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The Effect of Applying A Problem-Based Learning Model Using Google Earth on Understanding Hydrometeorological Disaster Mitigation at SMAN 1 Tanjung Palas Tengah

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KEYWORDS
model problem based learning, google earth, hydrometeorological disaster mitigation

ABSTRACT
This study aims to reveal whether there is a positive influence in the application of the problem-based learning model using google earth media on the understanding of hydrometeorological disaster mitigation in class XI of SMA N1 Tanjung Palas Tengah. The research design used in this study is a nonequivalent control group design with a quasi-experimental research method (Quasi Experiment). The sampling technique used in this research is purposive sample. The research instruments used are test instruments in the form of multiple-choice questions, as well as non-test instruments in the form of observation and documentation. The results of the study showed that there was a positive influence in the application of the problem-based learning model using google earth media on the understanding of hydrometeorological disaster mitigation in class XI at SMAN 1 Tanjung Palas Tengah in the form of a significant increase in the average class score. This is based on the results of N-Gain obtained a value of 66.96% and the t-test obtained a value of Sig. (2-tailed) of 0.001. This is also supported by the results of observational studies that show a positive response from the research subjects.

INTRODUCTION

The independent curriculum is a new curriculum used in Indonesia. The implementation of the independent curriculum can be applied with various learning models, one of which is the problem-based learning model in an effort to support the implementation of co-curricular programs that have been prepared in the independent curriculum. The problem-based learning model has a learning approach that places problems or cases as the main focus of the student learning process. This model encourages students to be able to think critically, creatively and be able to relate the knowledge that has been learned to the problems they are facing, so that they can develop thinking skills and apply them to real life (Purnomo, 2016).

Teachers in implementing the independent curriculum can use the problem-based learning model to adjust the complexity and flexibility of teaching materials contained in important learning outcomes (CP) and in accordance with the development of the times in the 21st century (Suparlan & Julianto, 2019). The problem-based learning model is a model that supports personal, social, academic, and medical skills, which is much better than other models such as lecture and demonstration methods. The problem-based learning model directs students to be able to analyze the problems that are occurring and find ways to solve them (Janssen & Lazonder, 2016).

The independent curriculum at the high school (SMA) level in geography material is divided into two phases, namely phase E for class X and phase F for grades XI and XII. Geography is part of social studies subjects and stands alone. The structure of the high school curriculum is divided into two, namely: 1) intracurricular learning; and 2) the project to strengthen the profile of Pancasila students with a time allocation of around 30% of the total lesson hours (JP) per year. The time allocation in class XI is assumed that 1 year has a total of 36 weeks and in each meeting 1 JP is 45 minutes. Geography subjects are at most 5 JP per week (Nurdiani et al., 2019).

One of the materials taught in the independent curriculum phase F grade XI is disaster mitigation and adaptation, with learning outcomes (CP) students at the end of learning able to convey, identify, understand, process, analyze, evaluate and communicate ideas between themselves and are able to work in groups or individually with their own product tools in the form of learning tool maps (PARJITO, 2015). This material is taught in the independent curriculum with the following objectives: 1) explanation of the concept of disaster, mitigation and adaptation, 2) application of disaster concepts in real life, 3) analysis of the impact of disasters on economic, social, cultural, and other aspects of life, 4) making a simple project design for disaster mitigation or adaptation in the surrounding environment (Rasyidin, 2014).

One of the CP explanations can be applied in learning with a problem-based learning model with the hope that students will easily understand the material that has been taught and then use it directly in the surrounding environment according to the problems faced. The learning model wants students to have the ability to think spatially in solving problems in the environment directly (Rosyid, 2016). The ability to think spatially aims to enable individuals to understand, recognize space, and understand geosphere phenomena. The main study geography subject is the relationship between humans and the environment, along with the mutual relationship between the two in space. Geography also studies the influence of the natural environment on human activities (Rustam et al., 2018).

The purpose of geography learning is to improve spatial analysis skills, but students often find that they are weak in these skills. Students are only able to be theoretical, this is because geography learning is only emphasized on the cognitive aspect. As a result, students still lack the basis to utilize the knowledge obtained and applied in real life by utilizing spatial analysis skills. Spatial analysis can be achieved with the help of appropriate media such as Google Earth or digital maps with more advanced technology (Sandu & Sodik, 2015).

