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MATHEMATICAL PROBLEM SOLVING ABILITY OF STUDENTS AND STUDENT RESPONSES IN THE GUIDED DISCOVERY LEARNING (GDL) LEARNING MODEL

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ABSTRAK

Kemapuan pemecahan masalah merupakan salah satu kemampuan yang perlu dimiliki oleh siswa. Namun pada kenyataannya kemampuan pemecahan masalah matematika siswa masih rendah. Salah satu solusi untuk meningkatkan kemampuan pemecahan masalah matematika adalah dengan menerapkan model pembelajaran GDL. Adapun tujuan dari penelitian ini adal untuk mengetahu peningkatan kemampuan pemecahan masalah matematis siswa pada pembelajaran GDL dan respon siswa terhadap pembelajaran matematika dengan model GDL. Metode yang digunakan dalam penelitian ini adalah metode kuasi eksperimen dengan desain nonequivalent pretest-posttest control group design. Berdasarkan hasil pengolahan data gain ternormalisasi dengan menggunakan uji-t pada taraf signifikansi 5% diperoleh terdapat perbedaan yang signifikan pada peningkatan kemampuan pemecahan masalah matematis antara siswa yang memperoleh pembelajaran dengan menggunakan model GDL dengan siswa yang memperoleh pembelajaran dengan konvensional. Adapun dengan melihat nilai rata-rata indeks gain ternormalisasi, siswa yang memperoleh pembelajaran dengan GDL lebih besar peningkatannya dibandingkan dengan siswa yang memperoleh pembelajaran konvensional. Selain itu, respon siswa terhadap pembelajaran matematika dengan model GDL juga sangat positif.

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ABSTRACT

Problem solving ability is one of the abilities that students need to have. However, in reality students' mathematical problem solving abilities are still low. One solution to improve mathematical problem solving abilities is to apply the GDL learning model. The aim of this research is to determine the increase in students' mathematical problem solving abilities in GDL learning and students' responses to mathematics learning using the GDL model. The method used in this research is a quasi-experimental method with a nonequivalent pretest-posttest control group design. Based on the results of normalized gain data processing using the t-test at a significance level of 5%, it was found that there was a significant difference in the increase in mathematical problem solving abilities between students who received learning using the GDL model and students who received conventional learning. Meanwhile, by looking at the average value of the normalized gain index, students who receive learning with GDL have greater improvements compared to students who receive conventional learning. Apart from that, students' responses to mathematics learning using the GDL model are also very positive.

Kata Kunci: Kemampuan pemecahan masalah, Model *Guided Discovery Learning*, respon siswa

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INTRODUCTION

Education has an important role to develop human abilities. These abilities can be used to sustain life and help promote prosperity in the face of the rapid development of science and

technology. Therefore, education plays a role in realizing the development of the nation and state. This is in line with the functions and objectives of education listed in Law of the Republic of Indonesia Number 20 of 2003 concerning the National Education System Chapter II Article 3, namely: "National education functions to develop the ability and shape the character and civilization of a dignified nation in order to educate the nation, aims to develop the potential of students to become human beings who believe and fear God Almighty, have noble character, healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens"

Education has strategic values for human survival, so it can be a capital in improving human resources in the long term. Some government efforts made to improve the quality of education include curriculum updates, teacher competency development, procurement of educational facilities and infrastructure, and development of learning models.

Mathematics is one part of the educational curriculum that has an important role in improving human resources in Indonesia. This is in line with the opinion of Kusnandar & Yusuf (2023) which states that mathematics is one of the most important subjects and is always related to everyday life, where every activity carried out by humans is always related to mathematics. Therefore, mathematics is one of the subjects that is considered to play an important role, so the purpose of learning mathematics in schools is to develop mathematical abilities in students. Furthermore, James and James (Hasanah, 2010) states that, "Mathematics is one of the subjects that is one of the systems in training students' reasoning, and through learning mathematics is expected to improve abilities, develop skills and their application. Moreover, mathematics is a means of thinking in determining and developing science and technology, even mathematics is a logical, systematic and consistent approach of thinking". Learning mathematics with a deep and meaningful understanding will bring students to feel the benefits of mathematics in everyday life. The arrangement of materials is certainly interrelated, making it easier to learn from one concept to another.

The process of learning mathematics not only develops the ability to understand concepts or procedures, but there are other things that arise after learning it. Problems in human life always exist, so problem-solving activities can be said to be basic human activities. Problem solving is one of the first steps for students to encourage ideas in building new knowledge and improving mathematical skills. Lester (Achsin, 2016) states that, "Problem solving is the heart of mathematics".

