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Growing Green Minds: Understanding Primary Students' Perspectives on Ecological Literacy

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ABSTRACT

Ecological literacy is an essential aspect for fostering an understanding of and responsibility for environmental stewardship in young learners, yet limited research examines how children engage with ecological concepts in unique island-based settings. This study aimed to explore the primary pupils' perceptions of ecological literacy at an island-based school through participation in a mangrove planting program. Employing a case study research design with ten participants, semi-structured interviews revealed five themes: foundational understanding, personal connection to nature, daily environmental awareness, environmental education value, and concern for preservation. Pupils' attitudes toward ecological responsibility revealed seven themes: belief in personal and collective agency, practical environmental actions, environmental impact awareness, emotional connection to nature, peer encouragement participation, stewardship, and experiential learning. The results undeline the need of practical, place-based educational activities in fostering ecological literacy. This program help pupils to develop active participation and feeling of responsibility and deepen their knowledge of environmental ideas.

***Keywords*:**

Ecological Literacy; Environmental Education; Environmental Stewardship; Primary School; Place-Based Education.

ABSTRAK

Literasi ekologi merupakan aspek penting dalam menumbuhkan pemahaman dan tanggung jawab terhadap kelestarian lingkungan pada peserta didik, namun penelitian yang membahas bagaimana anak-anak berinteraksi

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dengan konsep ekologi dalam lingkungan berbasis kepulauan masih terbatas. Penelitian ini bertujuan untuk mengeksplorasi persepsi siswa sekolah dasar mengenai literasi ekologi di sekolah yang berbasis kepulauan melalui partisipasi dalam program penanaman mangrove. Dengan menggunakan desain penelitian studi kasus dan melibatkan sepuluh peserta, wawancara semi-terstruktur mengungkapkan lima tema utama: pemahaman dasar, keterhubungan pribadi dengan alam, kesadaran lingkungan dalam kehidupan sehari-hari, nilai pendidikan lingkungan, serta kepedulian terhadap pelestarian lingkungan. Sikap siswa terhadap tanggung jawab ekologi mencerminkan tujuh tema: keyakinan pada peran individu dan kolektif, tindakan nyata dalam menjaga lingkungan, kesadaran terhadap dampak lingkungan, keterikatan emosional dengan alam, partisipasi yang didorong oleh teman sebaya, kepemimpinan dalam konservasi, serta pembelajaran berbasis pengalaman. Hasil penelitian ini menekankan pentingnya kegiatan edukasi berbasis praktik dan tempat dalam meningkatkan literasi ekologi. Program ini membantu siswa mengembangkan partisipasi aktif, rasa tanggung jawab, serta memperdalam pemahaman mereka tentang konsep-konsep lingkungan.

***Kata kunci*:**

Literasi Ekologi; Pendidikan Lingkungan; Kepedulian Lingkungan; Sekolah Dasar; Pendidikan Berbasis Tempat.

1. Introduction

The main challenges of ecological literacy have been extensively discussed worldwide, bringing to light a number of problems in diverse social and educational context. In Slovakia, for example, young learners often have misconceptions about fundamental ecological concepts such as ecology, community, population and ecosystem (Balážová, Ciceková, Macko, & Záhorská, 2024). This highlights the need for more effective teaching strategies to clarify these concepts. In Rusia, young people's ecological behaviors are greatly affected by media and social networks, which frequently result in artificial engagement instead of a profound commitment to the practices of sustainability (Shutaleva et al., 2021). Meanwhile in China, sociodemographic factors including age, educational background, and age help to explain variation in ecological literacy, which leads to uneven levels of comprehension and engagement with ecological issues (Ha & Dong, 2023). In Indonesia context, pupils may have theoretical ecological knowledge but find it difficult to translate this knowledge into meaningful actions, which discloses a disparity between awareness and practical application (Suryawati, Suzanti, Zulfarina, Putriana, & Febrianti, 2020). This worldwide trend implies that conventional approaches of instruction might not be sufficient to promote a thorough and practical knowledge of ecological principles. Thus, improving ecological literacy and promoting real-world application depend critically on creative, practical and exploratory learning methods (Balážová et al., 2024; Ricoy & Sánchez-Martínez, 2022).

