

THE INFLUENCE OF ROLE-PLAYING METHOD ON THE SOLUTION OF MATHEMATICAL STORY PROBLEMS IN ELEMENTARY SCHOOLS

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Abstract

Mathematics plays a crucial role in shaping students' thinking patterns to face daily life challenges. However, many students struggle with solving mathematical story problems, making the low ability of students in solving mathematical story problems a serious concern. This study aims to examine the effect of the role-playing method on students' ability to solve mathematical story problems in the topic of numbers in fifth-grade students at SDN Palumbonsari 1. This research uses a quantitative descriptive experimental approach with a Pretest Post-test Nonquivalent Control Group design. The sample of this study is fifth-grade students at SDN Palumbonsari 1 selected randomly, with class VC as the experimental group (role-playing method) and class VB as the control group (conventional method). The instrument used is an essay test that has been validated and tested on students outside the research sample. Data analysis was performed using normality and homogeneity tests, as well as hypothesis testing with Paired Samples Test. The results of data analysis show that there is a significant difference between the average learning outcomes of students before and after the treatment. Students who received learning with the role-playing method showed a more significant improvement in their ability to solve mathematical story problems compared to students who received conventional learning. In conclusion, the use of the role-playing method in mathematics learning can improve students' ability to solve mathematical story problems. This method makes learning more meaningful, enjoyable, and can increase student engagement in learning.

Keywords: teaching method; role-playing; mathematical word problems

Abstrak

Matematika memiliki peran penting dalam pembentukan pola pikir peserta didik untuk menghadapi tantangan kehidupan sehari-hari. Namun, banyak siswa yang mengalami kesulitan dalam menyelesaikan soal cerita matematika, sehingga rendahnya kemampuan siswa dalam menyelesaikan soal cerita matematika menjadi perhatian serius. Penelitian ini bertujuan untuk menguji pengaruh metode role playing terhadap kemampuan siswa dalam menyelesaikan soal cerita matematika materi bilangan di kelas V SDN Palumbonsari 1. Penelitian ini menggunakan pendekatan kuantitatif deskriptif jenis eksperimen dengan desain Pretest Post-test Nonquivalent Control Group. Sampel penelitian ini adalah siswa kelas V SDN Palumbonsari 1 yang dipilih secara acak, dengan kelas VC sebagai kelas eksperimen (metode role playing) dan kelas VB sebagai kelas kontrol (metode konvensional). Instrumen yang digunakan adalah tes berbentuk soal essay yang telah divalidasi dan diuji coba pada peserta didik diluar sampel penelitian. Analisis data dilakukan dengan uji normalitas dan homogenitas, serta uji hipotesis dengan Paired Samples Test. Hasil analisis data menunjukkan bahwa terdapat perbedaan yang signifikan antara rata-rata hasil belajar siswa sebelum dan sesudah perlakuan. Siswa yang mendapat pembelajaran dengan metode role playing menunjukkan peningkatan yang lebih signifikan dalam kemampuan menyelesaikan soal cerita matematika dibandingkan dengan siswa yang mendapat pembelajaran konvensional. Kesimpulannya, penggunaan metode role playing dalam pembelajaran matematika dapat meningkatkan kemampuan siswa dalam menyelesaikan soal cerita matematika. Metode ini membuat pembelajaran lebih bermakna, menyenangkan, dan dapat meningkatkan keterlibatan siswa dalam pembelajaran.

Kata Kunci: metode pembelajaran; role playing; soal cerita matematika

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Introduction

Mathematics is one of the subjects taught in schools and plays a crucial role in shaping students' thinking patterns, especially in daily life (Purnamasari & Setiawan, 2019). Learning mathematics trains students in logical thinking and reasoning (Siyamsih, 2024). Mathematics teaches students to analyze problems correctly and use their understanding of mathematical concepts to find appropriate solutions. This process trains students to think logically and analytically in everyday life situations (Laia, 2023). Mathematics, as a valuable subject, plays a dual role as both the queen and the servant in the fields of science and technology (Ismayala et al., 2023). Therefore, at all education levels in Indonesia, from elementary to high school and university, mathematics is compulsory to equip students with logical, analytical, systematic, critical, and creative thinking skills to solve problems encountered in daily life (Mashuri, 2019). Students studying mathematics are expected to improve their thinking skills, including reasoning, problem-solving, communication, and appreciation of the usefulness of mathematics in daily life (Novita et al., 2018).

