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IMPROVING CHILDREN'S ENVIRONMENTAL LITERACY THROUGH EXPERIENTIAL LEARNING

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Abstrak: Pengenalan ekosistem yang ada di sekitar masyarakat sejak dini memiliki dampak ekologis dan ekonomis yang besar. Namun, pengenalan literasi lingkungan kepada peserta didik di tingkat dasar belum secara maksimal dilakukan. Kegiatan pengabdian kepada masyarakat ini bertujuan mengenalkan peserta didik tingkat dasar mengenai literasi lingkungan, khususnya melalui pemahaman mengenai ekosistem mangrove. Sebanyak 48 siswa di Desa Petiken dan Desa Karangandong, Kabupaten Gresik diperkenalkan tentang konsep literasi lingkungan melalui mangrove, yang merupakan kekayaan natural yang dimiliki Kabupaten Gresik bagian pesisir. Metode pembelajaran yang digunakan pada program pengabdian kepada masyarakat ini adalah experiential learning, atau pembelajaran melalui pengalaman langsung. Metode ini juga secara langsung mengaplikasikan pendekatan Participatory Rural Appraisal (PRA), di mana terdapat keterlibatan masyarakat yang besar dalam pembangunan desanya. Hasil evaluasi kegiatan ini menunjukkan bahwa terdapat peningkatan yang signifikan secara statistik terkait pengetahuan dan perilaku peserta didik tingkat dasar terhadap lingkungan. Hasil dari program ini memiliki implikasi bahwa isu-isu krusial yang penting untuk diketahui sejak dini dapat diajarkan melalui metode experiential learning. Pembahasan mengenai rancangan program, hasil, dan kendala di lapangan juga didiskusikan pada artikel ini.

Kata Kunci: literasi lingkungan, hutan mangrove, pembelajaran melalui pengalaman

Abstract: Introducing the surrounding ecosystems to students early can yield significant ecological and economic impacts. However, environmental literacy has not been adequately introduced to students at the primary level. This community service activity aims to improve the environmental literacy of primary-level students, particularly related to mangrove ecosystems. Forty-eight students in Petiken Village and Karangandong Village, Gresik Regency, were involved in introducing the concept of environmental literacy through the mangrove ecosystem, which is a natural resource in the Gresik Regency coastal area. The learning method used in this community service program was experiential learning, or learning through direct experience. This method also directly applied the Participatory Rural Appraisal (PRA) approach, where there was significant community involvement in the development of their village. The evaluation results show a statistically significant increase in the knowledge and behaviour of primary-level students towards the environment. The results of this program have implications that crucial issues that are important to know from an early age can be taught through experiential learning methods. Discussions on the program design, results, and obstacles in the field were also presented in this article.

Keywords: environmental literacy, mangrove forests, experiential learning

Introduction

The development of information and communication technology in the era of globalization has influenced various aspects of human life, including education (Wiyono, 2013). The results of the Indonesia National Assessment Program in 2016 conducted by the Center for Educational Research (Puspendik) of the Ministry of Education & Culture itself revealed data that the national average distribution of literacy in the reading ability of students in Indonesia was 46.83% in the "Poor" category, only 6.06% were in the "Good" category, and 47.11% were in the "Fair"

category (Kementerian Pendidikan & Kebudayaan, 2017). The effect of the low interest in reading or literacy that occurs in Indonesia is also caused by several factors, including no habit of reading from an early age and facilities or activities that can support education/reading are still minimal (Anisa, Ipungkarti, & Saffanah, 2021).

Improving literacy in students is one of the main concerns in education. The Ministry of Education, Culture, Research and Technology (Kemendikbud Ristek) is currently trying to encourage the active role of local governments in designing a curriculum that suits the needs and potential of their respective regions. Implementing a local content-based curriculum that focuses on understanding environmental conditions and community demands can potentially develop students' knowledge, skills, and character (Alfi & Bakar, 2021). The Campaign for Environmental Literacy (2011) by Braun, Peter, & Kristen (2016) states that the definition of environmental literacy is an individual capacity to act in everyday life with a broad understanding of how individuals and community groups interact with natural systems and their implementation in a sustainable manner.

Granit-Dgani, Kaplan, & Kaplan (2017) stated that there are five goals of environmental education objectives that include learning, motivation, and identity formation, such as (1) promoting students' perceived relevance of environmental content, (2) facilitating students' sense of personal and collective responsibility for sustainability, (3) increasing students' knowledge of environmental content, (4) increasing students' readiness for environmental action and (5) initiating exploration of environmental questions. However, implementing environmental literacy-based learning at the elementary school level still cannot be optimized. Educators still pay less attention or rarely use environmental learning media (plants and animals) in learning resources inside and outside the classroom. Therefore, students' learning process is hampered because it does not involve the environment as a real-life-based learning object in increasing students' knowledge and experience.

