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Implementation of creative problem-solving model with RME approach on mathematics problem-solving ability

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Abstract

This research is motivated by the low problem-solving ability of students caused by focusing on memorizing formulas when answering questions. Innovation is needed to overcome this, one of which is through the innovative implementation of the creative problem-solving model. This study aims to see the effect of students' problem-solving skills through implementing the creative problem-solving model with the RME approach. This study uses a type of quasi-experiment with a non-equivalent control group design in class 6 on the material of building space. The population was 73 students, with a sample of 40 students consisting of 20 experimental classes and 20 control classes with simple random sampling techniques. The ice instrument used is a description test with as many as four questions. The t-test results obtained are Sig. 0.001 with a t-count of 2.387. Based on the test results that have been carried out, there is a positive influence on the implementation of the creative problem-solving model with the RME approach on students' problem-solving skills, and there is an increase in students' problem-solving skills based on the pretest-posttest value of 31.6.

Keywords: creative problem-solving model; mathematics problem-solving ability; realistic mathematics education approach

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Introduction

Education in the current era demands the development of thinking skills so that students get sufficient solutions to solve learning problems, one of which is by implementing learning mathematics (Pepin et al., 2017; Soboleva et al., 2022). The quality of human resources can be seen from their ability to solve problems caused by thought processes (Cahyati et al., 2022; Tripon, 2022). Thinking is essential, especially in learning mathematics (Ibrokhimovich et al., 2022). As a branch of science, mathematics is always related to life activities (Fauzi et al., 2018; Fauzi et al., 2022) and aids in developing thinking processes (Kenedi et al., 2019). However, the reality is that many students view mathematics as difficult or even frightening (Altaftazani et al., 2020; Garba et al., 2020). It provides a stimulus to students so that they continue to think that mathematics is boring learning. The result is that students' thinking skills could be higher (Aini & Ridwan, 2021). It was supported by the International Student Assessment Program (PISA) in mathematics in 2015; Indonesia was ranked the 8th lowest out of 72 countries related to thinking skills (Arsyad & Upu, 2021; Sahyar et al., 2020). It impacts students' difficulties in solving mathematical problems when learning is carried out and can be said to be in the low category regarding problem-solving abilities.

The teaching of mathematics in schools plays a crucial role in developing students' problem-solving abilities, ability to use mathematics as a tool for life, ability to communicate ideas using mathematical symbols, and creative problem-solving abilities (Anam et al., 2020; Özreçberoğlu & Çağanağa, 2018). The emphasis on learning mathematics can be focused on creative problem-solving related to students' daily lives. Mathematics learning is inseparable from everyday life and even intertwined (Sinniah et al., 2022). According to Inganah et al. (2023), students can develop creative solutions to problems more easily if the math lessons are organized systematically. This creative learning needs to be done because it determines the success of teachers in teaching (Schrittesser et al., 2014; Suyudi et al., 2022). In particular, creative learning can be done repeatedly when learning mathematics, which requires much effort to solve a problem (Assmus & Fritzlar, 2022; Darmayanti et al., 2022). According to Asrita (2022), periodic repetition of learning will help students remember and make it easier to answer questions.

Based on observation activities at SD N 1 Sedayu in class VI on the material of building space, several things were noted during the implementation of learning: (1) the teacher still dominates the provision of learning materials, (2) the implementation of enrichment to students when working on problems is only limited to answering whether or not the questions that students have done, and (3) the questions given by the teacher are straightforward and there is no visible implementation of a learning model that can increase student creativity in thinking problem-solving. In addition, students are very passive in responding to learning provided by the teacher and need to be bold in expressing their thoughts about a topic of discussion. When given questions related to indicators of problem-solving ability at the problem identification stage, it can be seen that only 20% of students are close to the correct answer. The indicator of formulating the problem is that only 25% of students who have successfully answered continued at the problem-solving strategy stage, and 15% of students can process their thoughts, almost by the flow of answers presented. In the solution verification stage, 10% of students can provide a solution, but it still needs improvement. From this incident, students' ability to solve math problems can be considered weak, especially in giving description questions. If this is not done, it will impact learning outcomes that are not implemented. However, not only that, students in the class rely on memorizing formulas so that if the memorized formula is forgotten, then they cannot answer the questions given.

