

# Exploring Environmental Awareness through Project-Based Experiences: A Qualitative Inquiry

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**Abstract:** This qualitative phenomenological study explored the experiences of students and educators in the implementation of project-based learning (PBL) in environmental education, focusing on how PBL influenced environmental awareness, values formation, skills development, and sustainable behaviors. The study was conducted among selected college students and instructors' participants involved in PBL-based environmental projects and utilized in-depth interviews and thematic analysis to examine their lived experiences. Findings revealed that project-based learning promoted transformative and values-driven learning by moving students beyond rote memorization toward meaningful, real-world engagement. Key themes that emerged included real-world and community-based learning, experiential and hands-on activities, collaboration and teamwork, development of critical thinking and leadership skills, positive changes in environmental attitudes and behaviors, and the development of personal responsibility toward sustainability. Results also identified challenges related to student motivation, mindset, collaboration, time management, and limited resources; however, these were addressed through structured planning, scaffolding of complex concepts, effective communication strategies, and continuous guidance from educators. Collaboration with peers, teachers, families, and community members further enhanced project relevance and learning impact. Overall, the findings indicate that project-based learning is an effective pedagogical approach for environmental education when supported by contextualized instruction, strong collaboration, and appropriate instructional support. The study provides insights that may guide educators and school stakeholders in strengthening environmental education practices through learner-centered, experiential, and community-engaged instructional approaches.

**Keywords:** project-based learning, environmental education, environmental awareness, sustainability, phenomenological inquiry, thematic analysis, Davao de Oro, Philippines

## I. INTRODUCTION

The environment plays a vital role in meeting both human basic needs and psychological well-being; however, unsustainable human behavior, urbanization, and materialistic consumption have contributed to growing environmental degradation and reduced public concern for environmental issues [21]. Schools are recognized as key institutions for fostering environmental awareness and enhancing students' environmental literacy, particularly through the integration of solid waste management in formal education [14]. Despite this, many students continue to demonstrate low levels of environmental literacy and concern, which tend to decline as they mature. Studies indicate that project-based learning (PBL) effectively addresses this gap by engaging students in real-world environmental challenges, improving their participation, understanding, and skills in

environmental education [16]. This underscores the need for greater emphasis on environmental education and sustainable practices across secondary and higher education institutions.

International studies highlight growing concern over environmental issues and the importance of effective educational strategies. A study conducted in Poland on 2023 found differing approaches to environmental education, with Arab students emphasizing seminars and events, while Polish students viewed digital media as a more effective tool for strengthening environmental awareness [6]. Global reports further confirm that environmental problems continue to intensify, negatively affecting daily life, according to IPCC (2022). In response, studies from India and Indonesia emphasize awareness campaigns and project-based learning (PBL) as effective strategies for enhancing environmental education. These approaches improve teachers' instructional capacities, promote experiential learning, and enhance student outcomes, particularly when supported by interactive multimedia and educational media integration [35, 43, 41].

Meanwhile, studies in the Philippines reveal persistent gaps in environmental education due to limited instruction, funding, and institutional support. In Zambales, students demonstrated low awareness of environmental issues, while teachers faced challenges in promoting environmental understanding because of inadequate resources [45]. Research involving senior high school students in Cavite highlights that a well-developed environmental education curriculum, complemented by school-based sustainability policies such as waste segregation and zero-waste practices, significantly enhances students' environmental awareness and understanding of sustainable development [42]. Furthermore, a study in Bukidnon showed that students exposed to digital project-based learning (PBL) outperformed those under non-PBL instruction, underscoring the effectiveness of PBL in promoting active engagement and meaningful learning across disciplines [15].

Moreover, studies in the Davao Region indicate that students generally exhibit high levels of environmental literacy and awareness, as reflected in pro-environmental behaviors [2]. However, these studies do not examine instructional strategies that actively foster environmental awareness. Addressing this gap, the present study investigates project-based learning (PBL) as an instructional approach for enhancing students' environmental awareness in Davao de Oro. This research is timely given the increasing impacts of climate change, including intensified flooding and landslides in the province linked to deforestation and improper waste disposal [33]. By examining the experiences of students and teachers engaged in PBL activities, the study aims to strengthen environmental literacy, support the integration of environmental education in classroom practices, and provide evidence to inform educational policies and sustainability initiatives at both local and national levels.

### *A. Purpose of the Study*

This qualitative phenomenological study examined how project-based learning (PBL) contributes to the development of students' environmental awareness from the perspectives of both students and teachers. It focused on participants' lived experiences to understand how engagement in PBL activities deepened students' understanding of environmental issues and fostered environmental awareness and commitment to sustainable practices.

### *B. Theoretical Lens*

The theoretical basis of this study was more focusing in theories concerning about environmental awareness and project-based approach. This study identified constructivist, and experiential learning as one of the possible main factors that pertained to exploring the environmental awareness through project-based experiences. Project-based learning was facilitated by two established learning theories; Kolb's Experiential Learning Theory (ELT) and Piaget's Constructivism in which both theories provided strong arguments for engaging students in real-world, meaningful projects, particularly when it came to environmental awareness.

The theory and idea of this study could be gleaned through Jean Piaget's (1964) constructivist theory. Piaget (1964) found that the development of cognitive structures is affected by the experience and action of objects and physical world. The constructivist learning theory suggested that learning occurs when new ideas are integrated into existing into cognitive structures. In the context of environmental projects, this means that students construct knowledge by engaging directly with environmental challenges, such as conducting local waste audits or water quality assessments. Principles of constructivist pedagogy form the foundation for project-based learning (PBL), which has been shown to engage students in problem-solving for global environmental issues while enhancing their awareness and enthusiasm for these challenges [5].

This research is consistent with Piaget's Constructivist Theory, which emphasizes the active role of learners in constructing knowledge through meaningful interaction with their environment. In this study, students developed ecological understanding by engaging in hands-on, project-based learning activities that required them to analyze real-world environmental problems within their local context and propose practical solutions. Through these experiences, students were able to connect new environmental concepts with their prior knowledge, leading to deeper understanding and heightened environmental awareness.

