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The Influence of The Problem Posing Learning Model on Students' Mathematical Problem Solving Abilities in One-Variable Linear Materials

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Abstrak

Tujuan utama dari studi ini adalah untuk menyelidiki dampak model pembelajaran problem posing terhadap kemampuan pemecahan masalah matematika siswa kelas tujuh dalam topik persamaan linear satu variabel. Studi ini bertujuan untuk menentukan sejauh mana model pembelajaran problem posing memengaruhi kemampuan pemecahan masalah matematika siswa di SMPN 2 Gading. Selain itu, studi ini bertujuan untuk meneliti aktivitas belajar siswa selama implementasi model pembelajaran problem posing dalam konteks persamaan linear satu variabel, dan untuk mengevaluasi efektivitas implementasi model pembelajaran problem posing untuk siswa kelas tujuh di SMPN 2 Gading. Teknik pengambilan sampel yang digunakan dalam studi ini adalah purposive sampling dengan pendekatan simple random sampling. Pengumpulan data melibatkan pertanyaan esai yang terdiri dari tiga item untuk menilai kemampuan pemecahan masalah matematika siswa. Pertanyaan-pertanyaan ini telah diuji coba untuk validitas, reliabilitas, kekuatan membedakan, dan tingkat kesulitan. Temuan penelitian menunjukkan pengaruh signifikan dari model pembelajaran problem posing terhadap kemampuan pemecahan masalah matematika siswa kelas tujuh di SMPN 2 Gading. Nilai effect size dilaporkan sebesar 4,202, menunjukkan dampak yang substansial. Selain itu, studi mengamati perubahan dalam aktivitas siswa selama proses pembelajaran, dengan peningkatan keterlibatan siswa, terutama selama pertemuan kedua. Implementasi model pembelajaran problem posing untuk siswa kelas tujuh di SMPN 2 Gading dilaporkan berjalan lancar dari pertemuan pertama hingga terakhir.

Abstract

The primary objective of this study is to investigate the impact of the problem posing learning model on the mathematical problem solving abilities of seventh-grade students in the topic of one-variable linear equations. The study aims to determine the extent to which the problem posing learning model influences students' mathematical problem solving abilities at SMPN 2 Gading. Additionally, the study seeks to examine the students' learning activities during the implementation of the problem posing learning model in the context of one-variable linear equations, and to evaluate the effectiveness of implementing the problem posing learning model for seventh-grade students at SMPN 2 Gading. The sampling technique employed in this study is purposive sampling with a simple random sampling approach. The data collection involves essay questions comprising three items to assess students' mathematical problem solving abilities. These questions were pre-tested for validity, reliability, distinguishing power, and level of difficulty. The findings of the research indicate a significant influence of the problem posing learning model on the mathematical problem solving abilities of seventh-grade students at SMPN 2 Gading. The effect size value is reported to be 4.202, indicating a substantial impact. Moreover, the study observes a change in student activities during the learning process, with an increase in student engagement, particularly during the second meeting. The implementation of the problem posing learning model for seventh-grade students at SMPN 2 Gading is reported to have proceeded smoothly from the first to the last meeting.

INTRODUCTION

Mathematics is one of the fields of study taught in schools, elementary schools, middle schools and high schools. Here we can see how important mathematics is in the world of education because mathematics is a tool in developing students' thinking. According to Mytra mathematics is a discipline of thought and logical processing procedures, both quantitatively and qualitatively (Mytra et al., 2023). In line with that, Cornelius Puspita states five reasons for the need to study mathematics because mathematics is (1) a means of clear and logical thinking, (2) a means of solving problems in everyday life, (3) a means of recognizing relationship patterns and

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generalization of experience, (4) a means to develop creativity, and (5) a means to increase awareness of cultural developments. Therefore, mathematics is important knowledge to be taught in schools (Puspita & Amalia, 2020).

Likewise, the expected goals in learning mathematics according to the National Council of Teachers of Mathematics are 5 (five) basic abilities that students must master, namely problem solving abilities, reasoning and evidence, connections, communication and representation. This process is carried out so that students can understand concepts, fluent in procedures and problem solving (Sintawati et al., 2020). From this explanation, according Santika, there is something special, namely problem solving ability is not only limited to the results or abilities that are expected to appear in students, but also the process that must be in place if students are expected to be skilled at solving problems (Santika et al., 2020). So it can be concluded that in learning Students must be trained and accustomed to solving a problem through certain stages.

