International Journal of Trends in Mathematics Education Research
Vol. 5, No. 4 (2022), pp. 435~440
ISSN 2621-8488 (online)
DOI: https://doi.org/10.33122/ijtmer.v5i4.169

Research Article

Effect of problem posing on problem-solving ability in mathematics learning of elementary school students

Witri Darlena, Agus Susanta✉, Irwan Koto & Edi Susanto

University of Bengkulu, Bengkulu, Indonesia, 60231
✉Corresponding Author: agussusanta@unib.ac.id | Phone: +6281237205641

Received: 26 September 2022 *Revised: 28 October 2022* *Accepted: 24 November 2022* *Available online: 30 December 2022*

ABSTRACT

Preliminary survey data on students' problem-solving abilities in elementary schools in Bengkulu City showed low results. To achieve maximum mathematics learning outcomes, applying the right learning approach is necessary. This study aims to analyze the effect of problem-posing learning on students' problem-solving abilities. The research method used is quasi-experimental with a quantitative approach. The population in this study were all fifth graders of SD Negeri 5 Bengkulu City. The research sample was selected by purposive sampling, in which class VB was the experimental class, and VC was the control class, with 26 students each. Data collection is done by observation and tests. Data were analyzed using an independent statistical test t-test. The results showed an effect of problem posing on the problem-solving abilities of fifth-grade students at SDN 5 Bengkulu City. This is shown from the t-test results at the 95% confidence level with a statistical significance of 0.000 <alpha (0.05). Problem posing is also effective in improving problem-solving ability, which is indicated by the N-gain value of 0.72 (high category).

Keywords: quasi experiment research; problem posing; problem solving

1. INTRODUCTION

Mathematics is one of the subjects taught from elementary school to college. In learning mathematics, there are abstract objects, which means that the object is still in mind, making it difficult for students to understand mathematics. Although mathematics is considered difficult, everyone should learn it because it is a means to solve everyday problems (Sundayana, 2015). This emphasizes the need to instill mathematical concepts at every school level to solve problems. Mathematics learning outcomes in Indonesia are still relatively low. One of them is evidenced by the Program International for Student Assessment (PISA) survey results. The results of the 2018 PISA show that Indonesian students' mathematical abilities are stated to be low. Indonesia's score is low because it is ranked 72 out of 78 countries. PISA results in studying mathematics for Indonesian students have not yet reached the PISA average standard, 489, while Indonesia only achieved a score of 379, far behind other countries (OECD, 2018). The data shows that the mathematical ability of students in Indonesia is still below the average when compared to other countries. Data mastery of mathematics, especially in secondary schools in Bengkulu City, is relatively low. The description of the ability of SMP/MTs students in Bengkulu City to solve math problems based on Trend International Mathematics and Science (TIMSS) is, on average, low. Mastery of number material is 59.18%, geometry is 36.39%, and data material and student mastery uncertainty is 50.39% (Susanta et al., 2021).

The results of the researcher's initial observations through the documentation of the grades of mathematics subjects in Class V semester 1 of the 2021/2022 academic year at SD Negeri 5 Bengkulu, the level of students' problem-solving abilities is still low. Of the 27 fifth-grade students who took the formative exam, only 8 students (40%) met the KKM score (≥70). Around 19 students (60%) did not meet the KKM score (<70). One of the causes of low student test results is the assumption that Mathematics is difficult to learn because it is always haunted by memorizing formulas, so it will cause anxiety when learning Mathematics. In the end, students are not interested in learning. This is in line with the opinion of Ulya & Rahayu (2017), who states that students' low mathematical ability is caused by displeasure with mathematics.

