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(Research/Review) Article

Project-Based Learning in Science Education: Strategies for Fostering Environmental Awareness in Fifth-Grade Students at SDIT Wihdatul Ummah Makassar

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Abstract: This study examines the application of the Project-Based Learning (PjBL) model in Natural and Social Sciences education to enhance environmental awareness among fifth-grade students at SDIT Wihdatul Ummah in Makassar City. The background of this research stems from the low environmental awareness observed among students, evidenced by behaviors such as littering, lack of concern for energy conservation, and minimal participation in school cleanliness activities. The study aimed to improve students' environmental consciousness by implementing the PjBL model, where students were tasked with creating environmental awareness posters. The research used a Classroom Action Research (CAR) method, which was carried out in two cycles, each consisting of three meetings. The stages of PjBL involved determining essential questions, project planning, scheduling, project implementation, result testing, and evaluation of experiences. Data collection was done through observations, attitude questionnaires, and documentation of student activities. The findings showed that the PjBL model successfully increased students' active participation, creativity in expressing environmental awareness through posters, and their practical actions toward environmental protection. The environmental awareness indicators, such as maintaining cleanliness, managing waste, conserving energy, understanding waste disposal systems, and using cleaning tools, significantly improved from Cycle I to Cycle II. The results indicate that the PjBL model is effective in enhancing environmental awareness while making the learning process more engaging and contextual for elementary school students.

Keywords: Classroom Action Research; Environmental Awareness; Fifth-Grade Students; Project-Based Learning; Science Education.

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1. Introduction

Environmental awareness is an important value that needs to be instilled from an early age, especially in elementary schools as the main educational institution for children. The cultivation of this character has even been regulated in environmental education policy, as stipulated in Regulation of the Minister of Environment and Forestry Number 1 of 2022 concerning the Movement for Environmental Care and Culture in Schools, which states that environmental education is an effort to increase the knowledge, skills, attitudes, and actions of individuals and communities towards environmental issues for the sake of sustainable development for current and future generations.

However, based on initial observations at SDIT Wihdatul Ummah, students' environmental awareness is still relatively low. This can be seen from various behaviors such as littering, lack of discipline in carrying out cleaning duties, not yet practicing the separation of organic and inorganic waste, and lack of awareness in conserving electricity and clean water. This condition shows that the habit of caring for the environment has not been fully integrated into teaching and learning activities or school culture.

Several previous studies have emphasized the importance of instilling environmental awareness from elementary school age. According to Erma et al. (2023), the integration of environmental values into school culture and learning is still not optimal, so continuous

efforts such as the Adiwiyata program are needed to encourage behavioral change among school members. Meanwhile, research by Nurul et al. (2023) shows that the implementation of Project-Based Learning (PjBL) can increase student engagement, motivation, and participation in learning. Wildah (2021) also proves that PjBL contributes to increasing students' environmental awareness, as seen from the results of observations and questionnaires that show a significant increase in cycles I and II.

Based on the results of observations and reviews of previous studies, the application of the PjBL model is considered appropriate for improving students' environmental awareness, as it involves them in real, collaborative, and contextual activities. In the context of Natural and Social Sciences (IPAS) learning, particularly the Bumiku Sayang, Bumiku Malang material, the project carried out can be in the form of creating environmental awareness posters as a means of fostering awareness and real action in preserving the environment. Therefore, this study was conducted with the aim of improving the environmental awareness of fifth-grade students at SDIT Wihdatul Ummah through the application of the Project-Based Learning model.

2. Preliminaries or Related Work or Literature Review

2.1. Sikap peduli lingkungan

Environmental awareness is an important aspect of basic education that needs to be instilled from an early age so that children become accustomed to preserving the environment in their daily lives. According to Apriliani, et al. (2020), environmental values have been integrated into the fourth grade textbook on the theme of My Neighborhood. However, implementation in the field is still far from expectations. This is reinforced by the findings of Ardiansyah, Rukmana, & Triwahyuni (2023), which show that the environmental awareness of elementary school students is still relatively low, as evidenced by habits such as littering and a lack of activity in maintaining classroom cleanliness.

