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# Utilization of Mangrove Ecotourism as a Science Learning Resource for Junior High School Students

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**Abstract:** The research was carried out with the aim of finding out the use of mangrove ecotourism as a learning resource, because almost all regions in Indonesia manage mangrove ecosystem areas into ecotourism. The data collection technique uses proportional random sampling, with descriptive quantitative research methods. The research subjects used in this research process were the population of junior high school students and junior high school science teachers, with a sample of 118 students and 22 science teachers. The instrument used in this research is a questionnaire. The results obtained from the science teacher questionnaire stated that 80.8% of teachers had never integrated mangroves in the science learning process, reinforced by the results of the student questionnaire which stated that 83.2% of teachers had never presented mangrove material in the classroom. In this way, science teachers should change the way they deliver material using the Argument Driven Inquiry (ADI) learning model to make it easier for science teachers to utilize mangrove ecotourism as a learning resource through the stages of the learning model syntax.

**Keywords:** Ecosystem mangrove; Ecotourism; Learning resource

## Introduction

As an archipelagic country, Indonesia consists of 17,504 islands with a coastline of around 95,181 km with diverse environmental and climatic biophysical conditions (Hur et al., 2021). Most of the coast is covered by mangrove forests with widths varying from a few meters to several kilometers from the coastline (Chumphong & Embree, 2022). Based on the latest information, the area of land with mangrove vegetation in Indonesia is reported to be around 3.2 million ha and the area of mangrove area (including land that has the potential to be planted with mangroves) is estimated to be around 7.7 million ha. In addition, the Ministry of Forestry of the Republic of Indonesia in 2007 reported that around 31% of the mangrove forest was in an undamaged condition and the remainder (69%) was in a damaged condition (Yani et al., 2021).

The mangrove ecosystem is a group of trees and shrubs that live in mangrove habitats that are different from each other, but have similar morphological and physiological adaptations to habitats that are influenced by tides (Praveena et al., 2007). Mangroves are inundated with sea water at high tide and free from puddles at low tide. Coastal ecosystems are very important for humans because they have economic, physical and ecological functions. Its economic function is through its use as firewood, building materials, batik dye and medicine (Yani et al., 2021). The physical function is as a sediment trap and wave barrier, and the ecological function is as a nursery ground, spawning ground, and feeding ground, as well as supporting the life of various biota such as fish, shrimp, crabs, shellfish, and other marine biota (Haris, 2014) (Lismarita et al., 2022). Marine fauna components are generally more common than terrestrial and tend to be dominated by gastropods and the number of species that use mangrove ecosystems only as temporary habitat, either for spawning, nursery or shelter (Kusmana, 2011).

Mangrove ecosystems also consist of trees (at least 47 species), shrubs (5 species) mangrove fauna in

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Indonesia consists of Gastropods (50 species), Bivalves (6 species) and Crustaceas (34 species). Mangrove ecosystem resources are believed to be very productive, not only able to provide various valuable forests (Rahmasari et al., 2015). However, it also maintains estuary water quality as a habitat for many commercially important species. For tropical countries, mangroves are an important natural resource for the development sector to improve human welfare through resource exploitation and environmental stability. Therefore, an adequate balance must exist and be sought between the environmental benefits of mangroves and the productive role of these ecosystems based on sustainable environmental management (Mawad, 2020; Nurliza et al., 2023).

Mangrove resource management in Indonesia is involved in mangrove forest management, exploitation, protection of mangrove resources and mangrove rehabilitation (mangrove reforestation or reforestation). Mangrove vegetated areas and potential areas planted with mangroves (including mangrove vegetated areas) in Indonesia are different in each province (Ifenthaler et al., 2018). According to the 2009 Bakosrtanal (National Survey and Mapping Coordinating Agency) East Java Province, there are 18.253.871 ha, while based on the 2007 RLPS-MOF it has 272.230.300 ha of mangrove area. Many mangrove areas in East Java have been managed as ecotourism which aims to maintain and attract people's attention to know and care about mangroves (Haryanto, 2008; Hadiprayitno et al., 2023).

