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Utilization of The Sayeung Mangrove Edu-Tourism Area, Gampong Baro Sayeung Village, Setia Bakti District, Aceh Jaya Regency. Aceh Province as an Environmental Literacy-Based Learning Resource in Elementary Schools

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Abstract
This study aims to examine environmental literacy-based learning practices at the Sayeung Mangrove Edu-Tourism Area, Gampong Baro Sayeung Village, Setia Bakti District, Aceh Jaya Regency, Aceh Province, which are integrated into the Merdeka Curriculum learning outcomes as a learning resource to develop environmentally literate students at the elementary school level. Descriptive qualitative research with a case study method was chosen as the approach for this study. Observation, interviews, and documentation were employed as data collection techniques. Data reduction, data presentation, and verification served as data analysis techniques. The Sayeung Mangrove Edu-Tourism Area can be utilized by implementing the principles of experiential learning, expedition, and project-based learning. These principles align with one of the key characteristics of the Merdeka Curriculum, namely project-based learning for developing soft skills and character in accordance with the Pancasila Student Profile, differentiated according to students' abilities and adapted to local context and content. Environmental literacy practices at the Sayeung Mangrove Edu-Tourism Area are integrated with the Merdeka Curriculum Learning Outcomes for lower and upper elementary grades, which can be implemented through lesson plans that promote environmental literacy.
Keywords: *mangrove edu-tourism, learning resources, environmental literacy.*

INTRODUCTION

The interaction between humans and the natural environment is an unavoidable reality. Throughout their lives, humans are perpetually dependent on the ecosystems that sustain them from clean air and freshwater to biodiversity and other ecosystem services whose value is often overlooked. However, as the pace of development and modernization accelerates, the harmonious relationship between humans and the environment has become severely strained. The Organisation for Economic Co-operation and

Development (OECD, 2019) identifies climate change, access to clean water and sanitation, loss of biodiversity, and declining health quality as the foremost global environmental challenges arising from uncontrolled environmental degradation.

Indonesia's coastal regions, including Aceh Province, face grave environmental threats, particularly with regard to the degradation of mangrove ecosystems. Mangroves are ecologically strategic ecosystems that serve as coastal barriers against erosion, habitats for a diverse range of marine life, effective carbon sinks, and vital sources of livelihood for fishing communities. Data from the Ministry of Environment and Forestry of the Republic of Indonesia indicate that the extent of mangrove cover in Indonesia has declined significantly due to land conversion, illegal logging, and environmental pollution (KLHK, 2021).

Environmental literacy refers to a deep awareness and concern for the state of the surrounding environment (Kusumaningrum, 2018). Furthermore, McBeth and Volk (2010) define environmental literacy as an individual's capacity to interpret and analyze environmental conditions and to identify appropriate solutions as concrete actions to restore, maintain, and improve environmental quality. A strong foundation in environmental literacy is essential to fostering consistent and sustainable pro-environmental behavior in daily life.

Empirical evidence indicates that the level of environmental literacy among elementary school students in Indonesia remains low. Research by Yulianti & Kusumaningrum (2021) confirms that environmental literacy among elementary school students, particularly in the domain of environmental knowledge, has only reached 62.5%, which falls within the low category. This finding reflects that conventional classroom-based learning approaches have not been sufficiently effective in cultivating students' understanding of and concern for the natural environment. More innovative,

contextual, and experiential learning approaches are therefore needed to enhance students' environmental literacy.

Utilizing the surrounding environment as a learning resource represents a relevant and effective alternative. According to Jean Piaget's theory of cognitive development, elementary school students are in the concrete operational stage—typically between the ages of 7 and 12 during which children learn most effectively through direct interaction with real objects and environments (Komalasari, 2017). Consequently, learning that makes direct use of the natural environment is not only aligned with students' cognitive developmental characteristics, but also has the potential to enhance their motivation, enthusiasm, and active engagement in the learning process.

Nature-based tourism areas hold considerable potential for use as innovative learning resources at the elementary school level. One particularly promising area is the Sayeung Mangrove Edu-Tourism site in Gampong Baro Sayeung Village, Setia Bakti District, Aceh Jaya Regency, Aceh Province. This nature-based tourism destination features a mangrove ecosystem that is rich in educational potential. Based on a preliminary study conducted through field observation and interviews with site managers, it was found that the Sayeung Mangrove Area encompasses a significant expanse of mangrove forest with diverse mangrove vegetation, a unique estuarine ecosystem, and a range of educational programs developed for visitors.