Conducting quality mathematics learning activities to understand concepts can improve students' mathematical abilities (Hasibuan et al., 2019). Therefore, in mathematics learning, students are not only required to understand concepts and theories but also to apply mathematical concepts and theories to problem-solving (Imswatama & Lukman, 2018). Problem-solving is a process that emphasizes the importance of steps and strategies that students find to solve problems and eventually find solutions (Risnanosanti et al., 2021). Good problem-solving does not only look at the end result but focuses more on the process or steps used to solve the problem. Meanwhile, mathematical problem-solving ability is the ability of a person to analyze or interpret problems to find solutions (Sagita et al., 2023). Problem-solving is a benchmark of mathematical processes because in mathematics learning, students are facilitated to use their abilities and experiences to solve mathematical problems (Siagian, 2019).

In solving story problems, almost all children experience difficulties. Several studies related to students' difficulties in solving mathematical story problems, such as the studies by O'Brien et al., 2011; Putri, 2021; Sesanti, N. R., & Bere, 2020; Rahmawati, 2019; and Utari et al., 2019 show the analysis results of problem-solving abilities related to students' difficulties in accommodating mathematical learning materials. Based on several studies, the ability to solve story problems in spatial materials has never been analyzed, and this is one of the important abilities to be analyzed. Mathematical story problems are more challenging than regular math problems because the content presents direct events (Dwidarti et al., 2019). Mathematical story problems provide a realistic picture of real-life situations (Susana et al., 2020). Mathematical story problems are presented in the form of stories related to situations that students face in daily life; therefore, it is essential for students to acquire these skills (Nailia et al., 2023). Providing mathematical story problems aims to introduce students to the benefits of mathematics in daily life and train students' problem-solving skills in daily life (Unaenah et al., 2020).

The results of the 2018 Program for International Student Assessment (PISA) show that Indonesia's students' mathematics abilities scored 379, while the OECD's average mathematics ability reached 487 (Nopriyanti et al., 2024). Indonesia ranks 73rd out of 79 countries in the mathematics numeracy category. Students' weaknesses in mathematics are low reading habits, thinking, and efforts to absorb important information that can help them identify problem-solving strategies. Students also tend not to spontaneously build knowledge to solve problems, so the problem-solving processes they have learned can be easily forgotten (Hasibuan et al.,

2019). According to Wahyuddin & Ihsan, students need to utilize reading abilities to interpret problems and reasoning abilities to analyze problems and apply mathematical concepts to solve story problems (Pradana & Murtiyasa, 2020).. Based on observation, the problems that arise in mathematical problem-solving abilities also occur in fifth-grade students at SDN Palumbonsari 1, particularly in solving mathematical story problems related to numbers. Many students still have difficulty solving mathematical story problems. Based on the results of the Indonesian National Assessment Programs (INAP), Indonesia's student mathematics achievement scores are categorized as low, indicating that students' problem-solving abilities in mathematics learning are still low (Sintawati et al., 2020).

Low problem-solving abilities certainly affect students' learning outcomes, especially in solving mathematical story problems. Therefore, an effort is needed to improve students' mathematical problem-solving abilities to enhance their ability to solve story problems. The low ability to solve mathematical story problems can be overcome by using the role-playing method. According to (Purwatiningsih, 2019), the use of the role-playing model can improve students' ability to solve mathematical story problems.