One of the areas that has a wide coastline in the East Java region is Madura. Madura has a mangrove area of 714.53 ha in good condition, 42 ha in fair condition, while 318 ha is in damaged condition. The difference between mangrove areas categorized as good and damaged is very small, this shows that special attention is needed regarding the condition of the mangrove ecosystem (Farid et al., 2022). Even in Madura, several mangrove areas have also been used for ecotourism to attract the attention of many people to work together to protect mangroves. Apart from that, the establishment of ecotourism in each region hopes to become a tourist spot that educates every visitor who attends about mangrove plants (Prihantini et al., 2022).

Tourism development has significant value and benefits for the progress of other sectors. However, developing tourism requires many activities that can have a negative impact on the environment (Henderson et al., 2022). To minimize the risks or negative impacts of tourism industry development, tourism development needs to be developed according to the uniqueness and conditions of the existing region (Kucher, 2021). The concept of tourism development based on the uniqueness and conditions of the region can be developed by implementing ecological tourism development (ecotourism) or sustainable tourism development in the form of ecotourism (Jantakoon et al., 2019). This is what mangrove managers in each region hope for, so that ecotourism can help the sustainability process of all communities.

However, in fact, ecotourism which has been designed and managed to be a place of education is not being used properly as a learning resource for students in Madura. Learning resources that utilize the environment can be the right choice, so that learning is more fun and meaningful (Hur et al., 2021; Iksan et al., 2023). An environment that has the power to become a learning resource can motivate students to carry out learning activities. Science learning by choosing the environment as a learning resource facilitates students in getting concrete and more contextual learning resources (Yang & Baldwin, 2020). So that the existing learning process will help students build their understanding of the concepts of the science material they are studying. This shows that learning that utilizes the environment will be carried out more effectively (Hikmawati et al., 2021).

One solution for maintaining, preserving, and optimize the mangrove ecosystem is through integrated learning with science learning by using a learning model Argument Driven Inquiry (ADI). Based on Minister of Education and Culture Regulation Number 22 of 2016, attitude learning outcomes are obtained through the activities of "accepting, carrying out, appreciating, appreciating and practicing" (Anistya et al., 2020). Using the environment as a learning resource can support learning activities optimally. So there needs to be involvement of school elements to utilize existing mangrove ecotourism as a place to gain knowledge related to science learning (Fakhriyah et al., 2021).

## Method

The type used in this research process is descriptive quantitative. The method used is a survey method with the aim of being a research tool carried out on large and small populations, but the data studied is data from samples taken from that population, so that relative incidence and distribution are found. The instrument used in this research is a questionnaire related to the use of mangroves as a science learning resource. The questionnaire used is a closed questionnaire with alternative answers in the form of "Yes" and "No".

The data collection technique in this research used proportional random sampling, where the population

used in this research was junior high school students and junior high school science teachers. The subjects used are classified into groups according to their employment status as students and science teachers. The research subjects used were 118 students and 22 science teachers, who were distributed to several junior high schools in Madura, Lamongan, Surabaya, Mojokerto, Sidoarjo, Gresik, and Jombang. In Figure 1 you can see the research process carried out using a "Yes" and "No" questionnaire.

