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AN ANALYSIS OF PROBLEM SOLVING ABILITY IN SOCIAL STUDIES SUBJECT USING PROBLEM BASED LEARNING MODEL

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Abstract

Research has been carried out which aims to see the comparison of problem solving abilities taught through Problem Based Learning assisted by Geogebra Software with direct learning assisted by Geogebra Software. This research is a quasi-experimental research. The population in this study were all class VIII students at SMP Negeri 11 Surabaya. The instrument used in the research was a problem solving ability test in the form of a description with 10 questions. The regression equation in the Experiment class is $\hat{Y}E$ = 45.21 + 0.86XE and the regression equation for the control class is $\hat{Y}K$ = 33.26 + 0.31XK.. Inferential analysis of the data was carried out using Analysis of Covariance (Anacova). The research results obtained were that students' problem solving abilities through the problem-based learning model assisted by GeoGebra software were higher than students who used the direct learning model assisted by GeoGebra software.

Keywords: *Problem Based Learning, Geogebra Software, Problem Solving Ability*

INTRODUCTION

Social Sciences as part of the school curriculum, plays a very important role in efforts to increase graduates who are able to act on the basis of social thinking, namely logically, rationally, critically, systematically in solving problems of daily life or in studying other sciences, by Therefore, efforts to improve the quality of education and learning in Social Sciences in particular are a top priority for educational researchers.

The ability to think socially is one of the factors that must be used as research material, one of which is the ability to solve social problems. According to Dahar (2020):, problem solving is a human activity that combines previously acquired concepts and rules, and is not a generic skill. This understanding means that when someone is able to solve a problem, then that person has a new ability. Meanwhile, Montague (2016); Prasetya et all. (2024), said that social problem solving is a complex cognitive activity accompanied by a number of processes and strategies. Social problem solving is a complex cognitive activity, as a process for overcoming a problem encountered and to solve it requires a number of strategies. Training students in problem solving in learning Social Sciences is not just expecting students to be able to solve the questions or problems given, but it is hoped that the habit of carrying out the problem solving process will enable

them to live a life full of complex problems (Fadillah, 2020).

The importance of problem solving was stated by the National Council of Teachers of Mathematics (NCTM, 2022) stating that problem solving is an integral part of learning Social Sciences, so it should not be separated from learning Social Sciences. Furthermore, according to Ruseffendi (2016) problem solving skills are very important in Social Sciences, not only for those who will later study or study Social Sciences, but also for those who will apply them in other fields of study and in everyday life. .

Determining a model and approach to learning Social Sciences is the initial key in the teacher's efforts to increase students' Social Sciences abilities. Learning models or approaches that are varied and provide many learning options enable the development of students' potential. In this way, students are given the opportunity to develop according to their capacity, learning style and learning experience. Wahyudin, (2008) said that one important aspect of planning relies on the teacher's ability to anticipate needs and materials or models that can help students to achieve learning goals. It is also supported by Sagala (2021) that teachers must have methods in learning as strategies that can make it easier for students to master the knowledge provided.

There are many innovative models that are suitable and recommended in the 2013 curriculum to accommodate the scientific approach which is the core process standard of the 2013 curriculum. One of these models is the Problem Based Learning model or known as Problem Based Instruction (PBI), a model commonly used by teachers or researchers to determine problem solving abilities. states that problem-based learning is an interesting alternative learning model in traditional classroom learning. Arends (2008:41) states that the Problem Based Learning model is a learning model where students work on authentic problems with the aim of building their own knowledge, developing inquiry and high-level thinking skills, developing independence and self-confidence.

The problem-based learning model is a learning model that uses real world problems. These problems are used as a context for students to learn critical thinking and problem solving skills, as well as to gain essential knowledge and concepts from the subject matter (Kharida & Rusilowati, 2022). According to Lidinillah (2023) Problem Based Learning is a learning approach that uses real world problems as a context for students to learn about critical thinking and problem solving skills, as well as to gain essential knowledge and concepts from lecture or lesson materials. According to Duch (2001) who states that the basic principles that support the concept of Problem Based Learning predate formal education itself, namely that learning begins by posing problems, questions, or puzzles that make students want to solve them. Meanwhile, Roh (2023) states that

Problem Based Learning is learning in the classroom that organizes or manages Social Sciences learning around problem solving and gives students the opportunity to think critically, propose their own creative ideas, and communicate with their friends socially.