Based on research conducted by Rahmawati et al. (2022) supports the results of observations stating that current mathematics learning is only limited to memorizing formulas. If students are only encouraged to memorize formulas when working on problems, they will need help to think (Pujakusuma & Pramuditya, 2023). If this continues, it will hamper students' creativity in thinking, and of course, students' ability to solve problems will also be hampered (Allers & Singh, 2023). Thus, a learning innovation is needed that can increase students' creativity in thinking to find solutions to problems, for example, by implementing the creative problem-solving model.

Low problem-solving skills can be improved by implementing a problem-based learning model (Ermayeni et al., 2020). The emphasis of the problem-based learning model requires students to be able to find their problem-solving solutions (Hadi & Izzah, 2019; Sesriani, 2021). Implementing the creative problem-solving model can increase student creativity in finding problem-solving solutions (Hobri et al., 2020; Khalid et al., 2020). Creative problem-solving emphasizes divergent-convergent thinking that centers on giving students ideas for solving mathematical problems (Selvia et al., 2020). Based on Fahrisa's research (2022), this CPS learning model can improve students' creative and critical thinking skills. It is supported by Van Hooijdonk et al. (2020). By implementing the CPS model, students can find facts and problems and the right solution to solving problems.

Implementing this creative problem-solving model will be combined with the realistic mathematics education approach so that problem-solving ideas will be based on students' real lives. The novelty of this research lies in integrating the creative problem-solving model and the RME approach with different student characteristics. Based on research by Papadakis et al. (2021), the realistic mathematics education approach can help students solve math problems. Real-life-based learning through the realistic mathematics education (RME) approach makes it easier for students to understand and solve problems in mathematics because it uses experiences, objects, and other things that are very close to students (Ajid & Soleh, 2021; Widyasari & Cahyani, 2021). It will minimize the appearance of bias, impacting problem-solving skills.

Based on the related literature study, this research aims to improve students' problem-solving ability by implementing a creative problem-solving model with a realistic mathematics education approach so that students' problem-solving ability in mathematics learning can increase and students are more interested and active in the learning process.

Methods

The research used is a quasi-experiment with a non-equivalent control group design with an experimental class and a control class. The experimental class will be given a creative problem-solving model with the RME approach, while the control class will be given a conventional model that teachers often teach. This research on the materials used in the building space was conducted from April 17 to April 24, 2023, in class VI. The study population was 73 students with a research sample of 40 students consisting of 20 students of class VI A and 20 students of class VI B of SDN 1 Sedayu, Tulungkan District, Klaten, with a simple random sampling technique.

The research instrument used is test questions in the form of descriptions with questions of as many as six items. Before use, the research instrument must go through the instrument validity process with the condition that if the calculated t value obtained is> 0.349, then the data is declared normally distributed. Furthermore, the instrument will go through a reliability test with the condition that if the Cronbach's Alpha value> 0.6, then the instrument used is declared reliable. The instrument test was conducted on students outside the 30 students with the Sig research sample — 5%. Of the six items tested for validity, four questions were declared valid with a t value> 0.349 and an Alpha Cronbach's value of 0.765 with high-reliability criteria on the items.

Data analysis techniques are carried out through 2 stages: descriptively and inferentially. Descriptive data analysis techniques are carried out by looking at means, standard deviations, and variances to describe the acquisition of pretest-posttest in experimental and control classes. Inferential data analysis techniques are carried out to test the hypothesis that the creative problem-solving model with the RME approach has an impact on improving students' problem-solving skills. Assumption of parametric statistical test requirements through normality test and homogeneity test. The requirement is if the Sig. value obtained is> 5%, then the data is declared normally distributed with the data variance declared homogeneous. After fulfilling the test requirements, hypothesis testing is carried out through the independent test. The conditions used are if the Sig value. <5%, then there is an effect of using the creative problem-solving model with the RME approach to improve students' problem-solving skills and indirectly say that Ha is accepted and H0 is rejected. It applies vice versa if the Sig. result obtained> 5%. Data analysis using IBM SPSS Statistics 26.

