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The Implementation of Project Based Learning (PjBL) to Enhanced Understanding of Environmental Conservation and Disaster Mitigation

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Abstract – The background of this research is to provide students with learning experiences to increase their understanding of environmental conservation and disaster mitigation in junior high schools. This study aims to obtain the students' understanding of reforestation and disaster mitigation efforts through the application of project-based learning models in the surrounding environment. This research used a descriptive quantitative study with a post-test design approach. This research was conducted at SMPN Ranoyapo, South Minahasa Regency. The results of this research showed that the level of students' understanding of greening was 26% in the excellent category, 48% in the good category, 24% categorized as fairly good category, and 2% in the poor category. Meanwhile, the average percentage of students' understanding of disaster mitigation efforts has a perfect understanding (41%), in the excellent category (39%), in the fairly good category (16%), and in the poor category (4%). These results indicate that project-based learning can improve students' understanding of learning and contribute to environmental learning.

Keywords: disaster mitigation; environment; project-based learning (PjBL)

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 problems 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 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's quality and the sustainability of human life.

Many things can be done for this under the fields and abilities possessed. One of them, especially in the field of educational background, can be done early on through the learning process of implementing environmental education. 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 (M.B.Turangan et al., 2020).

Based on our experience with preliminary studies that have been conducted on teachers at SMPN Ranoyapo located in Poopo Village, the learning process is still used with conventional methods, then teaching and learning activities are still relatively low. Similar reports have shown that the location of schools that are still in the form of villages or limited access, network disruptions, and lacking facilities and infrastructure in this area are the causes (Kuron & Tompodung, 2020). On the other hand, by considering the environment around Poopo Village is very supportive of implementing environmental-based learning, such as an environmental exploration by using the project-based

learning (PjBL) method as the previous report (M.B.Turangan et al., 2020; Viana et al., 2019).

PjBL is a learning method that uses projects/activities as a medium that[19] allow the learners to explore, evaluate, interpret, synthesize, and produce information in various forms of[19] learning outcomes (Nurdin & Wahyudin, 2020; Syukriah et al., 2020). There are several reports on the advantages of PjBL, such as improving student 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 orientated toward students and allows the student to learn independently in solving problems, and they[20] can produce a real[21] project or work (Niswara et al., 2019), provides opportunities for cultivating a wide range of sustainability competencies (Bramwell-Lalor et al., 2020), and problems or questions will guide them to understand the concepts and principles of the project (Khasanah et al., 2021; Sari et al., 2019; Viana et al., 2019).

In this case, this research aims to determine the understanding of students on environmental conservation, especially in reforestation and disaster mitigation efforts of students through the application of project-based learning models, which are focused[22] on environmental issues in their surroundings. The enhancement of understanding of the issues will be conducted[23] by research instruments with quantitative descriptive analysis.

METHODS

71 Type of this research is quantitative research using a descriptive method. This study was conducted[24] to determine the level of[25] students' understanding of the application of project-based learning models in science subjects at SMPN

Ranoyapo. The subjects in this study were 42 students of class VII who were treated with a project-based learning model (PjBL). This research was conducted in July-September 2022 in Poopo Village, South Minahasa Regency. The sampling method is by using total sampling.

The stages of the research carried out consisted of observation, implementation of project-based learning, 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 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 or events that are happening at present in the form of numbers. The level of students' understanding of project-based learning outcomes is represented by the following equation (Nopriyanti et al., 2020).

X%=F/N x100%

The X% symbol is Percentage, F is Frequency (number of respondents' answers), and N is the number of respondents. The percentage value is categorized into several levels, as shown in Table 1.

Table 1. The data category with its indicators

No.	Categories	Indicators
1		Mi + 1,5 Si ≤ Score < Mi + 3 Si

Very Good

2

Mi + 0,5 Si ≤ Score < Mi + 1,5 Si

Good

3

Mi – 0,5 Si ≤ Score < Mi + 0,5 Si

Fairly Good

4

Mi – 1,5 Si ≤ Score < Mi – 0,5 Si

Poor

Mi (Mean Ideal) is 1/2 (highest score-lowest score), and Si (Standard Deviation Ideal) is 1/6 (highest score-lowest score) (Putrajaya et al., 2013).