The environment is one of the learning resources that can be sustainable and useful for lifelong learning in society. Environmental utilization in education can be a unique material in learning (Widiasworo, 2017). The implementation of environmental literacy-based learning can encourage students to develop an understanding of knowledge concepts and experiences, increase awareness, and encourage decision-making and solutions to problems in the surrounding environment (Saymita, Aryaningrum, & Selegi, 2023). It will increase learners' awareness, understanding, and motivation by facilitating their development of related skills to maintain or change the ecosystem for the better.

More specifically, one of the urgent environmental lessons to be improved is related to mangroves. Mangrove forests are among the most productive ecosystems in many parts of the world. Mangrove forest is one of the vegetation zones that is unique because it is located in a muddy area with the meeting of land and sea in coastal areas or small islands that are influenced by tides and become potential natural resources (Jaya, Yusuf, & Nurdiana, 2020). Mangrove plants are vegetation or woody plants that grow and develop well in tidal areas and muddy beaches, generally growing in intertidal zones that get fresh water from river mouths and seawater from coastal areas (Latuconsina, 2018). Mangrove forests are a distinctive type of

forest that grows along the coast or river estuaries and is influenced by tides. One of the mangrove forest areas in Indonesia is located in the Kalimireng River estuary area, Manyar District, Gresik Regency, East Java. The distribution and extent of mangrove forests in the area have mangrove variations and are only distributed along the banks of the Kalimireng River (Laksmana, Hidayat, & Maulida, 2023).

Mangrove forests have ecological and economic benefits. According to Susanti (2021), the ecological benefits of mangrove forests are to act as a natural protector against abrasion, accelerate sedimentation, control seawater intrusion, and protect the area behind mangroves from high waves and strong winds, nesting, feeding, and shelter for fish, shrimp, crabs, and other marine life. Mangrove forests play an important economic role in coastal landscapes, especially in communities that depend on the richness of aquatic resources, including food and drink, medicine, natural dyes, and ecotourism (Rotich, Mwangi, & Lawry, 2016).

However, mangrove forests are not free from excessive resource exploitation and environmental degradation. One of the actions that cause environmental damage to mangrove forests is the disposal of industrial waste without standardized management into the river around the Kalimireng River in Manyar District, Gresik Regency. It is indicated by the condition of the river and watershed in the area, which is murky and smelly (Khoiri, Mauludiyah, & Noverma, 2020). These environmental destruction activities still reflect that the level of environmental literacy in the community is still low in their daily lives. One of the causes of the low level is the lack of early environmental education in the community to protect mangrove or coastal forest ecosystems. Marine environmental education can be done by providing environmental education activities. Learners must be introduced to or experienced directly in various ecosystems and their constituent components, especially in mangrove forests. Learning resources from local ecosystems can increase student productivity (Irwandi, 2019). The potential of local culture in community groups in preserving mangroves needs to be utilized, and collaboration through learning studies is needed to support the preservation of mangrove forests (Fingkrew, Tuhumury, & Dahlan, 2015). Utilization of local advantages and potential in the region can be implemented as one of the learning resources that can help students solve various environmental problems and develop their character (Juniati & Sari, 2016).

Petiken and Karangandong villages are among 16 villages in Driyorejo district, Gresik Regency, East Java province. The education services in and around Petiken and Karangandong villages are adequate. One of the public primary schools (SDN) around Petiken and Karangandong villages is UPT SDN 152, UPT SDN 162 and UPT SDN 163. One of the activities that can develop environmental literacy is integrating environmental education in schools through learning inside and outside the classroom. Based on observations, the number of students with the knowledge, skills, commitment, and environmental contributions to mangrove forests in Gresik Regency is still low. Improving environmental literacy learning through experiential learning can help introduce and foster students' interest in learning about the potential of local mangrove forest ecosystems and their contributions to conservation. Education about various ecosystems is crucial in maintaining the ecosystem (Bjorkland & Pringle, 2001). Mangrove forests can be one of the places for field learning, along with field trips for students.

Learning about mangrove forests provides new experiences for students (Asrial, Syahrial, Kurniawan, & Zulkhi, 2021).