The low student mastery of mathematics requires all parties to make improvements, especially in the learning process. In Indonesia, the learning objectives of school mathematics are stated in government regulations. According to Permendiknas No. 20 of 2006, which was refined in the 2013 Curriculum, the purposes of learning mathematics include, among others, that students can understand mathematical concepts, explain the interrelationships between concepts, and apply concepts or algorithms in a flexible, accurate, efficient, and precise manner in problem-solving (Kemendikbud, 2004). 2014). Especially in elementary schools, mathematics uses formal and abstract deductive reasoning methods where the students' thinking stage is still the concrete operation stage (Hudojo, 2005). According to Piaget, elementary school students aged 6-13 years are in the concrete operational phase, which is the thinking phase to operate logical rules. However, they are still bound by abstract objects (Heruman, 2010). This means that elementary school students cannot understand logical operations in mathematical concepts without being assisted by concrete objects. The goal is to instill a mathematical concept so students can easily solve problems in learning mathematics.

Based on the objectives of learning Mathematics, it can be said that Mathematics Education in Indonesia has paid attention to developing problem-solving abilities. As stated by Wijaya (2014), problem-solving abilities are abilities related to understanding mathematical content, problem-solving skills, use of reasoning, developing strategies or methods, and communicating ideas. In mathematics, alternatives are needed to improve students' problem-solving abilities through approaches or learning models. This approach is required to help to know so that it can change the paradigm of mathematics lessons, especially for formulas that are not memorized but to understand the concept so that they can solve problems. One learning approach that allows students to interact with each other and love the teaching and learning process is the problem-posing approach.

According to Suryosubroto (2009), problem posing or submitting problems as outlined in the form of questions focused on students' efforts to find new knowledge and experiences intentionally. Problem posing is creating one's problems, unlike traditional learning, which solves problems posed by others (Kopparla et al., 2019). Problem posing is a learning model in which students pose problems based on certain situations and then solve them (Zarkasyi, 2015). In this case, problem posing is one of the lessons that require the activeness of students both mentally and physically. The problem-posing approach's selection and application will affect how students learn from being passive to being more active. It aims to develop students' mathematical problem-solving abilities. In the problem-posing approach, the students design the questions and solutions. The importance of problem-posing skills in mathematics education comes from the knowledge and experience of the teacher (Erdik, 2019). Several empirical studies proved that problem-posing can improve students' thinking skills in learning mathematics.According to research by Kholifah (2016), problem-posing influences students' ability to understand mathematical concepts in fractional material, Agustin (2017) finds that problem-posing improves student learning outcomes. Suarsana, Letari, & Mertasari (2019) showed that students' problem-solving abilities in mathematics using online problem-posing teaching materials were better than conventional classes. Based on the above study, research was conducted to analyze the effect of the problem-posing approach on students' problem-solving abilities.

2. RESEARCH METHOD

Types of Research

The type of research used in this research is a quasi-experimental research with a quantitative approach. Experimental research is systematic, logical, and thorough to control conditions (Winarni, 2018). This research design is the pretest-posttest Comparations Group Design (Arikunto, 2014). The following is an overview of the research design, as shown in the following table.

Table 1. Research design

Eksperiment	O_1	X_1	O_2
Control	O_1	X_2	O_2

Information:

X_1 = learning with problem posing approach
X_2 = learning without problem possing approach
O_1 = Initial test before being given treatment
O_2 = Final Test after being given treatment

Research Time and Place

The research was carried out in the odd semester of 2022/2023 at SDN 5 Bengkulu City. The research was conducted for six months, from June-September 2022.

Research population and sample

The population in this study were all fifth graders of SD Negeri 5 Bengkulu City, as many as 113 students and spread over four classes. The sampling technique used in this study was a purposive sampling technique, namely, paying attention to the student's initial abilities. The class selected as the research sample class was class VB and class VC, with 26 students each. Furthermore, the selection of the experimental class and control class is done by lottery, where the class selected as the experimental class is the VC class, and the VB class is the control class.