The Sayeung Mangrove Edu-Tourism Area was selected as the research site based on several considerations. First, from an ecological perspective, the area maintains a relatively well-preserved mangrove ecosystem with high levels of biodiversity, making it highly relevant as a medium for environmental education. Second, from an accessibility standpoint, the Sayeung Mangrove Area is easily reachable by the community and schools throughout Aceh Jaya Regency. Third, in terms of educational programming, the site managers have developed a variety of educational tourism packages that can be

adapted as environmental literacy-based learning activities. Fourth, from a conservation urgency perspective, mangrove ecosystems along the Aceh coast face multiple threats that necessitate educational intervention from an early age.

The development of edu-tourism grounded in environmental literacy is considered highly important due to its innovative, flexible, and creative nature as a learning resource (Abbas et al., 2019). Environment-based learning has also been shown to enhance learning efficiency and students' understanding of environmental conservation (Wulandari, 2020). This study is relevant to the research of Maesaroh et al. (2021) on strategies for cultivating environmental literacy among students, as well as the work of Andayani & Suprayitno (2022) on ecoliteracy practices oriented toward Education for Sustainable Development in nature-based tourism settings.

The novelty of this research lies in the development of mangrove edu-tourism principles as an environmental literacy-based learning resource integrated with the Merdeka Curriculum learning outcomes at the elementary school level. This specific focus has not been extensively explored in the context of mangrove ecosystems in Aceh, and the findings of this study are therefore expected to make a meaningful contribution to the development of coastal environment-based learning models. Against this backdrop, this study is titled "Utilization of the Sayeung Mangrove Edu-Tourism Area, Gampong Baro Sayeung Village, Setia Bakti District, Aceh Jaya Regency, Aceh Province as an Environmental Literacy-Based Learning Resource in Elementary Schools."

METHOD

This study employed a qualitative approach with a case study method. This methodological choice was based on the research objective of gaining an in-depth understanding of environmental literacy practices at the Sayeung Mangrove Edu-Tourism Area and its potential as a learning resource in elementary schools. This is

consistent with the view of Widhagdha & Ediyono (2022), who explain that case study research is a form of inquiry that describes and focuses analysis on a specific event, activity, process, or unit within a particular context.

The study was conducted over the course of one month at the Sayeung Mangrove Edu-Tourism Area, Gampong Baro Sayeung Village, Setia Bakti District, Aceh Jaya Regency, Aceh Province. Informants were selected using purposive sampling and snowball sampling techniques. Purposive sampling was applied to identify informants with in-depth knowledge of the site's conditions and available educational programs. Snowball sampling was employed when initial informants were unable to provide complete information, allowing the number of informants to expand as needed. The initial research subjects were the managers of the Sayeung Mangrove Edu-Tourism Area, with subsequent expansion to include teachers and school principals from elementary schools that had previously conducted visits to the site.

Data collection techniques included field observation, in-depth interviews, and documentation. Observations were conducted to directly identify environmental literacy-laden activities available at the site. Interviews were carried out with site managers and school representatives to obtain information on educational programs and methods of utilizing the area as a learning resource. Documentation was used to gather supporting data in the form of photographs, field notes, and documents related to the site's educational programs.

Data analysis followed the Miles & Huberman model (as cited in Sugiyono, 2021), consisting of three stages: data reduction, data display, and conclusion drawing/verification (Sugiyono, 2021). Data validity was assessed through credibility testing by means of extended engagement, increased observational persistence, and triangulation of sources and methods. Supporting reference materials, including

interview recordings and photographic documentation, were used as evidence to substantiate the validity of the research findings.

