

Madura Coastal Potential as Ethnomathscience-Based Learning Content in Primary Schools

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Abstract: Utilization of the local cultural context in learning is one form of effort to optimize learning outcomes. Cultural context can be related to the content of lessons in schools such as mathematics (ethnomathematics) and science (ethnoscience). Ethnomathematics and ethnoscience, or what is later called ethnomathscience, is an approach to learning mathematics, physics, chemistry, and biology related to culture. Incorporating the potential of coastal tourism which is studied from an ethnomathscience point of view is very important in learning in order to prepare and shape the character of students who are always superior and ready to face the challenges of the times, but do not forget their ancestral heritage and are able to preserve both nature and culture. This study uses a mixed method that focuses on collecting, analyzing, and mixing qualitative and quantitative data in a single study. This research was conducted on the Madura Coast, especially in Pamekasan Regency. The research subjects were Pamekasan coastal communities, teachers, and students of Tanjung 3 Pamekasan Elementary School. The results of the study show that the Madura coast has the potential to be used as content in elementary school learning. Both teachers and students already understand the potential of the coast so that it can become the basis for contextual learning that promotes the culture of the local community. Mathematics and science content in elementary schools can be integrated with coastal culture.

Keywords: Ethnomathematics, Ethnomathscience, Ethnoscience, Learning content, Madura coastal

INTRODUCTION

Education has a role in building student character and culture, so that the development of future generations holistically in terms of character, culture, and future competencies or skills are an important part of the educational process (Iskandar, et.al, 2022). Education must prepare human resources capable of facing the challenges of globalization without losing the values of the personality and culture of the country (Pritasari, dkk, 2022).

Learning content in schools can be viewed from a cultural and scientific context based on a multicultural perspective. The cultural context can be related to the content of lessons in schools. The relationship between culture and mathematics is termed ethnomathematics, and the relationship between culture and science is termed ethnoscience. Ethnomathematics and ethnoscience or what is

then called ethnomathscience is an approach to learning mathematics, physics, chemistry, and biology that is related to culture (Anjarwati, dkk, 2022).

Learning math and science cannot be separated from the context of everyday life and there are elements of community culture embedded in it. The society of each region has distinctive noble values. Coastal communities have cultural values that are formed according to the conditions of the coastal environment. One of the coastal areas that have high cultural value is the coastal community of Madura.

Madura Island is one of the islands that is known to be quite advanced in terms of its fisheries and marine potential, both in the field of capture fisheries, aquaculture, and processing of fishery products, as well as in smallholder salt production (Hur, Ruchimat, & Nuraini, 2020). The coastal ecosystem of Madura has diverse biological resources. Madura Coastal Tourism includes north-coast tours, south-coast tours, and island tours. Coastal tourism that is often found in the Madura region includes beach tourism such as Siring Kemuning Beach, Tlangoh Beach, Camplong Beach, Jumiang Beach, and Sembilan Beach. In addition to beach tourism, coastal areas also have mangrove ecotourism, such as mangrove tours and mangrove swamp tourism. The coastal area of Madura is also synonymous with salt ponds, so salt tourism was developed as an educational place to learn all about salt.

Integrating the studied coastal potential with an ethnomathscience point of view is very important in learning in order to prepare and shape the character of coastal students who are always superior and ready to face the challenges of the times, but do not forget their ancestral heritage and are able to preserve the nature and culture of the local area. Given the importance of integrating local culture, especially with regard to the coastal potential for learning content in elementary schools in mathematics and science content, it is, therefore, necessary to conduct research to examine the potential of coastal Madura as ethnomathscience-based learning content.

Ethnomathematics grows and develops in Indonesia as an alternative to developing mathematics learning which so far tends to be conventional and less contextual. Ethnoscience is an activity of transforming between original science which consists of all knowledge about the facts of society that comes from hereditary beliefs and still contains myths (Novitasari, et.al, 2017). Original scientific knowledge consists of all knowledge pertaining to the facts of society. This knowledge comes from beliefs passed down from generation to generation (Rahayu, & Sudarmin, 2015). Integrating ethnomathscience in learning can clearly describe the peculiarities of teaching materials, classrooms, learning environment, learning methods, and culture-based learning approaches. The learning process will be effective if ethnomathscience is integrated into learning themes as the main theme of learning.

There are studies reviewing the ethnomathematics and ethnoscience learning trends, but it is rare to review them simultaneously at one level of education. Coastal ethnomathscience is also a new review that can be explored so that it can be used as a new innovation in education. This study aimed to analyze (1) the perspectives of teachers and students on the coastal potential of Madura; (2) the potential of the Madura coast in ethnomathscience studies; (3) the integration of coastal Madura ethnomathscience in learning in primary schools.