Moreover, Kolb's Experiential Learning Theory (ELT) reinforces this cognitive foundation by explaining how learning is transformed through experience and reflection. According to ELT, learning follows a cyclical process involving concrete experience, reflective observation, abstract conceptualization, and active experimentation. In environmental projects, students first encountered actual environmental issues, reflected on their causes and impacts, formulated possible solutions, and applied these solutions through action. This experiential process not only strengthened students' environmental knowledge but also enhanced their critical thinking, reflection, and problem-solving skills, thereby promoting sustained environmental awareness [11, 29].

Collectively, Piaget's constructivism and Kolb's ELT provide a complementary and comprehensive framework that supports the use of project-based learning in environmental education. While constructivism explains how students internally construct knowledge through exploration, experiential learning describes the external process through which experience is converted into understanding. This integration ensures that environmental projects are both educational and transformative, fostering responsible and environmentally conscious learners. Furthermore, this framework aligns with national educational policies, such as the Commission on Higher Education (CHED) Memorandum Order No. 20, Series of 2013, which advocates the use of innovative and experiential teaching strategies, including PBL, to promote environmental stewardship and sustainable development in higher education.

### C. Scope and Limitations

This study focused on the experiences of the participants in environmental awareness through project-based learning and delimited by ten (10) students and five (5) instructors in the higher education institution in Davao de Oro who were having Science-related courses with project-based learning to shape environmental awareness. This was conducted from August to December in the school year 2025-2026. Moreover, the study utilized the information gathered from the interview of the participants, who were students enrolled in Davao de Oro and instructors who were employed in the same institution.

This study was limited and was specific to the participants in Davao de Oro, and the findings might not have applied to different people, geographical areas, or project types since they represented the experiences, viewpoints, and results of a specific group. The results might not have been representative of larger trends or applicable to other educational or environmental situations because the study only examined qualitative input and specific outcomes. Furthermore, the findings of this study underwent the triangulation method, in which we utilized the method of in-depth interview by the students and triangulated it through focus group discussion by their instructors. The individual interview was conducted through face-to-face interaction.

## II. METHODOLOGY

### A. Research Design

This study used the phenomenological qualitative approach to understand the phenomenon being studied with the participants involved and to know their experiences in, coping strategies and insights in exploring environmental awareness through project-based learning approach.

### B. Research Participants

The research participants of this phenomenological study were the students and science instructors in the institution in Davao de Oro, particularly in Compostela, Maragusan, and New Bataan. Among the 15 participants, 10 students underwent in-depth interviews (IDI), and 5 instructors were subjected to focus group discussions (FGD). Bekele and Ago (2022) identified that, based on the selection of participants which Creswell recommended, the number of participants to be incorporated in a phenomenological study should be between 5 to 25 participants to allow the qualitative inquiry to saturate.

### *C. Data Sources*

In this qualitative study, data were primarily collected through in-depth interviews (IDIs) with students, supplemented by focus group discussions (FGDs) with instructors to enrich and validate participants' experiences. The participants were asked open-ended questions prepared from a validated research guide, allowing the researcher to explore their perceptions, understanding, and lived experiences [13][40]. FGDs, moderated using the research guide, facilitated unstructured group conversations that captured shared opinions and the underlying meanings of participants' views [15]. Additionally, secondary data sources, including research studies, journals, articles, and books, were used to enhance the credibility and reliability of the findings [50]. All data were collected within the participants' institutional setting in Davao de Oro, Philippines, ensuring contextual relevance.

### *D. Data Collection Procedure*

In qualitative research, data collection techniques include observation, interviews, document analysis, and audio-visual materials [13]. Securing an endorsement letter of approval from the Research Ethics Committee (REC) and the Dean of Graduate School at St. Mary's College of Tagum Inc. was the first step in collecting the data. This meant that the researcher had the authorization to conduct the study with the participants after receiving approval. Second, the researcher submitted the interview guide questions to the validators to ensure that the guide questions were aligned with the study for the credibility of the gathered data.

Permission was obtained from the institution in Davao de Oro, and participants provided signed Informed Consent Forms (ICF). Participants were informed of the study's purpose, importance, and their rights, and asked for approval to record responses. An orientation was conducted prior to participation.

The data was collected through in-depth interviews conducted face-to-face, since the participants were from across the institution of Davao de Oro, where its campuses were located in Compostela, Maragusan, and New Bataan. The participants were allowed to answer the questions in their own time, but responses were not to exceed one hour, and the responses were recorded by taking notes or audio recording during face-to-face interviews. Moreover, this collection procedure was planned to ensure that participants who declined to participate in the study were not subject to victimization or any legal misconduct by the researcher or author.

Recorded interviews were transcribed and translated verbatim, then given to a data analyst for coding and review to ensure validity and credibility. Data management followed strict confidentiality protocols, with sharing restricted to authorized personnel, and disposal occurred after the retention period.

### *E. Data Analysis*

In this qualitative phenomenological study, data were analyzed using thematic analysis (Caulfield, 2019; Braun & Clarke, 2024) to identify patterns and themes in participants' responses. The process involved transcribing the recorded interviews, generating initial codes from recurring ideas, and categorizing these codes into meaningful themes. The researcher reviewed and refined the themes to ensure relevance and accuracy, discarding insignificant codes, and then defined and labeled the final themes. This systematic approach allowed the researcher to answer the research questions, present a coherent thematic framework, and verify findings with a data analyst, ensuring the credibility and validity of the results [8].

### *F. Ethical Considerations*

Ethical research was maintained throughout this study by adhering to the Guidelines of Ethics in Research set by St. Mary's College Graduate School Department, ensuring participants' rights, safety, and well-being. The study emphasized social value by contributing knowledge on environmental awareness and project-based learning for students, teachers, schools, and the community. Participants provided informed consent after orientation, were allowed to withdraw at any time, and were treated fairly, with confidentiality and privacy protected under the Data Privacy Act of 2012. Risks were minimized, and benefits highlighted, while participants' vulnerability, inclusion, and safety were carefully considered. Transparency was upheld in data collection and analysis, and the researcher, supported by qualified advisers, ensured adequate facilities for effective and comfortable participation. Community engagement and respect for local values were prioritized to ensure meaningful societal impact.

### III. RESULTS AND DISCUSSION

#### A. Lived Experiences of Lived Experiences of the Instructors on Raising Environmental Awareness through Project-Based Learning.

