Effects of Disaster Mitigation Learning Using Project-Based Learning Model on Disaster Literacy Skills

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ABSTRACT

Indonesia is a disaster-prone country, therefore disaster mitigation learning is needed among students. The impact of disasters both materially and non-materially is difficult to minimize due to the lack of disaster literacy skills. The purpose of this research is to analyze the effect of disaster mitigation learning using the project-based learning model on disaster literacy skills. This research used experimental method with pretest-posttest control group design. This research was conducted at Madrasah Aliyah Al Hidayah Wajak . The research subjects used XI IPS 2 class as experimental class and XI IPS 2 class as control class. The treatment applied in the experimental class used a project-based learning model, while in the control class used the usual learning method carried out by the teacher, namely lectures and assignments. The instrument used in this study was an objective test of disaster literacy. Data analysis to test the hypothesis using SPSS 25 with independent-sample T-Test. The results of the research hypothesis test obtained a sig value (2-tailed) of 0.000 <0.05, which means that there is a difference in the average value of the gain score in the experimental and control classes. The conclusion of this study is that the project-based learning model has an effect on disaster literacy skills.

KEYWORDS: Project-Based Learning, Disaster Mitigation, Disaster Literacy, Google Earth

1   INTRODUCTION

Indonesia is a country that has the potential to be prone to natural disasters, because it is located at the confluence of the Indo-Australian, Pacific and Eurasian plates (Aslamia & Supardi, 2022; Riyadi, 2019; Syafitri, Bahtiar, & Didik, 2020; Triana, Hadi, & Husain, 2018; Zaimi, Syafriani, Rahmat, & Hamdi, 2018) and how many in the ring of fire position (Akbar, Darman, Marizka, Namora, & Ardewati, 2018; Aprianti et al., 2023; Christie Gosal, Ch Tarore, & Karongkong, 2018; Hadi, Agustina, & Subhani, 2019; Nugroho, 2018). The level of disaster vulnerability that occurs in several districts in Indonesia is a challenge for disaster education. Wajak sub-district in Malang district is one of the districts in East Java province, Indonesia that is potentially prone to floods, earthquakes, strong winds, and landslides. Schools in Wajak sub-district have taught disaster education through learning in Geography, Physics, Social Studies (I P S) and Natural and Social Sciences (I P A S) subjects at school, but still need to increase student awareness related to disaster literacy.

The need for awareness of disasters and the ability to reduce the risks posed by natural disaster events. A person's ability to read, understand and use disaster-related information to make decisions and based on responses to the disaster management cycle is termed disaster literacy (Amini et al., 2024; Çallşkan & Üner, 2021; Sampurno, Sari, & Wijaya, 2015). Disaster literacy is useful for measuring and building a person's ability in the aspect of disaster mitigation which includes the phase of action before, during and after a disaster (Mustofa, Setyowati, & Pramono, 2023). Disaster literacy-based learning aims to provide disaster understanding to minimize risks as a result of disasters that occur (Brown, Haun, & Peterson, 2014).

Based on results research Marlyono , et al (2016) Shows that student disaster literacy in Indonesia is classified as a low category. The weak condition of disaster literacy is shown in the lack of a culture of reading and writing among students about things related to disasters. In fact, an understanding of disaster literacy is needed to determine one's success in saving oneself in the event of a disaster (Maghfirah & Mutia, 2023). Shows that student disaster literacy in Indonesia is classified as a low category. The weak condition of disaster literacy is shown in the lack of a culture of reading and writing among students about things related to disasters. In fact, an understanding of disaster literacy is needed to determine one's success in saving oneself in the event of a disaster.

The results of research conducted by Sarwono, et al (2016) that the project-based learning model has a positive effect on disaster understanding. Disaster literacy skills are expected to be able to form an understanding and be able to solve problems and minimize disaster risks. This is related to the characteristics of the project-based learning model where students are accustomed to looking for problems and then students are required to be able to solve these problems in the form of projects or direct application.

The use of Google Earth media has proven to be effective as a tool for creating disaster mitigation-based learning projects (Saputri, Buwono, & Christanto, 2020). Google Earth-assisted learning can display areas prone to disasters. The project-based learning model assisted by Google Earth media can be collaborated in learning on disaster mitigation material with the aim that students have disaster literacy. Using this learning model, students will apply the material directly and be linked to the problems around them by following the following syntax: 1) determining basic questions, 2) making project planning designs, 3) preparing schedules, 4) supervising activities and monitoring project progress, 5) testing project results, 6) evaluating project results (Direktorat Pembina SMA, 2014). Students will more easily understand the material with direct application using the project-based learning model, so that students will also be encouraged to have disaster literacy by utilizing knowledge to be applied directly in problem solving or disaster mitigation.