Problem solving is a strategic competency in the form of application of concepts and skills in understanding, choosing solving strategies, and resolving problems, while mathematical problem solving ability is a student's ability to solve or find answers to questions contained in stories, texts, and assignments. assignments in mathematics lessons. Meanwhile, according to La'ia & Harefa problem solving abilities are an important part of the mathematics curriculum, because in the learning and solving process students can gain knowledge and use the knowledge they already have to be used in problem solving (La'ia & Harefa, 2021). The ability to solve problems is the main goal among several mathematics learning objectives. According to Rambe, the steps for solving mathematical problems are understanding the problem, determining a problem solving strategy plan, resolving the problem, and checking the answer again (Rambe & Afri, 2020). Through these steps, it is hoped that students can solve the mathematical problems they face.

However, in reality, in the field, students still have difficulty solving questions related to problem solving. This can be seen from the results of research conducted by Fatmala who also found a problem regarding students' mathematical problem solving abilities, where on average students experienced difficulty when working on questions presented in the form of story questions, where some students were unable to change the sentence of the problem (Fatmala et al., 2020). Into the form of mathematical symbols and some students are less able to understand the components of the questions if given in the form of story questions. Based on Sagita research results, it is known that students' problem solving abilities are in the low category (Sagita et al., 2023). This can be seen from the number of students who have problem solving abilities in the low category of more than 50%. Only 11.77% of students have problem solving abilities in the high category, 35.29% of students have moderate problem solving abilities and 59.24% of students have low and very low problem solving abilities.

The low ability of students to solve mathematical problems is also experienced by students at Singkawang State Middle School 4 where there are still many students who make mistakes when working on mathematics problems. Students have not been able to relate to the problem solving problem, which they have studied previously in the material on linear equations in one variable. It is evident from the results of an interview with one of the mathematics study teachers at SMP Negeri 2 Gading, that there are still many students who do not understand when faced with story problems related to mathematical problem solving abilities and even though in the learning process in class the teacher has used several methods such as: lecture methods and assignments containing questions as an effort to improve students' mathematical problem solving abilities in teaching. However, this does not have a good effect on students' mathematical problem solving abilities with an average of 60% whose scores have not reached the KKM.

The low problem solving ability is also strengthened by the results of research conducted by the author at Singkawang 4 State Middle School by providing related questions. With indicators mathematical problem solving abilities, namely: (1) understanding the problem; (2) developing a problem resolution plan (3) resolve the problem according to plan; (4) check again. The questions were given to 32 students and the results were that the students' mathematical problem solving abilities were still low. From the preliminary research results, it can be concluded that mathematical problem solving abilities are still relatively low. The low ability of students to solve

problems is caused by a lack of student understanding understand what problems are known and asked, develop a plan to solve the problem or develop a mathematical model, solve the problem according to plan and re-examine the results of solving the problem or conclude from the results of the solution.

Apart from conducting pre-research, researchers also conducted observations in the classroom to see student activities during the mathematics learning process. The results of observations obtained by the author at SMP Negeri 2 Gading, student learning activity is still relatively low. The low level of student activity can be seen from the lack of students asking questions about material that they do not understand and students' responses when asked questions related to the subject matter tend to be passive, apart from that, when doing practice questions, students tend to follow the steps used by the teacher, students are also not enthusiastic. in learning and quickly get bored in learning mathematics. Activities are important in the mathematics learning process, so that students can understand mathematics by interacting with friends and teachers. This indicates that the lack of active role of students when participating in the ongoing learning process has an impact on students not understanding the material which causes students' grades also to be low and not meeting the minimum completeness criteria, namely 70 marks which are not as expected.