##### *Instructors' Experiences:*

*Transformative, Values-Driven Learning Through PBL.* Instructors reported that project-based learning (PBL) transformed students into “agents of change” by engaging them with real-world environmental issues. Classroom tasks became meaningful missions rather than routine requirements, and students felt “responsible for something bigger than grades,” demonstrating values such as responsibility, empathy, and environmental stewardship. According to Wijnia *et al.* (2024) and Pudjiarti *et al.* (2024), PBL shifts students from surface-level learning to active, purposeful engagement, fostering ownership and accountability beyond the classroom. Similarly, Azrai *et al.* (2024) and Wibowo *et al.* (2024) emphasized that PBL cultivates environmental responsibility alongside academic skills, showing that structured, real-world projects create opportunities for deeper engagement with environmental challenges.

Furthermore, PBL fostered empathy and intrinsic values as students developed emotional connections to the environmental impacts of their work. According to Syamsuddin *et al.* (2025) and Istikomayanti *et al.* (2024), collaboration with peers and attention to community needs enhance social and ethical learning, including civic responsibility. Nanni and Allan (2020) also observed that students developed sustainable attitudes and behaviors through PBL projects that emphasized the interconnected relationships between humans and the environment. These findings suggest that real-world, values-driven projects not only increased environmental knowledge but also cultivated long-term stewardship, ethical awareness, and a commitment to sustainability.

*Aligning Projects with Timely and Authentic Environmental Challenges.* Implementing PBL required aligning projects with timely, relevant, and authentic environmental issues to ensure meaningful learning. Instructors highlighted that connecting projects to real-world problems, such as waste management, pollution, and climate-related concerns, allowed students to link theoretical knowledge to practical applications. According to López and Palacios (2024) and Wibowo *et al.* (2024), PBL is most effective when students can directly observe and experience real-world scenarios, making learning necessary and applicable rather than abstract or hypothetical. Through such contextualized projects, students developed stronger responsibility and environmental consciousness, applying their knowledge in practical ways beyond the classroom.

Students' engagement and sense of accountability were further enhanced by projects with observable outcomes and community relevance. According to Pudjiarti *et al.* (2024), realistic, issue-based PBL projects increased motivation and sustained engagement, while Firdausih and Aslin (2024) noted that science-focused, real-world projects improved conceptual understanding. Moreover, the adaptability of PBL allowed instructors to incorporate emerging environmental concerns without compromising curriculum goals. As Wijnia *et al.* (2024) found, relevance to current issues fosters continuous engagement, and Sudirman (2024) emphasized that integrating real-world challenges enhances eco-literacy and encourages proactive problem-solving. Taken together, these findings demonstrate that aligning PBL projects with authentic environmental challenges strengthens instructional relevance, motivates participation, and supports meaningful environmental action.

*Motivational, Attitudinal, and Ethical Challenges.* Implementing PBL posed several challenges despite students' engagement, including reliance on external rewards, attitudinal hesitations, and ethical dilemmas. According to Wijnia *et al.* (2024), students with performance-oriented mindsets often depended on grades or rewards, which sometimes reduced intrinsic motivation and ownership of projects. Additionally, some students struggled with uncertainty and open-ended tasks, perceiving environmental projects as overwhelming or irrelevant. López and Palacios (2024) noted that students frequently face ambiguity and differing viewpoints in authentic environmental initiatives, while Sudirman (2024) emphasized that the multidisciplinary nature of environmental problems requires higher-order thinking skills that not all students have fully developed. These attitudinal challenges highlighted the need for scaffolding, guided reflection, and persistent support to foster confidence and resilience.

Ethical dilemmas also emerged as a significant aspect of PBL. Students encountered questions about fairness, responsibility, and the environmental impact of their actions, particularly in resource use and waste management. According to Kopnina and Cherniak (2021), addressing ethical issues intentionally in environmental education promotes moral reasoning and stewardship. Similarly, Verlie *et al.* (2021) emphasized that complex environmental challenges often elicit emotional and ethical responses, which require guided

reflection. Despite their difficulty, these challenges reinforced PBL's role as both a cognitive and ethical learning strategy, cultivating students' environmental responsibility and values formation.

*Issues on Collaboration and Task Management.* Instructors reported several challenges in fostering effective collaboration during PBL, often influenced by students' cognitive abilities and attitudes. Although students generally enjoyed working in groups, sustaining long-term collaboration and shared accountability was difficult. According to Pudjiarti *et al.* (2024), while students may enjoy group inquiry, effective collaboration requires careful structuring and ongoing facilitation. Similarly, Wijnia *et al.* (2024) noted that teamwork in PBL depends on students' skills in role negotiation, communication, and conflict resolution. Setiyowati *et al.* (2024) further emphasized that enjoyment alone does not ensure productive collaborative outcomes, highlighting the need for deliberate instructional support to develop social skills.

Challenges also arose in planning, goal-setting, and task management, especially in projects with multiple interconnected activities. Students sometimes struggled to coordinate meetings, set clear targets, and distribute workload equitably, which hindered progress. Firdausih and Aslin (2024) observed that inexperienced PBL teams often encounter difficulties with strategic task management, while Sudirman (2024) emphasized the importance of scaffolding and guided sequencing to help students manage complex tasks. These findings underscore the necessity of structured planning frameworks and teacher facilitation to ensure effective teamwork and successful project completion, aligning with the perspectives of Haratua *et al.* (2024) and Bolick *et al.* (2024).

#### *Students' Experiences:*

*Gaining of Knowledge and Awareness About the Environment.* In this study, students' participation in project-based learning (PBL) significantly enhanced their knowledge and understanding of environmental issues, serving as the foundation for raising environmental awareness. According to López and Palacios (2024), PBL contextualized academic content within real-world environmental problems, helping students understand cause-and-effect relationships in ecosystems. Similarly, Azrai *et al.* (2023) emphasized that experiential and inquiry-based learning strengthened students' comprehension of environmental systems. Through hands-on projects, students gained practical insights into local environmental challenges and developed the ability to propose meaningful solutions, demonstrating that effective environmental education requires contextualized, action-oriented experiences.