Several studies have been carried out applying the Problem Based Learning Model as an effort to improve students' social problem solving abilities. Sumartini (2016) said that the increase in social problem solving abilities of students who received problem-based learning was better than students who received conventional learning. In line with this, Noriza (2015) said that the problem-based learning model is effective for problem-solving abilities and social disposition in geometry material. Furthermore, Masri (2018) concluded in his research that the social problem solving abilities of students who received the PBM learning method were higher than students who received conventional learning. So the PBM learning method needs to be applied in the learning process. Yuhani (2018) concluded from his research that the social KPM of students who used the PBM approach in their learning was better than the group of students who received regular learning in their learning. Meanwhile, Imam (2018) concluded that the social problem solving abilities of students who use problem-based learning are better than those who use regular learning.

However, in the process of implementing the Problem Based Learning Model, there are still obstacles such as: there are still students who have difficulty understanding the problem, students still have difficulty carrying out investigations individually or in groups for abstract concepts, and students have difficulty determining the solution to the problem given. Reflecting on these problems, one of the actions taken by teachers which they feel can overcome the problems of the Problem Based Learning Model is to use learning media designed with the help of computers.

There are many and varied computer programs that can be used, one of which is Geogebra. GeoGebra was developed by Markus Hohenwarter in 2001. According to Hohenwarter and Fuchs (2004), GeoGebra is a computer program (software) for teaching social sciences, especially calculus, geometry and algebra. GeoGebra is dynamic Social Sciences software (DMS) that can help teachers in learning Social Sciences in high schools or universities. GeoGebra is open source software under the GNU (General Public License) and can be obtained for free at www.GeoGebra.org. Majerek (2014) concluded that all students everywhere can be encouraged to study Social Sciences with GeoGebra.

Utilization of learning media using GeoGebra software provides immediate feedback to students. The media provided is seen as a stimulus. Any changes that occur when students use this media will immediately be given back by the computer. With the direct feedback provided by the

computer when using GeoGebra-assisted media, students will also respond so that a learning process occurs that is in line with the independent curriculum.

METHOD

This research is a quasi-experimental research (quasi-experiment). The stages in this research are preliminary study, development and validation of learning tools, selection of research subjects, application of learning models, data analysis, findings, conclusions and suggestions

The population in this study were all class VIII students at SMP Negeri 11 Surabaya. The sampling process refers to the size of the population. The results of the observations obtained information from the school principal that: (1) class VIII consists of 7 (seven) parallel classes; (2) the distribution of students in each class is even, including students with high, medium and low abilities, as well as male and female students. The research sample was chosen randomly and assigned to class VIII-A students as the experimental class who were given the Problem Based Learning model assisted by Geogebra Software, class VIII-B students as the control class who were given the Direct Learning model assisted by Geogebra Software and class VII-C students as the test class try devices and instruments.

The data that will be analyzed in this research are the pretest results as accompanying variables and the posttest results as the dependent variable. Inferential analysis of data was carried out using Analysis of Covariance (Anacova). testing the effect of treatment will be more accurate if analyzed using Anacova rather than using anova (Hanafiah & Sukamto, 1991). Analysis of covariance (Anacova) is a combination of comparative and correlational tests, so that the prerequisite test analysis for Anacova also uses prerequisite regression tests and Anova (Widihiarso, 2011). Ananova testing is carried out in the same way as anava, namely by calculating F, but the previous calculation changes due to the presence of covariables. The formula

$$F' = \frac{\frac{B-A}{(k-1)}}{\frac{A}{(n_B + n_K - 2k)}} \quad (1)$$

$$A = \sum_{j=1}^{k}\left\{\sum_{i=1}^{nj}(Y_{ij}-Y)^2 - \frac{\left[\sum_{i=1}^{nj}(Y_{ij}-Y)(X_{ij}-X)\right]^2}{\sum_{i=1}^{nj}(X_{ij}-X)^2}\right\} = SST_{x(adj)} \quad (2)$$

$$B = SST_y - \frac{(SPT)^2}{SST_x} \quad (3)$$

Keterangan:

SPT : Jumlah total produk

SST_x : Jumlah kuadrat total X

SST_y : Jumlah kuadrat total Y

k : banyaknya kelompok

n : banyaknya siswa kelompok dengan Pembelajaran Berbasis Masalah dan kelompok pembelajaran langsung.

used is;

Figure 1. Anacova Testing

RESULTS AND DISCUSSION

The data analyzed in this research are the results of tests on students' problem-solving abilities and social disposition towards Social Sciences. The initial and final ability tests of the experimental class were attended by 30 students and the control class was attended by 31 students. This

information is in the form of initial and final ability test results data.

