



The Implementation of Project Based Learning to Enhance Students' Understanding of Environmental Conservation and Disaster Mitigation

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Abstract – The aim of this research is to provide junior high school students with learning experiences to increase their understanding of environmental conservation and disaster mitigation. This study focuses on reforestation and disaster mitigation efforts through the application of project-based learning models in the surrounding environment. This research was a descriptive study with a post-test design approach, conducted at SMPN Ranoyapo, South Minahasa Regency. There were 42 students of class VII who participated in this study. The results of this research showed that the students' understanding of environmental conservation was in the level of excellent category (26%), good category (48%), fairly good category (24%), and poor category (2%). Meanwhile, the highest average percentage of students' understanding of disaster mitigation efforts was in the excellent category (41%), followed by the good category (39%), fairly good category (16%), and poor category (4%). These results indicate that project-based learning can improve students' understanding of learning, particularly that related to environmental learning.

Keywords: conceptual understanding; disaster mitigation; environment; project-based learning

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I. INTRODUCTION

Indonesia is the country with the third-highest annual global greenhouse gas emissions from forest loss (Basuki et al., 2022), which is a serious problem. Environmental issues such as conservation and disaster mitigation are aspects that require more attention in this era. It is because the relationship between humans as subjects and the environment as objects cannot be

separated from environmental exploration and exploitation activities to meet human needs and welfare (Anazifa & Hadi, 2016). It means that disaster mitigation is based on the environment, which needs an effort to be made in disaster risk reduction by arrangement and utilization (Oktorie et al., 2019). Thus, a severe concern for the environment is needed to maintain the environment quality and the sustainability of human life.

Many efforts can be made to overcome environmental problems. One of them is by implementing environmental education through the learning process at schools. Environmental learning can be integrated into the science subject learning that is taught in schools (Bramwell-Lalor et al., 2020), such as in junior high schools (Turangan et al., 2020).

The results of the preliminary studies that we conducted at SMPN Ranoyapo, located in Poopo Village, show that the teachers still use conventional methods in teaching, so the learning activities are not optimal. This situation is exacerbated by the location of the school in a village where there is limited access, network disruption, and inadequate facilities and infrastructure (Kuron & Tompodung, 2020). On the other hand, the environment around Poopo Village is very supportive of implementing environment-based learning, such as environmental exploration using the project-based learning method (Turangan et al., 2020; Viana et al., 2019).

Project-based learning (PjBL) is a learning method that uses projects or activities as a medium that allow the learners to explore, evaluate, interpret, synthesize, and produce information in various forms of learning outcomes (Nurdin & Wahyudin, 2020; Syukriah et al., 2020). There are several reports on the advantages of PjBL, such as improving students' creativity and learning outcomes (Guo et al., 2020; Nurdin & Wahyudin, 2020), problem-solving abilities

(Anazifa & Hadi, 2016; Choeriyah et al., 2021), and thinking skills (Lespita et al., 2023; Niswara et al., 2019; Suyatman et al., 2021; Viana et al., 2019). Moreover, PjBL is one of the learning models which is student-oriented and allows the students to learn independently in solving problems and to produce a real project or work (Niswara et al., 2019). PjBL also provides opportunities for cultivating a wide range of sustainability competencies (Bramwell-Lalor et al., 2020), and guides them to understand the concepts and principles of the project through problems or questions (Azizah et al., 2021; Sari et al., 2019; Viana et al., 2019).

Therefore, this study aims to determine students' understanding of environmental preservation, especially in efforts to reforest and mitigate students' disasters through the application of the PjBL model. This research focused on environmental problems around the student's school environment. The research questions are:

- 1) How to apply the PjBL model at SMPN Ranoyapo?
- 2) Can the PjBL model increase students' understanding of environmental conservation and mitigation efforts at SMPN Ranoyapo?