Moreover, PBL promoted positive shifts in students' values, attitudes, and self-awareness. Participants described developing a personal sense of responsibility and moral commitment toward environmental stewardship, aligning with Sudirman (2024), who highlighted the role of authentic environmental problem-solving in fostering eco-literacy and ethical consciousness. Setiyowati *et al.* (2024) also noted that regular engagement in environmental projects cultivated stewardship and responsibility, while Wibowo *et al.* (2024) and Wijnia *et al.* (2024) emphasized that sustained PBL engagement encouraged self-reflection, intrinsic motivation, and long-term environmental awareness. Taken together, these findings confirm that PBL effectively nurtures environmental knowledge, responsibility, and proactive attitudes, positioning students as informed and conscientious contributors to environmental preservation.

*Positive Changes in Attitudes and Behaviors Toward Environment and Sustainability.* In this study, students' participation in project-based learning (PBL) led to notable shifts in attitudes and mindsets regarding environmental and sustainability issues. According to Azrai *et al.* (2023), engaging students with authentic environmental challenges through PBL facilitates attitudinal changes by promoting active involvement and reflection. Similarly, Wibowo *et al.* (2024) emphasized that contextualized environmental projects enhance environmental consciousness and transform students' perceptions toward sustainability. Through these experiences, students developed a more thoughtful understanding of human impacts on the environment and recognized the importance of responsible actions.

Moreover, students' behaviors reflected these attitudinal changes, extending learning beyond the classroom into daily practices. Students reported adopting habits such as waste segregation and maintaining environmental cleanliness, which aligns with Setiyowati *et al.* (2024), who found that integrating environmental responsibility into regular activities fosters sustainable behaviors. According to Sudirman (2024), repeated engagement in environmental projects encourages behavioral internalization, resulting in long-term environmentally responsible practices. Taken together, these findings indicate that PBL not only strengthens environmental knowledge but also effectively connects awareness with concrete, sustainable actions.

*Collaboration and Support from School and Community.* In this study, collaboration between students, instructors, and community stakeholders was essential for the success of project-based learning (PBL). According to Pudjiarti *et al.* (2024), collaborative structures in PBL enhance learning outcomes by promoting group problem-solving and shared responsibility. Similarly, Wijnia *et al.* (2024) emphasized that instructional support and social connections maintain engagement and ensure project completion. Students reported that working closely with classmates and receiving guidance from instructors allowed them to refine ideas, manage tasks effectively, and sustain motivation, highlighting the importance of collaboration in strengthening both the social and academic dimensions of learning.

Moreover, engaging community stakeholders enabled students to connect projects with real-world environmental issues. López and Palacios (2024) noted that community involvement in PBL fosters relevance and authenticity, while Azrai *et al.* (2023) emphasized that local collaboration enhances students' environmental awareness and sense of responsibility. Setiyowati *et al.* (2024) also found that collaborative PBL enhances conceptual understanding and value creation, and Sudirman (2024) stressed that such environments promote long-term engagement and reflective learning. Together, these findings demonstrate that school and community collaboration enriches PBL experiences, providing students with meaningful, context-driven learning opportunities.

*Scholastic and Community-Related Challenges.* Although PBL effectively promoted environmental awareness, several scholastic challenges hindered its implementation. Students sometimes struggled to balance academic responsibilities with project tasks due to limited time, heavy workloads, and varying levels of readiness. According to Wijnia *et al.* (2024), insufficient time allocation and academic pressure may reduce the effectiveness of PBL, while Firdausih and Aslin (2024) emphasized that inadequate scaffolding and academic support make it difficult for students to manage both learning content and project execution. These findings highlight the need for careful alignment of curriculum pacing, assessment requirements, and instructional guidance to enable successful project-based learning.

Community-related challenges also emerged, particularly regarding coordination, access, and sustained involvement from stakeholders. López and Palacios (2024) noted that community-based PBL programs often encounter difficulties in collaboration and resource availability, and Sudirman (2024) stressed that genuine community engagement requires organized partnerships and transparent communication to avoid superficial participation. Addressing both scholastic and community-related constraints is therefore essential to ensure that environmental projects are meaningful, effectively executed, and have long-lasting impacts.

#### IV. COPING STRATEGIES OF THE INSTRUCTORS ON THE CHALLENGES OF RAISING ENVIRONMENTAL AWARENESS THROUGH PROJECT-BASED LEARNING

##### *Instructors' Coping Strategies:*

*Addressing Student Mindset and Learning Difficulties.* One of the key factors in successfully implementing PBL is addressing students' mindset and learning challenges. Participants reported that while many showed interest in environmental initiatives, some exhibited low self-esteem, limited motivation, or difficulty adjusting to collaborative tasks. The findings indicate that to ensure meaningful learning and effective environmental awareness, it is crucial to address these mindset issues and provide appropriate scaffolding. Limiting attitudes, resistance to open-ended tasks, problem-solving difficulties, and reliance on instructor guidance were identified as barriers to engagement and confidence. According to Wijnia *et al.* (2024), students accustomed to traditional instruction often struggle with the autonomy and complexity demanded by PBL, while Firdausih and Aslin (2024) highlighted that fixed mindsets and low self-efficacy impede full participation in project-based activities.

Despite these challenges, instructors emphasized that a positive and supportive approach can help students overcome learning difficulties. Contextualizing lessons and integrating projects with real-world environmental issues helped make learning more meaningful and accessible, increasing engagement and understanding. This aligns with López and Palacios (2024), who found that contextualized PBL enhances student involvement by linking abstract concepts to real-life situations. Additionally, Sudirman (2024) stressed the importance of teacher optimism and adaptive facilitation to scaffold learning, progressively fostering autonomy, resilience, and growth mindsets. Together, these results underscore the need to address students' attitudes and mindset through supportive, contextualized, and constructive teaching methods to maximize the effectiveness of PBL.

*Scaffolding and Simplification of Complex Concepts.* Effective implementation of PBL requires scaffolding and the simplification of complex concepts to enhance student comprehension. In this study, students were better able to understand environmental ideas and apply them successfully when assignments were divided into manageable parts, instructions were clear, and concrete examples were used. According to Wijnia *et al.* (2024), scaffolding is essential in PBL to manage cognitive load and maintain engagement, while Firdausih and Aslin (2024) emphasized that structured guidance enables students to explore challenging material without compromising the inquiry-driven nature of PBL. These findings suggest that breaking down tasks and providing step-by-step instructions are critical for supporting student learning in complex, real-world projects.