Inferential Statistical Analysis (Anacova) Problem Solving Ability Inferential analysis of the test results of students' Social Problem Solving ability is aimed at testing the hypothesis, namely that students' Social Problem Solving ability in applying the Geogebra software-assisted problem-based learning model is higher than direct learning in class VIII of SMP Negeri 11 Surabaya . Statistically, it is still necessary to test the significance of differences using the Anacova statistical test. Before using the Anacova statistical test, the data normality test, homogeneity test, determining the linear regression model, independence test, linearity test, similarity test of two regression models, and parallelism test of two regression models must first be used.

Before the data is analyzed, the normality of the data is first tested as a requirement for quantitative analysis. This test was carried out to see whether the data from the Social Problem Solving ability test results were normally distributed in the control class and experimental class. The normality test results of the Social Problem Solving ability test in both classes were analyzed using the Liliefors test and the One Sample Kolmogorov-Smirnov Test with the help of the SPSS 16.00 program. The test results using the Liliefors test on students' Social Problem Solving Ability data in the control class (Direct Model) obtained a value of LCount = 0.1520 and LTable = 0.2503. It turns out that LCount < LTable which means that the data obtained from the results of the Social Problem Solving Ability test of students in the control class (Direct Model) is normally distributed. Furthermore, the results of calculating data on students' Social Problem Solving Ability in the experimental class (Problem Based Learning Model) obtained a value of LCount = 0.1435 and LTable = 0.2503. It turns out that LCount < LTable which means that the data obtained from the results of the Social Problem Solving Ability test of students in the experimental class (Problem Based Learning Model) is normally distributed. Furthermore, the normality test results of the Social Problem Solving ability test in both classes were analyzed using the One Sample Kolmogorov-Smirnov Test with the help of the SPSS 16.00 program.

The data homogeneity test, namely testing the variance between the experimental class and the control class, is intended to determine whether the variance of the two classes is the same or different. Testing this hypothesis uses a variance test of two independent variables. It has been previously calculated that the samples in both classes in the initial and final ability tests are normally distributed. The initial ability test variance in the experimental class SE 2 = 185.42 and the initial ability test variance in the control class SK 2 = 132.45. So we get: $F\ hitung$ = 185.42/132.45= 1.39 and $Ftabel$ = 1.42 with v1 (numerator) = (30-1), v2 (denominator) = (31-1) and significance level α = 5%. Because $F\ h$

$itung < Ftabel$ then H 0 is accepted, meaning that the initial Social Problem Solving ability test data is homogeneous. For the final ability test variance in the experimental class SE 2 = 142.45 and the final ability test variance in the control class SK 2 = 87.01. So we get: $F\ h\ itung$ = 142.45/87.01 = 1.64 and $Ftabel$ = 1.82 with v1 (numerator) = (30-1), v2 (denominator) = (31-1) and significance level α = 5%. Because $F\ h\ itung < Ftabel$ then H 0 is accepted, meaning that the final Social Problem Solving ability test data is homogeneous.

Based on the calculation of the students' Social Problem Solving ability test results, the regression equation for the experimental class was YE = 45.21 + 0.86 XE and the regression equation for the control class was YK = 33.26 + 0.31 . Based on data from the Social Problem Solving ability test results of experimental class students, the regression equation YE = 45.21 + 0.86 XE was obtained . To test the significance of the coefficients of the regression equation, a hypothesis is formulated as follows: H 0 : θ1 = 0 and H a : θ2 ≠0

Testing the hypothesis used analysis of variance using F statistics with the specified formula and criteria analyzed with the help of the SPSS 16.0 program. Based on the results of data calculations on Social Problem Solving Ability in the Experimental class, F ∗= 114.24 was obtained and based on Table F, for α= 5% it was obtained: F (1− α,1:n−2) = F(0.95,1.30) = 4.17. The calculation results show that the F value∗ ≥F(0.95,1.31) which means H 0 is rejected and Ha is accepted. This means that there is a positive (significant) influence on the results of the Initial Ability test (X) on students' post-test results (Y) for the Experiment class. The following table presents the results of the independence test analysis in the experimental class:

Table 1Analysis of Independence Test in the Experimental Class

Source of variation	SS	df	M.S	F*
Regression	3078.231	1	3078.231	114.24
Error	783.2176	29	25,453	
Total	3654.678	30		