Results

Based on data analysis, the first thing to do is to describe the results of means, standard deviation, and variance as an overview of the results of descriptive analysis. The descriptive analysis is shown in Table 1.

Table 1. Descriptive analysis results of problem-solving ability

Data	*Means*	Deviation Standard	Varians
Pre-CE	52.35	9.074	82.345
Post-CE	83.95	10.966	120.261
Pre-CC	49.65	10.840	117.503
Post-CC	78.65	13.104	171.713

Referring to the results of Table 1, the acquisition of means between the experimental class (CE) and the control class (CC) experienced a significant difference. The average differences in the experimental class at pretest and posttest include 52.35 and 83.95, with an increase of 31.6. In the control class, the acquisition of the initial and final tests were 49.65 and 78.65, respectively, with a difference of 29. The standard deviation results show a relatively high difference, meaning the data obtained is wider. From Table 1, the average difference in the results of the ability to solve problems in the experimental class is much more significant than that of the control class. It indirectly proves that the creative problem-solving model with the RME approach improved problem-solving skills in grade VI students. They were continued at the stage of inferential data analysis to test the hypothesis. Test requirements must be met before hypothesis testing through normality and homogeneity tests. Continued at the stage of inferential data analysis to test the hypothesis. The normality test was carried out with the Kolmogorov-Smirnov test and is shown in Table 2.

Table 2. Kolmogorov-Smirnov test results

Data	Significance
Pre-CE	0.200
Pos-CE	0.196
Pre-CC	0.200
Pos-KK	0.200

Referring to Table 2, Sig. obtained from 4 data each > 0.05. This states that the 4 data attached are normally distributed. The homogeneity test continues because it has fulfilled one prerequisite for parametric statistical tests. This test is useful to identify whether the data variance is homogeneous or not. The results are shown in Table 3.

Table 3. Homogenity test result

Data	Sig. value
Based On Trimmed Mean	0.443

In Table 3, the Sig. value of the homogeneity test obtained is 0.443. If based on the assumption that Sig. the test obtained is more than 0.05, it is stated that the data has a homogeneous data variance. Two prerequisite test steps have been carried out, and the parametric statistical test is fulfilled. Then, we proceed with hypothesis testing using the independent test. The results are shown in Table 4.

Table 4. Independent test results

t_{count}	t_{table}	df	Sig. value
2.387	1.68	40	0.001

Referring to Table 4, the count is 2.387, and the table is 1.68. This indicates that the tcount value is higher than the t-table and the significance value obtained is less than 0.05. Based on the results obtained, Ha is accepted, and H0 is rejected, thus stating that there is an effect of using the creative problem-solving model with the RME approach on the ability to solve math problems in class VI at SD Negeri 1 Sedayu, Tulungkan District, Klaten.

Discussion

They referred to the research of Kintoko and Jana (2019), who found that building space is the most challenging material for students to understand when learning mathematics. Supported by Sari et al. (2023), the delivery of space-building material is difficult for students to accept because it is still abstract, and students depend on memorizing formulas alone. When students need to remember the formula, they can certainly not provide a solution to the problem given. It needs to be corrected by systematically examining each problem-solving process presented through students' real lives to be able to present a solution. The order of completion is based on the syntax of the creative problem-solving learning model.

Implementing learning on the material of building space through implementing the creative problem-solving model begins with problem classification. The teacher explains the learning material first by combining the explanation through the RME approach based on real-life experiences by students. The teacher has prepared a work module on problem-solving efforts shared in group activities. The teacher and students together listen to each problem-solving solution in the work module and follow the stimulus provided by the teacher. This problem classification stage makes it easy for students to examine the things that must be resolved appropriately. Based on research by Umam and Susandi (2022), the problem clarification stage helps students think early and draws students' attention in order to find the right solution to the learning problem presented. The problem clarification stage, given a good stimulus, will make it easier for students to think about finding a solution (Solikah & Novita, 2022; Wulan & Ilmiyah, 2022). Students express their opinions to the instructor regarding the problem-solving solution at this stage of the problem clarification process.