RESULTS AND DISCUSSION

The implementation of[32] the Project-Based Learning (PjBL) model in this research has been conducted[33] in several 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[34] implementation phase was by giving instructions on the project and exploration activity. The last phases were the evaluation of the project[35], data analysis, and reporting.

Implementation of PjBL in SMPN Ranoyapo has been successfully conducted and obtained various evidence and testimony. Figure 1. shows that the researcher gave apperception in class VII of SMPN Ranoyapo.

Figure 1. Apperception process by the researcher

Apperception is an approach to stimulate the student's learning motivation (Puteri, 2018). This activity is undertaken by the researcher to create a positive mind of student motivation and passion for absorbing knowledge.[36] This process is adapted[37] from a previous report (Viana et al., 2019).

After giving knowledge and instruction, we arrange for the student to explore the environment and mitigation as a topic in the surrounding area. The SMPN Ranoyapo, which is[38] located[39] in Poopo Village-North Sulawesi Province, has a potential educational resource to explore the topic. The student activity is shown[40] in Figure 2.

Figure 2. The student activity explores the natural resource to complete their project.

As shown in Figure 2., the students complete their project by exploring the information from nature. The student activity indicates enthusiasm which has the high motivation to learn more about the environment. A previous report (Setyaningsih & Fauziah, 2022) states that learning independence and motivation have an effect on[41] learning outcomes.

Furthermore, the evaluation results show that the implementation of[42] PjBL on environmental learning enhanced the understanding of environment conservation. The percentage of students' enhanced understanding of greening is presented[43] in Figure 3.

Figure 3. The percentage of the frequency distribution of student's understanding

Based on the data analysis, it can be concluded that the level of understanding of students about reforestation through the application of environmental-based, project-based learning models is mostly good (48%) and excellent (26%). This may be caused by the student learning activities that are in direct contact with nature through implementing environmental learning by using PjBl models. Meanwhile, these results were appropriate with the report, which declared the outdoor environmental education program has positive outcomes for students (Pirchio et al., 2021), provides an understanding of the importance of keeping the environment (M.B.Turangan et al., 2020), and effectively increase motivation and learning outcomes student (Perdiawan & Tini, 2021). Furthermore, with this PjBL, the students can be encouraged to be more active to improve their understanding, work and thinking for themselves by the subject matter (Syukriah et al., 2020).

Mitigation efforts are a way to reduce disaster risk (Pancasilawan et al., 2020; Varkkey, 2014). (Pancasilawan et al., 2020) reported that the mitigation efforts can generally be divided into two activities which are structural approaches and non-structural mitigation. Furthermore, we analyzed the students' understanding of disaster mitigation efforts, which can be seen in Table 2.

Table 2. The Average Percentage of Student's Understanding of Mitigation Efforts

No.

Indicators

The Average Percentage Level (%)

Very Good

Good

Fairly Good

Poor

1

Waste management

42

39

16

4

2

Riverside greening

3

Greening of open space

4

Greening of Water Resources

Table 2. shows the average percentage of mitigation efforts. The levels of understanding were categorized as very good understanding (42%), good category (39%), fairly good category (16%), and poor category (4%). So, with the learning model as project based learning, students have a very good understanding of disaster mitigation efforts. It follows the previous research, which states that the project-based learning model effectively increases knowledge (Sarwono et al., 2016), motivation and learning outcomes for students (Bramwell-Lalor et al., 2020; Perdiawan & Tini, 2021). With environment-based learning combined with project-based learning, students understand the importance of preserving the surrounding environment and the environmental conservation efforts they can make to prevent natural disasters.

CONCLUSION AND SUGGESTION

This paper has presented an enhancement of student understanding through implementing a problem-based learning model with a creative and fun experience learning environment and mitigation in their surroundings. Based on data analysis, the conclusion in this research is that implementing the problem-based learning model has enhanced the student understanding of the learning environment on greening at the level of the category good and the understanding of mitigation efforts at the category level excellent. As a suggestion, this research may need to utilize in the future by identification of various aspects of the implementation of PjBL on environmental learning especially at SMPN Ranoyapo.