Role playing is known as a teaching method where the teacher asks students to dramatize a social situation that contains a problem (Prawiyogi et al., 2022). The application of the role-playing method can help teachers facilitate students in understanding how to solve mathematical story problems by directly playing roles based on the problems they face (Oktaviani, 2018). Role-playing or acting out a scene is a method used by teachers in learning by developing students' imagination and appreciation by bringing roles from the real world into a role-playing performance in class to achieve the desired learning objectives (Azizah, 2022). Then, this game is used as a reflection material to help participants reflect on what they have learned and provide advice on how these roles can be expanded (Saidah, 2023). Through role-playing, students try to explore relationships between humans by acting them out and discussing them, allowing students to explore feelings, attitudes, values, and various problem-solving strategies together (Jhonnedy et al., 2023). In role-playing learning, students demonstrate relationships between humans by expressing themselves, cooperating, and discussing, expressing emotions, attitudes, values, and different problem-solving strategies (Listiani Eka, 2023). The role-playing method involves many student activities, starting from students explaining concepts of a material, observing, thinking, to drawing conclusions from the material they get through role-playing scenes (Imanizar et al., 2021). Through role-playing, students actively participate in learning. Thus, when students actively participate directly in the mathematics learning process, the ongoing process can be elevated to a higher process, namely the formation of new knowledge (Fitry et al., 2019). The advantage of this method is that it creates a fun and non-monotonous learning impression, and the material taught through role-playing games remains ingrained in students' memories for a long time (Rachma et al., 2023).

Previous studies have shown that the role-playing learning method can achieve learning completeness and increase student activity, helping students understand Grade I mathematical elements in indicators: Identifying everyday problems involving subtraction (Purwatiningsih, 2019). The study by Anditiasari, (2020) shows that by applying role-playing and problem-solving methods, students can understand story problems, making learning very enjoyable, and students can easily solve story problems. Another study by Oktaviani, (2019) shows that the implementation of the role-playing model or role-playing here can help students understand the given problems and also improve the ability to solve addition and subtraction story problems in first-grade students of SDN Kalisampurno I.

In contrast to previous studies, the novelty of this study is to improve the abilities of fifth-grade students in solving mathematical story problems on numbers up to 100,000 using the role-playing method. Therefore, the purpose of this study is to examine the influence of the role-playing method on students' ability to solve mathematical story problems on numbers up to 100,000 in fifth grade at SDN Palumbonsari 1.

Research Methods

This study employed a quantitative descriptive experimental approach. According to Sugiyono (2019), experimental research is a method conducted through experimentation, which is a quantitative method used to determine the effect of independent variables (treatment) on dependent variables (results) in controlled conditions. The research design used in this study was a Quasi-Experimental design, specifically the Pretest Post-test Non-equivalent Control Group Design. This study was conducted to determine the effect of using role-playing methods in solving mathematical story problems.

This research was conducted at SD Negeri Palumbonsari 1 East Karawang in the academic year 2023/2024. The population in this study was all fifth-grade students. The sampling method used in this study was random sampling, which was done by drawing lots to determine which classes would be the experimental and control groups. The selected sample for the experimental group was class VC, and class VB was the control group, each consisting of 40 students. The role-playing method was implemented in the experimental group, while the conventional method was used in the control group. In this study, to measure students' ability to solve mathematical problems using indicators according to Polya's theory, namely understanding the problem, determining the problem, solving the problem, and reviewing the obtained results (Sanutra et al., 2024).

The implementation stages in this study were conducting pre-tests in the control and experimental groups to determine the students' initial abilities. Then, after the pre-test, the students were given the learning material. In the experimental group, treatment was given in the learning process using the role-playing method, while in the control group, the conventional method was used. In the final stage, post-tests were conducted in the experimental and control groups to determine the final (output) learning outcomes after treatment. In this study, the implementation of the role-playing learning method was carried out for 5 meetings, with one final test (post-test) conducted in one meeting.

The data analysis technique obtained was from the results of the pre-test and post-test, which were then analyzed descriptively to determine the final learning outcomes before and after treatment. Meanwhile, the data collection technique used an instrument in the form of an essay test, namely mathematical story problems. The instrument was validated and tested on students outside the research sample before the study to determine whether the instrument was suitable for use. After testing the instrument on students, it was found that the questions in the instrument showed excellent results, which were valid and reliable. The questions that will be given in the pre-test and post-test for the role-playing method research are 10 items. The questions are answered by students in writing on the answer sheet provided to determine the students' learning outcomes in solving mathematical story problems.