Source: Primary Data Processed 2024

The regression model obtained for the Social Problem Solving abilities of experimental class students is $YE = YE$ = 45.21 + 0.86 , then the suitability of the linear regression model with the hypothesis will be tested: H 0: The regression model is linear H a: The regression model is not linear To test the above hypothesis, variance analysis was carried out using F-statistics with the specified formula and criteria. Analytical calculations were carried out with the help of the SPSS 16.0 program. The results of the linearity test analysis in the experimental class are presented in the following table:

Table 2 Analysis of Linearity Tests in Experimental Classes

Source of variation	SS	df	M.S	F*

Regression	3078.231	1	3078.231	0,676
Error	783.2176	29	25.453	
Lack of fit	112.6542	5	19.2130	
Pure Error	658.1234	23	28.2311	
Total	3654.678	30		

Sumber: Data Primer Diolah 2024

Based on Table 2 above for Social Problem Solving ability, the calculated F value = 0.676 and in accordance with Table F for α = 5%, the calculated F value (1- α,c-2,nc) = F(0.95,6.24) is obtained.)= 2.31. Means Fh < F (0.95,11,17). Which means that H0 is accepted or the experimental class regression model is linear

Based on the data from the control class Social Problem Solving ability test results, the regression equation YK = 33.26 + 0.31 XK was obtained . To test the significance of the regression coefficient, the following hypothesis is formulated: H 0 : θ3 = 0 and H a : 4θ ≠0. Testing the hypothesis used analysis of variance using F statistics with the specified formula and criteria analyzed with the help of the SPSS 16.0 program. The results of the independence test analysis in the control class are presented in the following table:

Table 3Analysis of Independence Test in Control Class

Source of variation	SS	df	M.S	F*
Regression	1387.250	1	1387.250	25,202
Error	1465.832	30	53,891	
Total	2870.110	31		

Source: Primary Data Processed 2024

From the calculation results in table 3 for Social Problem Solving, it is obtained that F ∗= 25.20 and based on Table F, for α= 5% it is obtained: F (1− α,1:n−2) = F(0.95,1.30) = 4.17. The calculation results show that the F value∗ ≥F(0.95,1.30) which means that H 0 is rejected and Ha is accepted. So, the regression coefficient is meaningful, meaning that there is a linear relationship between students' initial abilities and their final abilities. The regression model obtained for the Social Problem Solving ability of control class students is YK = 33.26 + 0.31 , then the suitability of the linear regression model will be tested with the hypothesis: H 0 : The regression model is linear H a : The regression model is not linear.

To test the above hypothesis, variance analysis was carried out using F-statistics with the specified formula and criteria. Analytical calculations were carried out with the help of the SPSS 16.0 program. The results of the linearity test analysis in the control class are presented in the following table:

Table 4 Analysis of Linearity Tests in the Control Class

Source of variation	SS	df	M.S	F*
Regression	1387.250	1	1387.250	0.23
Error	1465.832	30	53,891	
Lack of fit	100.12	5	20.54	
Pure Error	1348.56	25	60.41	
Total	2870.110	31		

Source: Primary Data Processed 2024

Based on table 4 above for Social Problem Solving ability, the calculated F value = 0.23 and according to the F table for α = 5%, the value F(1- α,c-2,nc) = F(0.95.5) is obtained. .25)= 2.60. The calculation results show that the Fh value < F (0.95, 5.25). Thus *H* 0 is accepted so that the control class regression model is linear. In other words, the relationship between the results of the initial ability test and the final ability test of control class students is expressed by a linear regression model or the proposed regression model is suitable.

To test the similarity of the two regression models for the control class and the experimental class, analysis of variance was used using the F statistic. To test the similarity of the two regression models, it was formulated as follows: H 0 : θ1 = θ3 (both regression models are the same) Ha : θ1≠ θ3 (the two regression models are not the same) To test the hypothesis, the values in Table 5 are required. The results of the linear similarity test of the two regression models are presented in the following table:

Table 5Covariance Analysis for Similarity of Two Regression Models

a	b	SSR (R)	SSTO(R)	SSE (R)	SSE (F)	F*	F(0.95,1.58)	H0
39.67	0.65	4382.11	9121.55	4328.12	2760.19	65.44	4.00	Reject

Source: Primary Data Processed 2024

From the calculation results in Table 5, the value for Social Problem Solving ability is F ∗= 65.44 and based on Table F, for α= 5% it is obtained that F (1−α,1:n−2) = F (0.95,1.58) = 4 .00. The calculation results show that the F value∗ ≥F (0.95,1.58) which means that H0 is rejected and Ha is accepted. This means that the two linear regression models are not the same or significantly different