Under these circumstances, to promote environmental awareness and responsible citizenship, ecological literacy education must be introduced in the early years. Young students learn the fundamentals of how ecosystems function and how they interact with these systems by being introduced to ideas of concepts such as sustainability, resource conservation, and biodiversity. As it is noted by United Nations (2022) that the requirement for early environmental education is underscored by the intensifying environmental challenges, including climate change, biodiversity loss, and pollution. Early exposure to ecoliteracy such as the program of environmental education (EE) increases pupils' knowledge of environmental issues and fosters empathy and respect for nature, which results to pro-environmental behaviour (Ernst & Theimer, 2011). Furthermore, instilling these values from an early age helps students develop critical thinking skills in addressing environmental challenges, and empowers them to make wise decisions for the good of their communities and the sustainability of the planet (Chawla & Derr, 2012). In Indonesia, ecological literacy is gaining traction through initiatives such as the Adiwiyata program and green school movements. These initiatives aim to cultivate environmental responsibility by encouraging students to take active roles in protecting the environment and promoting sustainable development (Lace-Jeruma & Birzina, 2019). For instance, the "Laskar Hijau" (Green Army) activity within the Adiwiyata program teaches students to appreciate and maintain a clean and beautiful school environment, fostering a sense of environmental stewardship (Fasikhi, Muliawat, Sulastri, & Fitriani, 2023). Such foundational education is indispensable for educating a young generation equipped with the awareness and understanding necessary to face future ecological issues conscientiously.

A large body of research has shown that children's interaction with outdoor environments promotes healthy development, well-being, and positive environmental attitudes and values (Blair, 2009; Chawla, 2015; Waite, 2010). Adams and Savahl (2017) provide additional evidence for the conclusion that 'childhood experiences in nature are crucial for children in their daily lives as it contributes to several developmental outcomes and various domains of their well-being' (p. 316) and that such experiences foster an intrinsic care for nature. In the context of introducing ecological literacy to children, previous research discovered children's positive attitudes toward the forest garden and their activities during their visits. Furthermore, children's care for living organisms there has increased as well (Hammarsten, Askerlund, Almers, Avery, & Samuelsson, 2019). Other studies have demonstrated that integrating environmental education in primary schools enhances students' ecological awareness and promotes sustainable behaviors. For instance, research conducted in nature primary schools revealed that students exhibited a good level of ecoliteracy, particularly in applying ecological knowledge to daily practices (Salimi, Dardiri, & Sujarwo, 2021). Additionally, Ricoy and Sánchez-Martínez (2022) programs that combine ecological education with digital literacy through gamification have shown positive impacts on students' environmental awareness and technological skills, which results into new habits on electricity, water, and recycling, and more effective online information sharing.

As the importance of environmental literacy in education continues to grow, there is a surprising lack of research focusing on how primary students perceive ecological literacy within specific contexts, such as schools on islands where they directly experience environmental issues. Most studies have concentrated on general urban or mainland settings, thereby neglecting the unique ways in which students' understanding of ecology may be influenced by living near vulnerable ecosystems like shorelines. This study aims to fill that gap by investigating how primary students in an island-

based school view ecological literacy, particularly in relation to a school program centered on mangrove planting along the seashore. This initiative seeks to educate students about the vital role of mangrove trees in preventing erosion, preserving biodiversity, and mitigating the effects of climate change on coastal areas. By examining students' perspectives, this research intends to provide valuable insights into how localized environmental education programs can foster ecological awareness and responsibility among primary school pupils. To guide this inquiry, we have formulated the following research questions:

1) How do primary school students perceive the concept of ecological literacy, and what aspects of the natural environment do they consider most relevant to their lives?
2) What are primary students' attitudes toward ecological responsibility, and how do they view their role in environmental protection?