Google Earth can be used to display geospherical phenomena in a place, so students can recognize the place. Furthermore, in the geosphere event, students can be invited to discuss the application and use of geography principles to solve these problems. The basis of spatial analysis is to introduce the place where geospherical phenomena occur (Siboro, 2021). Google Earth is a virtual media like a globe that can be observed from various perspectives and perceptions that resemble the earth. The ability of intelligence to analyze and be able to identify geosphere phenomena is an ability to think spatially. This thinking ability can be supported by the teacher's intelligence in choosing the learning model to be applied (Koehler et al., 2013).

The problem-based learning model is able to encourage the achievement of spatial analysis skills, because this learning model has characteristics such as: 1) students as the center of learning, 2) students are given the opportunity to choose problems in their environment, 3) students conduct analysis according to their knowledge and understanding, 4) students present solutions that have been made as answers to problems that have been found, 5) Teachers have a role as facilitators in learning (Murtakhamah, 2013).

The use of Google Earth media is expected to be able to support the learning model that has been designed, namely problem-based learning. According to research that has been carried out related to the application of problem-based learning in improving geography learning outcomes. The problem-based learning model requires students to learn to solve a problem that

has been designed beforehand. Solving these problems can be helped with Google Earth media, because Google Earth can help students in analyzing geosphere phenomena (Johni Dimyati, 2013).

The problem-based learning model assisted by Google Earth media can be collaborated in learning on disaster mitigation materials, with the aim that students have spatial analysis skills. The use of this learning model requires students directly to be able to solve the problems around them by following the following syntax: 1) problem-oriented, 2) organizing to learn, 3) guiding problem investigations, 4) developing and presenting results, 5) analyzing and evaluating problem-solving. Factual problem-based learning makes it easier for students to understand the material, so students will also be encouraged to have spatial analysis skills by utilizing knowledge to be applied directly in solving problems related to disaster mitigation.

Geography learning on disaster mitigation materials using Google Earth media and problem-based learning models needs to be carried out at SMAN 1 Tanjung Palas Tengah, because it was found that students have a low understanding of disaster mitigation issues. Learning with a problem-based learning model using Google Earth aims to provide an understanding to students so that they know how to overcome, reduce and overcome natural disasters that are currently hitting an area. In addition, by teaching students, it is hoped that the knowledge that has been obtained at school can be used by teaching it to their families and the surrounding environment.

Furthermore, based on the results of the assessment in the previous 2 school years in class XI Social Sciences for the 2021-2022 and 2022-2023 school years, the results were obtained that the learning activities carried out were quite good, but not effective. The meaning of being good enough here is that teachers have implemented a variety of learning models. while the meaning of not yet effective disisni is that the average score of students is still below the minimum completeness criterion (KKM) of 70, especially in geography subjects. The author found this problem based on the results of a study related to the learning outcomes of students in class XI IPS SMAN 1 Tanjung Palas Tengah in the last 2 school years, precisely in the chapter on types and management of natural disasters in Indonesia.

Based on the results of the average analysis of the average scores of grade XI social studies students in geography. The chapter on types and management of natural disasters in Indonesia in 2022 was 65, and in 2023 there was a slight increase of 67. In addition to the lack of KKM in the chapter on types and management of natural disasters in Indonesia in the learning process, there are only a few students who actively respond, especially students who are ranked in the top 10. This shows that the level of cognitive ability of students is still lacking.

Tanjung Palas Tengah is one of the sub-districts in Bulungan district. Based on the monitoring of the Bulungan district BPBD website, if reviewed in the last 2 years, natural disasters that occurred in Bulungan district were dominated by hydrometeorological disasters. Hydrometeorological disasters that have often occurred in Bulungan district over the past 2 years are recorded as follows; Floods 4 times, extreme weather 5 times, land fires 7 times and tornadoes 1 time from each of these disaster events often cause casualties both fatally and materially. Natural disasters that often approach the research site in Tanjung Palas Tengah District need to be made to increase understanding of the importance of disaster mitigation. Explanations about the benefits, and steps about disaster mitigation need to be taught, especially to students at SMAN 1 Tanjung Palas Tengah.

The use of Google Earth aims to display areas affected by disasters. So, it will be easier for students to see and analyze areas affected by natural disasters using these media. In addition, the use of a problem-based learning model assisted by Google Earth media aims to improve the understanding of disaster mitigation among SMAN 1 Tanjung Palas Tengah students by utilizing the disaster mitigation chapter material that has been studied.

Based on the background of the problems that have been described above, this study was conducted to provide information and answer the question of whether there is a positive influence of the application of the problem based learning model on the understanding of disaster mitigation using the help of Google Earth media in the analysis of the disaster potential, and the results are compiled in the form of a scientific paper with the title "The Effect of the Application of the Problem Based Learning Model Using Google Earth on Understanding Hydrometeorological Disaster Mitigation in Sman 1 Tanjung Palas Tengah".