Thus, this community service program focused on increasing environmental literacy in students, primarily through non-formal learning. This empowerment activity is also adapted from the Sustainable Development Goals (SDGs) points, especially number 13 on Climate Change. In addition, SDGs number 4 on Quality Education can also be achieved through this activity. The objectives of this community empowerment activity were: (1) see how the level of knowledge and skills on mangrove forests in Gresik Regency in students, (2) see how the level of commitment and environmental contribution to mangrove forests in Gresik Regency in students in learning biology about mangrove vegetation, and (3) evaluate whether experiential learning methods through environmental learning activities based on mangrove ecotourism can be one of the updates in increasing environmental literacy.

Methods

This community service applied the experiential learning method. Experiential learning is a learning model in which the learning process emphasizes experience as a medium so that learning materials are not only sourced from textbooks or teachers (Fathurrohman, 2015). This learning model requires an active and participatory role from students during the learning process so that learning activities can be more memorable and increase learning independence. According to Sato and Haan (2016), one of the four syntax models of experiential learning is experience. This learning model is one of the models in which direct learning experiences can develop knowledge, train values and attitudes, and improve learners' skills (Gao, 2015). This model allows learners to interact directly or conduct field observation activities, thus raising their awareness and skills in protecting and implementing the environment in everyday life.

The experiential learning model is believed to significantly influence the learning process in improving literacy for students. Improving learners' learning process and literacy can be done by using the environment as a learning resource. Interactive, fun, and collaborative learning models can make learners more active in gaining knowledge and experience and being creative (Saymita *et al.*, 2023). The learning process that can develop discussion patterns and participation in opinion can develop critical thinking patterns for students (Suprijono, 2016). Increased participation and ability to identify problems is one indicator that shows increased critical thinking skills in students (Hajjah, Munawaroh, Wulandari, & Hidayati, 2022).

This service was implemented in Petiken Village and Karangandong Village, Driyorejo District, Gresik Regency, East Java Province. This service's main participants or target groups were students, teachers, and school officials from UPT SDN 152, UPT SDN 162, and UPT SDN 163 in Gresik Regency. This empowerment applied Participatory Rural Appraisal (PRA) or a collaborative, participatory approach between students, teachers, and school parties through literacy corner design activities and various literacy corner program activities in the form of programs to support literacy improvement, non-formal learning and digitization of education. The participatory approach is one method that can address problems, meet practical needs, and

generate capacity through participatory community involvement (Afandi, 2020). Participation is the involvement of the target group that voluntarily and actively participates in the entire process of the program (Handini, Sukesi, & Hartati, 2021). Students and teachers participated in learning activities and related training in this community service program. In addition, teachers and schools participated in providing licenses, facilities, and infrastructure and assisting in mentoring activities. The first year focuses on developing human resources by applying technology and innovation and developing an interest in reading/literacy. The roadmap for implementing PkM FISIP 2023 activities can be seen in Figure 1.