2. Methods

2.1. Research Context

The study was conducted at a public elementary school on Pari Island, part of the Seribu Islands within the special capital region of Jakarta. This school offers a unique program focused on practical environmental activities, including mangrove planting along the island's coastline, in collaboration with university students from various regions of Indonesia, hosted by a private university in Jakarta. Students learn about the role of mangroves in coastal protection, biodiversity preservation, and climate resilience, which helps them cultivate ecological literacy. Through direct interaction with their environment, they gain first-hand knowledge of ecological concepts, including how mangroves support marine habitats and prevent shoreline erosion.

Additionally, the program integrates ecological topics with reading and writing exercises to enhance students' critical reading skills. Teachers supplement the curriculum with photographs of natural landscapes alongside reading materials to engage students' emotions and perspectives. This approach effectively combines basic literacy with ecological awareness, equipping students with a thorough understanding of their local environment and fostering critical thinking skills.

2.2 Research Design

This study utilized a qualitative case study design to thoroughly investigate primary students' perspectives on ecological literacy within the distinct context of an island school setting. Case studies facilitate an in-depth exploration of individuals' experiences and interpretations within a defined environment, making them particularly effective for understanding students' ecological awareness in a unique geographical and educational context (Yin, 2018). This approach enables the research to capture detailed insights on how the ecological characteristics of an island influence students' understanding and attitudes toward environmental issues.

2.3 Participants of The Study

A total of ten primary school pupils voluntarily participated in the study, comprising six females and four males selected purposively from the fourth, fifth, and sixth grades. This selection aimed to

represent a diverse range of grades and ages, allowing for varied perspectives on ecological literacy. The recruitment process involved collaboration with school teachers, who recommended students based on their involvement in the mangrove planting program. Parental consent was secured to uphold ethical standards and ensure the voluntary nature of the students' participation in the study.

2.4 Data Collection

We collected data through semi-structured interviews to gain insight into participants' perspectives on ecological literacy. The interview questions were crafted to delve into their experiences with mangrove planting, their understanding of ecological concepts, and their perceived responsibilities in environmental preservation. This approach allows us to capture their thoughts in their own words, resulting in rich and detailed data.

2.5 Data Analysis Techniques

For data analysis, thematic content analysis was employed, a technique designed to help identify recurring themes in qualitative data from the collected interviews (Braun & Clarke, 2022). Emphasizing the importance of mangrove planting, ecological concepts, environmental awareness, and responsibility, we systematically coded the data to identify recurring themes. This structured approach allows for a thorough analysis of qualitative data and enables us to draw significant conclusions regarding students' perspectives on ecological literacy. We employed several strategies to ensure the reliability and rigor of the data. Member checking upheld credibility by allowing students to verify the accuracy of their responses. To enhance readers' understanding of how the findings can be applied in various contexts, we provided detailed descriptions of the participants and the setting. Confirmability was strengthened by meticulously documenting each stage of the research process to minimize bias, while dependability was achieved through consistent data collection and analysis procedures. These efforts ensure that the results are trustworthy and accurately reflect students' views on ecological literacy.

2.6 Ethical Consideration

Prior to conducting the research, we obtained ethical approval and informed consent as part of our commitment to research ethics. We communicated with the principal, teachers, and pupils about the research objectives, procedures, and potential impacts. To protect the participants' identities, we used pseudonyms throughout the study. Participants were also informed that they could withdraw from the research at any time without needing to provide reasons or face any consequences. We ensured a relaxed atmosphere during the interviews, allowing pupils to feel safe and free to express their views without hesitation. Creating a comfortable environment is crucial for establishing trust between researchers and participants (Fitriani & Sari, 2023).

3. Results and Discussion

3.1 The Students' Perceptions on Ecological Literacy Concepts and Aspects of Natural Environment The Students Most Relevant to Their Lives

Based on students' responses, we can identify five key themes: 1) foundational understanding of environmental literacy; 2) personal connection to nature; 3) awareness of the environment in daily life; 4) appreciation for environmental education; and 5) concern for preservation and protection.