METHOD

This research is a type of mixed methods research. This research method focuses on collecting, analyzing, and mixing qualitative and quantitative data in a single study or several research series (Samsu, 2021). The main reason for using a combination of qualitative and quantitative approaches is that it provides a better understanding of the research problem than using a single approach. This study used an explanatory research design where qualitative research served as the main data and quantitative research data served as supporting data.

The stages in this study refer to Creswell's theory (2005) which identifies seven stages of mixed methods research regardless of the specifications used for each design. The stages are as follows.

1. Identify things or possibilities in conducting research;
2. Identify rationale;
3. Determine the design, techniques, and data collection instruments;
4. Make specific quantitative and qualitative research questions;
5. Collect data;
6. Analyzing data;
7. Write a report.

The research location is in the coastal area of Pamekasan Regency. The subjects of this study were Pamekasan coastal communities, teachers, and students of Tanjung 3 Pademawu Elementary School. Data collection techniques in this study were through questionnaires, observation, interviews, and documentation. The expected outputs from the data collection techniques are presented in Table 1. The data analysis techniques were carried out quantitatively and qualitatively.

Table 1. Data Collection Technique

Technique	Result
Angket	1. Data mengenai pemahaman guru dan siswa terhadap pesisir Madura 2. Data mengenai integrasi etnomatsains dalam pembelajaran
Observasi	Catatan lapangan terkait pesisir Madura
Wawancara	Transkrip wawancara
Dokumentasi	Wisata pesisir Madura

RESULT

Researchers conducted interviews with teachers and distributed questionnaires to students of Tanjung 3 Pademawu Elementary School to find out students' knowledge and experience of the coastal potential of Madura. The results of interviews with teachers at Tanjung 3 Pademawu Elementary School found that the majority of teachers came from Pademawu District and already had knowledge regarding the potential of the Madura Coast. In the learning process, the teacher has integrated coastal potential. For example, in the Indonesian lessons, the teacher once asked students to compose a poem about the beach around Pademawu. In sports lessons, the teacher once invited students to do sports activities such

as running on Padelegan Beach. Even though they have integrated coastal potential into the learning process, this has not been done intensely, and not all teachers apply this learning process.

The distribution of questionnaires was given to students in grades 4, 5, and 6 with a total of 50 students. The results of the questionnaire on the coastal potential of Madura are presented in Table 2 and Table 3 as follows.

Table 2. Results of the Student Experience Questionnaire on the Madura Coast

No	Question	Result	
		Ever	Never
1	Have you ever visited Jumiang Beach?	100,00%	0,00%
2	Have you ever visited Padelegan Beach	100,00%	0,00%
3	Have you ever visited Talang Siring Beach?	76,06%	23,94%
4	Have you ever visited Salt Edutours?	49,30%	50,70%
5	Have you ever visited Lembung Mangrove Ecotourism?	47,89%	52,11%
6	Have you ever watched the “rokat tase” tradition?	91,55%	8,45%
7	Have you ever watched the process of creating “bagan apung”?	23,94%	76,06%
8	Have you ever eaten “petis”?	100,00%	0,00%
9	Have you ever eaten “terasi”?	100,00%	0,00%
10	Have you ever eaten seafood processed fish?	100,00%	0,00%

Table 3. Results of the Student Knowledge Questionnaire on the Madura Coast

No	Question	Result			
		Very Understanding	Understanding	Lack of Understanding	Do not understand
1	How is your knowledge regarding the Pamekasan Coast?	7,04%	92,96%	0,00%	0,00%
2	What is your knowledge regarding Jumiang Beach?	50,00%	50,00%	0,00%	0,00%
3	How is your knowledge regarding Padelegan Beach?	50,00%	50,00%	0,00%	0,00%
4	What is your knowledge regarding Talang Siring Beach?	42,25%	57,75%	0,00%	0,00%
5	How is your knowledge related to Salt Ponds?	0,00%	80,28%	19,72%	0,00%
6	How is your knowledge related to Mangrove?	0,00%	63,38%	29,58%	7,04%
7	How do you know about Rokot Tase”?	7,04%	88,70%	4,26%	0,00%
8	What is your knowledge regarding “Petis Madura”?	87,32%	12,68%	0,00%	0,00%
9	How is your knowledge related to Terasi?	84,51%	15,49%	0,00%	0,00%
10	How is your knowledge regarding Coastal Flora and Fauna?	25,35%	66,20%	8,45%	0,00%

Apart from conducting interviews with class teachers and distributing questionnaires to students, the researchers also made observations and documentation of the Pamekasan coastal area and conducted interviews with the surrounding community. Based on the results of observations, it was found that the

potential of the Madura Coast, especially the Pamekasan Coast, includes Padelegan Beach, Salt Pond Educational Tourism, *bagan apung*, and mangrove forests. Padelegan Beach is one of the beaches in Pademawu District, located in Laok Tambak, Padelegan Village. Padelegan Beach will begin to be managed as a tourist spot in 2022. Its management was pioneered by Anshor youths through planting mangroves around the beach location. As a continuation, the management of the beach is carried out by local youths in turn. The majority of the people of Padelegan Village work as fishermen. Padelegan Village is also an IKM (small and medium industry) village for processed seafood, examples of its products include *rengginan lorjuk*, *petis tuna*, dried anchovy snacks, and fish chips.