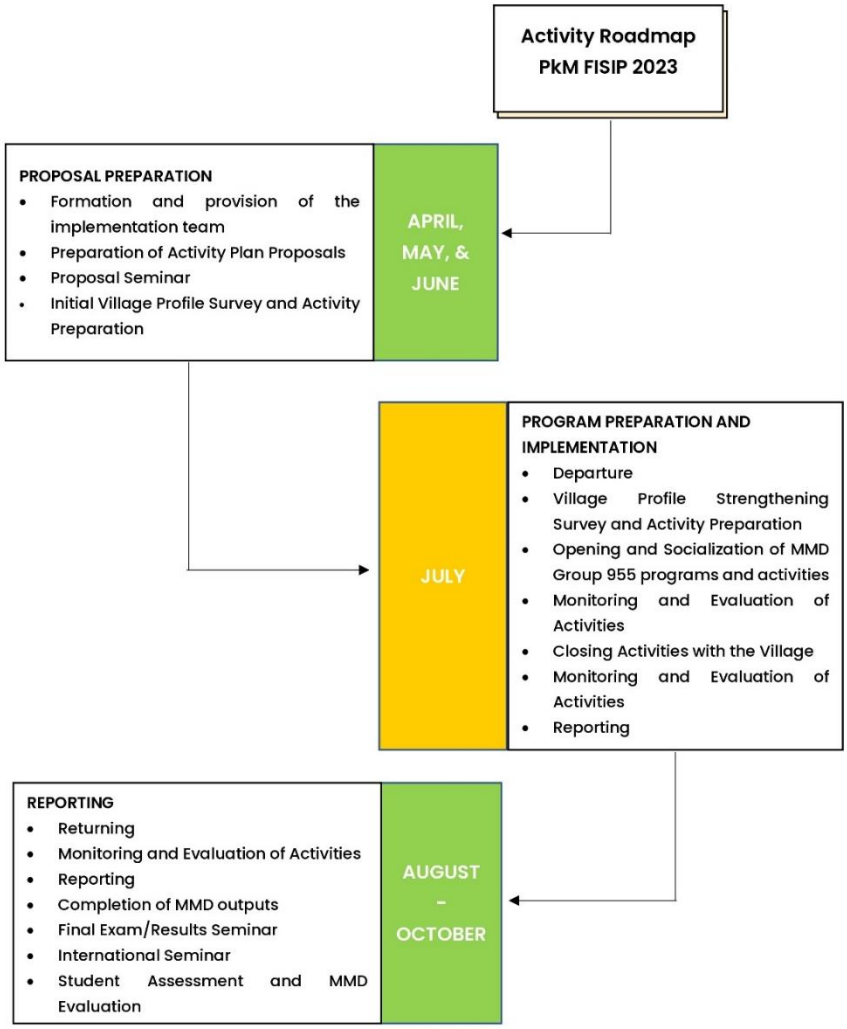

Figure 1. FISIP PkM Activity Roadmap

Figure 1 shows that the roadmap of this empowerment activity method consists of three stages: proposal preparation, program preparation and implementation, and reporting. The description of these activities was as follows:

Proposal Development

The accompanying lecturer formed and divided the tasks of the FISIP PkM implementation team. The implementation team acted as facilitators and implementers of activities in the field. At this stage, internal coordination was carried out to discuss the design and implementation of

all FISIP PkM activities during the planned 2023 year, from technical preparation and activity materials or modules, questionnaire lists and activity attendance to the preparation of proposals. This activity began with a survey in Petikan Village and Karangandong Village.

Surveys and interviews were conducted by asking several questions related to the problems and needs of the target community. The initial preparation of this program included an initial survey conducted for at least three days by interviewing community members of Petikan Village and Karangandong Village from various age groups with at least three respondents, each representing the age categories of children, adolescents, and adults regarding environmental literacy. The initial survey was conducted twice: the first survey in April and the second survey in June. Through the issues that have been identified, the needs of the target group were the creation of literacy improvement facilities, especially in non-formal learning activities for students.

Preparation and Implementation of the Program

The results of the previous preparation stage were then used to produce the program design. Discussion activities with the Petikan Village and Karangandong Village governments were intended to clarify the objectives and program design for the target group. The implementation of community service activities in Petikan Village and Karangandong Village for one month in July 2023. This program was carried out in several stages, including:

a) Preparation and socialization stage. At this stage, discussions, surveys, and socialization related to the FISIP PkM grant program with the target group were carried out.
b) Program execution stage. At this stage, program execution was carried out, namely approaching and assisting the participation of target groups in Petikan Village and Karangandong Village. Various non-formal learning activities were also carried out for the target group. One of the FISIP PkM activities was through mangrove ecotourism-based environmental learning activities, as shown in Table 1.

Table 1. Implementation of Environmental Learning Activities Based on Mangrove Ecotourism

Environmental Learning Based on Mangrove Ecotourism	
Pre-Activity	1. Finalizing concepts and plans to carry out program implementation. 2. Conducting transportation and consumption surveys. 3. Surveying and discussing with the manager of Kalimireng Mangrove Ecotourism regarding the preparation of activities. 4. Surveying and discussing with the school and Babinsa of Petiken Village and Karangandong Village. 5. Designing invitation letters, flyers, pre-tests, and post-tests for the participants. 6. Distributing invitations for activities.
Implementation	On July 29, 2023, Environmental Learning Based on Mangrove Ecotourism was carried out at Kalimireng Mangrove Ecotourism, Manyar Sidomukti Village, Manyar District, Gresik Regency at 06.00-15.00 which was attended by 24 students/participants each accompanied by two teachers, one village supervisor (Babinsa), and 13 students from Petiken Village (UPT SDN 161 and 162 Gresik) and Karangandong Village (UPT SDN 152 Gresik). The activity began with filling in the pre-test, then participants were invited to comb the river with a boat equipped with mangrove-related education, and then participants were invited to plant mangrove trees. Participants played games and filled in the post-test.

Environmental Learning Based on Mangrove Ecotourism	
Post-Activity	Monitoring and creation of activity outputs
Activity Output Achievement	1. The activity was attended by 24 students, two teachers, 1 Babinsa, and 13 students from Petiken Village and Karangandong Village. 2. Pamphlets, pre-tests and post-tests, and documentation of activities were produced.