The material on linear equations with one variable is one of the materials that junior high school students in class VII will study in the odd semester, where the learning process tends to take place in one direction, namely from teacher to student, as is the case at Singkawang 4 Public Middle School. Based on the results of the author's interview with the mathematics teacher at SMP Negeri 2 Gading on September 14 2019, it was stated that in the sub-discussion of mathematical models and determining equations in word problems there were questions related to mathematical problem solving abilities but students tended to have difficulties in solving the questions. This statement was agreed by several students who had studied it that in the learning process this material seemed easy to understand, but when the teacher gave questions in the form of problem solving, students have difficulty solving it.

Realizing the low ability of students in solving problems involving linear equations with one variable, it is necessary to use the Problem Posing learning model where there is a link between the problem posing learning model and problem solving abilities. Continuous application of problem posing can develop optimal problem solving abilities. Therefore, the problem posing learning model can be used as an alternative to develop students' mathematical problem solving abilities.

According to Rahmatiya the ability to ask questions or create questions can influence students' ability to solve problems (Rahmatiya & Miatun, 2020). This method is known as problem posing. The background to the question or problem can be based on a broad topic, questions that have been worked on or specific information given by the teacher to students. When students create questions, students are required to understand the questions well. This is the first stage in problem solving, considering that the questions created by students must also be solved, students will try to plan a solution strategy, carry out the planned strategy to get a solution, and re-examine the solution of the solution obtained to get the right results. Therefore, problem posing can be an alternative for developing students' mathematical thinking patterns.

Based on this description, Problem Posing is a learning model that requires students to compose their questions or break down a problem into simpler questions that refer to solving the problem. The steps in the Problem Posing Model according Harefa are as follows: 1) The teacher explains the lesson material to students using props to facilitate students in asking questions, 2) Students are asked to ask questions in groups, 3) Students Exchange the questions that have been asked, and 4) Then answer the questions in groups (Harefa, 2020). Based on the background of the problem above, researchers are interested in conducting research with the title "The Influence of the Problem Posing Learning Model on Students' Mathematical Problem Solving Ability in One Variable Linear Equations Material for Class VII Middle School."

METHOD

This research method is an experimental research method using the Nonequivalent Posttest-Only Control Group Design design. The population in this study was class VII students at SMP Negeri 2 Gading consisting of class VIIA and class VIIB totaling 60 people. Meanwhile, the sample in this study was class VIIA students as an experimental class using the Problem Posing learning model and class VIIB as a control class using a direct learning model. The data collection technique referred to in this research is by giving tests, namely the final test (post-test), activity observation sheets, observation of the implementation of the Problem Posing learning model and documentation. Data collection instruments in this research were mathematical problem solving ability test questions, activity observation sheets, implementation sheets and documentation. The data collection instrument in the form of a test is first tested for validity, reliability, distinguishing power and level of difficulty. The results of validity calculations can be seen in Table 1.

Table 1. Calculation test questions

Instrument	Number	r_{xy}	Interpretation
Posttest	1	2.1472	Very High
	2	2.0572	Very Tall
	3	2.1421	Very Tall

Based on the results of the test calculations, it was found that the reliability was 0.791 with high criteria. The results of the calculation of differentiating power can be seen in Table 2.

Table 2. Calculation of test differential power tryquestion

Instrument	Number	$D.P$	Interpretation
	1	0.37	Enough
Posttest	2	0.23	Enough
		0.22	Enough

Meanwhile, the level of difficulty of the test questions tested in terms of difficulty and calculation results can be seen in Table 3.

Table 3. Calculation of difficulty level test try the question

Instrument	Number	*IK*	Interpretation
	1	0.656	Currently
Posttest	2	0.683	Currently
	3	0.714	Currently

RESULTS AND DISCUSSION

From the results of data collection during the research, student test results were obtained, namely post-test data from classes taught using the Problem Posing model (experimental class) and classes taught using the direct learning model (control class). Next, the data obtained will be tested for normality and homogeneity analysis of post-test data for the experimental class and control class. To test the normality of post-test data in this study, the chi-square test was used. The results of the normality test analysis for post-test data on the mathematical problem solving abilities of experimental class and control class students can be seen in Table 4 as follows:

Table 4. Calculation of difficulty level test try the question

Class	Mark x^2 *hitung*	Mark x^2 *tabel*	Information
Experiment 1	1,099	7,815	Distribute normal
Control	-24.5	7,815	Distribute