**Figure 1. Padelegan Beach Condition
(Source: Researcher documentation)**

Padelegan fishermen build a boat to catch fish in mutual cooperation. From the results of interviews with fishermen, it is known that making boats using teak wood as the main material. The method of manufacture is started from the bottom of the boat which is commonly called "*tonas*", then designing the boards all the way to the top until they are assembled. Then proceed with the front of the boat which is called "*cocor*". The manufacturing process ends with decorating the boat and placing the engine inside the boat body. Production is estimated to take 5-8 months with about 4-5 workers. The cost of making the boat is estimated at 100-150 million rupiah. The catch of fishermen is in the form of anchovies, squid, shrimp, crabs, and tuna. The catch obtained by fishermen is influenced by the season. Sailing departures start after dawn and return at a maximum of one in the afternoon depending on the catch. Fishermen usually perform a special ritual or what is commonly called "*petik laut*" (*selamatan tase'*) which is usually done once a year.



**Figure 2. Fisherman in Padelegan Beach
(Source: Researcher documentation)**

Apart from catching fish by going to sea using boats, fishermen also use other methods by making “*bagan apung*”. *Bagan apung* are often found around Talang Siring Pamekasan Beach. *Bagan apung* is an alternative to catching fish by fishermen when extreme weather occurs so they cannot go out to sea. The first stage in the process of making *bagan apung* is to collect bamboo as needed. The bamboo is strung together to form a place to catch the fish using a sling/nylon rope. After it is firmly tied and formed, a fishing net is attached to the bottom. Fish houses or what local fishermen call *bagan apung*, are a means of catching fish for fishermen in the Pamekasan and Sumenep Regencies which are very environmentally friendly. The catch can be doubled when compared to fishing rods or fishing using a boat. Fishing techniques and how to fish using a *bagan apung* is also slightly different. First, the nets that have been installed are immersed in the seabed to trap fish. Inside the net is accompanied by a flashlight to lure the fish closer to the net. After enough fish have entered the net trap, the net is slowly lifted to the surface. The process of catching fish using a *bagan apung* is carried out at night. The fish caught are usually red anchovies, squid, and dorang fish.



**Figure 3. Bagan Apung in Talang Siring Beach
(Source: Researcher documentation)**

In Pamekasan, to be precise in Bunder Village, Pademawu District, there is also a salt pond which is a source of income for the local community when the dry season arrives. Madura is a salt-producing island in Indonesia. One area with a salt commodity is Pademawu. Salt farmers in Pademawu still make salt traditionally by relying on the weather and using simple tools. In producing salt, the Madurese people still use this method evaporation in ponds.



**Figure 4. Salt Pond Bunder Pademawu
(Source: Researcher documentation)**

Salt ponds are not only a source of salt farmers' products, but are also used as educational tours called Salt Edutours. Educational tourism is a tourism management concept that combines tourism activities with educational activities. Salt Edutourism is a tourist spot surrounded by salt ponds along the entrance. The good concept of this educational tour is the introduction and education of traditional folk salt processing and other salt innovations, such as salt recrystallization, tunnel salt, prism salt, and others. Education is needed so that the livelihoods and culture of the Madurese people do not end in the next generation. There is an embroidered gate "Kampung Garam, Bunder Village, Pademawu District" in the alley leading to the tourist spot. Along the way, the view alley that is visible is a stretch of salt ponds.



Figure 5. Kampung Garam Gate
(Source: Researcher documentation)

The southern coast of Pamekasan is also a suitable area for mangroves. Mangroves are often found in several areas such as sub-district Tlanakan, and Padelegan. A mangrove forest is a forest that grows in brackish water and is affected by sea tides. The existence of mangrove forests is very important because they act as a food chain in the waters, which can support the life of various types of fish, shrimp, shellfish, and mollusks which have high economic value.



Figure 6. Mangroves in Padelegan
(Source: Researcher documentation)

After conducting observations, interviews, and documentation of the Pamekasan coast, researchers studied the curriculum in elementary schools to analyze the slices of coastal potential and ethnomathscience aspects of primary school subject matter. The results are presented in Table 4 and Table 5.