The use of Google Earth aims to display areas affected by disasters, so that students will find it easier to see, analyze areas affected by natural disasters using this media. In addition, the use of the project-based learning model assisted by Google Earth media aims to improve the disaster literacy of Madrasah Aliyah Al-Hidayah Wajak students by utilizing material about disaster mitigation that has been understood to be used directly in overcoming and reducing the impact of natural disasters that occur in Wajak sub-district

2   METHOD

This research uses quasi experiment method. The research design uses The Nonequivalent Control Group Design by giving a pretest before learning and a posttest after learning. Pretest and posttest were given to the experimental class and control class to measure the improvement of disaster literacy skills. Students were treated in the experimental class with project-based learning integrated with Google Earth media. In contrast to the treatment in the control class such as learning in general conducted by the teacher using interactive lectures, printed books and interesting student worksheets. The scheme of the research plan with the pretest-posttest design of The Nonequivalent Control Group Design is as follows.

Table 1 Design of The Nonequivalent Control Group Design

Class	Pre-test	Treatment	Posttest
Experiment	O_1	X_1	O_2
Control	O_1	X_2	O_2

Description: O_1 : Pre test

O_2 : Post test

X_1 : Treated with project-based learning model assisted by Google Earth media.

X_2 : Learning with lecture method, using printed books and Student Worksheets

Madrasah Aliyah Al Hidayah Wajak Malang was used as a research site, because the Wajak area is an area where natural disasters such as landslides, floods, earthquakes and strong winds often occur. There were 5 meetings in this study. The initial activities of students were tested with pretest questions conducted in experimental and control classes with the same questions. Then the two experimental and control classes were given treatment according to the research design for 5 meetings. In the last session the experimental and control classes were given a posttest with the same questions as the pretest.

The research sample was taken based on two classes that had almost the same average daily test scores and at the same time. From the XI IPS class that has an average daily test score of geography that is almost the same, namely XI IPS 1 with an average of 78 and XI IPS 2 class with an average of 78.5. Selection of experimental and control classes is done by lottery using random picker application. The results showed the class XI IPS 1 as the experimental class and class XI IPS 2 as the control class.

The disaster literacy question instrument in this study used a multiple choice test. The questions used for pretests and posttests are the same questions. The question before being given to students is carried out expert validation. Then the questions that have been valid based on expert validation assessment will be tested in class XII. The results of the question trial were analyzed using the validation of the Product Moment Correlation formula, the reliability of the Cronbach Alpha formula, the level of difficulty and differentiation using excel. The selected questions are questions that have biased criteria results so that the questions have good quality. The number of questions in this study was 25 questions that were declared in accordance with the criteria for good questions. The question indicators for disaster literacy are as follows.

Table 2 Indicators disaster literacy

Indicator	Question No
Identify type disaster natural	1,2, 3
Identify characteristics disaster natural	4
Observe cycle countermeasures disaster natural	5, 6, 7
Identify distribution of vulnerable areas disaster in Indonesia	8. 9, 10, 11
Identify types and remedies disaster natural through education , wisdom local , and utilization modern technology .	12, 13, 14, 15
Serve report results discussion related disaster nature and mitigation disaster be equipped sketch , floor plan , and/ or map	16, 17, 18, 19
Do simulation mitigation disaster in the environment school	20, 21, 22, 23

Make map evacuation disaster in the environment around	24, 25

Data analysis using SPSS 25 is an independent t-test. Hypothesis testing in this study, this hypothesis will be accepted if t-count> t-table and if the significance level is less than 0.05 or $p < 0.05$ which means that the two groups, namely the experimental group and the control group have the same variant. The working hypothesis is as follows:

H_1 : Project Based Learning Model assisted by Google Earth media on disaster mitigation material affects the disaster literacy of students in class XI IPS Madrasah Aliyah Al Hidayah Wajak.

H_0 : Project Based Learning Model assisted by Google Earth media on disaster mitigation material has no effect on disaster literacy of XI IPS of Madrasah Aliyah Al Hidayah Wajak.