RESULTS AND DISCUSSION

Result

1. Environmental Literacy Content in the Sayeung Mangrove Edu-Tourism Area

The Sayeung Mangrove Edu-Tourism Area offers an ecosystem-based educational concept centered on the mangrove environment, integrated across a range of educational tourism programs. These programs are designed for early childhood education (PAUD), kindergarten (TK), and elementary school (SD) levels, presenting environmental education activities in an engaging and interactive manner. Based on interviews with site managers, the following was revealed:

> *"We have already developed educational tourism packages specifically designed for schools, ranging from early childhood education to elementary school level. These packages integrate tourism activities with learning about the mangrove ecosystem, including the types of mangroves, their ecological functions, and conservation strategies. We want visitors to not only enjoy recreation, but to return home with a new understanding of the importance of protecting mangroves." (Site Manager, September 15, 2024).*

The environmental literacy content of the Sayeung Mangrove Edu-Tourism Area was analyzed across three levels of environmental literacy: Nominally Environmentally Literate, Functionally Environmentally Literate, and Operationally Environmentally Literate. Analysis was also conducted along the environmental dimensions of conservation and preservation.

a. Nominally Environmentally Literate

1) Mangrove Nature Interpretation with a Guide

This activity invites students to traverse the nature interpretation trail within the mangrove area accompanied by an experienced guide. Along the route, students are introduced to the various mangrove species found within the Sayeung site, including *Rhizophora* sp., *Avicennia* sp., *Bruguiera* sp., and others. Students can observe firsthand the physical characteristics of each mangrove species, from root structures and leaf shapes to their distinctive growth patterns.

> *"We have an interpretation trail approximately 500 meters long that passes through various mangrove zones. Along this trail, guides explain the names of mangrove species, their distinguishing features, and their vital roles in the ecosystem. For elementary school children, we simplify the language and concepts to ensure they are easily understood." (Tour Guide, September 15, 2024).*

Through this activity, students acquire foundational knowledge of mangrove biodiversity that they would not ordinarily encounter in their daily surroundings. The experience of directly observing mangrove vegetation and its unique adaptations heightens students' sensitivity and concern for the mangrove ecosystem.

2) Mangrove Boat Ride

The mangrove boat ride provides students with an opportunity to navigate through the mangrove area aboard a traditional boat. During the journey, students can observe the mangrove ecosystem from a different vantage point, including direct encounters with the diverse fauna inhabiting the ecosystem such as shorebirds, mud crabs, mudskippers, and various other biota.

> *"The boat ride is one of the main attractions for visitors, including school groups. Children are very enthusiastic when they can see firsthand the animals that live around the mangroves. This becomes an unforgettable moment that makes them appreciate nature more." (Site Manager, September 15, 2024).*

This activity stimulates students' sensitivity to the presence of wildlife and their habitats within the mangrove ecosystem. Direct visual interaction with mangrove fauna can foster empathy and concern among students for the importance of preserving the natural habitats of coastal biota.

b. Functionally Environmentally Literate

1) Demonstration of the Ecological Functions of Mangroves

In this activity, students are guided to functionally comprehend the ecological role of mangroves in relation to human welfare and coastal environments. Guides demonstrate how the complex mangrove root systems function as barriers against erosion, how mangroves serve as nursery grounds for various species of fish and shrimp, and how they contribute to carbon dioxide absorption as part of climate change mitigation efforts.

> *"We show students how these mangrove roots work like a safety net that protects the coastline from the force of waves. We also show them small fish hiding among the mangrove roots. From this, children can directly see why it is so important to protect mangroves." (Tour Guide, September 16, 2024).*

Through this demonstration activity, students move beyond a nominal recognition of mangrove species to develop a functional understanding of the relationship between the mangrove ecosystem and the lives of coastal communities and long-term environmental sustainability. This functional understanding forms a critical foundation for the development of pro-environmental attitudes and behaviors in students.

c. Operationally Environmentally Literate

1) Mangrove Seedling Planting

The mangrove seedling planting activity is a core program that provides students with a genuine, hands-on experience of directly contributing to mangrove ecosystem

conservation. Students are taught the correct techniques for planting mangroves, from selecting a planting site and preparing seedlings to the actual planting and initial maintenance.

> *"This mangrove planting activity is always a favorite among children. Each student receives one mangrove seedling to plant themselves. We also number each seedling planted, so students can monitor the growth of their plant on subsequent visits. This cultivates a sense of responsibility and ownership toward the environment." (Site Manager, September 16, 2024).*

Through this activity, students gain operational knowledge of mangrove planting techniques while simultaneously building a genuine commitment to environmental conservation. The personal experience of planting a tree creates an emotional bond between students and the natural environment, which in turn fosters a long-term sense of environmental responsibility.