Data Collection and Research Instruments

Data collection in this study was done through observation and tests. The data collection instruments used were observation sheets and tests. The test instrument is a problem-solving ability test in the form of a description with 6 questions. Indicators of problem-solving instruments in this study: (a) identify, (b) link and formulate, (c) choose a solution strategy, and (d) interpret the results of the problem. We tested measuring instruments for data collection to ensure the data's validity and select research samples. Theoretical testing is carried out to prove whether the theoretically compiled instrument is valid. Validity analysis using Aiken's V formula (Aiken, 1980) with criteria referring to Azwar's opinion (2015), namely: the validity index in the range V 0.4 is categorized as weak, $0.4 < V < 0.8$ moderate category, and V 0.8 high category. The following are the results of the analysis of the instrument's validity using Aiken's V calculations with a focus on testing aspects of the material, construction, and language.

Table 2. The analysis of the validity Instruments

Quest	Material Aspects		Construction Aspects		Language Aspects	
	V	Criteria	V	Criteria	V	Criteria
1	0,79	Moderate	1,00	High	0,80	High
2	0,77	Moderate	0,95	High	0,79	Moderate
3	0,75	Moderate	0,86	High	0,76	Moderate
4	0,83	High	0,89	High	0,72	Moderate
5	0,96	High	0,92	High	0,82	High
6	0,96	High	0,72	Moderate	0,81	High

Based on the test results in **Table 2**, all questions meet the moderate to high criteria from the material, construction, and language aspects. This means that all questions meet valid criteria.

Data analysis

Statistical analysis was used in this study using descriptive and inferential statistics. Descriptive statistics aim to describe the distribution of research data that includes measures of data concentration, such as mean, median, maximum, minimum, and standard deviation. Inferential analysis was conducted to test the research hypotheses. In conducting the analysis, the data prerequisite tests were first carried out: the normality test using the Shapiro-Wilk test (Cahyo, 2015) and the data homogeneity test using the Fisher test (Sugiyono, 2018). After the data meets the prerequisites, the hypothesis is tested using the independent sample t-test (Winarni, 2011). The criteria for testing the hypothesis, whether the hypothesis is rejected or accepted, can use the results of data analysis based on the value of t-table at a significant level of 5%; if t count > t-table, then Ho is rejected and if t count t-table then Ho is accepted.

3. RESULTS AND DISCUSSION

3.1 Results

Description of Research Results

In this study, the test was used to determine the students' mathematical problem-solving abilities that had been achieved. After learning is given to the experimental class using a problem-posing approach, the control class is the conventional class. After learning is complete, a posttest is provided with problem-solving abilities. The following are the results of the posttest of the experimental class and control class students' problem-solving abilities.

Table 3. Students' problem-solving abilities

Statistic Descriptive	Experiment	Control
Mean	60.56	36.68
Minimum	42.25	20.00
Maximum	80.20	62.20
Standard Deviation	5.47	6.25

Based on these data, it can be seen that the average problem-solving ability of students in the class given posing learning is higher than in the conventional learning class. This shows that the experimental class's ability is descriptively better than the control class. Thus, in terms of the average ability of students, problem-posing models can improve students' problem-solving abilities. In addition to descriptive data, students' mastery of problem-solving aspects is presented, such as the following graph.

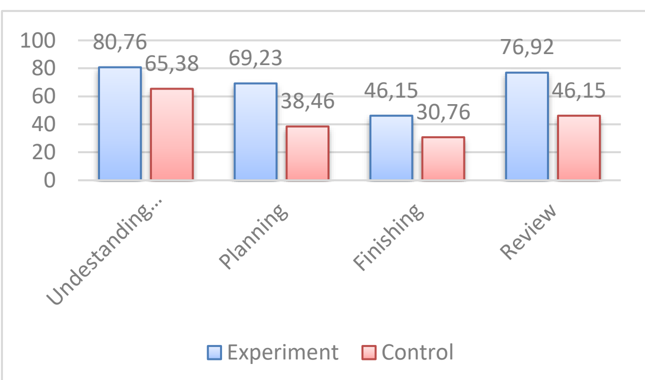

Figure 1. Mastery of student problem-solving on indicators

Figure 1 shows that the problem-solving ability based of the experimental class students is higher than the control class. The percentage of high problem-solving indicators is in understanding and reviewing the problem, reaching 80%.