The Adiwiyata programme is one of the national policy efforts to foster a culture of environmental awareness in schools. Handayani, Iskandar, & Rahayu (2023) found that the implementation of the Adiwiyata programme at SDN Serang 11 was able to increase student awareness, although there were still obstacles in terms of teacher participation and programme sustainability. Similarly, Sahabuddin et al. (2023) emphasised that the implementation of Adiwiyata at SDN Minasaupa has not been fully consistent in shaping students' caring behaviour. In a follow-up study, Sahabuddin et al. (2024) also highlighted that the Green School programme can instil environmental values, but the biggest challenge remains the involvement of the entire school community.

In addition to formal programmes, physical school facilities also influence the development of environmental awareness. Kongidatun & Hidayah (2023) emphasise that school sanitation facilities can be an effective medium for fostering clean living habits and environmental awareness. This means that developing environmental awareness requires a combination of curriculum, school culture, and habit formation through physical facilities and practical activities.

2.2 Model Project-Based Learning

The Project-Based Learning (PjBL) model is a learning approach that emphasises learning experiences through working on real projects. In PjBL, students are actively involved from the planning and implementation stages to the reporting of the project, so that they learn to relate their knowledge to real-world problems (Wena, 2011; Dahri, 2022). PjBL is in line with the requirements of the Merdeka Curriculum because it can develop 21st-century competencies such as collaboration, creativity, communication, and responsibility (Kemdikbud, 2022).

A number of studies have proven the effectiveness of PjBL in shaping environmental awareness. Triana, Anggraito, & Ridlo (2020) found that the implementation of environment-based PjBL was able to foster awareness and a sense of responsibility among primary school students. Similar results were shown by Nasution (2021), who found a 25% increase in environmental awareness from cycle I to cycle II through project-based social studies learning.

Recent research shows the relevance of PjBL to environmental issues in the Merdeka Curriculum. Putri, Sari, & Arifin (2025) emphasise that integrating PjBL with ecological issues can significantly increase students' ecological awareness. Farhin et al. (2023) add that PjBL can also improve student learning outcomes, not just attitudes. In addition, PjBL also develops social skills. Mahsun, Wahyuni, & Nurhadi (2025) found that PjBL can improve student collaboration and social responsibility. Meanwhile, Suryawati & Andayani (2024) show that ecoliteracy-based project learning can strengthen students' sense of responsibility towards the environment by connecting projects with real ecological issues. Thus, PjBL does not only focus on knowledge transfer but also serves as an effective means of fostering students' ecoliteracy and environmental awareness.

Although many studies have proven the effectiveness of environment-based school programmes and PjBL, there are still several gaps in the research. First, most previous studies have emphasised cognitive learning outcomes rather than environmental awareness as the main focus (Farhin, et al., 2023). Second, PjBL research is rarely directly linked to specific IPAS materials, such as Bumiku Sayang, Bumiku Malang. Third, the sustainability of school policy-based programmes is still constrained by the active participation of teachers and students and the sustainability of the programme (Sahabuddin, et al., 2023; Handayani, et al., 2023).

3. Materials and Method

This study utilised Kemmis & McTaggart's Classroom Action Research (CAR) model, which consisted of two cycles, each comprising three meetings. The research subjects were 23 fifth-grade students at SDIT Wihdatul Ummah in Makassar for the 2024/2025 academic year. The research object focused on improving environmental awareness through the application of the Project-Based Learning (PjBL) model with a project to create environmental awareness posters on the theme of Bumiku Sayang, Bumiku Malang (My Beloved Earth, My Poor Earth).

3.1. Research Procedure

The research process consists of several stages:

3.1.1 Pre-action: initial observation, completion of an environmental awareness questionnaire, and analysis of learning conditions.