The majority of students at the problem classification stage to find solutions are only able to provide a single solution. When this happened, the teacher began using the RME approach, starting from the understanding of contextual problems. This application is based on students' actual experiences. At this stage, it shows a change in students' understanding in a more positive direction. It can be seen from students' responses that they began understanding and finding solutions to the problems. According to Gistituati and Atikah (2022), the RME approach makes it easy for students to review learning easily. Harahap and Sari (2023), the RME approach not only helps students acquire information but also links information and applies it in real life because they have experience with the learning process. The reality obtained when combining the RME approach with the presence of stimuli at the problem classification stage was that students found four solutions.

It will be easier for students to reconstruct the presented problem-solving solutions if students are open and daring to offer ideas to solve problems. It will provide much input for other students to consider. It occurs as a result of thinking. Research from Lu et al. (2022) shows that brainstorming can increase students' interest in thinking if they have different opinions. The brainstorming stage can improve students' ability to solve problems (Bagus et al., 2022; Ivcevic et al., 2022). During this brainstorming stage, the instructor gives the students a stimulus that prompts them to try to solve problems based on their opinions. As a result, the teacher's next step is to select and evaluate the ideas of other students in order to find the best solution to the problem. This effort to evaluate and select ideas aims not only for students to be able to find appropriate problem-solving strategies but also to improve students' thinking skills.

Based on Saad and Zainudin's (2022) opinion, students and teachers discuss the right ideas for solving the problem at the evaluation and selection stage. In its implementation, the teacher can propose a selection of ideas from students that students think are appropriate, and students are required to provide reasons for choosing these ideas. The most selected ideas with reasonable reasons can be considered when choosing the right solution. At this stage, the implementation of the RME approach is also given by the teacher by comparing and discussing the problem solutions given for the remaining answers. It creates an opportunity for students to deepen their problem-solving skills so that they can lead to the correct answer. The process experienced by students on the various inputs received in solving problems leads to a more mature student thinking process. It helps improve students' learning, which is sometimes monotonous when receiving information from the teacher (Nasir et al., 2023). Based on the research of Sutarni and Aryuana (2023), a realistic approach to mathematics can apply a learning style that is by its characteristics and makes it easier for students to learn. The process of implementation is the final stage. This stage lets you decide which solution is best. In the wake of being viewed as correct, then, at that point, understudies are given inquiries by the educator. Giving inquiries is finished to check regardless of whether understudies' numerical critical thinking abilities have moved along.

According to the findings of the research that was carried out, the Creative Problem-solving model can positively affect the creative thinking that students use to process information, both in the classroom and in the student environment. Learning is done exhaustively by introducing a cadenced methodology, with the goal that it can help understudies in recreating information and thinking. The primary objective is for students' mathematical critical thinking skills to improve due to integrating the creative problem-solving model and the RME approach, which helps students find the right solution to the problem at hand and boosts student engagement.

Conclusion

The creative problem-solving learning model with the RME approach positively influences students' problem-solving skills compared to the conventional model. The new thing obtained in this study is an increase in higher-level thinking skills that develop students' confidence in exploring various ways to solve problems, developing creative thinking skills into abilities that develop due to implementing the creative problem-solving model with the RME approach.

The limitation of this study lies in the small research sample, so it is still impossible to generalize the findings with the same results to other research subjects. However, if there are problems related to low mathematical problem-solving ability, you should try to overcome these problems by using the creative problem-solving model with the RME approach.

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Conflicts Of Interest

The authors declare no conflict of interest regarding the publication of this manuscript.

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Author Contributions

Joko Rahmadi: Concept, analysis, discussion, supervision and correspondence author; **Yoppy Wahyu:** writing review and visualization; **Viscal Oktari:** Validation and supervision, translator, collect data, and analysis.

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