

Integration of the Manongkah Shellfish Tradition of the Duano Tribe in Science Learning: Innovative Steps for Developing Culture-Based Modules

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Abstract: This research explores the integration of the Duano tribe's shellfish manongkah tradition into science education to develop culturally relevant learning modules. This research aims to address the gap between local wisdom and its application in science learning, increasing students' understanding and appreciation of their cultural heritage. A qualitative approach was used by conducting surveys and interviews with the Duano tribe community and distributing questionnaires to teachers and students in the Indragiri Hilir coastal area as many as 40 respondents. The findings in this research are that the shellfish Manongkah tradition can be integrated into learning. Furthermore, many teachers and students know about the Manongkah Shell tradition, have never carried out culture-based learning, there is a lack of teaching materials at school, and teachers lack understanding of culture-based learning. This research highlights the importance of contextual learning in preserving cultural traditions while providing practical solutions to today's educational challenges. In conclusion, to overcome this problem, it is necessary to develop a science learning module based on the Manongkah Shellfish tradition so that apart from overcoming this problem, it is hoped that it will be able to improve students' 21st century skills.

Keywords: Local Wisdom, Manongkah Shellfish Needs analysis, Development module.

1. INTRODUCTION

Education is a learning process that can take place through formal, informal and non-formal activities, with the main aim of developing individuals so they can master various aspects, be it cognitive, affective or psychomotor (Anders et al., 2011; Musbaing, 2020; Sotto, 2021; Tripon, 2014). The educational process is not only carried out and facilitated by teachers at school, but also involves the role of parents, family and the surrounding environment (Al-Hail et al., 2021; Kartel et al., 2022; Kelty & Wakabayashi, 2020; Shamir-Inbal & Blau, 2021; Yulianti et al., 2022). The learning process is the main core of educational activities that take place in schools (Bararah, 2020; Firnando Sabetra et al., 2021). Through education, a person can improve their insight, skills and form a responsible person (Fau et al., 2023). Education cannot be separated from the culture found in a society. The learning process not only aims to transfer knowledge, but also to shape 21st century character and skills which include creativity, collaboration, communication and critical thinking skills (Pardede, 2020; Sumardi et al., 2020). As part of the education system, learning in schools must be designed in such a way that it is relevant to students' needs and global challenges (Korkmaz & Toraman, 2020).

Learning Natural Sciences (IPA) has a strategic position in the educational curriculum, learning natural sciences contributes directly to students' understanding of natural phenomena and their application in everyday life (Owens et al., 2020; Zidny et al., 2020). Science learning aims to foster curiosity, critical thinking, and problem-solving abilities (Ammar et al., 2024; Chusni et al., 2020; Maksum et al., 2021; Nursakinah & Suyanta, 2023), 21st century capabilities are all needed to build a society based on science and technology. However, in practice, science learning is often still theoretical and less relevant to students' local context (Eviota & Liangco, 2020; Hefni Dwika Sari & Surtikanti, 2024). This condition makes it difficult for students to understand science concepts because learning tends to be separated from their daily experiences (Umaroh & Pujiastuti, 2020; Wicaksono et al., 2020).

The 2013 curriculum and the merdeka curriculum come with an approach that integrates cultural values and national character into learning. This curriculum provides space for regions to develop local content that is relevant to local local wisdom. Culture-based learning not only aims to preserve traditions, but also to enrich students' learning experiences by connecting scientific concepts with long-standing cultural practices (Idhayani et al., 2023; Rosada et al., 2017). Learning local wisdom can improve students' scientific abilities, because in essence learning will be meaningful if the material studied is in harmony with what students find in their environment, such as culture (Zulirfan et al., 2023b). Thus, culture-based learning can be an effective medium for building students' identities while increasing the relevance of learning to their lives. One local tradition that has the potential to be integrated into science learning is the shellfish manongkah tradition carried out by the Duano tribe in Riau.

The clam manongkah tradition is a cultural activity of the Duano tribe that involves traditional techniques for searching for shells in coastal areas (Salmiah, 2021; Vitasari et al., 2023). This activity not only reflects local wisdom, but also contains scientific principles that are relevant to science learning, such as understanding coastal ecosystems, adaptation of living creatures, and sustainable use of natural resources. However, this tradition has not been widely introduced in the context of formal education, especially in science learning. In fact, integrating the Manongkah Shellfish tradition into learning can provide a more contextual and meaningful learning experience for students, especially in coastal areas which are closely related to this tradition. Learning that integrates culture into scientific concepts is called ethnoscience.