Table 1. Students' Perceptions

Themes	Interview excerpts
Foundational understanding of environmental literacy	*I think environment means knowing about trees, animals, and places like rivers, mountains, hills, lake, ocean. (Farah)* *To me, it's learning about how to keep the earth clean and healthy, and not polluted. (Diba)* *Environment means knowing why nature is important and how to take care of it, such as not throwing the trash to the river. (Anjani)* *I think of parks, forests, and clean rivers where animals live. (Dika)* *For me, it means everything around us, like air, water, trees, and animals. (Niko)*
Personal connection to nature	*I think trees are important because they give us oxygen and make the world green. (Metty)* *I'd say animals, because if they are healthy, it means nature is healthy too. (Sheila)* *The ocean is important because it has so many creatures and helps keep the air clean. (Jihan)*
Awareness of the environment in daily life	*I notice trees and plants when I walk to school. I also think about recycling. (Farhan)* *I think about water a lot, like when I turn off the tap to save it. (Jeriko)*
Value of environmental education	*Yes, because if we know more about nature, we can help it stay beautiful. (Farah)* *It's important because if we don't learn, we might do things that hurt the earth. (Diba)*
Concern for preservation and protection	*I like birds because they are pretty, and I care about clean air so they can fly safely. (Anjani)* *I like flowers because they make the world beautiful, and I care about animals, so they can have a safe home. (Metty)*

3.2 Students' Attitudes Toward Ecological Responsibility and How They View Their Role in Environmental Protection

To address the second research question, we conducted interviews with students to explore their attitudes toward ecological responsibility and their role in environmental protection. Our analysis revealed seven key themes: 1) Belief in personal and collective agency, 2) Practical environmental actions, 3) Awareness of the environmental impact on life and health, 4) Emotional connection to nature, 5) Encouragement of peer participation, 6) Sense of responsibility and stewardship, and 7) The importance of experiential learning in schools, as illustrated in the following table.

Table 2. Students' Attitudes on Ecological Responsibility and Their Views on Environmental Protection

Themes	Interview excerpts
Belief in personal and collective agency	*Yes, we can pick up litter and recycle things like bottles. (Sheila)* *I think we can by not wasting water or food and keeping parks clean. (Jihan)* *Well, I think we can protect our environment by keeping ocean clean from trash.(Dika)*
Practical environmental actions	*I turn off lights when I don't need them and recycle paper. (Dika)* *I bring a reusable water bottle to school instead of plastic ones. (Niko)*
Awareness of environmental impact on life and health	*It's important because nature gives us everything we need, like food and air. (Farhan)* *If we don't protect nature, animals might lose their homes and we could get sick. (Jeriko)*
Emotional connection to nature	*I feel sad because it's not good for animals or the earth. (Farah)* *It makes me angry because they are hurting the planet. (Diba)*
Encouragement of peer participation	*I'd say every little action counts, so even picking up one piece of trash helps. (Anjani)* *I would tell them that if we don't help now, the earth might get worse. (Metty)*
Sense of responsibility and stewardship	*I'd say every little action counts, so even picking up one piece of trash helps. (Anjani)* *I would tell them that if we don't help now, the earth might get worse. (Metty)* *Yes, because we all live here, so we should all help keep it clean. (Sheila)* *I feel it's everyone's job, even kids, to take care of our planet. (Jihan)*
Value of experiential learning in schools	*They could make classes outside so we can see nature up close. (Dika)* *Schools could do projects where we plant mangrove trees or learn about recycling. (Niko)*