This research is motivated by the problem of low effectiveness of the learning model used by teachers in the disaster mitigation learning process, which causes student learning outcomes to still be below KKM. In addition, teachers have not found learning media that are suitable for students' conditions, especially in understanding the types and management of disasters. For this reason, this research is limited to efforts to improve understanding and learning outcomes of disaster mitigation through the application of the problem based learning (PBL) learning model in the classroom and the use of Google Earth learning media. The formulation of the problems raised includes the influence of the application of the PBL model on the understanding of hydrometeorological disaster mitigation at SMAN 1 Tanjung Palas Tengah, as well as increasing students' understanding of potential disasters based on regional characteristics after the use of Google Earth. The purpose of this study is to determine the influence of the PBL model on the understanding of hydrometeorological disaster mitigation and improve learning outcomes related to potential disasters through Google Earth. The theoretical benefits of this research are expected to be a reference for the geography education study program and further research, while the practical benefits are increased researcher insights, students' comprehensive understanding of disaster mitigation, and considerations for the Education Office in formulating policies related to disaster education.

RESEARCH METHOD

The research approach used is quantitative by testing objective theories and conducting research on the relationship between variables using measuring tools in the form of instruments, then the data is analyzed using statistical procedures (Sedarmayanti & Hidayat, 2011). The experimental model was used in this study which aimed to determine the effect of treatment on symptoms in two groups, namely the control group and the experimental group where each class was given a different treatment or stimulus according to the purpose of the research. The type of experimental research used is quasi-Experimental Design because in this study there is no application to randomize each group, both the control class and the experimental class (Sugiyono, 2019).

RESULTS AND DISCUSSION

Normality Test

The normality test is used to find out whether the data population is normally distributed or not. Data normality test in experimental group and control group research using the Shapiro-Wilk test with the help of the SPSS 29 For Windows application. As for decision-making, the data is called normal if $p > 0.05$ and the data is abnormal if $p < 0.05$. The results of the pretest normality test in the experimental and control groups can be seen in the following table.

Table 1 Results of the Normality Test

	Shapiro-Wilk		
Class	Statistics	Df	Sig.
Pretest Experiment	.957	30	.256
Posttest Experiment	.934	30	.061
Pretest Control	.953	30	.199
Posttest Control	.935	30	.068

Based on table 1, the results of the classification pretest normality test show that the data is normally distributed because p > 0.05. This can be seen in the significance value of each group, which is 0.256 in the experimental group and 0.199 in the control group. Furthermore, the results of the posttest normality test showed that the data was normally distributed because the p > 0.05, which was 0.061 in the experimental group and 0.068 in the control group. Based on the summary table of the results of the pretest and posttest normality tests, the two groups showed that the data was normally distributed, because the p > 0.05. So it can be concluded that the two groups are normally distributed.

a. Homogeneity Test

The homogeneity test was carried out to determine the variants of several data populations. The homogeneity test of pretest and posttest data for disaster mitigation understanding used levene statistics. Data is called homogeny if it has a p value > 0.05. The results of the pretest homogeneity test can be seen in the following table.

Table 2 Results of Pretest Homogeneity Test

	Levene Statistic	df1	DF2	Sig.
Based on Mean	5.490	1	58	.023
Based on Median	4.208	1	58	.045
Based on Median and with adjusted df	4.208	1	51.650	.045
Based on trimmed mean	5.229	1	58	.026

Based on table 2 of the results of the pretest homogeneity test for disaster mitigation understanding, it shows that the data is homogeneous because the value (sig.) p > 0.05. This can be seen in the significance value of 0.023.

The results of the postest homogeneity test can be seen in the following table.

Table 3 Postest Homogeneity Test Results

	Levene Statistic	df1	DF2	Sig.
Based on Mean	.157	1	58	.694
Based on Median	.135	1	58	.715
Based on Median and with adjusted df	.135	1	57.226	.715
Based on trimmed mean	.147	1	58	.703

Based on table 3 of the results of the posttest homogeneity test for disaster mitigation understanding, it shows that the data is homogeneous because the value (sig.) p > 0.05. This can be seen in the significance value of 0.694.