3 RESULT AND DISCUSSION

Exposure of research data in the form of multiple choice test results that have been tested in experimental and control classes. The information presented includes the lowest, highest and average scores obtained in each class after the pre test and post test using SPSS 25.0 for windows. Table 3. displays the scores of the experimental and control classes.

Table 3. Pretest and posttest scores

Deskripsi	Kelas Eksperimen		Kelas Kontrol	
	Pre test	Post testt	Pre test	Post testt
Jumlah siswa	30	30	29	29
Nilai tertinggi	58	96	58	88
Nilai terendah	20	60	20	52
Rata-rata	39,73	76,07	39,86	64,76

Based on table 3, it can be concluded that before being given the treatment the control class had an average value of 39.86 while the experimental class had an average value of 39.73. The results of the average value of the data in table 3 considering disaster literacy qualifications show that before being given the treatment of the control class learning model and the experimental class had a very poor disaster literacy category.

Descriptive analysis data in table 2 shows that after the treatment of the experimental class, the average post-test score is 76.07 and the average post-test score of the control class is 64.76. These results show that there was an increase in each class after the treatment was given, namely in the experimental class The project based learning model uses Google Earth, while the control class uses the lecture method , However , the increase in the experimental class was greater than in the control class.

Hypothesis testing is used to test existing hypotheses, namely testing students' disaster literacy using the *Project Based Learning model.* Hypothesis testing using *SPSS 25. for Windows* with t-test *(Independent sample t-test)* T-test calculation results *(Independent Sample t-Test)* in table 4.

Table 4. Independent Samples T Test

Independent Samples Test										
	Levene's Test for Equality of Variances		t-test for Equality of Means							
					Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
	F	Sig.	t	df				Lower	Upper	
Disaster_ Litercy	Equal variances assumed	.049	.826	3.791	57	.000	11.308	2.983	5.335	17.281
	Equal variances not assumed			3.789	56.806	.000	11.308	2.984	5.332	17.284

Based on table 4 of the calculation of the t test (Independent Sample t-Test), it can be seen that there is an effect of the project-based learning model using Google Earth media on disaster literacy on disaster mitigation material in class XI social studies Madrasah Aliyah Al Hidayah Wajak. Evidenced by the value of Sig. (2- tailed) value of $0.000 \leq 0.05$ and evidenced by the average post-test value of the experimental class is higher at 76 than the control class post-test value of 64.8. The explanation above can be concluded that H$_0$ is rejected, thus H$_1$ is accepted which states that the Project Based Learning Model assisted by Google Earth media on disaster mitigation material affects the disaster literacy of XI IPS of Madrasah Aliyah Al Hidayah Wajak.

Discussion

Based on the data analysis that the researchers carried out, it was found that the *project based learning model* using *Google Earth media* had a significant effect on the disaster literacy of class XI IPS Madrasah Aliyah Al Hidayah Wajak students. The implementation of *the project based learning* model is known to be better to apply compared to learning using the lecture method. In the control class, the learning model using the lecture method resulted in lower disaster literacy compared to the experimental class. This is because the teacher is the center of learning, so that students have knowledge that is built through the explanations given by the teacher. Learning in the control class also has question and answer sessions and assignments, however, students are still less interested in participating in learning, do not really analyze the problems that occur in the surrounding environment so that in doing the assignments students are not able to solve the problems and disaster literacy is not optimal.

Researchers found the results in the experimental class data analysis that the average value was higher than the control class. This is supported by the results of data analysis which show that the *project based learning model* using Google Earth media has an effect on students' disaster literacy (Sarwono et al., 2016) . Using *Google Earth* media can help develop disaster literacy skills in students (Saputri et al., 2020) .

Observation results show that *project based learning* influential positive to literacy disaster caused by factors, namely: 1) students can analyze the area in a real and clear way so that students have their own views regarding the area to be analyzed; 2) students can find out changes in an area from year to year; 3) students can analyze the causes, the process of occurrence, the impacts caused by these problems; 4) students can relate the same problems in different areas or the same problems in the same area and different years; 5) students are able to find solutions to existing problems. The above statement is in line with Alfansyah & Insani's statement (2024) that by using Google Earth disaster literacy will develop such as: 1) students can be aware of changes that occur in an object in a certain area; 2) students are able to analyze the impact, cause and effect of problems using Google Earth; 3) students have the ability to relate problems that occur in the surrounding environment and able to provide problem solving solutions relating to problems that occur in the surrounding environment and able to provide problem solving solutions .