3.3 Discussion

Five major themes—foundational knowledge of environmental literacy, personal connection to nature, awareness of the environment in daily life, appreciation for environmental education, and concern for preservation and protection—emerged from initial findings that reveal primary students' attitudes and perceptions of ecological literacy. These themes illustrate the students' deepening understanding and appreciation of ecological concepts, aligning with various theories and previous studies on ecological literacy and environmental education. There is a noticeable increase in

awareness of ecological literacy, as students describe the environment using examples such as rivers, trees, animals, and clean air. This growing awareness resonates with Orr's ecological literacy theory, which posits that developing an ecological worldview necessitates knowledge of the fundamental components of nature (Orr, 1992). The mangrove planting as an outdoor activity contributes their understanding about ecology. As it is evidenced by previous research which demonstrates how ecological fieldwork can foster ecological literacy by emphasizing the interconnectedness between humanity and the Earth's biophysical systems (Persson, Andrée, & Caiman, 2022). Ecology fieldwork can also offer unique, place-specific experiences that, unlike classroom instruction, may emphasize more grounded and context-rich ways of engaging with nature (Gannon, 2017; Mannion, Fenwick, & Lynch, 2013). In addition, place has been widely explored and theorized within environmental and outdoor education. Mannion et al. (2013) for instance, propose a place-responsive pedagogy that aligns with ontological views of socio-material relationships. They illustrate how, in planning environmental excursions, teachers aim to stay adaptable to unexpected events and emphasize the importance of places and the connections between humans and nonhuman entities. Correspondingly, Häggström and Schmidt (2020) found that students' interactions and direct experiences with two outdoor learning environments fostered agency, emancipation, and empowerment. These learning opportunities were partly attributed to the teachers' flexible, non-prescriptive guidance and innovative approaches. Such methods encouraged student autonomy and supported the development of critical thinking skills in a self-directed manner.

Students' inherent appreciation for nature is reflected in their personal connections to specific natural features, such as trees, animals, and the ocean. Research indicates that children perceive nature in diverse ways: literally (as living, non-living, or human-made elements), symbolically (as representations of past experiences), and as both dynamic and static entities. Photography provides children with new opportunities for connection, broadening the cognitive-behavioral-sensory-affective model to incorporate artistic elements such as symbolism, photo editing, and perspective-taking, thereby enhancing their engagement with nature. (Shakespear, Varghese, & Morris, 2020). Wamsler (2020) emphasized the importance of fostering internal transformations in sustainability education, achievable through the integration of ecological literacy into formal learning. Environmental education programs led to a significant short-term increase in connectedness with nature across all age groups. However, only younger children (under age 11) maintained this connection four weeks after the intervention. These findings suggest that environmental educators should prioritize fostering a connection to nature in children before the age of 11, as it is more likely to have a lasting impact (Liefländer, Fröhlich, Bogner, & Schultz, 2013).

Place-based education, which stresses the value of local environments in fostering ecological literacy, is demonstrated by the students' attention to natural elements they see on a daily basis, such as trees and water (Sobel, 2013). Language arts, mathematics, social studies, and science are among the subjects incorporated into place-based education, which utilizes the local environment and community as its foundation. This experiential and hands-on approach not only enhances academic performance but also fosters stronger connections within the community, deepens students' appreciation for nature, and promotes civic engagement. By involving local citizens, organizations, and environmental resources, place-based education further contributes to community well-being and

the quality of the environment. (Sobel, 2013). Chawla (2020) In her literature review on the importance of connecting children with nature, it is emphasized that childhood experiences in natural settings foster a lifelong commitment to environmental stewardship. The students in this study express that practices such as recycling and water conservation are integral parts of their daily routines, reflecting their understanding of ecological responsibility. These behaviors underscore the critical role of integrating ecological education into students' everyday experiences, which can encourage practical and sustainable habits from an early age.