3.1.2 Cycle I:

a. Meeting 1: orientation and determination of project guiding questions.
b. Meeting 2: implementation of the poster-making project (data collection, sketching, group discussion).
c. Meeting 3: presentation of results, joint reflection, and teacher evaluation.

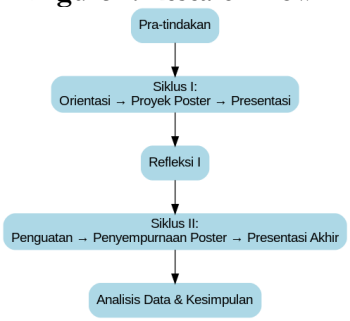
3.1.3 Reflection I: analysis of observation and questionnaire results, identification of weaknesses, and improvement of the learning plan.

3.1.4 Cycle II:

a. Meeting 1: concept reinforcement and technical guidance.
b. Meeting 2: poster refinement.
c. Meeting 3: final presentation, discussion, and further evaluation.

3.1.5 Post-action: completion of final questionnaires, data processing, and drawing conclusions.

Figure 1. Research Flow.



3.2. Research Instruments

3.2.1 Observation sheet

Observe each event as it occurs, then record the essential points referring to the observation sheet instrument. In this study, the observation sheet instrument consists of an observation sheet for the application of the project-based learning model and an observation sheet for the achievement of environmental awareness indicators from the students' perspective.

3.2.2 Environmental Awareness Questionnaire

This questionnaire was used to determine students' attitudes towards environmental awareness. The questionnaire was closed-ended, meaning that respondents were only given the opportunity to fill in the provided answer options..

Table 1. Alternative answers to the research instrument.

Type of Research	SS	S	TS	STS
Positive	4	3	2	1
Negative	1	2	3	4

Source: Sugiono (2017)

3.2.3 Documentation

Documentation is used to collect supporting secondary data in research. Documentation is a technique used during the teaching and learning process in the form of images of student activities during the learning process, and other documents related to the research.

3.3. Data Analysis Techniques

Data related to students' environmental awareness will be analysed quantitatively and then described systematically.

Quantitative analysis is used to calculate environmental awareness scores using the following equation:

$P=(f)/n \times 100\%$

Explanation:

P= Percentage of achievement score

f= Frequency of score

n= Maximum score

Qualitative: analysis of observation data, teacher reflections, and field notes through the stages of data reduction, presentation, and conclusion drawing.

3.3.1 Observational Data Analysis

Data from the observation sheets were analysed by calculating the average student engagement score. The results were compared with the success indicator (at least 75% of students were assessed as active).

3.3.2 Questionnaire Analysis

Improvement in Environmental Awareness:

a. Pre-test and post-test questionnaire scores were calculated for each student.
b. The difference between pre-test and post-test scores was analysed to determine the improvement in attitude.
c. The percentage of students who achieved a significant improvement (e.g. ≥ average score) was calculated. If ≥75% of students showed improvement, the success indicator was achieved.

3.3.3 Project Results Analysis

Poster Quality:

a. The scores from the poster assessment rubric are calculated for each group.
b. The average score is compared to the minimum standard (for example, an average score of 75 out of 100 is considered satisfactory).

3.4 Success Indicators

3.4.1 Process Indicators

This classroom action research can be considered successful if observations of the implementation of the experimental method show an increase in student and teacher activity. If the observations show that 70% of all indicators observed are in the good category, then the action has been successful. Conversely, if 70% has not been achieved, then the action has not been successful.

Table 2. Learning Process Categories

Activity (%)	Category
70-100	B (Good)
50-69	C (Fair)
0-49	K (Poor)

Source: (Arikunto, 2013b)

3.4.2 Outcome Indicators

This research is deemed successful if students in the class have achieved a minimum of 80% environmental awareness or are in the good category in IPAS learning.

Table 3. Categories of Student Success.