Based on the table of the summary of the homogeneity test results, the results of both the pretest and posttest showed a significant value or p > 0.05. In the pretest , a significance value of 0.023 was obtained, and a significance value of 0.694 was obtained in the pretest. The numbers from the calculation show a number greater than 0.05, so it can be concluded that the data variants of the two classes, both pretest and posttest , are the same or homogeneous.

b. N-Gain Test

The Normalize Gain test aims to measure how effective the use of the PBL method with Google Earth media is on the learning outcomes of students of SMAN 1 Tanjung Palas Tengah. Furthermore, after going through the statistical calculation procedure using the SPSS application, the following N-Gain results were obtained:

Table 4 N-Gain Test Results

Class			Statistics	Std. Error
Experiment	Mean		.6696	.03038
	95% Confidence Interval for Mean	Lower Bound	.4074	
		Upper Bound	.5317	
	5% Trimmed Mean		.4737	
	Median		.5000	
	Variance		.028	
	Std. Deviation		.16643	
	Minimum		.14	
	Maximum		.71	
	Range		.57	
	Interquartile Range		.24	
	Skewness		-.367	.427
	Curtosis		-.657	.833

Based on the results of the N-Gain calculation in the table above, it shows that the average value (mean) of N-Gain is 66.96 or if it is proportioned to 66.96%.

If we are guided by using the standard interpretation of N-Gain effectiveness with the category (%) as used (Hake R.R., 1999), then the table is as follows:

Table 5 Classification of N-Gain Values

Percentage	Interpretation
<40	Ineffective
40-55	Less Effective
56-75	Quite Effective
>76	Effective

Thus, referring to the standard interpretation of N-Gain effectiveness (%) as shown in the table above, the results of the N-Gain test are included in the category **of quite effective**, namely with a mean percentage of 66.96%, which when viewed in the interpretation standard above, is in the mean interval56-75 %. So it can be concluded that the PBL method is quite effective in improving student learning outcomes in disaster mitigation materials in class XI.

Hypothesis Test

The hypothesis test using the t-test aims to determine the difference between the average score of the experimental class that applies the problem-based learning model and the average score of the control class that applies the classical learning model. Hypothesis testing in this study uses an Independent Sample T-Test (T-Test) in the SPSS 29 program with criteria if significant or Asymp. Sig. t-test (2-tailed) > 0.05, then H is rejected, while if signification or Asymp. Sig. t-test (2-tailed) < 0.05 then H is accepted.

The results of the hypothesis test regarding the difference between the average score of the experimental class that applied the problem-based learning model and the average score of the control class that applied the classical learning model can be seen in the table below:

Table 6 t-Test Results

		Paired Differences					t	Df	Significance	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			One-Sided p	Two-Sided p
Pair 1	Pre Test - Post Test	-22.16667	10.64176	1.94291	-26.14037	-18.19297	-11.409	29	<,001 reviews	<,001 reviews

Based on table 6, the value of the Sig t-test (2-tailed) was 0.001, so H was accepted because the Sig t-test (2-tailed) value was 0.001 < 0.05. Furthermore, the hypothesis proposed is:

H = Through the application of the learning model Problem Based Learning can improve the understanding of hydrometeorological disaster mitigation for students at SMAN 1 Tanjung Palas Tengah.

Thus, it can be explained that the average score of the experimental class that applied the problem-based learning model was higher than the average score of the control class that applied the classical learning model. The conclusion obtained by the application of the problem-based learning model is that there is an increase in understanding of hydrometeorological disaster mitigation in class XI of SMAN 1 Tanjung Palas Tengah in the form of an increase in the average score of the experimental class which is higher than that of the control class.

Discussion

Based on the data analysis that has been carried out, it is found that the problem-based learning model using Google Earth media has a significant influence on the understanding of hydrometeorological disaster mitigation of grade XI students at SMAN 1 Tanjung Palas Tengah. The implementation of the problem-based learning model is known to be better to be applied compared to learning with the lecture/classical method. It is evidenced by the average learning outcomes obtained by the experimental class after implementing learning using the problem-based learning model of 75 while the control class using the lecture/classical method only obtained an average score of 59.

In the control class, the learning model using the lecture/classical method resulted in a lower understanding of hydrometeorological disaster mitigation compared to the experimental class. This is because teachers are the center of learning activities, so that students' knowledge is only built through explanations delivered by teachers. Learning in the control class also has discussion sessions, questions and answers, and assignments, but students are still not interested in participating in learning, and do not analyze seriously about the problems that occur in the surrounding environment so that in doing their assignments students are not able to solve existing problems.