Source: Primary Data Processed (2023)

c) Monitoring and evaluation stage. At this stage, monitoring and evaluation of the work program that has been implemented was carried out to see the progress and results of the program implementation. The team also monitors by providing a recap of attendance for each agenda implemented. If there were obstacles or barriers, an appropriate solution was immediately made so that the program could run smoothly and positively impact the people of Petikan Village and Karangandong Village. Before and after the activity, a pre-test and post-test were conducted for the participants to evaluate the increase in the level of environmental literacy in the target group, which consisted of aspects of environmental knowledge and skills (questions 1–5) and commitment and contribution/behaviour to the environment (questions 6–10). The level of environmental literacy was evaluated by comparing the test results against the criteria of the questionnaire designed by the implementation team. It aimed to see how much literacy increases and the impact of target group participation in following and supporting mangrove ecotourism-based environmental learning activity programs.

Reporting

The reporting stage was crucial in this program, including processing data and writing reports. Data was processed and reported as results, documentation, cost usage, and success indicators. At this stage, the success of this program could be identified.

Results and Discussions

Pre-Activity

The implementation team conducted surveys and discussions with the Kalimireng Mangrove Ecotourism Manager regarding environmental learning activities based on mangrove ecotourism. After an agreement was made, the implementation team, together with the school from UPT SDN 152, UPT SDN 162, and UPT SDN 163 Gresik Regency and representatives from the Driyorejo District Koramil, coordinated and licensed empowerment activities. Discussion activities with the school can be seen in Figure 2.

The empowerment activity involved representatives from students and accompanying teachers from the school, as well as Babinsa from Petiken Village and Karangandong Village. The implementation team designed invitation letters, pre-test and post-test questionnaires for participants, and environmental learning pamphlets on mangroves to facilitate and attract students' interest in learning about the ecosystem environment in mangroves. The cover design related to the environmental learning pamphlet on mangroves can be seen in Figure 3. The implementation team then distributed and socialized invitation letters to teachers and Babinsa from Petiken Village and Karangandong Village.

Figure 2. Survey and licensing activities at UPT SDN 152 Gresik Regency

Figure 3. Environmental Literacy Pamphlet on Mangroves

Implementation

Environmental learning activities based on mangrove ecotourism were conducted on July 29, 2023, at Kalimireng Mangrove Ecotourism, Manyar Sidomukti Village, Manyar District, Gresik Regency. The activity lasted about 9 hours, from 06.00 to 15.00 WIB. Participants in the activity were attended by representatives from Petiken Village (UPT SDN 161 and 162 Gresik) and Karangandong Village (UPT SDN 152 Gresik), each of which had 24 students accompanied by two teachers and 1 Babinsa. The participants were divided into three study groups to facilitate the implementation of activities. The implementation team as activity facilitators were 26 (university) students. Implementing the activity began with filling in the pre-test for students. Subsequently, participants swept the river with a boat equipped with mangrove-related

education, planted mangrove trees, played games, and filled in the post-test for students until the activity ended.

Non-formal learning activities in increasing environmental literacy in mangroves became one of the movements carried out by providing students with access to activities that led to experiential learning. At each stage of the activity, the implementation team and the Kalimireng Mangrove Ecotourism manager provided environmental learning assistance to students. Each study group was assisted by one assistant from the manager, two teachers, and 11 university students in learning and practising material about environmental literacy. Students directly learnt and practised knowledge and experience about the environment and mangrove ecosystems with this assistance. Photos of the implementation of the activity can be seen in Figure 4.

(a) (b)

Figure 4. (a) Joint Mangrove Forest Exploration Activity and (b) Joint Mangrove Planting Activity

Post-Activity

Monitoring and evaluation activities were carried out during the implementation and after the mangrove ecotourism-based environmental learning activities. Monitoring was carried out at the implementation stage of empowerment activities to ensure smooth running. The evaluation was carried out by analyzing the results of the pre-test and post-test questionnaires that have been designed, focusing on the aspects of Environmental Knowledge and Skills, as well as on the Aspects of Commitment and Contribution, each of which consists of 5 questions. The survey focused on environmental knowledge and skills, consisting of questions about mangrove plants, mangrove habitats, mangrove plant care, positive and negative impacts of mangrove ecosystems, and ecosystems contained in mangrove forests. This question point was administered to explain the conditions before and after students conduct experiential learning activities, especially when students must first know about mangrove forests. The aspect of commitment and contribution consisted of questions regarding attitudes toward protecting mangrove forests, contributions in inviting family and friends to protect mangrove forests, the desire to discuss with family and friends, curiosity in finding information about mangrove forests, and the plan to carry out environmental activities actively at the school/regional level. The purpose of this question was to describe the conditions before and after students in conducting experiential learning activities, especially students who must have an essential commitment and contribution to the mangrove forests.