Value range	Category	Meaning
81-100	A	Very Good
61-80	B	Good
41-60	C	Fairly Good
21-40	D	Not Very Good
0-20	E	Very Poor

Source: Tampubolon (2014: 35)

This study is considered successful if there is a significant increase in environmental awareness among students, with at least 75% of students showing positive changes based on observation data and questionnaire results completed before and after learning. In addition, the quality of the posters produced by students is also an indicator of success, whereby the posters must meet criteria such as creativity, clear educational messages, and relevance of the theme in accordance with the learning objectives set out in the assessment rubric.

4. Results and Discussion

4.1 Research Results

This classroom action research was conducted in two cycles, each consisting of three meetings. The research results were obtained through three main instruments, namely observation of teacher activities, observation of student activities, and an environmental awareness questionnaire. In cycle I, the observation results showed that teacher activities were not yet optimal. The teacher's score in the first meeting was 61% (fair category), increased to 72% (good category) in the second meeting, and reached 89% (good category) in the third meeting. Student activities in cycle I also increased, from 61% in the first meeting, 67% in the second meeting, and 72% in the third meeting. However, despite this increase, the results of cycle I did not meet the predetermined success indicator, which was a minimum of 80% of students in the good category.

The results of the environmental awareness survey in cycle I showed an average score of 63%, which is considered adequate. In detail, the indicators for maintaining cleanliness scored 63%, waste management 57%, energy conservation 64%, waste disposal systems 54%, and cleaning equipment 73%. This data indicates that in cycle I, most students have begun to show environmental awareness, but their behaviour is not yet consistent in their daily lives..

In cycle II, improvements were made based on reflections from cycle I, particularly in terms of clarity of project instructions, division of group tasks, and time management. The results of the observations showed a significant improvement. Teacher activity increased to 89% in the first meeting, 94% in the second meeting, and 100% in the third meeting. Student activity also showed similar progress, namely 72% in the first meeting, 88% in the second meeting, and 94% in the third meeting..

Meanwhile, the results of the environmental awareness survey in cycle II showed an average of 87% in the excellent category. Almost all aspects were in the excellent category, with details of maintaining cleanliness at 81%, waste management at 84%, energy conservation at 90%, waste disposal systems at 83%, and cleaning equipment at 93%. These results indicate that the consistent implementation of the Project-Based Learning model is capable of improving students' environmental awareness.

Table 4. Results of Teacher Observations, Student Activities, and Environmental Awareness Attitude Questionnaires

Aspect	Cycle I (%)	Cycle II (%)	Category
Teacher Activities	61 – 89	89 – 100	Fair → Good
Student Activities	61 – 72	72 – 94	Fair → Good
Environmental Awareness	63	87	Fair → Very Good

The table shows a consistent improvement from cycle I to cycle II. In terms of teacher and student activity, the category improved from 'fair' to 'good', while in terms of

environmental awareness, the average student score improved significantly from "fair" to 'very good'.

4.2 Discussion

A classroom action research entitled 'The Application of the Project-Based Learning Model in IPAS Subjects to Improve the Environmental Awareness of Grade V Students at SDIT Wihdatul Ummah in Makassar' was conducted in two cycles. In cycle I, the implementation of the Project Based Learning model did not fully provide an optimal impact on students' environmental awareness. This was due to students' limited understanding of the concept of environmental awareness, minimal active involvement in projects, and a lack of responsibility in group work. In addition, teachers did not fully provide maximum reinforcement and guidance on the values of environmental awareness.

These conditions indicate that learning using the Project Based Learning model needs to be carefully prepared, both in terms of project planning, classroom management, and teacher guidance during the process. In line with this, Putri et al. (2025) emphasise that the effectiveness of Project Based Learning in fostering empathy and environmental awareness is highly dependent on the quality of teacher facilitation and the relevance of the project to real environmental issues around the students.