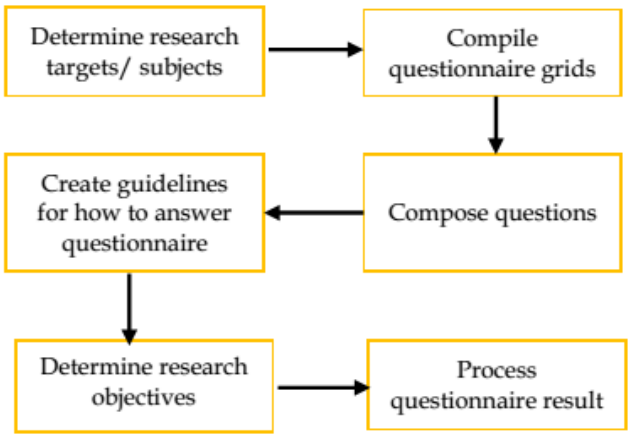


**Figure 1.** Research process

## Result and Discussion

In this section, the results of the questionnaire that have been distributed to students and science teachers can be obtained and defined. The results of the questionnaire will be presented in table form with percentages based on the question indicators given to the research subjects. As well as a presentation regarding the use of mangrove ecotourism as a science learning resource in junior high schools, and also providing appropriate solutions regarding the results of using mangrove ecotourism as a learning resource from the results of the questionnaire answers obtained.

According by research Santoso et al. (2022) that the use of the environment as a learning resource in the science learning process is very necessary, not only to encourage students to get to know nature but also to influence students to understand the concepts of the material being studied easily because it is related to nature. And based on research Valentino et al. (2023) that one of the local potentials that can be utilized as a learning resource is the mangrove ecosystem which is often found around coastal areas. By utilizing the mangrove ecosystem as a learning resource it will create fun and meaningful learning for students because it helps students understand the material. Mangrove ecosystems can be used as a source for students to learn to understand the concepts of science material related to the environment, which leads students to learn directly what they have learned (Rumanta et al., 2023).

The results of the questionnaire distributed to research subjects consisting of junior high school students and junior high school science teachers, obtained very indicative results regarding the subject's response to existing Mangrove ecotourism. Table 1 shows the results of a student questionnaire regarding mangrove ecotourism that students know about.

**Table 1.** Student Questionnaire Result

| | Indicator | Percentage (%) | |
|---|---|---|---|
| | | Yes | No |
| Student | Knowledge of mangrove ecotourism | 85.12 | 14.92 |
| | Learning activities outside the classroom (ecotourism) | 15.83 | 84.25 |
| | Understanding environmentally based science material | 90.15 | 9.91 |
| | Introduction of mangroves in science learning | 16.80 | 83.20 |

Based on the results of the student questionnaire which have been presented in the table, this can strengthen the evidence of the science learning process that students have been carrying out so far. It was proven that many of the students knew about mangroves and the benefits of mangroves because some of the students lived near the coast, so they clearly knew about mangroves and their benefits for coastal communities there. In the learning process of students, 84.25% stated that they had never carried out learning activities in an ecotourism, but some stated that they had carried out science learning activities in an ecotourism but the learning carried out was learning outside of class hours (holidays). However, learning outside the classroom is often carried out during science lessons, such as observing the environment around the school.

In the student questionnaire, 90.15% answered that science material was easy to understand when presented on an environmental basis. It is proven that students understand better because there are real examples, namely the environment around the students, so that students can see real environmental conditions apart from just studying theoretical concepts in the classroom. Science learning is balanced between material and direct practice, so students are more interested because environment-based learning is not boring for students.

However in fact, the introduction to the environment that is applied in the learning process is only about the school and home environment, and is

not discussed in detail by integrating it into the science material presented. According to research by Sagala et al. (2021) and Alika et al. (2021) that science learning rarely utilizes the surrounding environment to be integrated into the science learning process, this is because teachers only focus on theoretical concepts.So that 83.20% of students answered that it was not related to the introduction of Mangrove plants during the science learning process that had been carried out. This is a concern that students need science learning that is environmentally based but must also be integrated into every material concept, so that students better understand the science material provided.

**Table 2.** Teacher Questionnaire Result

| | Indicator | Percentage (%) | |
|---|---|---|---|
| | | Yes | No |
| Teacher | Knowledge of mangrove ecotourism | 95.82 | 4.12 |
| | Utilization of the surrounding environment as a source of science learning | 79.25 | 20.82 |
| | Learning activities outside the classroom (ecotourism) | 16.15 | 83.95 |
| | Mangrove integrated science learning | 10.24 | 80.83 |
| | Use of the Argument Driven Inquiry (ADI) learning model | 1.05 | 98.15 |

The results of the questionnaire distributed to science teachers in Table 2 can be seen and stated that so far the science learning process implemented rarely involves the environment and direct practice with the involvement of students in environmental care movements. This is proven by the answers of science teachers in the questionnaire that has been given, namely 83.9% of science teachers do not involve students in the learning process outside the classroom or in existing ecotourism. So learning seems boring and passive, even though science learning actually requires learning that provides meaning, direct practical activities, and learning that is aware of the facts in the surrounding environment.