If in testing the similarity of the two regression models above H 0 is rejected (the regression models are not the same), then proceed with testing the parallelism of the two regression models. To test the parallelism of the linear regression model for the experimental class and control class, covariance analysis was used using F statistics with the specified formula and criteria. The results of the parallelism test analysis of two regression models are presented in the following table:

Table 6 Covariance Analysis for Regression Model Alignment

Source of variation	SSTx	SSTy	SPT	SSTx (adj)
PBM model	5237.887	3787.347	4055.923	782,320
Direct Model	3789.611	2987.210	2287.901	14350.931
Total	9028.345	7675.564	6543.460	2456.890
A	B	F*	F(0.05, 1.62)	H0
2379.250	2344,001	1,356	3,996	accepted

Source: Primary Data Processed 2024

From the calculation results in Table 6 Social Problem Solving Ability, the value F ∗= 1.356 is obtained and based

on Table F, for α= 5%, F (1− α,1:n−2) = F(0.95,1.62)= 3.996 is obtained. The calculation results show that the value of F ∗< F (0.05, 1.62) means H 0 is accepted with a significance level of 5%. This means that the two linear regression models for the control class and the experimental class are parallel. Because the two regression models are not the same (do not coincide) and are parallel, students' Social Problem Solving abilities in applying the problem-based learning model assisted by Geogebra software are higher than direct learning.

After the linearity and parallelism test results of the regression model are fulfilled, to test whether students' Social Problem Solving abilities in applying the problem-based learning learning model assisted by Geogebra software are higher than direct learning, it can be analyzed using Anacova as a modification of variance analysis. For this reason, an analytical hypothesis was formulated by estimating the distance between the two linear regression lines of the control and experimental groups from each final test score of the control class and the final test score of the experimental class. The hypothesis is as follows: H 0 : θ 1 = θ 3 H a : θ 1 > θ 3. To test this hypothesis several values are required which are summarized in the following table:

Table 7Analysis of Covariance for Complete Design

Source of variation	X	Y	XY	Df
treatments	17.56	2535.90	201.45	1
Error	9231.23	6754.70	6453.67	62
Total	9132.50	9218.68	6775.01	63
	Adjusted SS	Adjusted Df	Adjusted MS	F*
treatments	2078.33	1	2083.44	52,897
Error	2535.02	61	38.88	
Total	4912.33	63		

Source: Primary Data Processed 2024

From the calculation results for Social Problem Solving ability in Table 7, the value F is obtained $*$ = 52.19 and based on Table F, for significance α = 5% we get F (1− α .1; n −2) = F (0.95.1;63) = 3.99. It can be seen that the value of $F * > F$ (0.95,1;63) so that H0: r1 = r2 = 0 is rejected. This means that students' Social Problem Solving abilities in applying the problem-based learning learning model assisted by Geogebra software are higher than direct learning

The regression model that has been obtained for the Social Problem Solving ability of the experimental class is YE = 45.21 + 0.86 XE and the regression equation for the control class is YK = 33.26 + 0.31 .

Furthermore, because the two regressions for both classes are homogeneous and the constant of the linear regression line equation for the social problem solving ability of the experimental class, namely 45.21, is greater than the constant of the linear regression line equation for the control class, namely 33.26, then geometrically the regression line for the experimental class is above the regression line. control class. This indicates that there is a significant difference, and in the hypothesis above there is a difference in the height of the two regression lines which is influenced by the regression constant. The height of the regression line describes student learning outcomes, namely when This means that it can be concluded that students' Social Problem Solving abilities in applying the problem-based learning model assisted by Geogebra software are higher than direct learning.

CONCLUSION

Based on the research results of differences in students' problem solving abilities through the *Geogebra -assisted PBM model* and direct learning, it was concluded that there was a significant difference in increasing Social Problem Solving Ability between students taught through the *Geogebra Software - assisted Problem-Based Learning Model* and students taught using *the Software- assisted Direct Learning Model Geogebra* . This can be seen from the results of the analysis of covariance (Anacova) for the FCount value which is 54.21 which is greater than the FTable value (0.95,1.60) which is 4.22. Apart from that, based on the results of statistical analysis of the regression equation, social problem solving abilities also illustrate the value of the regression constant for the Problem Based Learning Model assisted by *Geogebra Software* , namely 45.11 which is greater than the constant of the linear regression line equation for the control class, namely 35.18, so geometrically the regression line for the experimental class is above the control class regression line. This indicates that there is a significant difference in increase, due to the difference in height of the two regression lines which is influenced by the regression constant. The height of the regression line describes student learning outcomes, namely when

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