In cycle II, there was a significant change in student engagement and responsibility. Students began to show enthusiasm in completing their environmental awareness poster projects, dared to express their ideas, collaborated with their group members, and expressed their concern through pictures and slogans. This increase in student participation and creativity indicates that the Project-Based Learning model is able to encourage students' emotional and social involvement in understanding environmental issues.

This finding is reinforced by Suryawati & Andayani (2024), who state that Project-Based Learning combined with an ecoliteracy approach is able to develop students' creative thinking skills and ecological awareness in a tangible way. Real projects enable students to understand the cause-and-effect relationship between human actions and the environment, as well as foster awareness that they have a role in preserving it. In addition, improvements made by teachers in cycle II, such as providing clearer directions, guiding the discussion process, managing time effectively, and building a collaborative classroom atmosphere, support the creation of a more meaningful learning process. Mahsun et al. (2025) in their research also emphasise that the success of Project-Based Learning is determined by the quality of student-teacher interaction and the provision of reflective space during the learning process.

Triana, Anggraito & Ridlo (2020) mention that Project-Based Learning integrated with environmental themes can develop 4C skills (critical thinking, collaboration, creativity, communication), which are very relevant to the observations in cycle II. Students were not only active in communicating, but also skilled at organising ideas, filtering information, and composing meaningful messages through their posters.

Based on the research data, it can be concluded that the Project-Based Learning model is effective in IPAS learning to foster students' environmental awareness. This success is supported by group cooperation, creativity in completing projects, students' emotional involvement, and consistent guidance from teachers as facilitators.

5. Comparison

The results of this study indicate an increase in students' environmental awareness from 63% in cycle I to 87% in cycle II after implementing the Project-Based Learning model in IPAS learning. These findings are consistent with the results of Putri et al. (2025), who reported that the implementation of PjBL was able to significantly increase empathy and environmental awareness among primary school students. The increase obtained in this study is even slightly higher than the findings of Suryawati & Andayani (2024), which showed an average increase of 82% through the integration of PjBL with the ecoliteracy approach. Furthermore, these results also reinforce the findings of Triana, Anggraito, & Ridlo (2020) that PjBL is effective in developing students' 21st-century skills, particularly collaboration, creativity, and communication, which in this study were reflected in the students' active participation in group discussions and poster making. In line with the research by Darmawan, Sukmawati, & Damayanti (2023), PjBL has also been proven to improve students' understanding of ecosystem concepts and their attitude towards caring for the environment. Similar results were reported by Ayerbe López & Perales Palacios (2024), who found that the implementation of PjBL had a positive effect on the environmental awareness of secondary school students. In fact, Pertiwi, Oetomo, & Sugiharto (2024) emphasised that the integration of STEM-based PjBL can significantly strengthen students' environmental literacy. Thus, the main contribution of this study is to provide empirical evidence that environmental campaign

poster-based projects can be an effective alternative implementation of PjBL to foster environmental awareness among primary school students.

6. Conclusion

Based on the results of the research and discussion described above, it can be concluded that the application of the project-based learning model can improve the environmental awareness of fifth-grade students at SDIT Wihdatul Ummah in Makassar. This is evidenced by the fact that the application of the project-based learning model by teachers and student activities in learning in cycle I were in the good category and improved in cycle II to the very good category.

Based on the research results and conclusions, several suggestions can be made. First, school principals are encouraged to provide full support for the implementation of innovative learning models, such as project-based learning, by offering necessary facilities, allocating sufficient time, and providing guidance for teachers. This support will enable teachers to develop methods that foster environmental awareness and student skills. Second, teachers are urged to develop and apply project-based learning models, especially for topics related to environmental issues. Continuous guidance from teachers is essential to create an active and collaborative learning environment while instilling environmental awareness values in a contextual and meaningful way. Lastly, for other researchers interested in similar topics, this study can serve as a foundational reference. Further research could explore broader subject matter, various educational levels, or combine the project-based learning model with other approaches to maximize results in shaping student character.

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