



Identifying the Ethnoscience of Bivalves in Madura Beach and Its Integration in Science Learning

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Abstract. Madura beach has a diverse ecosystem and biota, one of them is bivalves. Bivalves are invertebrates that have special characteristics, which are two valves. Ethnoscience is a part of science that correlates the indigenous knowledge and scientific knowledge. This study aimed at identifying the ethnoscience of Bivalves in Madura beach and its integration in science learning. This study was conducted from July to August 2023 and was included as qualitative research. The study was conducted through observation, interview, and documentation technique. The findings indicated that there were reinforcement and correlation in the indigenous knowledge and scientific knowledge of Bivalves which are analyzed in science view. It was also reported that the ethnoscience of Bivalves in Madura beach can be integrated in the science learning. According to the correlation between indigenous knowledge and scientific knowledge obtained in this study, it can be assumed that it is important to integrate ethnoscience of bivalves in science learning process since it can engage students to learn science concepts actively and think critically. To conclude, there is a correlation between indigenous knowledge and scientific knowledge of Bivalves in Madura beach that can be integrated in science learning in order that the science learning process can be more effective and meaningful.

Keywords: Beach, Bivalves, Ethnoscience, Integration, Science Learning.

1 Introduction

Ethnoscience is defined as a study that focuses and discusses about the local wisdom and its integration with science. In cognitive science, ethnoscience refers to a theoretical framework and research methodology that focuses on comprehending the ways that other cultures organize and construct the world around them [1]. It investigates the categorization, interpretation, and understanding of the environment by members of various civilizations, including things, occasions, and phenomena. Ethnoscience also examines the indigenous knowledge that is comprehended by society and its correlation with scientific knowledge. Ethnoscience focuses on various knowledge in nature and social environments, including plants, animals, and more [2].

Ethnoscience focuses on the importance of discussing and correlating indigenous knowledge and local knowledge that may have distinct ways in science knowledge. It

also involves in discussing the hierarchy of living things, the systems of classification, nomenclature, and taxonomy that various cultures use to organize their knowledge. It contributes to our comprehension of how local wisdom can be part of knowledge so that we are able to understand society and interpret the environments [3].

Madura, one of big island in Indonesia which is located in the north-eastern of Java Sea, has a huge ecosystem and local wisdom. Madura has a rich ecosystem of beach and sea, which involves biota. Biota is defined as the organisms in a certain ecosystem, one of this is biota in beach ecosystem referring to all living things that inhabit in beach environment. One of biota is bivalves which can be found in beach ecosystem. Bivalves are included in a class of molluscs which has a special characteristic by their two valves or two-part shells that have a role in protecting their visceral organs. Bivalves can be found in marine beach and have economic significance as well. In addition, bivalves also have ecological importance which contribute to nutrient cycling, and more [4].

Madura society mostly utilize bivalves in daily life, such as for consumption. Besides that, bivalves have roles in ecological aspect due to the environment. By filtering the water and acting as both a habitat and a food source for a range of marine organisms, many bivalve species contribute significantly to aquatic and marine ecosystems. Bivalves also help in defending waterways against eutrophication's consequences. However, most people understand more about the role of bivalves in economic aspect, as one of food sources. Therefore, it is useful to know the indigenous knowledge of bivalves which will be correlated into scientific knowledge.

Ethnoscience approaches often involve working closely with members of a particular culture or community to document their indigenous knowledge and cognitive frameworks. This can involve techniques such as participant observation, interviews, and collaborative research to gain insights into how people from a specific culture perceive and categorize their environment [5]. The identification of bivalves is important to learned more because there is local knowledge of bivalves which is valuable for cultural reasons and conservation aspects. This identification can be also used to connect between communities and natural environments. Furthermore, the identification of ethnoscience in Bivalves has important roles in science learning process.

Engaging ethnoscience into science learning process can enrich education by recognizing local wisdom, encouraging critical thinking, and establishing a stronger link between students' identities and their learning experiences. It is also consistent with the development of education that values various modes of students' comprehension [6]. It is also relevant with the way students thinking, and their pre-knowledge. Ethnoscience can help educators to understand how students may approach problem-solving, critical thinking, and decision-making based on their cultural backgrounds [7].

Ethnoscience recognizes that various cultural perspectives and knowledge structures are distinctive. Teachers can make education more culturally relevant by adding ethnoscience into the learning process. This will respect and value the various points of view and modes of knowing that students bring to the classroom [8]. Students are more likely to feel engaged and motivated when they encounter examples of their own cultural knowledge and experiences in the learning materials.

The educational experience can be made more relevant and relatable by connecting learning to students' own cultural surroundings, according to ethnoscience [1].