Results and Discussion

This study is a quasi-experimental research involving an experimental class and a control class, each consisting of 40 students. Both classes were given the same test instrument but with different treatments. The experimental class was taught using the role-playing teaching method, while the control class did not receive the role-playing teaching method. Before conducting the research, the researcher conducted validity and reliability tests. The validity test was conducted with 10 questions and resulted in 10 valid questions based on the T-table of 0.361. Subsequently, the 10 valid questions underwent reliability testing based on the established criteria, which stated that data is considered reliable if the Cronbach's Alpha is greater than 0.70. If the Cronbach's Alpha coefficient is less than 0.70 ($r\text{-calculation} < 0.70$), it is considered unreliable, requiring revision or improvement. The reliability test yielded a data value of $0.81 > 0.70$, which can be concluded as reliable and suitable for use in the study. The next step involved conducting the research at SDN Palumbonsari I, involving both the experimental and control classes. The data obtained were tested for normality.

Table 1. Results of Normality Test for Pretest and Posttest Data

Class		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Mathematics Word Problems	Pretest Experimental Class	.112	40	.200*	.956	40	.121
	Posttest Experimental Class	.094	40	.200*	.965	40	.240
	Pretest Control Class	.110	40	.200*	.954	40	.107
	Posttest Control Class	.104	40	.200*	.955	40	.110

Based on Table 1 regarding the results of the normality test, it can be seen that the significance level for the pre-test in the experimental class is 0.121, which is greater than 0.05, indicating that the data are normally distributed. Similarly, the significance level for the pre-test in the control class is 0.107, which is also greater than 0.05, indicating normal distribution of the data. As for the normality test results for the post-test, the experimental class has a significance level of 0.240, which is greater than 0.05, indicating normal distribution. Likewise, the control class has a significance level of 0.110, which is also greater than 0.05, indicating normal distribution. Therefore, it can be concluded that both the pre-test and post-test results for both the experimental and control classes have normally distributed data.

Table 2. Homogeneity Test of Pre-test and Post-test for Experimental and Control Classes

		Test of Homogeneity of Variance			
		Levene Statistic	df1	df2	Sig.
Mathematics Word Problems	Based on Mean	.973	1	78	.327
	Based on Median	1.029	1	78	.313
	Based on Median and with adjusted df	1.029	1	76.195	.314
	Based on trimmed mean	.930	1	78	.338

Based on Table 2 regarding the results of the homogeneity test, it can be seen that the significance level based on the mean for the pre-test and post-test data for the experimental and control classes is 0.327, which is greater than 0.05. This indicates that the significance level of $0.327 > 0.05$, suggesting that both the experimental and control classes have the same variance or are homogeneous.

Table 3. Results of the Hypothesis Testing Samples Test

		Paired Samples Test								
		Paired Differences						Significance		
		Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference		t	df	One-Sided p	Two-Sided p
					Lower	Upper				
Pair 1	Pretest Experimental Class- Posttest Experimental Class	-27.500	13.713	2.168	-31.886	-23.114	12.683	39	<,001	<,001
Pair 2	Pretest Control Class - Posttest Control Class	-19.250	14.951	2.364	-24.031	-14.469	-8.143	39	<,001	c<,001

In Table 3 above, for output pair 1, the obtained sig value (2-tailed) is $0.001 < 0.05$. Therefore, it can be concluded that there is a difference in the average learning outcomes between the pre-test and post-test of the experimental class (using role-playing method). Based on the output from pair 2, the obtained significance value (2-tailed) is $0.001 < 0.05$. Thus, it can be concluded that there is a difference in the average learning outcomes between the pre-test and post-test of the control class (using conventional method).

The use of the role-playing method in mathematics education, especially in solving mathematical story problems, can significantly influence students' ability to solve such problems. This is because through role-playing, students can apply mathematical concepts and knowledge to real-world situations. Mathematical story problems contain contexts or backgrounds related to everyday life, requiring students to understand the meanings and relationships between variables. The role-playing method involves students actively participating in completing tasks related to the material they are studying. Furthermore, mathematical problems must meet problem-solving indicators, which include students' ability to understand the problem, plan problem-solving strategies, implement these strategies, and evaluate the results. By using the role-playing method, students can practice their problem-solving skills in a fun and interactive way. They are given the opportunity to act as actors in the roles played, making it easier for them to understand abstract mathematical concepts and apply them in real-life contexts.