Table 4. Integration of Coastal Ethnomathematics in Elementary School Mathematics Content

No	Location/ Potency	Ethnomathematics	
		Mathematics Content	Socio-Cultural Aspects

1	Padelegan Beach	Numbers, measurements, geometries and angles	Mutual cooperation, care for the environment
2	Salt Pond Edutourism	Measurement, shape, scale, social arithmetic, and debit	Salt farmer activities, community communication, mutual cooperation
3	Bagan Apung	Measurements, numbers, geometry, angles, and scales	Fishing activities, community communication, mutual cooperation, care for the environment
4	Mangroves Forest	Numbers, measurements, data analysis and probability	Care for the environment

Table 5. Integration of Coastal Ethnoscience in Elementary School Natural Science Content

No	Location/ Potency	Ethnoscience	
		Natural Science Content	Socio-Cultural Aspects
1	Padelegan Beach	Ecosystems, biodiversity, water cycle	Mutual cooperation, care for the environment
2	Salt Pond Edutourism	Heat, change of form, force	Salt farmer activities, community communication, mutual cooperation
3	Bagan Apung	Biodiversity, animal locomotion systems	Fishing activities, community communication, mutual cooperation, care for the environment
4	Mangroves Forest	Ecosystem, biodiversity	Care for the environment

DISCUSSION

The coast of Madura has very abundant potential. Community activities have created social and cultural systems so that they become local characters and wisdom. Coastal potential combined with community socio-cultural activities can contribute to meaningful learning. Based on Table 2, students' experience of the potential of the Pamekasan Coastal area obtained an average of 89% of students having visited Coastal attractions in Pamekasan, and 11% had never visited. Based on Table 3, students' knowledge of the potential of the Pamekasan Coastal area obtained an average of 52% of students very understanding, 24% of students understood, 16% of students lack understanding, and 7% of students did not understand. Sources of information related to the coast were obtained by students from parents, teachers, books, friends, television, YouTube, the internet, and others. Teachers have integrated coastal potential in the learning process, as a source or study of learning, but this is still rare. The coastal potentials of Madura that are known by students and understood by teachers include beaches, salt ponds, and mangrove forests.

The cultural diversity of coastal communities is so distinctive and has a different character from other regions. The values of “*gotong royong*” (cooperate) and caring for the environment are very dominant in the daily lives of coastal communities and have become inherent characters. This diversity can be used as study material related to topics relevant to learning content in schools. Activities in

culture-based learning are not designed only to activate students, but are made to facilitate social interaction and negotiation of meaning until the creation of meaning occurs. Meaningfulness in this case is obtained from the results of social interaction and negotiation between the knowledge possessed by students and new information obtained in learning, between students and other students, and between students and teachers in the context of cultural communities (Mayasari, 2017).

Madura Coastal Potential has socio-cultural values of the local community and can be integrated into mathematics and science content, in ethnomathematics and ethnoscience studies. In the content of mathematics, coastal ethnomathematics integration is found in the matter of numbers, shapes, addition and subtraction, angles, geometric shapes, scales, and debits. In natural science content, the integration of coastal ethnoscience is found in living things and their environment, environmental preservation, ecosystems, heat, motion systems, forces, and biodiversity. The presence of mathematics and science with cultural nuances will make a very big contribution to learning. What's more, the concepts of mathematics and science in culture can be easily learned because they are already familiar in students' daily lives.

Community culture can be integrated into various learning facilities such as strategies, approaches, models, methods, and learning resources (Syazali & Umar, 2022). Learning by presenting contextual content by inserting cultural elements in the community invites students to get to know the culture in the surrounding environment so that students do not forget the culture that already exists around them. Students will more easily understand the material being taught because it is directly related to cultural concepts that are often encountered in their daily activities in society, so an increase in understanding and motivation in learning can occur. Instilling concepts through a cultural approach is expected to be able to invite students to learn more meaningfully (Putri & Agustika, 2022).

CONCLUSION

Based on the results of research that have been done researchers obtained the following conclusions.

1. Students' experience of the potential of the Pamekasan Coastal area obtained an average of 89% of students having visited Coastal attractions in Pamekasan, and 11% had never visited it. As for students' knowledge of the potential of the Pamekasan Coastal area, it was obtained that on average 52% of students really understood, 24% of students understood, 16% of students did not understand, and 7% of students did not understand. Sources of information related to the coast were obtained by students from parents, teachers, books, friends, television, YouTube, the internet, and others.
2. Teachers have integrated coastal potential in the learning process, as a source or study of learning, but this is still rare.
3. Coastal Potential has socio-cultural values of the local community, and can be integrated into mathematics and science content, in ethnomathematics and ethnoscience studies.

4. In mathematics content, coastal ethnomathematics integration is found in the material of numbers, plane shapes, addition and subtraction, angles, and geometric shapes.
5. In natural science content, the integration of coastal ethnoscience is found in living things and their environment, environmental preservation, ecosystems, heat, and biodiversity.

ACKNOWLEDGMENT

Thank you very much to LPPM Trunojoyo University for the support in implementing the research grant.

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