Recently educators have become more concerned about implementing ethnoscience in the classroom activities as an additional activity which is incorporated into dominant scientific programs that is useful for students' thinking development [9], [10]. Ethnoscience is useful to be integrated in a science learning process since students are able to learn the science concepts by themselves by applying everyday phenomenon [2]. By comprehending science concepts that are correlated in ethnoscience approach, students are able to think critically and connect the concepts scientifically. Ethnoscience can also assist students to understand how society develops with different forms of knowledge and focuses on the historical and ecological contributions in society [11].

This study focused on the identification of ethnoscience in Bivalves found in Madura beach and its integration in science learning. By integrating ethnoscience into science education, educators also can foster cross-disciplinary connections, promote cultural understanding, and encourage students to think critically and creatively about the intersections between science, culture, and innovation. This approach can prepare students to engage with global challenges while valuing the knowledge and practices of diverse communities. Therefore, it is important to analyze the ethnoscience of one of local diversity.

2 Method

This research was included as qualitative study which has been conducted from July to August 2023. Qualitative research involves in collecting and analyzing non-numerical data, such as data in text and explanations [12]. This research was conducted in the aim of understanding concepts, knowledge, and opinions from society. The qualitative study that has been conducted including observation, interviews, and documentation. Observations were completed by recording the ecosystem of beach that have been seen around Madura beach. Interviews were conducted by personally giving several opened questions toward five people around Madura beach in one-to-one conversations. Furthermore, the documentation was completed by collecting documents related to Ethnoscience of bivalves.

The qualitative research was conducted through several steps, 1) preparing and organizing the data, 2) reviewing and exploring the data, 3) developing the data, 4) assigning the findings, and 5) identifying the conclusions. The research findings were then analyzed in triangulation technique which refers to the use of multiple data in developing a comprehensive conclusion. This triangulation technique was completed to enhance the validity of research findings and minimize the research bias. Furthermore, the triangulation technique was also conducted to cross-check evidence, ensuring the data from one source is credible. It also can help to make a complete understanding of research questions. Therefore, it will be assumed that several data will be used to reach on one theoretical perspective that can answer the research problems.

3 Results and Discussion

This research focused in identifying the Ethnoscience of Bivalves in Madura beach and its integration in science learning. The indigenous knowledge that has been collected from the society is correlated with the scientific knowledge. The findings that have been collected during the observation in Madura beach related to Bivalves is presented in Figure 1 below.



Fig. 1. Bivalves in Madura beach.

According to the survey in Madura beach, there were bivalves found during the sampling. The diversity index of bivalves in the beach indicates in 0.457 which means that the diversity of bivalves is low. Bivalves vary on several types, such as bamboo clams. In addition, the study was also continued by having interviews toward people around Madura beach. The findings related to the Ethnoscience of bivalves is described in Table 1.

According to the findings, it is concluded that there is indigenous knowledge related to Bivalves that are comprehended by people. Furthermore, the indigenous knowledge is correlated to scientific knowledge to know the true concepts of Bivalves. Most people comprehend that bivalves are a kind of fish, since they live at marine. However, the true concept is Bivalves include in the invertebrate, phylum of Mollusca. Bivalves include clams, scallops, mussels, and oysters, to name a few. Bivalves come in more than 15,000 different species. Bivalve species, which include both marine and freshwater animals, are all aquatics [13].

The next indigenous knowledge is about bivalves as one of food sources. However, bivalves not only can be consumed but also can act important in ecological aspect. Bivalves influence in nutrient cycling, develop and alter habitat, and have an impact on food webs both directly (as prey) and indirectly (as a result of the flow of energy and nutrients). Bivalves also have roles in environmental monitors, since they are able to act as materials deposited in soft tissue and shells. Therefore, it is assumed that the quality of habitat can depend on the quality of bivalves. If the water quality in the habitat of bivalves is low, then the diversity of bivalves is also bad. If the water is also contaminated by heavy metals, then the bivalves will accumulate these since they are filter feeding organisms [14].