Statistical Analysis

The evaluation was carried out by statistically analyzing the results of the pre-test and post-test that had been carried out for mangrove ecotourism-based environmental learning activities. The results of the analysis on the pre-test of 48 students can be seen in Figure 5.

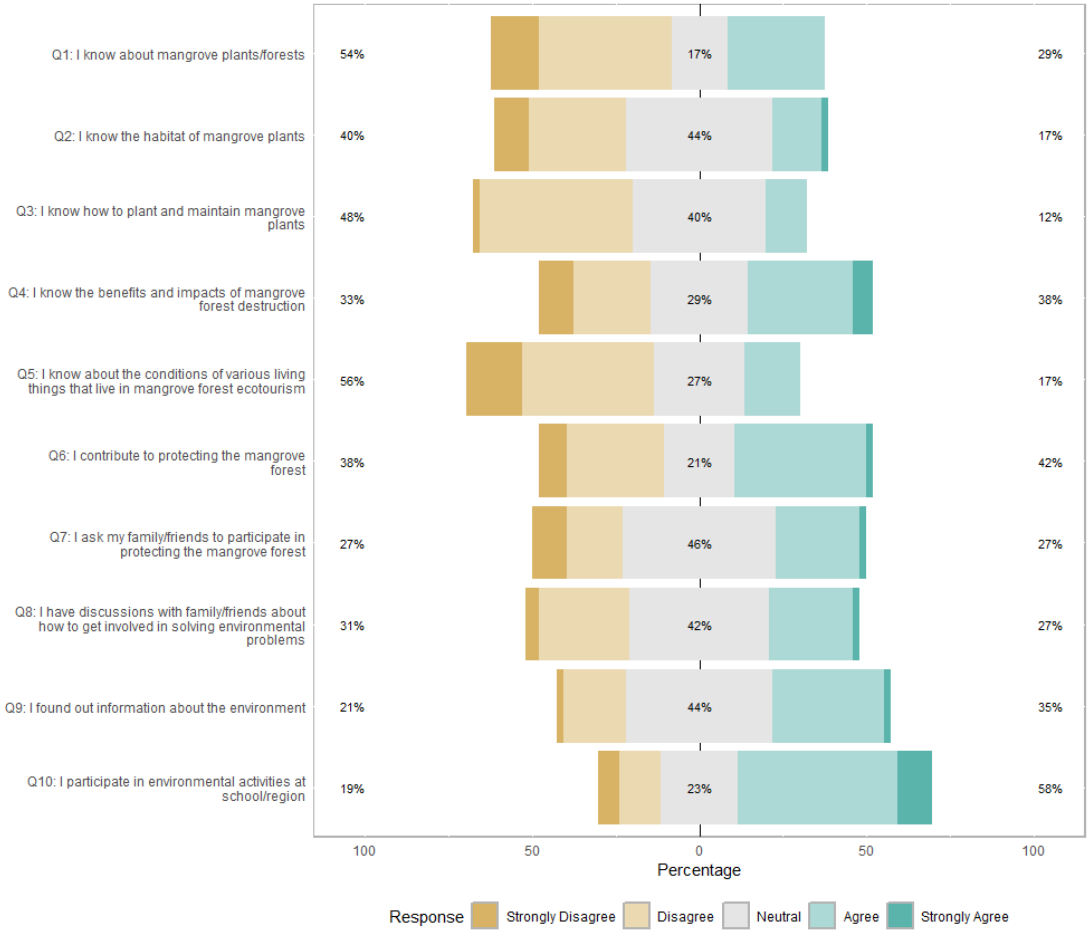

Figure 5. Results of Pre-Test Questionnaire Analysis

Figure 5 illustrates the aspects of environmental knowledge and skills (questions 1-5) and environmental commitment and contribution (questions 6-10); most students responded with "neutral" answers (the response results were 4 out of 10 questions). In the aspect of environmental knowledge and skills, the highest percentage for responses "strongly disagree" and "disagree" was in question 5 (the condition of various living things that live in mangrove forest ecotourism) with a value of 56%, then for the highest percentage for "neutral" responses was in question 1 (mangrove plant habitat) with a value of 44%, and for the highest percentage for responses "agree" and "strongly agree" was in question 4 (the benefits and impacts of mangrove forest destruction) with a value of 38%. In the aspect of commitment and contribution, the highest percentage for responses "agree" and "strongly agree" was in question 4 (the benefits and impacts of mangrove forest destruction), with a value of 38%. In the aspect of commitment and contribution, the highest percentage for responses "strongly disagree" and "disagree" was in question 6 (contributing to protecting mangrove forests) with a value of 38%,

then the highest percentage for "neutral" responses was in question 7 (asking family/friends to participate in protecting mangrove forests) with a value of 46%, and for the highest percentage for responses "agree" and "strongly agree" was in question 10 (participating in environmental activities in schools/regions) with a value of 58%.