Students recognize the value of learning about the environment in school, associating ecological literacy with the ability to take actions that protect nature. This appreciation of environmental education reflects constructivist learning theories, which argue that knowledge-building helps students develop meaningful connections with subject matter (Piaget, 1971). Ernst and Theimer (2011) asserted that early environmental education fosters a sense of agency, enabling young learners to feel responsible for contributing positively to their surroundings. The students' feedback indicates that environmental education empowers them to make informed decisions, fostering a lifelong commitment to ecological awareness and responsibility. Their expressions of concern for the preservation and protection of nature demonstrate an early dedication to conservation, which aligns with the principles of environmental stewardship. A study on U.S. Forest Service citizen science programs conducted with secondary students revealed that, despite variations in program design and objectives, these initiatives effectively integrated science and environmental education, promoted ecological literacy, and encouraged environmental stewardship in accordance with each program's goals. (Pitt, Schultz, & Vaske, 2019). Prior research suggested the commitment to offering children nature experiences that nurture emotional, cognitive, and physical well-being while encouraging lifelong pro-environmental behaviors (Beery, Fridberg, Præstholm, Uhnger Wünsche, & Bølling, 2024). The students' appreciation for clean air, safe animal habitats, and beautiful flowers reflects a desire to protect the aesthetic and ecological value of nature. This commitment to preservation suggests that primary students can develop strong conservationist attitudes when given the opportunity. Engaging in ecological projects is essential for promoting environmental awareness among students. For example, research conducted in a Swedish elementary school identifies three key educational concerns: the teacher's role in fostering student agency, the challenge of cultivating ecological literacy within a complex 'digital-ecology' context, and the importance of nurturing students' connections to and care for both living and non-living elements of the environment. (Caiman & Kjällander, 2024).

The second set of findings from this study indicates that primary students exhibit a meaningful understanding of ecological responsibility and a robust sense of personal agency regarding environmental protection. Their responses reflect both a deep emotional connection to nature and active engagement in pro-environmental activities, aligning with various educational theories and previous research on ecological literacy and environmental education. Bandura's social cognitive theory, which emphasizes self-efficacy and the significance of perceived agency in motivating behavior, aligns with the students' belief that they can positively impact the environment through recycling and waste reduction. (Bandura, 1997). The study conducted by Chawla and Cushing highlights the importance of fostering a sense of empowerment among young people, which encourages them to embrace sustainable behaviors. Based on the responses gathered from student

interviews, it was found that even at a young age, they recognized the positive effects of simple actions on the environment. This underscores the significance of instilling ecological responsibility early on. Ecologically literate individuals possess the ability to contribute to a sustainable society by integrating intellectual, emotional, practical, and ethical dimensions. This includes having a well-rounded understanding of the world and actively engaging with the environment. (McBride, Brewer, Berkowitz, & Borrie, 2013).

The pupils' behaviors, which demonstrate environmental responsibility are consistent with the theory of planned behavior (TPB), which advocates that attitudes, subjective norms, and perceived control affect individual intentions and actions (Ajzen, 1991; Fishbein & Ajzen, 2011). Similarly, students' comprehension of the significance of preserving the environment for resources reflects the ecological literacy theory (Orr, 1992), which holds that an appreciation of natural systems is necessary to recognize the interdependence between human health and the environment. Ernst and Theimer (2011) provides further support for this perspective, arguing that early ecological education helps students recognize the interdependence of all living systems—an understanding crucial for fostering a conservation mindset. The students' remarks indicate an increasing awareness of the significance of environmental health for human welfare, aligning with the broader goals of ecological literacy instruction.

The students' feelings of sadness and anger toward environmental harm reveal a strong emotional bond with nature, which is consistent with affective ecological theories that emphasize the role of emotions in environmental attitudes (Kals, Schumacher, & Montada, 1999; Mossner, 2017). Research by Rios and Menezes (2017) using group discussion revealed that children feel a deep emotional connection with nature, which fosters a strong sense of protection toward it. The study revealed that nature fosters an emotional connection with individuals, which in turn encourages pro-environmental behaviors. In the realm of education, nature-based instruction has been shown to enhance graduation rates, cognitive and emotional outcomes, and standardized test scores. The presence of nature enriches the learning experience by promoting self-discipline, reducing stress, and increasing interest and enjoyment in the educational process. Furthermore, it provides opportunities for independence and imaginative play, which are essential for developmental growth, while also creating a peaceful, collaborative, and secure learning environment. (Kuo, Barnes, & Jordan, 2019). Similarly, Cheang, So, Zhan and Tsoi (2017) found that campus ecological gardens enhance students' cognitive and emotional engagement in sustainability learning.