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1.	by applying	Wordy sentences	Clarity
2.	*was conducted*	Passive voice misuse	Clarity
3.	~~the level of~~	Wordy sentences	Clarity
4.	~~fairly~~ → pretty, reasonably	Word choice	Engagement
5.	~~is the country with~~ → has	Wordy sentences	Clarity
6.	~~serious~~ → severe	Word choice	Engagement
7.	~~are aspects that~~	Wordy sentences	Clarity
8.	*is based*	Passive voice misuse	Clarity
9.	*be done*	Passive voice misuse	Clarity
10.	*be integrated*	Passive voice misuse	Clarity
11.	~~that is~~	Wordy sentences	Clarity
12.	~~that have been~~	Wordy sentences	Clarity
13.	*been conducted*	Passive voice misuse	Clarity
14.	*is still used*	Passive voice misuse	Clarity
15.	~~, then teaching~~ → . Teaching	Hard-to-read text	Clarity
16.		Tone suggestions	Delivery
17.	~~that are~~	Wordy sentences	Clarity
18.	*On the other hand, by considering the environment around Poopo Village is very supportive of implementing environmental-based learning, such as an environmental exploration by using the project-based learning (PjBL) method as*	Unclear sentences	Clarity

	the previous report (M.B.Turangan et al., 2020; Viana et al., 2019).		
19.	*PjBL is a learning method that uses projects/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).*	Unclear sentences	Clarity
20.	~~, and they~~ → . They	Hard-to-read text	Clarity
21.	~~a real~~ → an actual	Word choice	Engagement
22.	*are focused*	Passive voice misuse	Clarity
23.	*be conducted*	Passive voice misuse	Clarity
24.	*was conducted*	Passive voice misuse	Clarity
25.	~~the level of~~	Wordy sentences	Clarity
26.	*were treated*	Passive voice misuse	Clarity
27.	*The subjects in this study were 42 students of class VII who were treated with a project-based learning model (PjBL).*	Unclear sentences	Clarity
28.	*was conducted*	Passive voice misuse	Clarity
29.	*The stages of the research carried out consisted of observation, implementation of project-based learning, and a test at the end of the lesson.*	Unclear sentences	Clarity
30.	~~at present~~	Wordy sentences	Clarity
31.	*is represented*	Passive voice misuse	Clarity
32.	Implementing	Wordy sentences	Clarity

33.	*been conducted*	Passive voice misuse	Clarity
34.	~~, while the~~ → . The	Hard-to-read text	Clarity
35.	project evaluation	Wordy sentences	Clarity
36.	*This activity is undertaken by the researcher to create a positive mind of student motivation and passion for absorbing knowledge.*	Passive voice misuse	Clarity
37.	*is adapted*	Passive voice misuse	Clarity
38.	~~which is~~	Wordy sentences	Clarity
39.	*is located*	Passive voice misuse	Clarity
40.	*is shown*	Passive voice misuse	Clarity
41.	~~have an effect on~~ → affect	Wordy sentences	Clarity
42.	implementing	Wordy sentences	Clarity
43.	*is presented*	Passive voice misuse	Clarity
44.	*be concluded*	Passive voice misuse	Clarity
45.		Tone suggestions	Delivery
46.	*This*	Intricate text	Clarity
47.	*be caused*	Passive voice misuse	Clarity
48.	*This may be caused by the student learning activities that are in direct contact with nature through implementing environmental learning by using PjBl models.*	Unclear sentences	Clarity
49.	~~for themselves~~	Wordy sentences	Clarity
50.	we were reported, or we are reported	Incomplete sentences	Delivery