After implementing environmental learning activities based on mangrove ecotourism, data were collected through a post-test questionnaire. The analysis results on the post-test of 48 students can be seen in Figure 6.

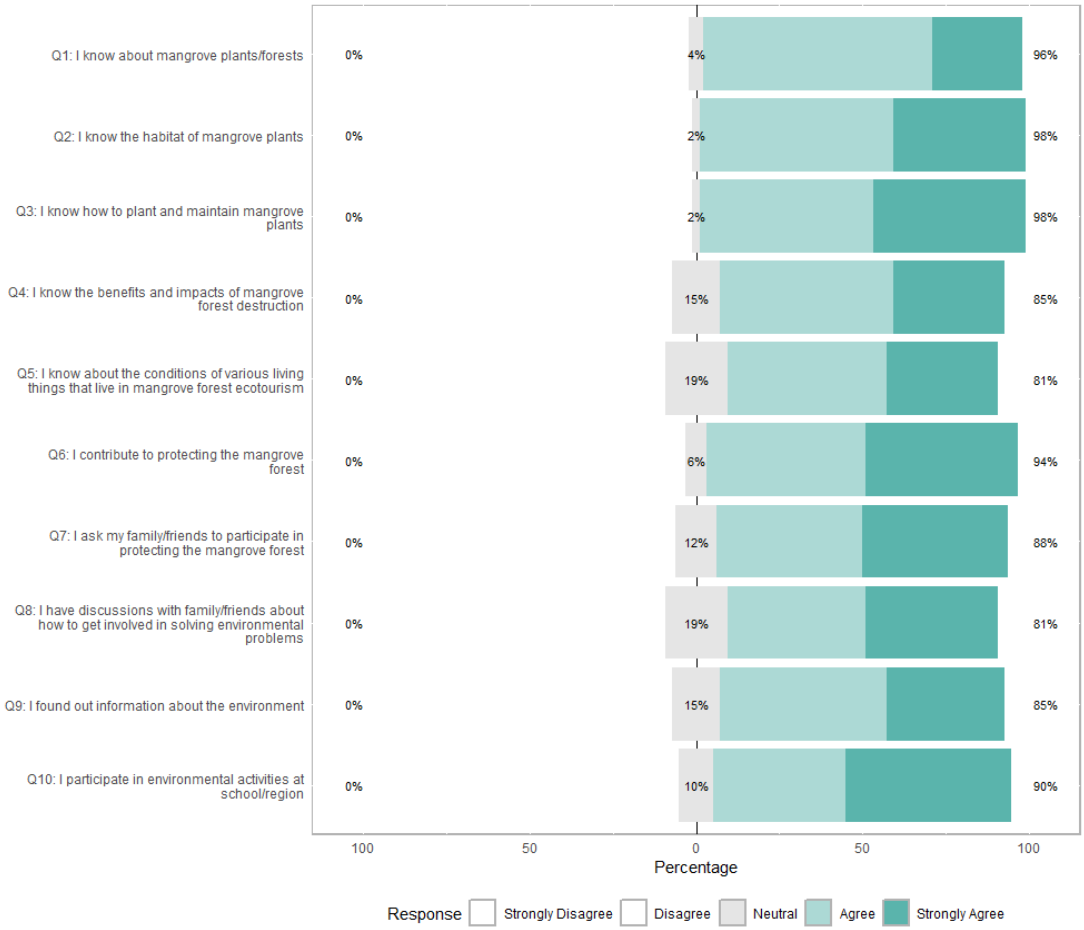

Figure 6. Results of Post-Test Questionnaire Analysis

Based on the results of Figure 6, it shows that in the aspects of environmental knowledge and skills (questions 1-5) as well as in the aspects of commitment and contribution (questions 6-10), most students responded with answers "agree" and "strongly agree" (showing a response of 10 out of 10 questions). In the aspect of environmental knowledge and skills, the highest percentage for "neutral" responses was in question 5 (the condition of various living things that live in mangrove forest ecotourism) with a value of 19%, and for the highest percentage for responses "agree" and "strongly agree" was in questions 2 (mangrove plant habitat) and 3 (how to plant and maintain mangrove plants) with a value of 98%. In the aspect of commitment and contribution, the highest percentage for "neutral" responses was in question 8 (having

discussions with family/friends about how to get involved in solving environmental problems) with a value of 19%, and the highest percentage for responses "agree" and "strongly agree" was in question 6 (contributing to protecting mangrove forests) with a value of 94%.