In addition, instructors highlighted the importance of using plain language, visual aids, analogies, and concrete examples to simplify discussions. This approach helped reduce anxiety and enhanced comprehension, consistent with Sudirman (2024), who noted that simplifying scientific terminology and incorporating visual supports improves conceptual clarity and environmental literacy. López and Palacios (2024) similarly emphasized that contextualized explanations make abstract concepts meaningful, while Ngereje *et al.* (2020) and Eilam and Trop (2022) argued that dividing environmental concerns into achievable tasks supports the application of theoretical knowledge. Setiyowati *et al.* (2024) further observed that scaffolded PBL enhances retention, understanding, and confidence. Collectively, these results indicate that careful scaffolding and simplification, combined with real-world examples, are essential strategies for promoting student engagement, comprehension, and success in environmental PBL.

*Structured Planning and Time Management Approaches.* The successful implementation of PBL relied heavily on organized planning and effective time management. Instructors reported that students completed tasks more efficiently when deadlines were clear, objectives well-defined, and tasks properly distributed. Structured preparation and scheduled timelines helped students manage their workload and stay focused on project goals. According to Firdausih and Aslin (2024), efficient planning and task coordination are essential in PBL as they reduce cognitive burden and facilitate project completion, while Wijnia *et al.* (2024) noted that students who used structured time management strategies demonstrated stronger persistence and engagement in complex tasks. These findings highlight that deliberate planning is crucial for supporting deep learning without compromising academic rigor.

Moreover, participants emphasized the importance of sequencing, scaffolding, and breaking tasks into manageable components to improve clarity and effectiveness throughout projects. Defining clear goals and milestones enabled students to track progress, anticipate challenges, and maintain momentum. This aligns with Sudirman (2024), who stressed that scaffolding and deliberate sequencing are key instructional supports in environmental PBL, while López and Palacios (2024) observed that organized planning fosters stronger teamwork and better project outcomes within time constraints. Overall, structured planning and time management were not only practical necessities but also instructional strategies that enhanced student engagement, collaboration, and reflective learning in real-world, environmentally focused PBL.

*Monitoring, Delegation, and Guidance Practices.* Effective monitoring, delegation, and guidance were essential in supporting students during the PBL process. Instructors reported that frequent supervision helped students stay on track, address challenges as they arose, and relate project activities to environmental principles. These strategies provided structure and promoted environmental consciousness, ensuring the successful implementation of PBL. According to Wijnia *et al.* (2024), organized monitoring improves student perseverance and task completion, while Shah and Gillan (2024) emphasized that clear delegation combined with formative monitoring enhances self-regulation and collaborative effectiveness. By assigning specific roles and regularly checking progress, instructors ensured accountability, prevented uneven workload distribution, and maintained productivity throughout the projects.

Additionally, ongoing guidance and a well-defined project structure were critical to PBL success. Instructors provided timely feedback, clarified expectations, and intervened when students encountered difficulties, particularly with complex environmental topics. This aligns with Sudirman (2024), who noted that continuous instructor support strengthens students' conceptual understanding and confidence, and López and Palacios (2024), who stressed that systematic guidance ensures projects remain engaging, focused, and aligned with learning objectives. These findings indicate that deliberate instructor involvement acts as a scaffold, facilitating deeper learning while still supporting student autonomy in environmental PBL contexts.

*Having Sense of Ownership in the Project.* Maintaining student engagement in PBL required acknowledgment, encouragement, and optimism from instructors. Instructors reported that praising students' efforts and progress, rather than focusing solely on outcomes, boosted self-esteem and motivation to complete

environmental initiatives. This ongoing support helped students remain optimistic despite difficulties in project implementation. According to Wijnia *et al.* (2024), emotional and instructional support in PBL enhances student motivation and commitment, while Niemiec and Ryan (2021) highlighted that emotionally sensitive teaching supporting autonomy increases resilience and intrinsic motivation. Similarly, Fredricks *et al.* (2022) found that recognizing students' work and voice positively influenced behavioral and emotional engagement, underscoring the role of acknowledgment in sustaining persistence and engagement in student-centered learning.

In addition, giving students choice and emphasizing the tangible impact of their projects strengthened their sense of ownership. Instructors noted that allowing students to select topics or design project elements made learning more meaningful and fulfilling, boosting confidence and self-efficacy. Shah and Gillan (2024) similarly reported that autonomy and positive recognition in PBL enhance students' commitment to learning goals. Moreover, López and Palacios (2024) found that observing real-world effects, such as waste reduction initiatives, reinforced students' environmental responsibility, and Sudirman (2024) emphasized that recognizing project outcomes strengthened students' sense of purpose. Collectively, these findings show that acknowledgment, encouragement, and optimism are key strategies for fostering student motivation, engagement, and values-driven learning in environmental PBL.

*Contextualization and Real-World Connections in Projects.* The study revealed that student engagement and comprehension increased when environmental projects were connected to local challenges and real-life scenarios. Instructors reported that learning became more relevant and purposeful when students could apply environmental topics to their everyday lives, highlighting the importance of contextualized, real-world projects in enhancing PBL effectiveness. This aligns with Hofner and Schütze (2021) and Araújo *et al.* (2022), who emphasized that situating students in real-world settings deepens conceptual understanding and reinforces the relevance of learning. By rooting projects in familiar contexts such as local waste management, pollution, and resource use, students were better able to grasp abstract environmental concepts and relate them to tangible community issues.

Moreover, the study's findings correspond with Bramwell-Lalor *et al.* (2020) and López and Palacios (2024), who observed that project-based environmental learning is most successful when students engage with real-world community impacts. Instructors noted that students' active participation in addressing environmental problems fostered accountability and ownership over their work. Linking academic learning with practical action not only enhanced students' understanding of environmental issues but also promoted sustained engagement and long-term pro-environmental behaviors. These findings underscore that connecting classroom projects to authentic, real-world contexts is a critical strategy in cultivating meaningful and impactful environmental education through PBL.

#### *Students' Coping Strategies:*

*Sustaining Effort and Practicing Self-Care.* Students' engagement in PBL was strongly influenced by perseverance and attention to self-care. According to the participants, environmental projects often demanded sustained effort, which could lead to fatigue, stress, or frustration. Those who demonstrated persistence were better able to overcome obstacles and successfully complete project tasks, while incorporating self-care practices helped them manage the workload and maintain well-being. These findings suggest that promoting both perseverance and self-care enhances students' resilience, positive learning experiences, and continued engagement in PBL, ultimately supporting meaningful environmental awareness. This aligns with Wijnia *et al.* (2024), who emphasized that consistent effort and persistence are critical in cognitively demanding PBL contexts, and with Shah and Gillan (2024), who noted that perseverance enables students to navigate uncertainties and challenges in real-world problem-solving.