2) Coastal Waste Management

The coastal waste management activity actively engages students in efforts to maintain the cleanliness of the mangrove area. Students are invited to sort organic and inorganic waste found around the mangroves and to learn about the proper management of each waste type. Organic waste is processed into compost, while inorganic waste is sorted for recycling or upcycled into handcrafted items.

> *"One of the biggest threats to our mangroves is plastic waste carried in by ocean currents. We invite children to join in cleaning and sorting the waste, and we explain the impact of plastic pollution on the mangrove ecosystem and marine biota. In this way, they not only learn about environmental problems, but also actively contribute to solving them." (Site Manager, September 16, 2024).*

Through the coastal waste management activity, students not only come to understand the environmental challenges facing the mangrove ecosystem, but also take

an active role in addressing them. This experience builds students' capacity as responsive and responsible environmental citizens.

3) Mangrove Nursery

The Sayeung Mangrove Edu-Tourism Area is equipped with a mangrove nursery facility that serves as an educational venue for visitors. Students are taken directly to the nursery area to learn about the process of mangrove propagation, from the collection of propagules or seeds and the preparation of growing media, to sowing techniques and seedling care until the plants are ready for transplanting.

> *"In this nursery, children can see firsthand how a mangrove propagule grows into a seedling ready for planting. This process requires patience and dedication. We hope children will take away the lesson that caring for nature is a long-term process that demands commitment." (Site Manager, September 17, 2024).*

The mangrove nursery activity provides students with a comprehensive understanding of the mangrove life cycle while introducing them to the concrete efforts undertaken to conserve the mangrove ecosystem. This experience aligns with the conservation dimension of environmental literacy.

2. Identification of the Sayeung Mangrove Edu-Tourism Area's Content in Elementary School Learning

The environmental literacy content found within the Sayeung Mangrove Edu-Tourism Area is closely aligned with the Natural and Social Sciences (IPAS) subject within the Merdeka Curriculum Learning Outcomes. This alignment can be identified across each phase of learning, from Phase A (Grades 1 and 2) and Phase B (Grades 3 and 4) through to Phase C (Grades 5 and 6).

In Phase A (Grades 1 and 2), IPAS competencies that can be developed through a visit to the Sayeung Mangrove Area include the ability to observe living organisms using

the five senses, identify differences in the form and characteristics of various plant and animal species, and describe objects and living organisms found in the surrounding environment. Lower-grade students can be guided to directly observe various mangrove plant species, describe the shapes of their leaves, roots, and stems, and identify animals inhabiting the mangrove ecosystem. Process skills at this phase include observing, questioning, and predicting based on direct observation in the mangrove area.

In Phase C (Grades 5 and 6), IPAS competencies that can be developed encompass the ability to explain the relationship between ecosystem stability and its constituent components, analyze coastal environmental phenomena, and identify the impacts of environmental change on community livelihoods. Upper-grade students can be guided to analyze the role of the mangrove ecosystem in maintaining the stability of coastal areas, identify threats to the mangrove ecosystem and their associated impacts, and design concrete solutions to contribute to mangrove conservation. Process skills at this phase include planning and conducting simple investigations, analyzing data, and communicating observation results both orally and in writing.

Practical skills that students can acquire at the Sayeung Mangrove Area include identifying and observing various coastal plant and animal species, understanding the processes of photosynthesis and mangrove plant adaptation to saline environments, and actively participating in mangrove planting and maintenance activities as an expression of environmental responsibility. The diverse features available at the Sayeung Mangrove Edu-Tourism Area strongly support experiential, hands-on learning and communicate a holistic approach toward coastal environmental conservation.