The science learning process implemented so far, in terms of utilizing the surrounding environment as a learning resource, has been good, namely with a percentage of 79.25% of science teachers who have utilized the surrounding environment. However, teachers' use of the surrounding environment is only limited to the school environment and the home environment which science teachers use as learning resources. For example, science teachers stated that these uses include planting botanical seeds in school gardens, utilizing school and home environments that are dirty due to rubbish, as well as greenhouses in schools which are used as learning resources.

This is proven that not many science teachers use the mangrove ecosystem as a learning resource. With a result of 10.24%, science teachers stated that they had integrated mangroves in science learning, although not completely, only by introducing mangroves and the benefits of mangroves in the classroom. Therefore, regarding the use of the mangrove environment as a learning resource, it is still categorized as not good, there needs to be improvement so that the mangroves found in each region can be utilized well and introduced well to students in conjunction with the concept of science material. So that it produces science learning that is more fun, meaningful, and there is student involvement with direct practice.

The learning models that are often used by science teachers in the learning process so far are lectures, discovery learning, problem based learning, and guided inquiry learning models. Of the 22 science teachers who were research subjects, there were 13 science teachers who often used the guided inquiry model in the science learning process. Meanwhile, 5 science teachers revealed that they used problem based learning, 2 teachers used discovery learning, and 2 other science teachers still used the lecture method in the science learning process. Each teacher has various reasons for using this learning model, teachers state that this model is easy to apply in the science learning process. Where science learning that is difficult to understand will seem even more difficult if you use a learning model that is less flexible and has many stages. This is why science teachers still use the learning model that has long been applied even though the curriculum has changed to become an independent curriculum.

The results of the questionnaire analysis that have been presented can reveal several things related to the use of mangrove ecotourism as a learning resource in the science learning process in existing junior high schools. The facts show that existing science learning still uses fixed methods, science teachers rarely make changes by implementing new learning models and even the use of the environment as a learning resource is not widespread. This is something that science teachers need to pay attention to when presenting science lessons, so that students are more interested, communicative, and able to understand the meaning of the concepts of the science material being studied. In accordance (Peters-burton & Stehle, 2019) with the demands of the 21st Century faced by the world of education today, students are able to have the 4C skills (communication, collaboration, creativity, and critical thinking). This is what students will gain and improve from the learning process.

It should be noted that "Natural roaming" is emphasizes existing learning activities related to the natural environment around students. So they have diverse insights, learn about various concepts, and connect problems with real-life problems (Melo, 2018; Fadli & Irwanto, 2020). Learning resources are materials that can be used in the learning process as messengers to facilitate the learning process. Learning resources can influence learning outcomes. So the mangrove ecosystem area can be used as a learning resource in various science materials, such as ecosystem material in biology, physics material related to sea waves found in mangrove areas, and other science material (Lubis et al., 2022; Tohri et al., 2022).

According the research by Capelo et al. (2019) which states that student learning outcomes have increased by using the mangrove ecosystem as a learning resource in the science learning process. The influence of using appropriate learning models also supports the presentation of material that makes the mangrove ecosystem a learning resource, so the use of learning resources must also be accompanied by an appropriate learning model in order to obtain maximum results. Learning by integrating mangroves into science material, then inviting students to explore the mangrove ecosystem area which will create students' understanding regarding the concepts of material presented in class as well as direct observation activities (Febrian et al., 2021).