In addition, participants highlighted that self-care strategies—such as adjusting schedules, breaking tasks into manageable parts, and taking regular breaks—helped mitigate stress and maintain motivation throughout projects. Firdausih and Aslin (2024) similarly found that flexible planning and adaptive task management reduce stress and improve engagement in project-based learning. Likewise, Niemiec and Ryan (2021) argued that environments supporting autonomy and emotional well-being enhance students' resilience and intrinsic motivation. These results indicate that sustained effort in PBL is most effective when coupled with self-care and adaptive strategies, enabling students and instructors to remain balanced, motivated, and engaged while navigating complex environmental projects.

*Strategic Planning and Management of Time and Tasks.* Successful participation in PBL required careful strategic planning and efficient management of time and tasks. According to the students, environmental

projects were more manageable when tasks were clearly organized, timelines were realistic, and responsibilities were distributed appropriately. The study found that guidance in planning and task management enabled students to complete projects effectively, collaborate with peers, and maintain focus on objectives. These observations highlighted the critical role of strategic planning in ensuring meaningful and sustained engagement in PBL. This aligns with Firdausih and Aslin (2024), who reported that clear task assignment and role clarity improved teamwork and reduced confusion, and with Wijnia *et al.* (2024), who emphasized that structured project planning supports sustained engagement and helps students handle complex tasks successfully.

Furthermore, participants stressed that time management strategies, such as setting attainable deadlines, sequencing activities, and presenting schedules clearly, helped reduce stress, maintain accountability, and improve performance. Groups that employed these strategies were able to avoid last-minute pressures and maintain steady progress throughout their projects. López and Palacios (2024) similarly noted that effective time management in PBL promotes better pacing and reflection, while Sudirman (2024) emphasized that setting achievable goals reduces anxiety and encourages deeper engagement. Together, these findings demonstrate that strategic planning and time management are essential learning strategies that enhance collaboration, support responsibility, and facilitate the successful completion of complex, real-world environmental projects.

*Leveraging School, Community, and Family Support.* The successful implementation of PBL depended heavily on support from families, schools, and the broader community. According to students, access to financial and material resources significantly improved their ability to complete environmental projects. Contributions from these stakeholders not only facilitated the acquisition of necessary materials but also enabled smoother project execution. These findings align with Frederico and Whiteside (2016), who emphasized that parental involvement including material support and reinforcement of sustainable practices at home—enhances student engagement and commitment to learning. Similarly, Haight (2024) highlighted that coordinated partnerships among stakeholders, clear leadership, and shared responsibility are crucial for effective collaboration in project-based initiatives.

Furthermore, the study revealed that multiple sources of support were leveraged to overcome financial constraints, including assistance from local government units (LGUs), schools, and community sponsors. Participants reported that institutional support, such as materials provided by the school or modest funding, was essential in sustaining project activities. This finding corresponds with López and Palacios (2024), who noted that institutional and community backing strengthens the feasibility and impact of PBL programs, especially those with an environmental focus. Additionally, students demonstrated initiative by engaging local stakeholders and LGUs through fundraising and sponsorship efforts, ensuring that projects continued despite limited personal resources. Collectively, these results underscore the importance of multi-level support in enhancing student participation, resource accessibility, and the overall success of PBL in environmental education.

## V. INSIGHTS OF STUDENTS AND INSTRUCTORS ON RAISING ENVIRONMENTAL AWARENESS THROUGH PROJECT-BASED LEARNING

### *Instructors' Insights:*

*Community-Based, Hands-on Projects as Drivers of Impactful Learning.* The findings of this study showed that community-based, hands-on projects made learning more relevant and meaningful for students engaged in PBL. By working directly with community members on real environmental issues, students were able to apply abstract concepts in authentic contexts, which strengthened their understanding and environmental awareness. Simple initiatives such as clean-up drives, waste segregation, and awareness campaigns helped students connect theory to practice and promoted reflective learning. This supports González-Gómez and Jeong (2022) and Sudirman (2024), who emphasized that experiential and community-based PBL enhances comprehension by situating learning in real-world settings.

Moreover, observing the tangible outcomes of community projects encouraged positive attitudinal and behavioral changes among students. According to Azrai *et al.* (2024) and Rianti *et al.* (2024), visible project results increase students' motivation and sense of responsibility. Similarly, López and Palacios (2024) highlighted that locally contextualized environmental projects strengthen community engagement and sustainability. These findings indicate that small-scale, community-based projects not only improved understanding but also fostered ownership, motivation, and accountability in addressing environmental issues.

*Collaboration and Teamwork as a Way to Successful Environmental Projects.* Collaboration with peers and classmates proved essential for the success of PBL in environmental education. According to the instructors, students who worked collaboratively were able to share ideas, distribute tasks, and provide mutual encouragement throughout their projects. The study revealed that effective teamwork enhanced students' problem-solving and decision-making skills, allowing them to address environmental challenges more effectively. Additionally, collaboration fostered a sense of shared accountability and engagement with sustainability objectives, indicating that meaningful participation and successful outcomes in environmental projects heavily depended on teamwork. These findings align with Kusnoto *et al.* (2023), who emphasized that collaborative learning promotes collective understanding and group responsibility in environmental education, and with Wijnia *et al.* (2024), who noted that structured collaboration reduces cognitive overload and encourages shared ownership in PBL contexts. Similarly, Firdausih and Aslin (2024) found that collaboration enhances students' problem-solving abilities and facilitates deeper comprehension through peer learning.

Furthermore, the study highlighted the significance of teamwork and communication with community members beyond the classroom, which increased both environmental advocacy and project impact. According to López and Palacios (2024), engaging with community stakeholders strengthens the authenticity and sustainability of environmental PBL initiatives. Students were able to acquire contextual knowledge and ensure that their projects addressed local needs while remaining culturally relevant. This aligns with Choi *et al.* (2023), who observed that collaboration with the community fosters long-term environmental awareness and collective action. Overall, the findings indicate that PBL's emphasis on cooperation and teamwork not only enhances academic learning but also empowers students as active participants in community-based sustainability efforts, enabling them to engage in meaningful, real-world environmental problem-solving.