Furthermore, inferential analysis was conducted to obtain statistical evidence of differences in scores before and after the learning intervention. The statistical test technique used was the Wilcoxon Signed-Rank Test. Score differences were analyzed at the item level to provide more detailed evidence. Table 2 summarizes the results of the difference test of evaluation scores before and after experiential learning-based environmental learning.

Table 2. Summary of the results of the independent sample t-test of evaluation scores before and after experiential learning-based environmental learning

Statements	Median *pre*	Median *post*	V-statistics	*p*-value
I know about mangrove plants/forests (Q1)	2	4	7	0.000
I know the habitat of mangrove plants (Q2)	3	4	7.5	0.000
I know how to plant and maintain mangrove plants (Q3)	3	4	0	0.000
I know the benefits and impacts of mangrove forest destruction (Q4)	3	4	75	0.000
I know about the conditions of various living things that live in mangrove forest ecotourism (Q5)	2	4	0	0.000
I contribute to protecting the mangrove forest (Q6)	3	4	22.5	0.000
I ask my family/friends to participate in protecting the mangrove forest (Q7)	3	4	24.5	0.000
I have discussions with family/friends about how to get involved in solving environmental problems (Q8)	3	4	9.5	0.000
I found out information about the environment (Q9)	3	4	50	0.000
I participate in environmental activities at school/region (Q10)	3	4	59	0.000

Based on the overall pre-test and post-test evaluation questionnaires on mangrove ecotourism-based environmental learning, as well as the results of inferential analysis (difference test) using the Wilcoxon Signed-Rank test, it can be concluded that there was a significant increase in all aspects of the question ($p < 0.000$). In general, it can be explained that participants who initially responded mostly towards "neutral" or "disagree" before the implementation changed towards an agreeable response. In the aspect of environmental knowledge and skills, it was known that many students from Petiken Village (UPT SDN 161 and 162 Gresik) and Karangandong Village (UPT SDN 152 Gresik) thought that there was an increase in environmental knowledge and skills compared to before the implementation. This result was in accordance with the research conducted by Chumphong & Embree (2022) which stated that

there were changes in knowledge that were better for students who learnt about mangrove forest conservation.

In the mangrove forest ecosystem, various kinds of biodiversity can help develop students' knowledge and skills (Gitgeatpong & Ketpichainarong, 2022). While in the aspect of commitment and contribution, it was also known that students from Petiken Village (UPT SDN 161 and 162 Gresik) and Karangandong Village (UPT SDN 152 Gresik) thought that there was an increase in commitment and high contribution in applying materials related to mangroves and the existing environment. This result was in accordance with the results of research conducted by Surjanti, Soejoto, Seno, & Waspodo (2020) which stated that learning integrated with mangrove forests can develop sustainable behaviour, help coastal conservation programs, and increase understanding of students. It could happen because field trips with real experiences to mangrove forests can help strengthen students' knowledge through learning natural facts and phenomena that occur in mangrove ecosystems, making it easier to understand the concept of environmental pollution (Ratnasari, Koosbandiah & Supriatno, 2017). The increase in character that supports environmental conservation was in line with the increase in student's knowledge about mangroves (Tagulao, Bernardo, Kei, & Calheiros, 2022).

Conclusions

Community empowerment through environmental education via mangrove ecotourism has been effectively executed. This initiative offers practical experiences and knowledge for students from Petiken Village and Karangandong Village, particularly regarding mangrove ecosystems. The program's efficacy is evidenced by questionnaire results from 48 students, indicating a notable enhancement in environmental knowledge, skills, commitment, and contribution. The participants' high enthusiasm stemmed from their collaborative involvement in the activity. The experiential learning-focused environmental literacy program represents a significant initiative to enhance students' environmental comprehension. This pedagogical approach effectively supported educational resources in and out of the classroom. Early program implementation necessitates stakeholder coordination, including students, supervisors, teachers, and schools. The implementation team and lecturers are responsible for assessing the effectiveness and longevity of empowerment initiatives.

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