Table 1. The ethnoscience of bivalves in Madura beach

Indigenous knowledge	Scientific knowledge	Reinforcement of science concepts
Bivalves are a kind of fish, because they are found in the marine	Bivalves are invertebrates	Bivalves are invertebrates, in mollusks class that have two valves as their diagnostic characters
Bivalves can only be consumed as foods	Bivalves have both economic and ecological significance	Bivalves contribute to ecology in the form of nutrient cycling and in marine ecosystem
Shells of bivalves are not part of its body	Structure of organs of bivalves is shells and visceral organs	Shells of bivalves are made of calcium carbonate, and used for protecting visceral organs
Bivalves should not be consumed by pregnant woman	What bivalves contained is affected by water quality	If the water quality is low such as contaminated, bivalves can be also affected because they are filter-feeder
Bivalves are found in the sand of marine beach during low tide	Habitat of bivalves vary on beach, estuary, mangrove, and river	Bivalves can be found in aquatic ecosystem, such as marine, river, estuary and mangrove
Bivalves are consumed much because it tastes delicious and salty. The taste may come from their habitat which is in the marine	Bivalves taste delicious because they contain some proteins.	Bivalves taste delicious because they contain free amino acids like threonine, glycine, and alanine that contribute to the distinctively flavor of bivalves, while glutamic and aspartic acids are in charge of the acidic flavor and aspartate and glutamate are in charge of the delicious flavor.

The third indigenous knowledge stated that shells of bivalves are not the part of their body. However, the scientific knowledge comprised that bivalves have organ structures that consist of shells, or valves and visceral organs. Shells of bivalves are made of calcium carbonate and used for protecting visceral organs. The shells of a bivalve molluscs are formed of two valves that are hinged at the top. The two valves of the shell are held closed by massive adductor muscles located between them and connected by an elastic protein hinge ligament [15]. The two valves of the shell, which may or may not be equal and entirely cover the inner soft parts, are the most notice-able characteristic of bivalves. Species determines how many different forms and colours they have. The inner or nacreous layer, the middle or prismatic layer, which makes up the majority of the shell, and the outside layer or periostracum, a brown leathery layer that is frequently absent due to abrasion or weathering in older animals, are the three layers that make up the valves, which are primarily comprised of calcium carbonate [14].

In addition, the fourth indigenous knowledge is about bivalves that should not be consumed by pregnant woman. The scientific knowledge discusses about the reason why bivalves can be sensitive for certain pregnant woman. It is caused by the content of bivalves that really depends on the water quality in which the bivalves live. If the water quality is low such as contaminated, bivalves can be also affected because they are filter-feeder [16]. However, bivalves are not only sensitive for pregnant woman

but also for other people since bivalves readily assemble bacteria, viruses, and poisons in their body because they consume and filter water as food. If they are not properly cooked before eating, this can frequently result in outbreaks of food-borne illness [4], [17].

The next indigenous knowledge is about bivalves which can be only found during low tide in the sea. However, the true concept is that habitat of bivalves can vary on marine, river, estuary, and mangrove. Bivalves mostly live on the bottom of rivers, lakes, and oceans. Others hide beneath the surface, where they have some shelter from predators, while some, like scallops, lay on the surface. The majority of bivalves burrow themselves in sand or mud and dwell on the bottom in shallow water, only exposing the edge of their shell [18]. Some of them, such as oysters and sea mussels, adhere to rocks using adhesive. A few, like scallops, move around to avoid being buried [19].

The last indigenous knowledge is about the taste of bivalves which tastes delicious and salty. The taste may come from their habitat which is in the marine. However, the true concepts rely on the content of bivalves in which bivalves taste delicious because they contain free amino acids like threonine, glycine, and alanine that contribute to the distinctively flavour of bivalves, while glutamic and aspartic acids are in charge of the acidic flavour and aspartate and glutamate are in charge of the delicious flavour. Bivalve species are categorized as high-protein foods. Bivalves particularly contain high protein up to an astounding level of 22 grams per serving [20].

According to the correlation of indigenous knowledge and scientific knowledge obtained in this study, it can be assumed that it is important to integrate ethnoscience of bivalves in science learning process. Through the recognition of indigenous knowledge, integrating ethnoscience into the science learning process can enhance education since it can assist students in attaining their critical thinking, and strengthening the connection between students' identities and their learning experiences [21], [22]. It is in line with a more comprehensive and thorough teaching approach that appreciates the different ways students comprehend material. Additionally, it is crucial to understand how students think and their prior knowledge [23], [24]. Thus, a better understanding of students' problem-solving, critical thinking, and decision-making processes based on their cultural backgrounds can be gained by educators through ethnoscience [25], [26]. By relating real-world experiences to educational materials, ethnoscience can also help students better understand topics found in everyday life and supports their science literacy in terms of both content and context.

4 Conclusion

This study aimed at identifying the ethnoscience of Bivalves in Madura beach and its integration in science learning. According to the research findings, it can be concluded that there is a correlation between indigenous knowledge and scientific knowledge of Bivalves in Madura beach which can be integrated in science learning so that the science learning process can be more effective and meaningful. It is also suggested that further research should be conducted in another local diversity, leading

to further correlation of indigenous knowledge and scientific knowledge in any local diversity, especially in Madura.

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