So the data in the experimental group and control group comes from a normally distributed population. After the posttest data for the experimental class and control class were

calculated and found to be normally distributed, the next step was to test the homogeneity of the two data using Fisher's test. This is done to find out whether the two classes have homogeneous variance or not. The complete data can be seen in Table 5 below:

Table 5. Calculator of data homogeneity test

Information	Class Experiment	Class Control
Variance	45.6655	136.6161
F_{count}	2.9917	
F_{table}	3.36	

The test criterion is that H0 is accepted if Fcount < Ftable. Based on Table 5, it can be seen that the experimental class variance is 45.6655 and the control class variance is 136.6161 so that Fcount is 2.9917 and Ftable is 3.36. It is known that 2.9917 < 3.36 means it can be concluded that the variance of the post-test data for both classes is homogeneous.

After testing the normality and homogeneity of the data. Then the next posttest data analysis test will be carried out for the first sub-problem. The test used was the independent two-sample t-test. Complete data can be seen in Table 6 below:

Table 6. T-two sample test calculations independent

Information	$\sum X_1$	$\sum X_2$	$\bar{X}_1$	$\bar{X}_2$	S_1^2	S_2^2
Score	53	1473	88	49	35,64	136,66
t_{count}			16,277			
t_{table}			1,673			

Based on Table 6 above, it can be seen that tcount is 16.277 and ttable 1.673. Because 16.277 > 1.673, Ha is accepted. This means that there are differences in students' mathematical problem solving abilities between the experimental class and the control class. Next, an analysis of the influence of the Problem Posing learning model on students' mathematical problem solving abilities was carried out. This was done to find out how much influence the Problem Posing learning model has on mathematical problem solving abilities. The results of the Effect Size calculation can be seen in Table 7 as follows.

Table 7. Calculation effect size

Information	Class Experiment	Class Control
elementary school	5.97	11.97
***Effect Size* (ICE)**	**4,202**	
Criteria	**Tall**	

Based on the Effect Size calculation in Table 7 above, the Effect Size value obtained is 4.202. Based on the Effect Size criteria that have been explained, ES = 4.202 is in the ES > 0.8 criteria, which means the criteria are classified as high. This can be concluded, namely that there is an influence of the problem posing learning model on students' mathematical problem solving abilities.

Based on that at the first meeting for the Visual Activities category, the average percentage obtained from the three observers in the experimental class was 62%, in the control class it was 42%. For the Oral Activities category, the average percentage obtained from the three observers in the class in the experiment, it was 44%, in the control class it was 35%. For the Listening Activities category, the average percentage obtained from the three observers in the experimental class was 87%, in the control class it was 78%. For the Mental Activities category, the average percentage obtained from the three observers in the experimental class was 64%, in the control class it was 63%. For the Writing Activities category, the average percentage obtained from the three observers in the experimental class was 34%, in the control class it was 32%. So, the overall

average of the five categories of student learning activities obtained by the experimental class was 56.3% and the control class was 45.7%.

Meanwhile, at the second meeting for the Visual Activities category, the average percentage obtained from the three observers in the experimental class was 74%, in the control class it was 57%. For the Oral Activities category, the average percentage obtained from the three observers in the experimental class was 77%, in the control class it was 61%. For the Listening Activities category, the average percentage obtained from the three observers in the experimental class was 86%, in the control class it was 74%. For the Mental Activities category, the average percentage obtained from the three observers in the experimental class was 93%, in the control class it was 60%. For the writing Activities category, the average percentage obtained from the three observers in the experimental class was 62%, in the control class it was 42%. So, the overall average of the five categories of student learning activities obtained by the experimental class was 78.3% and the control class was 57%. Namely 78.3% and the control class 57%. The recapitulation of data from observations of student learning activities as a whole can be presented in Table 8 below.

