

Mangrove Planting: Implementation and Application of Science Instructional Design in Elementary Education Masters Program

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ABSTRACT

Mangrove planting has great ecological benefits, including preventing abrasion, absorbing carbon, and supporting biodiversity. However, mangrove degradation due to land conversion and lack of public awareness requires intervention in the form of ecosystem rehabilitation. This activity also integrates environmental education to increase student awareness. The purpose of this service is to integrate mangrove conservation practices in project-based learning for students, involving instructional design theories that are relevant to real environmental issues. This activity also aims to support collaboration between universities and coastal communities. The results of this service are education to increase participants' understanding of the role of mangroves and correct planting techniques, seedlings are planted according to ecological conditions, with assistance to ensure success, then observation of seedling growth, additional rehabilitation, and community empowerment to maintain the sustainability of the program. The conclusion is that mangrove planting is not only beneficial for environmental conservation but also improves community welfare through ecotourism development. This activity supports sustainable development goals while providing practical learning experiences for students.

Keywords: Mangrove Planting, Science, Elementary School

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ABSTRAK Penanaman mangrove memiliki manfaat ekologis besar, termasuk mencegah abrasi, menyerap karbon, dan mendukung keanekaragaman hayati. Namun, degradasi mangrove akibat alih fungsi lahan dan kurangnya kesadaran masyarakat memerlukan intervensi berupa rehabilitasi ekosistem. Kegiatan ini juga mengintegrasikan pendidikan lingkungan untuk meningkatkan kesadaran peserta didik. Tujuan pengabdian ini yaitu mengintegrasikan praktik pelestarian mangrove dalam pembelajaran berbasis proyek untuk mahasiswa, melibatkan teori desain instruksional yang relevan dengan isu lingkungan nyata. Kegiatan ini juga bertujuan untuk mendukung kolaborasi antara perguruan tinggi dan

masyarakat pesisir. Hasil penabdian ini yaitu edukasi meningkatkan pemahaman peserta tentang peran mangrove dan teknik penanaman yang benar, bibit ditanam sesuai kondisi ekologis, dengan pendampingan untuk memastikan keberhasilan, selanjutnya pengamatan pertumbuhan bibit, rehabilitasi tambahan, dan pemberdayaan masyarakat untuk menjaga keberlanjutan program. Kesimpulan penanaman mangrove tidak hanya bermanfaat bagi pelestarian lingkungan tetapi juga meningkatkan kesejahteraan masyarakat melalui pengembangan ekowisata. Kegiatan ini mendukung tujuan pembangunan berkelanjutan sekaligus memberikan pengalaman belajar praktis bagi mahasiswa.

Keywords: Penanaman Mangrove, IPA, Sekolah Dasar

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INTRODUCTION

Mangrove planting is a significant form of ecological intervention to address coastal environmental degradation. Mangroves play an essential role in maintaining the balance of coastal ecosystems, protecting shorelines from erosion, and serving as habitats for various marine biodiversity (Salu et al., 2024). Previous studies have shown that mangrove conservation not only provides ecological benefits but also increases community awareness of the importance of environmental sustainability (Sari et al., 2021; Wicaksono et al., 2023). Therefore, integrating mangrove planting activities into educational programs can have significant multidimensional impacts on both students and the surrounding environment. Mangroves are unique ecosystems that grow in coastal areas and play a crucial role in ecosystem stability. Mangroves not only function as barriers against abrasion but also as carbon absorbers, waste filters, and habitats for coastal biodiversity (Primadona et al., 2021). The existence of mangroves also significantly contributes to supporting coastal communities' food security by providing ecosystems for fisheries (Nugraha et al., 2023).

Unfortunately, mangrove ecosystem degradation continues to increase due to land conversion, resource exploitation, and the lack of community awareness about the importance of conservation. Therefore, efforts in mangrove rehabilitation and replanting have become priorities in various environmental conservation programs (Rahmawati et al., 2020). Integrating environmental education into school and university curricula has proven to be an effective approach to raising students' environmental awareness. The *Instructional Design for Elementary Science* course in the master's Program in Elementary Education provides an opportunity to connect theory with real-world practice through a project-based learning approach.

Mangrove planting can be utilized as a contextual learning medium that integrates scientific concepts with sustainability values. In this context, students not only learn about environmental rehabilitation processes but also practice designing environment-based learning relevant to the needs of elementary school students (Putri & Rahman, 2022; Japa, Syukur & Ibrahim, 2022). Mangrove planting, as part of academic downstream offers several advantages. First, this activity fosters collaboration between universities and coastal communities in environmental conservation efforts. Second, students engage in experiential learning that is relevant to real-life contexts. Third, this program strengthens the role of universities in supporting sustainable development goals (Sari et al., 2021).