*Experiential Learning and Hands-On Activities as Means to Enhance Understanding.* The findings of this study revealed that students developed a clearer understanding of abstract environmental concepts through direct, hands-on engagement in environmental activities. Instructors noted that practical exercises allowed students to connect theory with real-life applications, making learning more relevant and meaningful. This experiential approach played a key role in improving students' comprehension of environmental topics within the PBL framework.

Consistent with this finding, González-Gómez and Jeong (2022) emphasized that experiential PBL enhances conceptual understanding by immersing students in real-world environmental tasks. Similarly, Firdausih and Aslin (2024) found that active application of concepts promotes deeper cognitive engagement and knowledge retention. Participants in this study also highlighted that community-based activities and upcycling projects fostered eco-literacy and a sense of responsibility, supporting Sudirman (2024) and López and Palacios (2024). These results confirm that experiential and hands-on learning not only strengthens understanding but also connects classroom learning to real-world environmental contexts, leading to more meaningful and lasting learning experiences.

*Raising Awareness and Shaping Environmental Mindsets.* The findings of this study indicate that students who participated in environmental projects developed increased awareness of environmental challenges and more positive sustainability-oriented mindsets. According to López and Palacios (2024), engaging students in authentic, real-world environmental contexts strengthens their understanding of environmental responsibility. Instructors in this study similarly observed that exposure to real environmental issues encouraged students to reflect on their roles in protecting the environment, indicating that PBL effectively supports the development of environmental awareness and responsible mindsets.

Furthermore, the study revealed that project-based learning influenced students' attitudes and daily behaviors, including more mindful plastic use at home and in school. This aligns with Sudirman (2024), who emphasized that PBL enhances environmental literacy by enabling students to interact directly with environmental issues. In addition, González-Gómez and Jeong (2022) found that reflective, hands-on PBL experiences promote both awareness and behavioral change, while Choi *et al.* (2023) highlighted how sustained engagement can lead to collective environmental action. These findings confirm that PBL not only increases environmental knowledge but also encourages environmentally conscious attitudes and practices.

*Developing Skills and Personal Growth through PBL.* The findings of this study indicate that Project-Based Learning (PBL) supported students' personal growth and skill development through engagement in environmental projects. According to the instructors, students improved their critical thinking, problem-solving, communication, and teamwork skills while working collaboratively on real-world tasks. Students also became more confident, accountable, and resilient when facing project challenges. This aligns with Wijnia *et al.* (2024),

who found that learner autonomy in PBL enhances motivation, confidence, and cognitive engagement, as well as with Firdausih and Aslin (2024), who emphasized that student-centered and self-directed learning environments promote deeper understanding and personal responsibility.

Furthermore, the study revealed that PBL-based environmental projects enhanced students' leadership abilities and higher-order thinking by requiring them to plan activities, collaborate with peers, and address authentic environmental issues. These findings are consistent with González-Gómez and Jeong (2022), who highlighted that PBL supports holistic development by integrating cognitive, social, and ethical learning dimensions. Similarly, Choi *et al.* (2023) observed that sustainability-focused PBL strengthens leadership skills and encourages long-term advocacy. Collectively, these results demonstrate that PBL fosters not only academic learning but also transferable skills and values that prepare students to engage actively in future environmental and sustainability initiatives.

*Effective Communication and Engagement Tools Enhance Learning.* Effective communication and engagement strategies were found to be crucial in the successful implementation of Project-Based Learning (PBL), particularly in raising environmental awareness. Instructors reported that students demonstrated better understanding and sustained participation when project expectations were clearly communicated and supported by continuous feedback and appropriate technological tools. The use of engaging communication methods enhanced interaction, facilitated smoother project implementation, and deepened students' understanding of environmental concepts. These findings suggest that structured communication and active engagement are essential in promoting meaningful learning experiences within environmental PBL contexts.

The study further revealed that visual aids, multimedia resources, and practical demonstrations significantly improved students' engagement and comprehension of complex environmental issues. This finding aligns with Sudirman (2024), who emphasized that multimedia and interactive elements in PBL support eco-literacy by making abstract environmental concepts more accessible. Similarly, López and Palacios (2024) and González-Gómez and Jeong (2022) found that visual and experiential learning tools bridge theoretical content and students' lived experiences, thereby increasing relevance and motivation. In addition, Firdausih and Aslin (2024) noted that incorporating interactive and visual components enhances focus, engagement, and knowledge retention. Collectively, these findings demonstrate that effective communication tools not only clarify learning tasks but also sustain student interest and active involvement in real-world environmental problem-solving.

#### *Students' Insights:*

*Real-Life, Experiential Learning for Environmental Understanding.* Project-Based Learning (PBL) enabled students to develop a deeper understanding of environmental issues through real-world, experiential learning. Students reported that engaging directly with environmental challenges allowed them to connect classroom concepts with real-life situations, making learning more meaningful and easier to comprehend. Learning through hands-on activities and reflection helped students move beyond abstract theory and gain practical insights into environmental problems. This finding aligns with Eilam and Trop (2022), who argued that experiential PBL enhances environmental awareness by situating learning in authentic contexts that require observation, reflection, and action. Similarly, López and Palacios (2024) found that embedding projects within students' immediate environments increased relevance, understanding, and environmental awareness.

Participants further observed that environmental concepts were better understood through experience than through theory alone, as practical activities enabled students to form their own judgments and internalize learning more effectively. This supports González-Gómez and Jeong (2022), who emphasized that authentic PBL engages students cognitively, socially, and ethically, promoting reflective thinking and long-term understanding. In addition, Firdausih and Aslin (2024) noted that experiential PBL strengthens comprehension and retention by allowing students to actively apply knowledge in real contexts. Through community-based projects such as clean-up drives and sustainability initiatives, students developed practical skills, collaboration abilities, and a heightened sense of environmental responsibility, reinforcing the value of experiential learning in fostering environmental understanding and awareness.