Table 8. Calculation of activity observations study students as a whole

Information	Class Experiment	Control Class
Meeting 1	56.3%	45.7%
Meeting 2	78.3%	57%.
Average whole	**67.3%**	**51.35%**
Criteria	**Active**	**Quite Active**

Based on Table 8 above, it can be seen that the overall average percentage in the experimental class is 67.3% with active criteria and the control class is 51.35% with moderately active criteria. Because the percentage of student learning activities in the experimental class is active, it can be concluded that student activity during the learning process using the problem posing learning model shows that the number of students in each activity increased from the first meeting to the second meeting and obtained an average of 67.3% with active criteria. The factor that influences high student learning activity is the Problem Posing learning model which emphasizes maximum student activity to search for and discover mathematical ideas with their knowledge.

Based on Table Observation The implementation of the Problem Posing model is used to determine the implementation of the Problem Posing model which has been carried out as many times as possible 2 meetings. To observe the implementation of the Problem Posing model, the researcher provided an observation sheet and asked 2 people to act as observers. The results of calculating the average percentage of implementation of the Problem Posing learning model can be seen in table 9 as follows:

Table 9. Model implementation results problemposting

Information	Class Experiment	Control Class
Meeting 1	90.4%	60%
Meeting 2	90.9%	63.18%.
Overall average	**90.65%**	**61.59%**
Criteria	**Very good**	**Good**

So, the overall average of the five categories of student learning activities at the first meeting of the experimental class was 56.3% and 45.7% for the control class. and the overall average of the five categories of student learning activities at the second meeting was obtained by the experimental class

From table 9 above, the average can be seen whole percentage on class the experimental class was 90.65% with very good criteria and the control class was 61.59% with good criteria. Because the average percentage of implementation of the problem posing learning model in the experimental class is very good, it can be concluded that the implementation of learning through

the Problem Posing Learning Model for class VII students at SMPN 2 Gading from the first to the last meeting went well and an average of 90.65 was obtained. % with very good criteria.

The results of research conducted using the problem posing model in one-variable linear equation material in class VII A show that the problem posing model has a significant influence on students' mathematical problem solving abilities. This can be seen from the results of tests on students' mathematical problem solving abilities which were implemented using the problem posing model which are different from the results of tests on students' mathematical problem solving abilities which were implemented using the direct learning model. We can see the difference in the results of the mathematical problem solving ability test from the calculation of post-test data with four indicators of students' mathematical problem solving ability which was carried out using a two independent sample t-test, where the count value was greater than the table.

The value obtained for count is greater than table because the learning process which is carried out using the problem posing model in the development step requires students to be active in the learning process, where students are guided and given the freedom to collect new, relevant information from books or other sources that can help. students in studying the material so that it makes students active in independent learning to solve problems given by the teacher. Apart from the development step, it also requires students to be active, where students are asked to work together in groups to solve problems given by the teacher with new information or new knowledge that has been received in the development step, and students are asked to explain to other students the results of their group discussions, where can make students motivated to be the best than other students in the field explain the results of group discussions regarding problems given by the teacher, so that students can become enthusiastic in participating in class learning.

After carrying out the t-test calculation for two independent samples, the Effect Size calculation was then carried out, and the Effect Size value was obtained which was in the High criteria category. From the results of the Effect Size calculation, it shows that learning using the problem posing model has a positive influence on students' mathematical problem solving abilities. So it can be concluded that the problem posing model has a big influence on students' mathematical problem solving abilities.

From the calculation of the t-test for two independent samples and the Effect Size, it shows that the problem posing learning model has a good influence on students' mathematical problem solving abilities in the material of linear equations with one variable. This can be seen from the change in students' better mathematical problem solving abilities after implementing the problem posing model. Learning using the problem posing model provides direct opportunities for students to be involved in the learning process, and where students better understand meaningful learning. This is because the process of problem posing learning starting from the Preparation, Introduction, development, implementation and Closing stages invites students to participate actively in ongoing learning activities. Learning using the problem posing model provides students with the opportunity to be directly involved in the learning process. So that student behavior in the learning process becomes better. This behavior change also has a good influence on student learning outcomes, where students' mathematical problem solving abilities are better after implementing the problem posing learning model.