Problem-solving ability is one of the abilities that students need to learn (Agustami, Aprida &; Pramita, 2021). This is necessary because if students do not have problem-solving skills it will be difficult for them to solve problems. Therefore, problem-solving skills are one of the important goals in mathematics education. As stated by Haeti & Putra (2022), Damayanti & Kartini (2022), Nugroho & Dwijayanti (2019) which states that mathematical problem solving skills are one of the mathematical abilities that students need to have and are important to develop. According to (Allo, Sudia, Kadir, & Hasnawati, 2019) students' mathematical problem solving ability is students' ability when solving difficulties encountered to solve a problem in work or problems by mathematical means. More specifically, Haeti & Putra (2022) define mathematical problem solving ability as a person's ability to use the knowledge, understanding, and skills he has to find solutions to mathematical problems that are not routine,

for which there is no direct procedure in how to solve them, so gradual steps are needed in achieving the expected goals. In Law of Republic of Indonesia Number 22 of 2016 concerning Primary and Secondary Education Process Standards, one of the objectives of mathematics learning is to solve mathematical problems consisting of the ability to understand problems, form solving models, solve models, and determine the right solution (Sofyan, Sumarni, &; Riyadi, 2021).

Based on interviews with class VIII mathematics teachers at SMP Negeri 4 Sumedang, there was information obtained that after the Covid-19 pandemic, students' mathematical problem-solving skills were decreased. This condition also occurs in elementary, junior high, and high school/MA schools in other regions (Ili & Jusmaningsih, 2022; Agustami, Aprida &; Pramita, 2021; Apriadi, Elinda, &; Harahap, 2021). The low problem-solving ability can be seen from student learning outcomes which show most students cannot solve non-routine problem solving problems. Moreover, when solving math problems students often use formulas or quick ways that exist without understanding the concept of using procedural steps to solve problems.

Based on the above problems, students' mathematical problem solving ability, that is still low, requires an innovative learning model so that it can develop these abilities. One of the innovative learning models is the discovery learning model. The discovery learning model is one of the learning models suggested by the 2013 Curriculum (Septianingsih, Bharata & Gunowibowo, 2018). In implementing the discovery learning strategy, you can use various appropriate learning methods. Learning methods that are part of the discovery learning strategy include the guided discovery method, free discovery and modified free discovery (Wibowo, 2019). Guided Discovery Learning (GDL) model is a learning model that involves students to actively participate in trying to find their own expected information and knowledge with guidance and direction from teachers. The Guided Discovery Learning (GDL) model is considered to be one of the learning models that can improve students' mathematical problem solving abilities (Wibowo, 2019). Through the Guided Discovery Learning (GDL) learning model, students are given direction from starting to find something, formulate, to draw conclusions.

Apart from mathematical problem solving abilities, students' responses to learning also need to be considered. Mardianto, Azis & Amelia (2022) stated that students' responses to mathematics learning were not good (negative). During the transition period from online learning during the Covid-19 pandemic, students also returned to face-to-face learning. Students' response to online learning is quite good because the learning process is more flexible and does not take up a lot of time (Padli and Rusdi, 2020). However, Purniawan and Sumarni (2020) stated that online learning gave rise to several polemics in learning activities, because there were students who had positive responses to online learning, but there were also students who had poor responses to learning. Therefore, it is necessary to conduct research regarding the influence of the GDL learning model on increasing mathematical problem solving abilities and how students respond to the mathematics learning model with GDL.

RESEARCH METHOD

The method used in this research is quasi-experimental because there is a causal relationship between the treatment carried out on the independent variable, namely the

application of the Guided Discovery Learning (GDL) model and the results shown in the dependent variable, namely an increase in mathematical problem solving ability. The research design used is nonequivalent pretest-posttest control group design as follows.

O	X	O
O		O

Explanation:

O = initial test (pre-test)/final test (post-test)

X = treatment for experimental class using the Guided Discovery Learning (GDL) model

The population of this research is class VIII students of SMP Negeri 4 Sumedang for the 2022/2023 academic year. The sample taken consisted of two classes, namely the experimental class whose learning used the Guided Discovery Learning (GDL) model and the control class whose learning used conventional models. The sampling technique is carried out by purposive sampling. Purposive Sampling is determining samples with certain considerations. In this study, the researcher chose classes based on the school's considerations. Where the class chosen is a class where the students' mathematical abilities are the same.