In the context of education, the Elementary School Science Instructional Design course aims to develop students' abilities to design applicable learning based on real problems in the field. One relevant approach is to integrate ecological programs, such as mangrove planting, as an implementation of environmentally oriented learning design (Putri & Rahman, 2022). Thus, this activity can be a means of academic downstreaming that not only provides practical experience to students but also makes a real contribution to environmental conservation. Instructional design plays a role in creating a systematic and directed learning process. In the context of Elementary School Science education, instructional design allows educators to design interactive and problem-based learning experiences. The integration of mangrove planting into learning provides an authentic experience that involves direct observation, analysis, and reflection on environmental issues (Widodo & Kusumawardani, 2023)

However, in previous studies, there has been little research that directly links instructional design to the implementation of environmental conservation activities. Many studies tend to focus on the ecological aspects of mangrove planting, while the educational dimension has not been studied in depth (Rahmawati et al., 2020). This shows an opportunity to explore how mangrove planting activities can be used as a holistic and contextual learning medium in the scope of elementary education. Therefore, this article aims to explain the implementation and downstream of mangrove planting as part of learning in the Elementary School Science Instructional Design course in the Elementary Education Masters study program. This article is expected to provide new insights regarding the collaboration between education and the environment while expanding the scope of practical applications in instructional design.

METHOD

Activity Design

This community service activity uses a participatory and collaborative approach, involving students, lecturers, and coastal communities in all stages of the activity. This method is designed so that participants are actively involved in the planning, implementation, and evaluation of mangrove planting activities. This approach aims to create sustainability by increasing the capacity of local communities and students as

agents of environmental change. The stages of this activity can be seen in the flowchart in Figure 1

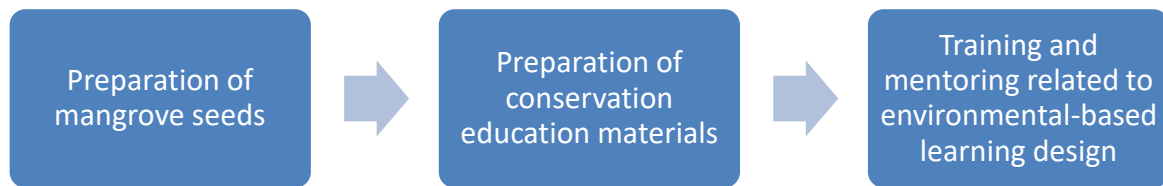


Figure 1. Activity flow

Participants

Participants in this activity consisted of the head of the International Community Service from Universiti Teknologi Mara Malaysia, Dr. Wan Irham Ishak while the head of the activity coordinator from the International Community Service was Dr. Reza Rachmadtullah. This activity involved lecturers from PGSD and Elementary Education, the PAWITRA Nature Lover Student Activity Unit of Universitas PGRI Adi Buana Surabaya, and Lecturers and Masters (S2) and Doctoral (S3) Students of Universiti Teknologi Mara Malaysia.

Location and Time

The location of activity was carried out in the coastal area of the Gunung Anyar Mangrove Eco-Tourism. The Gunung Anyar Mangrove Eco Tourism is an ecological tourism area located in Surabaya, East Java. This place is one of the destinations that combines natural beauty with environmental education. The mangrove ecosystem in this area functions as a coastal protector from abrasion, a carbon absorber, and a habitat for various types of flora and fauna, such as migratory birds and marine biota.

RESULTS

Environmental education is one of the important components in supporting mangrove conservation. Through an educational approach, communities and young generations can understand the importance of mangrove ecosystems and their role in maintaining their sustainability. School and university-based programs, such as field practice or community service, can be a means to integrate aspects of education and mangrove conservation more holistically. Damage to mangrove ecosystems is a serious concern in environmental conservation. Various factors, such as land conversion, fish farming activities, and unwise coastal area management, have caused the loss of most of the world's mangrove forests. The results of this community service activity can be explained as follows.

