transform students into real and imaginable things because they are related to the surrounding environment or students' daily lives. Therefore, teachers must be good at designing contextual learning materials following the steps of a realistic mathematical approach.

Based on the results of the research and discussion above, it can be said that the realistic mathematics approach significantly influences mathematical problem-solving abilities. So that the hypothesis, which states that a realistic mathematical approach affects the problem-solving skills of fifth-grade elementary school students in the Tanete Rilau sub-district, Barru Regency, has been proven true.

Conclusion

The realistic Mathematics Approach is an approach that places students' reality and experience as the starting point of learning, where students are allowed to construct their formal mathematical knowledge through existing realities problems. The realistic mathematical approach was chosen because it will guide students to find their concepts according to the actual situation. The context presented is related to other ideas, so students are expected to understand the concept, including its application.

From the study results, it has been proven that there is indeed an effect of a realistic mathematical approach on students' mathematical problem-solving and communication skills, especially in class fifth-grade elementary schools in Tanete Rilau District, Barru Regency based on hypothesis testing (Independent Sample T-Test) Realistic mathematics approach on the solving ability of fifth-grade elementary school students in Tanete Rilau District, Barru Regency.

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