Many students demonstrated an awareness of group responsibility by expressing a wish to inspire their peers to take small, sustainable actions. This is consistent with Vygotsky's theory of social development, which holds that social interactions play a crucial role in attitude formation and learning (Vygotsky, 1978). Students show how social encouragement and shared values reinforce ecological responsibility by promoting peer involvement. Stewardship theory, which emphasizes protecting the natural world as a moral duty, is consistent with students' belief that they have a personal and collective responsibility to protect the environment (Leopold, 1949). Students' enjoyment of outdoor education and practical environmental projects is consistent with experiential learning theory (Kolb, 1984), which holds that firsthand encounters improve comprehension and memory. In the words of Sobel (2013) ecological literacy and a sense of connection to the

environment are supported by place-based education, especially when it takes place in natural settings. The students' desire for hands-on activities, such as planting trees, supports this theory and demonstrates how well immersive, experiential learning approaches can raise young students' ecological awareness. Furthermore, Chawla (2009) highlights key factors shaping children's environmental values and actions, including the influence of social relationships (family, teachers, mentors), the role of interest and perceived benefits, the importance of empathy in fostering care for nature, and the need for hands-on experiences to build their sense of efficacy in achieving environmental goals.

In contrast to other research that has emphasized gardening as a means to enhance students' cognitive and emotional engagement in sustainable learning, this study focuses on group discussions about nature to foster children's emotional connections and their care for both living and non-living elements of the environment. It also includes programs such as tree planting in forests, which aim to deepen students' understanding of ecological issues and promote lifelong pro-environmental behaviors. The originality of the current study lies in exploring primary school pupils' perspectives on a hands-on mangrove planting initiative in an island-based school setting. This practical experience is designed to cultivate their awareness and sense of responsibility toward their local environment. Furthermore, this ecological project, which involves collaboration between university students and the school, has proven effective in sparking pupils' interest in ecology and increasing their commitment to environmental protection. This collaborative effort is crucial for both students and teachers, enhancing their understanding of ecological issues in a comprehensive manner.

4. Conclusion

The objective of this study is to investigate pupils' perspectives on the mangrove planting program designed to enhance ecological literacy. The findings revealed five key themes, alongside an exploration of students' attitudes toward ecological responsibility, which identified seven additional themes. This suggests a significant need for practical, place-based educational activities to cultivate both ecological literacy and responsibility. The experiential nature of this program fosters active participation and a sense of responsibility among students, while simultaneously deepening their understanding of environmental concepts.

This study underscores the importance of incorporating related initiatives and similar programs into broader educational settings to enhance ecological awareness and responsibility among young learners. Moreover, cultivating ecological literacy is crucial for students to comprehend global environmental issues and encourage sustainable behaviors from an early age. It equips them to tackle future environmental challenges with the necessary knowledge, sense of responsibility, and critical thinking skills.

By integrating innovative and experiential learning methods, educators can effectively promote ecological literacy, ensuring that future generations are prepared to contribute to sustainable development and environmental stewardship. However, this study does have limitations, as it focuses solely on a single primary school located near the coast and employs a qualitative approach. Thus, further research is recommended, including comparative studies with non-island schools and the use of mixed methods to gather data. Additional studies could explore the impact of specific teaching

strategies, such as inquiry-based learning or collaborative environmental projects, on students' ecological literacy and their sense of environmental responsibility.

This study has significant practical and pedagogical implications. Practically, students can effectively engage with ecological literacy through hands-on, place-based learning activities, such as recycling initiatives and mangrove planting projects. Schools should consider integrating outdoor learning and environmental initiatives that allow students to directly interact with and care for their local environment, particularly in areas that are ecologically sensitive. This approach not only enhances students' understanding of sustainability but also fosters a strong sense of environmental stewardship. From a pedagogical standpoint, teachers can further advance ecological literacy by facilitating discussions about local environmental issues alongside conversations with environmental activists and experts. This would help students connect their learning to the specific environmental challenges faced by their community.

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