II. METHODS

The research is a quantitative research using a descriptive design. This study was conducted to determine the level of students' understanding of the application of project-

based learning models in science subjects. The subjects in this study were 42 students of class VII at SMPN Ranoyapo, South Minahasa Regency, North Sulawesi, who were treated with a PjBL model. The sample was taken by using total sampling. This research was conducted from July to September 2022. The research procedure in this study is shown in Figure 1.

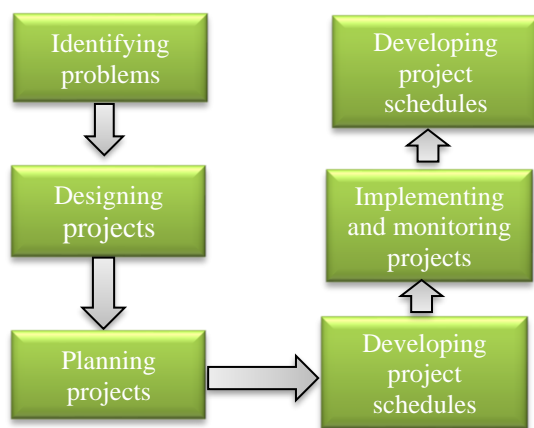


Figure 1. Research procedure

The stages of the research carried out consisted of observation, implementation of the PjBL model, and a test at the end of the lesson. The PjBL implementation process is carried out by identifying problems, designing and planning projects, developing project schedules, implementing and monitoring projects, and testing project results. The data used in this study are documentation, observation, and assessment using research instruments. The research instrument used in data collection is in the form of multiple-choice questions.

The data analysis technique used in this research is the quantitative descriptive analysis which aims to describe or explain events that

are happening at present in the form of numbers. The level of students' understanding of the PjBL outcomes is represented by the following equation (Auliya & Lazim, 2020).

$$X\% = \frac{F}{N} \times 100\% \quad 1)$$

Description:

X : percentage

F : frequency (number of students' answers)

N : the number of students.

The percentage value is categorized into several levels, as shown in Table 1. As we can see, M_i (Mean Ideal) is $1/2$ (highest score-lowest score), and S_i (Standard Deviation Ideal) is $1/6$ (highest score-lowest score) (Astuti & Wangid, 2018).

Table 1. The data category with its indicators

No.	Categories	Indicators
1	$M_i + 1,5 S_i \leq \text{Score} < M_i + 3 S_i$	Very good
2	$M_i + 0,5 S_i \leq \text{Score} < M_i + 1,5 S_i$	Good
3	$M_i - 0,5 S_i \leq \text{Score} < M_i + 0,5 S_i$	Fairly good
4	$M_i - 1,5 S_i \leq \text{Score} < M_i - 0,5 S_i$	Poor

III. RESULTS AND DISCUSSION

The PjBL model in this research was implemented through three phases, namely preparation, implementation, and evaluation. The preparation phase was conducted by observing the environmental issues around the subject area and making an assessment instrument, while the implementation phase was done by giving instructions on the project and exploration activity. The last phase is the

phase of evaluating the project, analyzing data, and making activity reports.

The implementation of the PjBL in SMPN Ranoyapo has been successfully conducted, and obtained various evidence and testimony. Apperception is an approach to stimulate the students' learning motivation (Puteri, 2018). This activity is conducted to create a positive mind, good motivation, and passion for getting ready for the lesson. This process is adapted from a previous report (Viana et al., 2019). Figure 2 below shows the appreciation process carried out by teachers and students at SMPN Ranoyapo.



Figure 2. Apperception process

After giving checking prior knowledge and giving instruction, the students were asked to explore the environment and mitigation as a topic in the surrounding area. The SMPN Ranoyapo, which is located in Poopo Village-North Sulawesi Province, has a potential educational resource to explore the topic. The student activity is shown in Figure 3.



Figure 3. The students' activity by exploring the natural resources to complete their project.