3. Methods by Which Schools Utilize the Sayeung Mangrove Edu-Tourism Area as a Learning Resource

Nature-based tourism destinations have considerable potential for use as meaningful contextual learning media for students. The Sayeung Mangrove Edu-Tourism

Area has been utilized by several schools in the Aceh Jaya Regency through outing class activities that integrate IPAS learning materials with direct experiential learning in nature. Based on interviews with school principals who have conducted activities at this site:

> *"We organized an outing class to Sayeung Mangrove as part of our IPAS learning on ecosystems. The students were very enthusiastic and asked many questions. They learned things they could not find in textbooks—such as seeing firsthand how mangrove roots hold the soil in place, or watching mud crabs take shelter among the roots. That experience was far more memorable than learning from pictures alone." (Principal of SDN X, September 18, 2024).*

Outing class activities at the Sayeung Mangrove Edu-Tourism Area are designed to integrate school-based subject matter with direct observation and experiential learning within the mangrove environment. In practice, teachers prepare Student Worksheets (LKPD) containing observation guides, exploratory questions, and observation reporting tasks. Accompanied by their teachers, students tour the mangrove area while completing the LKPD, observing various mangrove vegetation and fauna, and participating in mangrove seedling planting activities.

Hasyim (2019) affirms that the utilization of the surrounding environment as a learning resource can increase student engagement and is relevant to students' everyday activities, which can be explored across various scientific disciplines. This is consistent with the research findings, which show that students who learned at the Sayeung Mangrove Area demonstrated high levels of enthusiasm, posed numerous questions, and developed a deeper understanding of coastal ecosystems compared to students who studied solely within the classroom.

Discussion

The Sayeung Mangrove Edu-Tourism Area holds significant potential for enhancing the environmental literacy of elementary school students. The research

findings demonstrate that the diverse activities available at this site ranging from nature interpretation walks and boat rides to seedling planting, coastal waste management, and nursery visits consistently reflect the three levels of environmental literacy identified by scholars: nominally, functionally, and operationally environmentally literate.

These findings corroborate the results of Rohmawati & Gunansyah (2021), who demonstrated that natural tourism areas contain environmental literacy content that can be integrated as learning resources in elementary schools. More specifically, the mangrove ecosystem context adds distinctive value, given the close relationship between this ecosystem and the livelihoods of Aceh's coastal communities, thereby rendering the learning experience more contextual and meaningful for students.

The development of the Sayeung Mangrove Edu-Tourism Area as a learning resource gains particular urgency in light of the Merdeka Curriculum implementation, which emphasizes project-based learning, contextual approaches, and the cultivation of the Pancasila Student Profile. The "Faith, Piety to God Almighty, and Noble Character" dimension of the Pancasila Student Profile encompasses a moral relationship with nature, which can be expressed through concrete activities such as mangrove planting and coastal ecosystem stewardship. The "Global Diversity and Collaboration" dimension can be fostered through collective coastal clean-up and mangrove planting activities.

Outdoor learning, particularly in natural settings such as mangrove forests, has been shown to be effective in enhancing student enthusiasm by offering rich sensory experiences that cannot be replicated within the classroom. Students can see, hear, smell, and touch concrete learning objects directly an approach that is fully aligned with the cognitive developmental characteristics of elementary-aged children. These findings are consistent with the research of Palupi & Suprayitno (2019) on the use of coastal tourism sites as geo-literacy-based learning resources in elementary schools.

The implementation of the Sayeung Mangrove Edu-Tourism Area as a learning resource also yields a dual benefit: it improves the quality of student learning while simultaneously supporting the ongoing conservation of the mangrove ecosystem. When students plant mangrove seedlings and develop a sense of ownership over the plants they have tended, a strong emotional bond between students and the natural environment is forged. This bond has the potential to cultivate a generation of future citizens with a genuine commitment to environmental conservation particularly the mangrove ecosystem, which constitutes a natural heritage for the coastal communities of Aceh.

CONCLUSION

The Sayeung Mangrove Edu-Tourism Area, Gampong Baro Sayeung Village, Setia Bakti District, Aceh Jaya Regency, Aceh Province, contains rich environmental literacy content that can be utilized as a learning resource in elementary schools. This environmental literacy content encompasses three levels of capability: Nominally Environmentally Literate (mangrove nature interpretation and boat ride), Functionally Environmentally Literate (demonstration of mangrove ecological functions), and Operationally Environmentally Literate (mangrove seedling planting, coastal waste management, and nursery activities). Furthermore, this content was analyzed along two environmental dimensions: conservation and preservation.

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