The learning process in the experimental class using the role-playing method tends to be enjoyable and makes students actively engage in learning, starting from students expressing concepts, observing, thinking, to drawing conclusions from the material they learn through role-playing scenes. This is in line with Karnia et al., 2023 opinion that the role-playing method aims to provide students with the opportunity to actively participate in learning by role-playing, and teaches them to build confidence by expressing various expressions. With students actively role-playing in the learning process, the material delivered by teachers will be easier to understand by students. In addition, learning using the role-playing method also makes the learning process enjoyable, not monotonous, and not boring, so the material delivered is more memorable and can be remembered by students for a long time. This is in line with Wulandari et al., (2021) opinion that the use of the role-playing method can ignite students' enthusiasm and have a long-lasting impact on students' memories. Subagyo mentioned in (Haliza & Nugrahani, 2021) the steps of the role-playing learning method as follows: (1) Determine the problem to be played,

(2) Select actors, (3) Arrange scenarios, (4) Prepare the audience as observers, (5) Play roleplay, (6) Conduct discussion and evaluation, (7) Re-play, (8) Share experiences and draw conclusions.

In this study, learning using the role-playing method can create more meaningful learning and provide reinforcement in understanding how to solve mathematical story problems compared to conventional methods. Judging from the average post-test results of the experimental class using the role-playing method, which is much higher than the control class at 86.45. Thus, it can be interpreted that the role-playing learning method can improve students' ability to solve mathematical story problems.

The learning process in the control class does not use the role-playing method. The learning process in the control class only uses a conventional approach. In this class, students tend to be passive because they prefer to remain silent while receiving learning materials provided by the researcher. This is in line with research conducted by (Oktaviani, 2018) that the low ability of students in solving mathematical story problems is influenced by several factors, one of which is the learning method used by teachers. The researcher explains the material and then gives students the opportunity to ask questions. Some students already understand and master the material provided by the researcher. However, when given practice questions, many students still do not answer. Judging from the difference in pre-test and post-test scores between the experimental group and the control group.

Table 4. Pretest and Posttest Results from Experimental Group and Control Group

Class	Mean Pretest	Mean Posttest	Percentage Increase
Experimental	58,95	86,45	47%
Control	65,15	84,40	30%

Based on Table 4, it can be seen that in the experimental class, the average pretest score was 58.95 and the average posttest score was 86.45, with a percentage increase of 47%. Meanwhile, in the control class, the average pretest score was 65.15 and the average posttest score was 84.40, with a percentage increase of 30%. This indicates that the use of the role-playing teaching method is more effective in improving students' understanding of mathematical word problems, especially in the material of whole numbers up to 100,000, compared to the conventional method. The results of this study are relevant to the research by Ambari, 2019, titled "Improving the Ability to Solve Mathematical Story Problems Using the Role-Playing Model," which showed that using the role-playing method can enhance students' ability to solve mathematical story problems in the form of word problems in the fourth grade of Vidya Qasana Elementary School. Providing opportunities for students to construct mathematical knowledge with easily remembered and understood concepts through the enjoyable learning process of role-playing makes students more active and increases their curiosity. However, there are also shortcomings in the implementation of the role-playing learning method, namely, not all students get a role to play in learning using the role-playing method. Some students become distracted observers, chatting and joking with their friends. However, this can be addressed by the researcher.

Conclusion

Based on the quasi-experimental study conducted, it can be concluded that the use of the role-playing learning method in mathematics, especially in solving mathematical story problems, has a significant effect on students' ability to solve mathematical story problems. This is evident from the average post-test scores of the experimental class students using the role-

playing method (86.45), which is higher than the average post-test scores of the control class students who did not use this method (84.40). Furthermore, the increase in post-test and pretest scores is also greater in the experimental class (40%) compared to the control class (30%). This indicates an improvement in students' ability to solve mathematical story problems after being treated with the role-playing learning method. This method helps students to apply mathematical concepts and knowledge to real-life situations through the roles they play. Learning through role-playing provides students with the opportunity to actively participate, communicate, argue, and discuss within their role-playing groups. The enjoyable and non-monotonous learning process makes the material easier to understand and remember for a longer period of time. Thus, the role-playing method can improve students' learning outcomes in solving mathematical story problems compared to conventional methods.

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