51.	*be divided*	Passive voice misuse	Clarity
52.	~~which can be~~ → as	Wordy sentences	Clarity
53.	*be seen*	Passive voice misuse	Clarity
54.	~~very good~~ → excellent, perfect	Word choice	Engagement
55.	~~fairly~~ → reasonably	Word choice	Engagement
56.	~~project based~~ → project-based	Misspelled words	Correctness
57.	~~a very good~~ → an excellent, a perfect	Word choice	Engagement
58.	, especially	Punctuation in compound/complex sentences	Correctness
59.		Incorrect citation format	Correctness
60.	~~Problem Based~~ → Problem-Based	Misspelled words	Correctness
61.	~~School~~ → Schools	Incorrect noun number	Correctness
62.	~~project based~~ → project-based	Misspelled words	Correctness
63.	*terhadap*	Unknown words	Correctness
64.	*Pengaruh model project based learning terhadap high order thinking skill.*	Incomplete sentences	Delivery
65.	~~Project Based~~ → Project-Based	Misspelled words	Correctness
66.	a project-based	Determiner use (a/an/the/this, etc.)	Correctness
67.	~~students'~~ → student's	Confused words	Correctness
68.		Incorrect citation format	Correctness
69.	~~based~~ → Based	Confused words	Correctness

70.	*The results of this research showed that the*	Sustainability | Free Full-Text | Sustainable Development and Value ... https://www.mdpi.com/2034202	Originality
71.	*This study was conducted to determine the level of*	Evaluation of Temporal Artery And Disposable Digital Oral Thermometers in Acutely Ill Patients	Originality
72.	*The data analysis technique used in this research is*	Scilit | Article - The Effect of Place Attachment On The Satisfaction ... https://www.scilit.net/article/6babd710657a6e4a0ebfebbeee2b63b7	Originality
73.	*Based on the data analysis, it can be*	HDC-Net: A hierarchical dilation convolutional network for retinal vessel segmentation	Originality
74.	*Guo, P., Saab, N., Post, L. S., & Admiraal, W. (2020). A review of project-based learning in higher education: Student outcomes and measures. International Journal of Educational Research, 102(April), 101586. https://doi.org/10.1016/j.ijer.2020.101586*	The Effectiveness of STEM-Based PjBL on Student's Critical Thinking ... http://ejournal.radenintan.ac.id/index.php/al-jabar/article/view/8831	Originality
75.	*2020). The Implementation of Project Based Learning to Improve Student Creativity and Learning Outcomes. Proceedings of the 7th Mathematics, Science, and Computer Science Education International Seminar, MSCEIS 2019,*	The Implementation of Project Based Learning to Improve Student ... - EUDL https://eudl.eu/doi/10.4108/eai.12-10-2019.2296340	Originality
76.	*Pancasilawan, R., Utami, S. B., Sumaryana, A., Ismanto, S. U.*	Disaster Management System in Indonesia | Sumatra Journal of ... - UNP http://sjdgge.ppj.unp.ac.id/index.php/Sjdgge/article/view/377	Originality
77.	*Mitigation of Disaster Risk Reduction in Pangandaran Regency. Sosiohumaniora,*	Disaster Management System in Indonesia | Sumatra Journal of ... - UNP http://sjdgge.ppj.unp.ac.id/index.php/Sjdgge/article/view/377	Originality

78.	*Pirchio, S., Passiatore, Y., Panno, A., Cipparone, M.*	Frontiers | The Effects of Contact With Nature During Outdoor ... https://www.frontiersin.org/articles/10.3389/fpsyg.2021.648458/full	Originality
79.	*Carrus, G. (2021). The Effects of Contact With Nature During Outdoor Environmental Education on Students' Wellbeing, Connectedness to Nature and Pro-sociality.*	Frontiers | The Effects of Contact With Nature During Outdoor ... https://www.frontiersin.org/articles/10.3389/fpsyg.2021.648458/full	Originality
80.	*International Journal of Education, Training and Learning, 2(1*	Passion-Driven Statistics: A course-based undergraduate research experience (CURE)	Originality
81.	*The Implementation of Problem-based Learning Model with Online Simulation to Enhance the Student's Analytical Thinking Skill in Learning Physics.*	A Study of the Problem Solving Activity in High School Students ... https://typeset.io/papers/a-study-of-the-problem-solving-activity-in-high-school-56a7gvmc35	Originality