In this study both sample class were given test instruments and non-test instruments were used for the experimental class. The test instruments used are tests of mathematical problem solving abilities, namely the initial test (pre-test) and the final test (post-test). Before the treatment is given, an initial test is first given to measure the students' initial ability. After getting treatment, a final test was carried out to see the improvement of students' abilities. The experimental class was given a non-test instrument, namely a questionnaire consisting of 20 statements to determine the extent of student responses to the Guided Discovery Learning (GDL) learning model.

The analysis was carried out on two class samples, such as data on students' mathematical problem solving ability test results given in the form of initial tests and final tests, so that normalized gains and questionnaire results data were obtained. Based on the normalized gain data obtained, a data normality test is carried out to determine the distribution of the data, whether it comes from a population that is normally distributed or not. If after testing the two groups are normally distributed, then it would be proceed with the homogeneity test to find out the data has the same variance or not. After the research data is known to be normally distributed and has homogeneous variance, the t test can be used. If the data is normally distributed but the variance is not homogeneous, then it would be proceed with the t test. The t test is intended to determine whether or not there is a difference in improvement using the Guided Discovery Learning (GDL) model with conventional learning models. Meanwhile, the questionnaire data was analyzed using the Likert scale to determine students' attitudes towards mathematics learning using the Guided Discovery Learning (GDL) learning model.

FINDINGS AND DISCUSSION

Findings

This research data is in the form of mathematical problem solving ability test results and student attitude questionnaires. After the initial test and final test, researchers conducted data analysis to determine students' mathematical problem solving abilities after being given

different treatment, while questionnaire data was analyzed to determine students' attitudes towards the application of the Guided Discovery Learning (GDL) model.

Normality Test

The normality test is performed using the Liliefors test to find out whether the data comes from a normally distributed or non-normally distributed population. The calculation results of the Liliefors test of normalized gain data are, as follows.

H_o : The sample comes from a normally distributed population.

H_a : The sample comes from a population not normally distributed.

Table 1. Normality Test Results of Normalized Gain Data (α = 5%)

Class	N	L_{count}	$L_{critical}$	Description
Experimental	33	0,1460	0,1542	H_o is accepted
Control	33	0,0757	0,1542	H_o is accepted

Based on Table 1, it can be seen that the normality test results in the experimental class and the control class have $L_{count}<L_{critical}$ values, hence H_0 is accepted. This means that it can be concluded that the The gains index for the experimental class and control class is normally distributed. Since the two classes are normally distributed, the next calculation is the homogeneity test of the two variances.

Homogeneity Test of Two Variances

The homogeneity test is carried out to find out whether the data has the same variance or not. The hypothesis used is as follows.

$H_o : v_1 = v_2$; both variances are homogeneous.

$H_a : v_1 \neq v_2$; both variances are not homogeneous.

The results of the homogeneity test calculation of the two variances of the experimental class and the control class can be seen in Table 2.

Table 2. The Results of Homogeneity Test of Two Variances (α = 5%)

Class	Variances	F_{count}	F_{table}	Description
Experimental	0,0559	1,5944	1,81	H_o is accepted
Control	0,0351			

Based on the table above, it can be seen that the value of $F_{count}<F_{table}$, then H_o is accepted. Therefore, it can be concluded that the variances of both classes are homogeneous. The gain data is normalized in the experimental class and the control class is normally distributed and has homogeneous variance, so the next test step is to use the t test.

t test

The t test was carried out to determine whether there was a significant difference in the increase in students' mathematical problem solving abilities between experimental and control class students.

$H_o : \mu_A = \mu_B$ there is no difference in improving mathematical problem solving skills between students whose learning uses the GDL model and conventional learning.

$H_a : \mu_A \neq \mu_B$ Significant difference in improving mathematical problem solving skills between students whose learning uses the GDL model and conventional learning.

The results of the t test calculation can be seen in Table 3.

Table 3. *The Results of the t test* (α = 5%)

Class	Average	t_{count}	t_{table}	Description
Experimental	0,7237	2,7657	1,9977	H_o is rejected

From the table above, it can be seen that the t_{count} value is 2.7657 and the t_{table} is 1.9989, where the t_{count} is outside the Ho reception area, then H_o is rejected. It means that the significant difference in the increase in students' mathematical problem solving abilities between experimental and control class students. To see which one is better, you can look at the average gains index. Where the average gain index in the experimental class (0.7237) is greater than the average gain index in the control class (0.5785). This means that the increase in mathematical problem solving abilities of students who receive learning using the GDL model is better than students who receive learning using the conventional learning model.