As shown in Figure 3, the students completed their project by directly exploring the information from nature. The students showed enthusiasm and excitement to learn more about the environment. Setyaningsih and Fauziah (2022) state that learning interest and motivation have an effect on learning outcomes.

Furthermore, the evaluation results show that the implementation of PjBL on environmental learning enhanced the students' understanding of environment conservation. The percentage of students' understanding is presented in Figure 4.

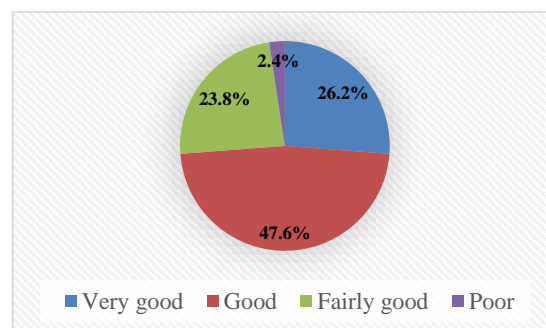


Figure 4. The percentage of the frequency distribution of students' understanding

Based on the data analysis presented in Figure 4, it can be seen that the level of understanding of students about reforestation through the application of the PjBL models is 26.6% in the very good category and 47.6% in the good category. Then, in the fairly good category of 23.8% and in the poor category of 2.4%.

Mitigation efforts are a way to reduce disaster risk (Pancasilawan et al., 2020; Varkkey, 2012). Pancasilawan et al. (2020) suggested that mitigation efforts can generally be divided into two activities: structural approaches and non-structural mitigation. Furthermore, we analyzed the students' understanding of disaster mitigation efforts. The results can be seen in Table 2.

Table 2. The average percentage of students' understanding of mitigation efforts

No.	Indicators	The average percentage level (%)			
		Very good	Good	Fairly good	Poor
1	Waste management				
2	Riverside greening				
3	Greening of open space	41	39	16	4
4	Greening of water resource				

Table 2 shows the average percentage of students' understanding of mitigation efforts. The levels of understanding were categorized as very good understanding (41%), good understanding (39%), fairly good understanding (16%), and poor understanding (4%). This indicates that the implementation of PjBL model could help the students to have a

good understanding of disaster mitigation efforts.

The high number of students who are in the very good and good category is caused by the students' learning activities that are in direct contact with nature through implementing environmental learning by using PjBL models. Outdoor environmental learning has positive effects on students (Pirchio et al., 2021), provides an understanding of the importance of keeping the environment (Turangan et al., 2020), and effectively increases students' motivation and learning outcomes (Perdiawan & Tini, 2021). Furthermore, with this PjBL, the students can be encouraged to be more active to improve their understanding, work, and think for themselves through the subject matter (Syukriah et al., 2020).

The results of this study were also supported by previous reports, which stated that the PjBL model was effective in increasing students' knowledge (Sarwono et al., 2016). In addition, PjBL can also increase student motivation and learning outcomes (Bramwell-Lalor et al., 2020; Perdiawan & Tini, 2021). Thus, environment-based learning combined with project-based learning can increase students' understanding of the importance of preserving the surrounding environment and the environmental preservation efforts that they can take to prevent natural disasters from occurring.

IV. CONCLUSION AND SUGGESTION

Based on the data analysis, it can be concluded that the implementation of PjBL at SMPN Ranoyapo has been successfully implemented. PjBL implementation is carried out through three stages, namely preparation, implementation, and evaluation. The implementation of the PjBL model has increased students' understanding of environmental conservation in the good category (highest score) and understanding of mitigation efforts in the very good category (highest score).

This research has several weaknesses. For example, it only focuses on examining students' conceptual understanding, and there is no comparison class (conventional class). As a suggestion, future researchers may need to identify various aspects of implementing PjBL in environmental learning, such as motivation, teamwork skills, and critical and creative thinking skills. In addition, research is also needed involving a comparison class so that the results obtained are more accurate.

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