Statistical test analysis results

The purpose of this study was to analyze the effect of the application of problem-posing learning on students' problem-solving abilities. Before testing the hypothesis, the research data met the prerequisite analysis tests, namely the normality and homogeneity tests. The normality test of the data used the Shapiro-Wilk test with the help of SPSS. The results of the posttest data analysis of the experimental class obtained a significance value of 0.0938 and the control class of 0.081. Based on the normality test criteria, the post-test data on problem-solving abilities in the experimental and control classes with sig. More than alpha (0.05), so it can be concluded that the data meets the normal criteria. Furthermore, the homogeneity test was carried out using Fisher's exact test with homogeneous data if the significance of the results was more than alpha, with = 0.05. The calculation above shows that it is significant with a value of 0.895, so the data is homogeneous. This the sample used in this study is homogeneous. After the prerequisites are met, hypothesis testing is carried out, which aims to analyze whether there is a difference between the average problem-solving ability of students between learning with problem-posing and conventional models.

The analysis uses an independent t-test test with the following hypothesis testing.

$H0$: There is no difference in the average problem-solving ability between students who take part in learning with problem-posing and students who use conventional learning

Ha: There is a difference in the average problem-solving ability between students who take part in learning with problem-posing and students who use conventional learning

The criteria for concluding the independent t-test are 0 is accepted, and a is rejected if the significance level <0.05, meaning that there is no difference in the average problem-solving ability between students who take learning with problem posing and students who use conventional learning. On the other hand, if the significance level > 0.05, 0 is rejected, and a is accepted.Thus there is a difference in the average problem-solving ability between students who take part in learning with problem-posing and students who use conventional learning. The results of hypothesis testing using the independent t-test are summarized as follows:

Table 4. Independent Test Results t-Test

Variable	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig. (2-tailed)
EV assumed	.218	.643	4.33	50	.000
EV not assumed			4.33	36.97	.000

Table 4 shows that the significant value in each group is 0.000, and the t-value is 4.33 because 0.000 <0.05, then 0 is rejected, and a is accepted. Thus, it can be concluded that there is a difference in the average problem-solving ability between students who take part in learning with problem-posing and students who use conventional learning. Based on the t-test analysis, it is concluded that there is an effect of problem-posing learning on students' solving abilities. This study also shows how significant the increase is as an impact of problem-posing learning on problem-solving. The data were analyzed using the N-gain () test by analyzing the pretest and posttest data for the treatment class. The N-gain test criteria refer to the opinion of Lestari and Yudhanegara (2015) with the following criteria: g < 0.29 (low), 0.30 g < 0.69 (medium), and g 0.70 (high). Based on the results of the N-gain analysis, the gain value is 0.72 with high criteria. This result means that the effect of problem-posing learning on problem-solving is a high category. Problem-posing learning can improve students' problem-solving skills.

3.2 Discussion

Based on the comparison of the results of the descriptive analysis and statistical testing of problem-solving ability data in both the experimental class and the control class, it shows that there is an influence on the mathematical problem-solving ability achieved by using a problem-posing learning approach that is higher than the students who receive treatment. The average mathematical problem-solving ability of students taught using the problem-posing learning method is higher than conventional learning. In this study, the material given to the experimental class was the same as the control class, namely the addition and subtraction of fractions. The difference between the two classes is in the treatment given in the learning process. Learning in the treatment class is given treatment using a problem-posing approach where the teacher tends to act as a transmitter of learning material, which bridges students with the material being studied so that the focus of students is to receive information provided by the teacher. Constraints in the application of problem posing in this study are when group structuring, namely distributing answer sheets to make questions or submitting questions and sheets, reading and understanding the material being studied takes a relatively long time.