Project Based Learning learning model in this research provides advantages in each syntax. Learning is carried out through syntax, namely: 1) providing essential questions, 2) preparing a project plan, 3) preparing a project work schedule, 4) monitoring student project progress, 5) assessing results, 6) evaluating learning experiences (Direktorat Pembina SMA, 2014) . The first syntax provides essential questions, at this stage the teacher begins the lesson by asking important questions with the aim that students can understand the lesson in question. This stage also encourages students to actively answer questions related to disaster mitigation. This stage makes students actively answer and give their opinions regarding examples of disaster-prone areas in the environment around where they live. Student show activeness by exchanging information about disaster-prone areas around where they live. Student activity in ask answer This encourages increased disaster literacy (Wilujeng & Suryaningsih, 2022) .

The second syntax is preparing a project plan. The preparation of the project plan is associated with information obtained from exchanging information that students have carried out in the first syntax. Information about problems with geosphere phenomena, such as areas that have experienced disasters around where students live, encourages increased curiosity to find out the characteristics of areas that are prone to disasters and the causes of these disasters. Students use smartphones to find out additional information about disasters. The information obtained by each student encourages students to think critically (Farhan & Ardimansyah, 2022; Musi'in, 2022) . The increase in disaster literacy indicators in this syntax is proven by students actively thinking critical in observation by looking for information sources via the internet or other sources to gain new knowledge about natural disasters . Students' ability to look for examples of surrounding areas that are prone to disasters shows that students' disaster literacy has increased, because they are able to criticize them problems in the surrounding environment.

The third syntax is the stage of preparing a *project work schedule* , at this stage the teacher and students discuss the time allocation for collecting *the project* . This time determination is based on discussions between teachers and students. At this stage, students learn to operate Google Earth. Students are also given the freedom to ask questions about operational obstacles so that this is also taken into consideration when compiling a project work schedule. This stage really encourages students' enthusiasm in learning to use the Google Earth application, because students can find out about the surrounding area without having to come to that area. The positive content in using Google Earth makes students' interest high Study material disaster (Saputri et al., 2020) . Students stated that this was the first time they were familiar with the *Google Earth application* , learning with this application was very fun because students could see the shape of the earth's surface as a whole. Students are very enthusiastic in using the application, because according to students' opinions, by using this application students can see and analyze areas that cannot be reached or cannot be visited. Students can also see the condition of the region from previous years. Using the *Google Earth application* will encourage students to have disaster literacy skills, because students observing the images in the application can encourage their brains to store data. This is in accordance with the opinion of Deutscher (2011) which states that using the *Google Earth application* can help students understand the contents of the world and its surroundings .

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The fourth syntax monitors the progress of students' *projects* . In this stage, the researcher monitors the progress of *the projects* that students have worked on. In this syntax, students analyze images of selected regions from different years to find out why the region experienced changes. Students are also able to show the effects caused by the disaster in the area chosen as *the project* to be collected. Students are also able to provide solutions to overcome or minimize the impacts caused. Ability student give solution to problem disaster is increasing literacy indicators disaster (Amanda, Kurnianto, Pangastuti, Astutik, & Nurdin, 2024; Tamam & Subrata, 2022) .

Project based learning consists of 6 syntaxes, but in this research four syntaxes encourage disaster literacy skills. Syntax 5 is testing results project and 6, namely evaluation The results of the project have not been able to be carried out optimally so that the impact is less on disaster literacy abilities. Further research is needed to strengthen the implementation of learning in syntags 5 and 6.

4   CONCLUSION

Based on the objectives and results of the research carried out, it was concluded that the *Project Based Learning Model* had a positive effect on the disaster literacy of class XI IPS Madrasah Aliyah Al Hidayah Wajak students. This is evidenced by the increase in the average disaster literacy pretest and posttest results which were higher in the experimental class than in the control class. In learning to use bast learning projects, several obstacles occurred, one of which was that students were still confused about deciding what project to make, so the researcher had already prepared a detailed project that would later be made by the students. Apart from that, there is a lack of punctuality when collecting projects. Input for further research: the timeline for making projects in learning is arranged in detail and students are always reminded of the schedule for implementing projects. It is also necessary to periodically develop disaster simulation activities in schools to train students' preparedness when a disaster occurs.

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