Learning in the control class is carried out through steps, namely at the first meeting, the teacher provides a briefing on disaster mitigation materials. At this meeting, teachers gave handouts of materials and assignments related to the topic of types and characteristics of natural disasters, the distribution of natural disaster-prone areas in North Tanjung Palas District, and the cycle of natural disaster management. At the second meeting, students were formed in groups and teachers gave handouts followed by group assignments to be discussed related to the topic of the distribution of disaster areas in North Tanjung Palas District, as well as the types of natural disaster management through education, local wisdom, and the use of technology. At the time of the discussion activity, there were only a few who carried out the teacher's directions and only a few students were active during the discussion process. At the third meeting, the teacher explained the topic of disaster simulation in the environment, as well as disaster evacuation maps in the school environment. At this meeting, students were given a group assignment regarding the entire material from the first meeting to the third meeting. After the discussion, each group presented the results of the discussion. In this session, it can be observed that the understanding and teaching skills of students are quite adequate, this is evidenced by the number of students who are only able to copy the answers from the handouts and are not associated with real problems in the surrounding environment.

In the experimental class, learning was carried out using a problem-based learning model using Google Earth media. The researcher found that the results in the data analysis of the experimental class were higher than the control class which only used the lecture/classical

method, discussion, question and answer and assignment. This is supported by the results of data analysis which shows that the problrm-based learning model using Google Earth media has an effect on students' understanding of hydrometeorological disaster mitigation.

Through Google Earth media, it can help develop spatial thinking skills in students. This is caused by several factors, namely: 1) students can analyze the area in a real and clear way so that students have their own views on the area to be analyzed; 2) students can find out the changes in an area from time to time; 3) students can analyze the causes, processes of occurrence, and impacts caused by these problems; 4) students can relate the same problem to different regions or the same problem to the same region and different years; 5) students are able to find solutions to existing problems.

The implementation of the Problem Based Learning learning model in this researcher provides advantages in each syntax. Learning is carried out through syntax, namely: 1) reviewing and presenting problems, 2) developing problem-solving strategies, 3) implementing strategies, 4) discussing and evaluating results.

The first syntax provides a review and presentation of problems, at this stage the teacher begins learning by providing important questions with the aim that students can understand the learning in question. This stage also encourages students to actively answer the questions given related to disaster mitigation. This stage makes students actively answer and give their opinions about examples of disaster-prone areas in the environment around where they live

The second syntax is to develop a problem-solving strategy. The preparation of strategies in solving problems is carried out in group collaboration, each group digs information about the problems of geospherical phenomena such as areas that have experienced disasters around the students' residences so as to encourage curiosity to find out the characteristics of disaster-prone areas and the causes of these disasters. At this stage, students learn to operate Google Earth and analyze the potential disasters that exist in the location of observation objects, students are also given the flexibility to ask about obstacles in operation. This stage really encourages students' enthusiasm in learning using the Google Earth application., because students can know the surrounding area without having to come to the area. Based on the positive side of using Google Earth, it makes students' interest in using Google Earth high. Students are very enthusiastic about using the application, because in the opinion of students by using this application students can see and analyze areas that cannot be reached or cannot be visited. Students also use the help of smartphones to find out additional information about disasters. The information obtained by each student encourages students to think critically in formulating an effective strategy.

The third syntax is to apply a strategy, at this stage the teacher and students discuss the strategies that have been obtained by each group. The teacher serves as a facilitator who accompanies each group in analyzing and evaluating whether the strategies prepared are feasible and possible to be applied in the context of real life before later being presented in front of other groups.

The fourth syntax discusses and evaluates the results, at this stage the researcher asks each group to be able to concisely explain the results of their investigation related to potential disaster threats and solutions that can be proposed to reduce the risk of existing disasters. Each discussion result presented will be evaluated jointly and strengthened by other groups. In this syntax, students are able to analyze the causal relationship. Students analyze the images of the selected regions with different years by finding out the causes of changes in the regions. Students are also able to show the consequences caused by the disaster. By analyzing the causal relationship, students are also able to provide solutions to overcome or minimize the impact caused. Students are also able to provide solutions to overcome or to minimize the impact caused.

Based on the presentation of hydrometeorological disaster mitigation learning and the results of treatment using the problem-based learning method, it can be concluded that this study is able to support the theories that have been put forward that the problem-based learning method provides a better understanding of hydrometeorological disaster mitigation when compared to only using lecture/classical method learning.

CONCLUSION

Based on the formulation of the problem and the results of the research conducted, it was concluded that the Problem Baased Learning Model using Google Earth Media on Disaster Mitigation Materials had an effect on the understanding of hydrometeorological disaster mitigation of grade XI students at SMAN 1 Tanjung Palas Tengah. This statement is supported by the learning results from the average posttest test in the experimental class is higher than the posttest results of the control class.

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