Based on the results of the analysis carried out, the level of achievement of the problem-solving ability indicators most achieved by students is identifying the elements that are known, asked, and the adequacy of the required elements. Adjusting various strategies suitable for solving problems and making solutions are the indicators that are the least achieved by students. Students' obstacles in solving mathematical problems include applying suitable strategies to solve math problems. In posing learning, students are invited to experience firsthand the problems in learning which are arranged in the form of real activities, where the content in Mathematics learning seeks to be presented in the context of life closely related to students' daily lives. This is in line with Kholifah (2016) research, which shows a significant effect of problem-posing models on students' mathematical problem concept skills in fractional material. The analysis results of student answers based on problem-solving indicators in the experimental class already have a sufficient percentage. In general, students have led to the problem-solving step, for the step of understanding the problem, students have clarified what is known and asked so that students can carry out solutions, and also, students clarify questions to create mathematical models as a step in planning solutions. The results of the analysis of student answers show that the problem-solving step of identifying the problem has reached a percentage (80.76%) has been achieved because students have written down what is known and asked about the problem, then planned a solution with a percentage (69.23%) students have written an example. For variables and writing mathematical models, to do the completion with a percentage (46.15%) of students have completed the problem, while the percentage in the step of checking again with a percentage (76.92%).

These results indicate that students' problem-solving abilities after being given problem-posing learning are in a good category. This is because problem posing is closely related to training problem-solving skills, especially those related to everyday life in Mathematics learning content. As stated by the problem-posing approach, Suryanto in Thobroni (2015: 280) means that the word problem posing is a problem or problem, so proposing a problem is seen as an act of formulating a problem or from a given situation. The results of research conducted by Pisaba (2018) show that an increase in problem-posing can improve the problem-solving abilities of fourth-grade elementary school students. The problem-solving ability of students with problem-posing learning is better than conventional learning (Rasmianti, Raga, & Agustiana, 2013; Saleh, 2011; Djamarah, 2021).

4. CONCLUSION

Based on the research and discussion results, it can be concluded that the use of the problem-posing approach affects problem-solving abilities in mathematics learning for class V SDN 5 Bengkulu City. The problem-posing approach to problem-solving skills in this study contains material for solving mathematical problems related to addition and subtraction of fractions along with examples and is continued by providing practice questions to students. The problem-posing approach to problem-solving skills includes: a) understanding the problem; b) making a problem-solving plan; c) implementing a problem-solving plan, and d) looking back. This study suggests that in applying problem posing, it is necessary to pay attention to time, especially in preparing groups and assignments.

AUTHOR’S CONTRIBUTIONS

The authors discussed the results and contributed to from the start to final manuscript.

CONFLICT OF INTEREST

There are no conflicts of interest declared by the authors.

REFERENCES

Agustin, M., Yensy, N. A., & Rusdi, R. (2017). Upaya meningkatkan aktivitas belajar siswa dengan menerapkan model pembelajaran problem posing tipe pre solution posing di smp negeri 15 kota bengkulu. Jurnal Penelitian Pembelajaran Matematika Sekolah (JP2MS), 1(1), 66-72.

Aiken, L. R. (1980). Content validity and reliability of single items or questionnaires. Educational and psychological measurement, 40(4), 955-959.

Arikunto, S. (2014) Prosedur Penelitian, Suatu Pendekatan Praktik. Jakarta: Rineka Cipta.

Azwar, S. (2015). Reliabilitas dan Validasi. Yogyakarta: Pustaka Pelajar.

Cahyo,A. (2013). Panduan Aplikasi Teori-teori Belajar Mengajar. Jogjakarta: DIVA Press.

Erdik, C. (2019). Investigation of Mathematics Teachers' Opinions about Problem Posing. Journal on Mathematics Education, 10(1), 1-20.