The competencies needed in the 21st century namely 4C, are competencies that are important to teach to students. According to the explanation of the Deputy Minister of Education and Culture of Indonesia, future challenges such as communication skills and clear and critical thinking skills are 2 of the 10 reasons for curriculum development (Kleimola & Leppisaari, 2022). By using the inquiry model which is widely applied in junior high schools, 4C abilities can be developed that are in line with the demands of the 21st century (Sutiani et al., 2021). So the Argument Driven Inquiry (ADI) learning model is designed to set the objectives of class activities as an effort to develop, understand, or evaluate a scientific explanation of a phenomenon in nature or a solution to the problem presented (Hasnunidah et al., 2019). The ADI model is capable of being a solution in implementing science learning that is integrated with the mangrove ecosystem.

Argument-Driven Inquiry based on Antonio (2020) is an effective model for increasing academic achievement and science process skills. Able to enable students to have the opportunity to learn in reflective scientific investigations so that they can develop the skills of each student. In the ADI learning model there is a syntax or stages consisting of; problem identification, data collection, tentative arguments, argumentation sessions, report preparation, report review, report revision, and reflective discussions. The ADI model has advantages, according by Erenler et al. (2019) that is frame the goals of classroom activities as efforts to develop, understand or evaluate scientific explanations for natural phenomena or solutions to problems, involve students in investigations, encourage individuals to learn how to produce arguments that articulate and justify explanations for research questions as part of the inquiry process, provide opportunities for students to learn how to propose, support, evaluate, revise ideas through discussion and write in a more productive way, create a classroom community that values evidence and critical thinking; 6) Encourage students to take control of their own learning.

The process of utilizing and optimize the mangrove ecosystem as a learning resource can be implemented using the Argument Driven Inquiry (ADI) learning model. Through 8 stages that will help science teachers in utilizing mangroves. So the teacher will start science learning by identifying problems that exist in the mangrove ecosystem area, which will then invite students to observe and identify how the existing mangrove ecosystem area is. The results of these observations will require students to collect data to strengthen and convey it based on the results of their understanding in the form of a statement of the problem presented. The process of building understanding itself is obtained from the teacher's explanation of science material concepts and the results of direct observation or practice in the mangrove ecosystem area.

The teacher will ask students to prepare a report on the results of direct practical activities in writing, so that students will convey the results obtained from direct observation activities in the mangrove ecosystem. The final stage of the ADI learning model is in the form of a reflective discussion which invites students to find out what has been achieved during the learning process, find out what attitudes students should have, and find out whether learning with mangrove integration is easy to understand and linked to the concepts of science material.

So science teachers can utilize mangrove ecotourism as a learning resource in science learning by using the Argument Driven Inquiry (ADI) learning model, in this way the use of mangroves as a learning resource will increase. Initially only 10.2% of science teachers integrated mangroves in learning, with the presence of the ADI learning model solution which was considered appropriate and capable of processing

mangroves to become a learning resource in the science learning process. In fact, the ease of using mangrove ecotourism must be supported by a learning model, so that more science teachers use mangroves as a learning resource.

So that environment-based learning is not only related to the environment around schools and homes, but has a wider scope so that it can take advantage of ecotourism that exists in each region. In this way, science learning is created to be more interesting, communicative, meaningful, and capable of demanding students' learning independence. This will enable science teachers to easily utilize the mangrove ecotourism area as a learning resource in the science learning process. So that existing ecotourism is not only a tourist spot, but can be used as an educational forum for students in the learning process.

## Conclusion

This research was conducted to obtain data related to the use of mangrove ecotourism as a learning resource. The results obtained from the questionnaire were that 80.8% of science teachers stated that they had never utilized and integrated mangrove ecotourism in the science learning process in junior high schools. So, there needs to be a learning model that is appropriate and able to help science teachers in integrating existing mangrove ecotourism. The Argument Driven Inquiry (ADI) learning model with a syntax consisting of eight stages is used to help science teachers, because at each stage it will encourage students to learn independently and carry out direct practical activities to prepare reports on the results of observations that have been made. Therefore, it is hoped that science teachers can utilize mangrove ecotourism as a science learning resource well and optimally in the science learning process.

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