The success of this research is in line with research conducted by Sari, the learning results in using the problem posing model on students' mathematical problem solving abilities on the subject matter of fractions in class VII-5 (Post-Test) were obtained with a result of 74.37, linked to classification of solving ability assessment Students' mathematical problems on the main topic of fractions are in the "Good" category (Sari & Prihatnani, 2021). This gives the use of the problem posing model a positive influence on students' mathematical problem solving abilities in class VII SMP Negeri 3 South Angkola. Apart from Sari, Siti Nurasih's research is also in line with this research. Nurasih shows that student learning outcomes in the mathematical problem solving ability of students at SMP Negeri 1 Prambon class VIII on the subject of algebraic operations with the application of the pre solution posing type of problem posing learning model during two meetings have increased (Nurasih, 2017). At the first meeting the mathematical problem solving

ability students reached 86% and at the second meeting reached 89%, thus the mathematical problem solving ability of students from two meetings increased by 3%, in other words the mathematical problem solving ability of students at SMP Negeri 1 Prambon class VIII after implementing the pre type problem posing learning model solution posing during two meetings became better. From this description, it can be concluded that the research hypothesis is acceptable, namely that there is an influence of the problem posing learning model on students' mathematical problem solving abilities in class VII SMP Negeri 2 Gading.

This shows that student activity data is data obtained from the results of student observation sheets during learning using the problem posing learning model from the beginning of learning to the end of learning. Based on the results of observations of learning activities carried out by the three observers during 2 meetings, the average percentage of the overall results of observations of student learning activities in the experimental class was 67.3% and in the control class was 51.35%. Based on the criteria for student learning activities as explained in Chapter III, the experimental class is included in the active criteria and the control class is included in the moderately active criteria. There is a significant difference in overall percentage results between the experimental class and the control class. The experimental class showed that there were learning activities using the Problem Posing learning model, while the control class was quite active in learning. Factors that Highly influencing student learning activity is the Problem Posing learning model which emphasizes maximum student activity to search and discover with their knowledge.

Based on the results of observation the implementation of the Problem posing learning model, in general researchers have implemented it series activity learning using the problem posing learning model on algebraic material well in class VII SMPN 2 Gading. This is evident from the results of calculating the implementation of the Problem Posing learning model for 22 learning activities which were observed that the results of calculating the average percentage of implementation at meeting I were in the very good criteria, meaning the learning model was implemented well, while the results of calculating the second meeting were in the very good criteria, meaning The problem posing learning model was implemented very well too.

Judging from the average percentage between meeting I and meeting II there was an increase of 0.5%. This can increase the score of learning activities, namely; 1) at the preparation stage the teacher asks how students are doing and asks how absent students are doing; 2) the teacher arranges students' seats in groups; 3) the teacher conveys the learning objectives; 4) in the preliminary stage the teacher provides apperception; 5) the teacher provides motivation or stimulation for students to focus their minds; 6) at the development stage the teacher distributes teaching materials (LKS); 7) the teacher explores students' initial understanding and knowledge through distributed worksheets; 8) at the implementation stage, the teacher asks each group to work on questions on the LKS and present them to the class; 9) at the closing stage, the teacher directs students to ask questions about material they have not yet understood.

At meeting II the average percentage increased compared to meeting I, this was because the researcher had evaluated the shortcomings of learning activities at meeting I and meeting II by carrying out all activities by the learning implementation plan that had been made. In this way, students can better understand learning and find solutions to problems given independently through group learning and seek new information through the media or other sources with teacher guidance and learning can be carried out well. From this statement it can be interpreted that it is implemented well so that it can improve student learning outcomes.

CONCLUSION

Based on the results of research data processing carried out in general, it can be concluded that there is an influence of the problem posing learning model on students' mathematical problem solving abilities. In particular, several things can be concluded as follows. There is an influence of the problem posing learning model on students' mathematical problem solving abilities in class VII SMP Negeri 2 Gading. The problem posing learning model has a big influence on students' mathematical problem solving abilities in class VII SMP Negeri 2 Gading with an effect size value of 4.202. Student activities during the learning process using the problem posing

learning model showed that the number of students in each activity increased from the first meeting to the second meeting and obtained an average of 67.3% with active criteria. The implementation of learning through the Problem Posing Learning Model for class VII students at SMPN 2 Gading from the first to the last meeting went well and obtained an average of 90.65% with very good criteria.

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