Haji, S. (2011). Pendekatan problem posing dalam pembelajaran matematika di sekolah dasar. TRIADIK, 14(1), 55-63.

Heruman. (2010). Model Pembelajaran Matematika di Sekolah Dasar. Bandung:PT Remaja Rosdakarya.

Hudojo, H. (2005). Pengembangan Kurikulum dan Pembelajaran Matematika. Malang: Universitas Negeri Malang

Kemendikbud. (2014).Peraturan Menteri Pendidikan dan Kebudayaan, Nomor 58, Tahun 2014 tentang Kurikulum 2013 Sekolah Menengah Pertama (SMP)/Madrasah Tsanawiyah (MTs).

Kholifah. (2016). Keefektifan Model Problem Posing terhadap Aktivitas dan Hasil Belajar Materi Pecahan Siswa Kelas IV SD Negeri 01 Wonopringgo Kabupaten Pekalongan. Jurnal Universitas semarang.

Kopparla, M., Bicer, A., Vela, K., Lee, Y., Bevan, D., Kwon, H., ... & Capraro, R. M. (2019). The effects of problem-posing intervention types on elementary students' problem-solving. Educational Studies, 45(6), 708-725.

Lestari dan Yudhanegara. 2015. Penelitian Pendidikan Matematika. Bandung: PT. Refika Aditama.

OECD. (2015).PISA Draft Mathematics Framework, Paris: OECD Publishing.

Pisaba, M. (2018). Peningkatan Kemampuan Pemecahan Masalah melalui Metode Problem Solving pada Mata Pelajaran Matematika Kelas IV SD Negei 2 Bumiharjo Tahun Pelajaran 2017/2018. Jurnal Universitas Diponegoro.

Rasmianti, I., Raga, G., & Agustiana, I. G. T. (2013). Pengaruh metode pembelajaran problem posing terhadap kemampuan pemecahan masalah matematika siswa Kelas IV SD Gugus VI Kecamatan Banjar. MIMBAR PGSD Undiksha, 1(1).

Rusmiyati, S. (2021). Meningkatkan hasil belajar siswa melalui pemberian tugas problem possing secara berkelompok pada materi teorema phytagoras di kelas viii. 4 smp negeri 2 batang hari. Jurnal Education of Batanghari, 4(03), 001-011.

Suarsana, I., Lestari, I. A. P. D., & Mertasari, N. M. S. (2019). The Effect of Online Problem Posing on Students' Problem-Solving Ability in Mathematics. International Journal of Instruction, 12(1), 809-820.

Sugiyono. (2018). Metode Penelitian Pendidikan. Bandung: Alfabeta.

Suryosubroto,B. (2009). Proses Belajar Mengajar Di Sekolah. Jakarta: Rineka Cipta.

Susanta, A., Susanto, AS., Maizora,S., & Rusdi. (2021). Analisis Kemempuan Siswa Smp/Mts Kota Bengkulu Dalam Menyelesaikan Soal Matematika Timss. Jurnal THEOREMS (The Original Research of Mathematics), 5(2),

Thobroni,M. (2015). Belajar dan pembelajaran. Yogyakarta: Ar-Ruzz Media

Ulya, H., & Rahayu, R. (2017). Pembelajaran etnomatematika untuk menurunkan kecemasan matematika. Jurnal Mercumatika: Jurnal Penelitian Matematika Dan Pendidikan Matematika, 2(1), 16-23.

Wijaya,A. (2014). Pendidikan Matematika Realistik. Yogyakarta: Graha Ilmu.

Winarni, E. W. (2021). Teori dan praktik penelitian kuantitatif, kualitatif, PTK, R & D. Bumi Aksara.

Winarni, E.. (2011). Penelitian Pendidikan, Bengkulu: FKIP UNIB.

Zarkasyi, R. (2015). Penelitian Pendidikan Matematika. Bandung: Refika Aditama.