1. Preparation, The mangrove conservation team began the activity with thorough preparation, including (a) Location Survey: Determining coastal areas that have experienced damage to the mangrove ecosystem based on the level of abrasion,

- loss of vegetation, or land conversion. (b) Coordination with Stakeholders: Involving local governments, community leaders, and environmental organizations to support the success of the program. (c) Provision of Seedlings: The mangrove seedlings used usually come from local nurseries, with mangrove species that are appropriate to ecosystem conditions, such as *Rhizophora* sp. or *Avicennia* sp. (d) Coordination with Stakeholders: Communicate with relevant parties such as local government, community leaders, and conservation organizations to obtain permits and support. (e) Division of Tasks: Divide responsibilities among team members, such as seed preparation, equipment transportation, and field supervision. (f) Schedule Preparation: Determine the time of the activity based on ideal tidal conditions for planting.
2. Educational Activities, Before planting, the team held an educational session for the community and other participants. This session includes (a) Importance of Mangroves: Explaining the role of mangroves in preventing abrasion, absorbing carbon, and supporting biodiversity. (b) Planting Techniques: Providing training on how to plant mangroves properly so that seedlings have a greater chance of survival.
 3. Mangrove Planting, Planting activities are carried out together with the community, and students, then providing training to team members on the correct mangrove planting techniques, such as the depth of the planting hole and the distance between seedlings. Conveying information about the importance of mangroves for the ecosystem and the community as additional motivation for participants. The conservation team with the following steps (a) Division of Planting Areas: The location is divided into zones according to the level of damage. (b) Planting Process: Mangrove seedlings are planted in coastal mud areas at certain distances, according to ecological needs and the type of seedlings used. (c) Technical Assistance: The team assists in the planting process to ensure the method is carried out correctly.
 4. Monitoring and Maintenance, After planting is complete, the team continues with periodic monitoring activities to ensure the success of conservation, including: (a) Seedling Growth Inspection: Observing mangrove growth to detect the success of plant adaptation. (b) Additional Rehabilitation: Replanting if there are dead or damaged seedlings. (c) Community Empowerment: Involving local communities in maintaining the mangrove ecosystem, such as controlling waste or protecting the area from destructive activities.

DISCUSSION

Mangroves are one of the important ecosystems that function as a buffer between land and sea. This ecosystem has a significant ecological role, such as protecting the coastline from erosion, absorbing large amounts of carbon, and being a habitat for various species of coastal flora and fauna (Primadona et al., 2021). In the context of global climate change, mangroves are considered one of the effective natural solutions

to reduce the negative impacts of global warming through their ability to absorb carbon dioxide emissions. Mangroves also function as natural filters that can absorb pollutants and maintain water quality. Overall, mangroves provide very important ecological, social, and economic benefits, so their preservation is very necessary to maintain the balance of coastal ecosystems (Mardin, et al, 2024; Chaniago, Lubis & Hasrizart, 2024).

Mangrove forests are a collection of trees that grow in areas around the coastline that are affected by the ebb and flow of seawater and are located in places that experience The accumulation of organic matter and muddying (Dewi, 2022). Mangrove forests, also commonly known as mangrove forests, are a unique ecosystem due to the activity of the tidal inundation cycle (Agustiadi & Sagala, 2024). In this habitat, only mangrove trees can survive due to the evolutionary and adaptation processes that mangrove plants have gone through.

Mangrove forests have a very important function for our environment, including (1) as plants that can withstand sea currents that erode coastal land, in other words, mangrove plants are able can plant functions, mangroves also function as absorbers of carbon dioxide (CO₂) and producers of oxygen (O₂). (3) Mangrove forests play a role as a habitat for various marine biota such as small fish to take shelter and find food. In addition to marine animals, mangrove forests with a fairly large scope, there are often types of land animals in them such as monkeys and birds (Japa & Syukur, 2021).

Mangrove forests have a very important role in the environment and the surrounding community. Support in planting mangroves is a form of our commitment to help protect the environment. Not only is it beneficial for environmental sustainability, but planting mangroves can also have a positive impact on the welfare of the surrounding community through the development of ecotourism areas. The main focus of this PPM activity is education on conservation, utilization of mangroves, and cleanliness of the coastal environment. The International Community Service activities carried out include the preparation stage, field surveys, program design, and implementation.

CONCLUSION

The activity was carried out at the Gunung Anyar mangrove tourism park in Surabaya, East Java province. The activity was attended by lecturers and students of Universiti Teknologi Mara Malaysia and Universitas PGRI Adi Buana Surabaya, which was held in the framework of the tridharma activities of higher education, namely International Community Service This activity provides benefits as a natural fortress because of its crucial role in protecting the coastline. Strong mangrove roots can withstand waves and tidal currents, thereby reducing coastal erosion.

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