*Collaboration and Teamwork for Stronger Project Outcomes.* Collaboration and teamwork were key to successful PBL outcomes. Students reported that working with peers helped them share ideas, assign tasks, and support each other, improving communication, problem-solving, and accountability. This aligns with López and Palacios (2024), who found collaborative PBL strengthens environmental awareness through shared decision-making, and Gök and Boncukñ (2023), who noted that teamwork enhances engagement and problem-solving in sustainability projects.

Students also recognized the long-term value of collaboration for future academic and community tasks. Shared planning, encouragement, and task division made complex projects manageable and motivating. This supports Uzorka *et al.* (2024), highlighting that collaborative leadership sustains engagement, and González-Gómez and Jeong (2022), who emphasized teamwork builds social responsibility and skills essential for addressing environmental issues. Collaboration, therefore, improved immediate project results and equipped students with skills for lasting environmental advocacy.

*Innovation, Flexibility, and Resourcefulness as Support to Problem-Solving.* Innovation, flexibility, and resourcefulness were essential for students to navigate environmental challenges in PBL. Students often needed to modify plans, think creatively, and use available resources to overcome obstacles, allowing them to complete tasks effectively. This aligns with Almulla (2020) and Shah and Gillan (2024), who highlighted that PBL fosters adaptive problem-solving by placing students in unpredictable scenarios requiring creativity and quick decision-making. Similarly, Firdausih and Aslin (2024) observed that resource constraints enhance critical thinking and resilience.

Participants also emphasized that real-world constraints encouraged reflective planning and evidence-based decision-making. Students adjusted methods, refined goals, and modified timeframes to balance creativity with realism. This supports González-Gómez and Jeong (2022) and Uzorka *et al.* (2024), who noted that adaptability and strategic thinking sustain participation and project momentum. Overall, creativity and flexibility not only ensured project completion but also cultivated problem-solving skills and responsible environmental citizenship.

*Project Participation as Means to Foster Personal Responsibility and Sustainable Behaviors.* Active participation in PBL helped students develop personal responsibility and adopt sustainable behaviors. Students reported becoming more accountable for their actions and outcomes when involved in planning and executing environmental projects, applying their learning beyond the classroom. This supports López and Palacios (2024), who found that engagement in environmental PBL enhances both behavioral and affective aspects of environmental awareness, and Sudirman (2024), who highlighted that practical projects foster eco-literacy and responsible environmental practices.

Furthermore, sustainability-focused PBL encouraged reflection, ethical responsibility, and long-term pro-environmental behavior. Students emphasized that participation motivated them to maintain positive attitudes and engage in future environmental initiatives, such as advocacy and volunteer work. This aligns with González-Gómez and Jeong (2022) and Uzorka *et al.* (2024), who noted that experiential environmental projects increase students' commitment to sustainable lifestyles. Overall, active project participation reinforced the connection between environmental knowledge and real-world action, fostering lasting responsibility and sustainable habits.

*Effective Communication and Community Engagement as Means to Promote Awareness.* Communication and collaboration with the community enhanced the effectiveness of environmental projects. Students reported that engaging with community members improved their understanding of local environmental issues, allowed them to share ideas, and receive feedback, thereby increasing the impact of their initiatives. This aligns with Azrai *et al.* (2024), who noted that community-engaged PBL fosters pro-environmental attitudes and behaviors, and López and Palacios (2024), who emphasized that socially relevant, contextualized projects strengthen environmental awareness and responsibility.

Furthermore, running awareness campaigns helped both students and community members deepen their understanding of environmental topics. Practical communication of scientific concepts encouraged reciprocal learning, where facilitators reinforced their knowledge while educating others. This supports González-Gómez and Jeong (2022), who highlighted that education and awareness campaigns are crucial for fostering informed, responsible, and socially conscious environmental advocates. The findings confirm that clear communication and community participation are key strategies for promoting environmental understanding and sustained engagement.

*Sustainable Practices as Ways to Foster Long-Term Environmental Impact.* PBL encouraged students to adopt sustainable behaviors through active participation in eco-friendly activities such as recycling, waste reduction, and conservation campaigns. Students reported that repeated involvement in these tasks helped them connect classroom learning to real-world environmental responsibility. This supports Rianti *et al.* (2024), who highlighted that practical, problem-solving projects promote environmentally responsible conduct and foster long-term stewardship.

Moreover, engaging in real-life environmental tasks reinforced lasting pro-environmental habits. Kusmawan *et al.* (2021) found that experiential PBL leads to sustained behavioral change, while González-Gómez and Jeong (2022) emphasized that combining knowledge with practical application strengthens commitment. Choi *et al.* (2023) also noted that community-based projects encourage continued adoption of sustainable practices. Together, these findings show that PBL cultivates enduring environmental awareness and proactive, responsible behaviors.

## VI. CONCLUSION

The successful completion of this study reflects the sustained effort, patience, and dedication invested throughout the research process, demonstrating that project-based learning in environmental education effectively shapes students' attitudes, values, and sense of responsibility toward the environment. The findings highlighted how even simple, community-based projects foster meaningful learning when students actively apply knowledge to real-life situations, seeing themselves as contributors rather than passive recipients. The study also revealed the realities of implementing PBL, including challenges with motivation, teamwork, time management, and limited resources, emphasizing the need for patience, adaptability, scaffolding, communication, and careful planning.

Moreover, the research underscored the importance of collaboration among students, teachers, schools, and communities in achieving sustainable learning outcomes, showing that environmental education becomes more authentic and effective when situated in real-world contexts. Personally, this experience strengthened my commitment to designing value-driven, contextualized learning opportunities that foster empathy, critical thinking, and environmental stewardship while prioritizing student welfare. It has inspired me to continue developing as an educator who motivates students to become responsible, environmentally conscious members of their communities.

## VII. RECOMMENDATION

It is recommended to future research to examine how project-based learning (PBL) in environmental education influences students' knowledge, attitudes, and sustainable behaviors across different contexts, grade levels, and learning modalities. Studies could explore strategies to support instructors in managing challenges like student mindset, teamwork, and time constraints, as well as investigate the role of school and community collaborations in enhancing project impact. Longitudinal or mixed-methods research may also assess the long-term effects of PBL on students' environmental advocacy, habits, and engagement, while systematically measuring cognitive, behavioral, and attitudinal outcomes. Such research would provide actionable insights for improving instructional methods, fostering sustainable behaviors, and promoting values-driven, experiential environmental learning.

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