Apart from knowing how to increase problem solving abilities, this research also aims to see students' responses to mathematics learning using the GDL model. To find out student responses, data was collected through a questionnaire. The results of the questionnaire processing can be seen in Table 4.

Tabel 4. Results of Student Response Questionnaire Analysis of the GDL Learning Model

Class	n	Average Number of Student Scores (x)	Mean(Xts)	Category
Eksperimen	33	103,25	3,13	Sangat Positif

From Table 4 it can be seen that the total average result is 3.13, so these results are in the interval ≥3.00 which is included in the very positive category. So it can be concluded that students' responses are positive towards learning mathematics using the Guided Discovery Learning (GDL) model.

Discussion

This research was carried out in experimental class and control class with many meetings in each class, which is five meetings. Before the class starts, the experimental class and the control class carry out an initial test first to determine the initial ability of students before being given the treatment of the Guided Discovery Learning (GDL) model and conventional learning models on the subject of building a flat side room. From the preliminary test results of the

experimental class and the control class, it is known that the initial abilities of the two classes are not significantly different.

After the subject matter in the class has been completed, both classes carry out a final test to determine the students' mathematical problem solving ability after being given treatment. Based on the results of data analysis, the results showed that there was a significant difference in the increase in mathematical problem solving abilities between students who received learning with GDL compared to students who received learning with conventional learning models. Where the average gain index in the experimental class (0.7237) is greater than the average gain index in the control class (0.5785). This means that the increase in mathematical problem solving abilities of students who receive learning using the GDL model is better than students who receive learning using the conventional learning model. The results of this study are in line with the results of research from Putri & Nugraheni (2022) which shows that there is an increase in the capacity of mathematical problem solving abilities in students who get the Guided Discovery Learning (GDL) model because it is superior and effective than conventional models. Moreover, the results of research by Septianingsih Bharata & Gunowibowo (2018) showed that the increase in mathematical problem solving ability of students who followed the Guided Discovery Learning (GDL) model was higher than the increase in mathematical problem solving ability of students who followed conventional learning. This is because the Guided Discovery Learning (GDL) model is a learning model that uses an inductive approach through the presentation of problems that are solved by trial and error, thus providing opportunities for students to be able to build knowledge and find solutions to a problem (Yuliasari, 2017).

The results of the questionnaire analysis of student responses to mathematics learning using the learning model were very positive. This is in line with research conducted by Maya, Ibrahim & Safrina (2018) which stated that students' responses to the Guided Discovery Learning learning model were very positive. Rini, Sa'diyah & Muhid (2021) further stated that the guided discovery learning model makes conditions in the classroom more interactive, because students are required to actively find answers to the questions they encounter through teacher guidance in order to obtain the correct concept of knowledge.

Learning with the Guided Discovery Learning (GDL) model train students to participate actively when the learning process is more active in finding solutions to a given problem starting from students being given stimulus, identifying problems, collecting data, processing data, proving, and drawing conclusions with guidance from the teacher, where the process of identifying problems, collecting data, processing data, proving, and drawing conclusions is said to be a mental process (Wibowo, 2019). Based on the results of Luzviminda's research (Putri, 2021) shows that the application of the Guided Discovery Learning (GDL) model in groups is effective in developing students' mathematical problem solving skills. When learning in groups through guidance from teachers, students are trained to be able to express their respective opinions, work together, and be responsible in solving a problem.

According to Lestari and Yudhanegara (2018: 93), attitude is a tendency to feel towards an object, situation, concept, other person, or themselves due to the results of the learning process or experience in the field that expresses liking or supporting (positive attitude) or dislike or dissupport (negative attitude). Student attitudes are included in the positive category because learning with the Guided Discovery Learning (GDL) model trains students to be more active

and independent in finding problem solving. Learning using the Guided Discovery Learning (GDL) model adds to a more interesting learning atmosphere by training students to work together and have responsibility in solving problems in groups. Thus, the Guided Discovery Learning (GDL) model can increase student enthusiasm in learning mathematics.

CONCLUSION

Based on the findings and discussion of research on the ability to solve mathematical problems in grade VIII students of SMP Negeri 4 Sumedang with samples of class VIII A and and class VIII B, several conclusions were obtained as follows. (1) The improvement of mathematical problem solving ability of students whose learning uses the Guided Discovery Learning (GDL) learning model is better than students whose learning uses conventional learning models and (2) the positive attitudes of the students towards mathematics learning using the Guided Discovery Learning (GDL) learning model.

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