Ethnoscience is a collection of knowledge possessed by a community that is obtained using methods and procedures that are part of the community's traditions and have been proven to be true (Suciayati et al., 2021). Ethnoscience can improve cognitive abilities (Syafitri et al., 2024), think creatively (Widya, D. E., Zulirfan, Z., & Yennita, 2024), and problem solving

(Rahman A et al., 2023). Ethnoscience learning can improve students' scientific abilities, because in essence learning will be meaningful if the material studied is in harmony with what students find in their environment, such as culture (Zulirfan et al., 2023a). There are many advantages of ethnoscience, so it is necessary for a teacher to link learning to local culture. However, teachers still find it difficult to implement ethnoscience-based learning (Alfiana & Fathoni, 2022). Integrating learning based on local wisdom can be done by developing teaching materials.

This research is based on the gap between the potential of local wisdom as a learning resource and its implementation in science learning in schools. Even though the curriculum provides opportunities to integrate local content, in reality many schools still have difficulty developing and implementing culture-based learning. This is caused by several factors, such as limited resources, teachers' lack of understanding of cultural integration strategies, and a lack of supporting teaching materials. As a result, science learning in schools is often unable to explore the local potential that exists around students.

Apart from that, this research also has urgency in the context of cultural preservation. The Manongkah Shell tradition is a cultural heritage rich in local values, but is threatened by modernization and environmental change. Through the integration of these traditions into science learning, students not only learn about scientific concepts, but also understand the importance of maintaining traditions and preserving the coastal environment. In this way, education not only serves to increase students' knowledge, but also to build their awareness of the environment and local culture.

In the initial stages of research on developing a science learning module based on the Duano tribe's shellfish manongkah tradition, researchers need to obtain various information related to the shellfish Manongkah tradition and the need to build a science learning module based on the shellfish Manongkah tradition. Research questions include:

1. How is the Manongkah tradition integrated into science learning?
2. To what extent do science teachers and students on the Indragiri Hilir coast understand the Duano tribe's shellfish manongkah tradition?
3. To what extent do science teachers on the Indragiri Hilir coast understand local wisdom-based learning?
4. How is the availability of teaching materials in Indragiri Hilir coastal schools?

2. LITERATURE REVIEW

Contextual Learning Based on Local Wisdom

Contextual learning is an approach that includes subject matter in the context of students' daily lives, so that learning becomes more meaningful (Asmara, 2019; Budiman et al., 2020; Hakim et al., 2020). This approach is based on the concept that the knowledge students gain will be more effective if it is linked to the real experiences they face (Hefni Dwika Sari & Surtikanti, 2024). One important element of a contextual approach is the integration of local wisdom, which reflects the cultural values and traditional practices that live in society.

Local wisdom is knowledge passed down from generation to generation and is closely related to the environment in which people live (Abas et al., 2022). In the educational context, local wisdom has an important role as a bridge between modern science and students' cultural realities. Local wisdom-based learning helps students understand scientific concepts through familiar cultural practices.

The application of a contextual model based on local wisdom has many benefits such as increasing conceptual understanding (Mudana, 2023), collaboration and creativity (Fitriana et al., 2024), scientific literacy (Dewi, 2021; Yuliana et al., 2021), learning outcomes (Hikmawati et al., 2022). Implementation of local wisdom such as culture and traditional values strengthens the relevance of learning and supports the internalization of social and cultural values. According to Sundari, (2024) a contextual learning model based on local wisdom has great potential to improve the quality of education in Indonesia, although its success requires teacher training support and good integration into the curriculum.

The Importance of Contextual Science Learning

Science learning has a central role in building students' understanding of natural phenomena and the application of science in everyday life. One of the goals of science learning is to foster critical thinking skills, problem solving and curiosity which are 21st century competencies (Defi Triana Sari et al., 2022; Owens et al., 2020; Zidny et al., 2020). However, in practice, science learning in schools still tends to be theoretical and less relevant to students' local context. Eviota & Liangco (2020) stated that science learning is often separated from students' experiences, making it difficult for them to understand the material being taught. As a result, learning becomes less interesting and lacks motivation. Therefore, a contextual learning approach based on local wisdom is the right solution. This approach allows students to learn science concepts through daily activities in their

environment, such as the Manongkah Shell tradition. This activity provides students with the opportunity to directly observe, experiment and analyze scientific concepts.

The Manongkah Shellfish Tradition as a Source of Science Learning

Shellfish manongkah is an activity of searching for shellfish using light wooden boards carried out by the Duano tribe on the coast of Riau (Ilhami et al., 2021; Suhaimi, 2021). This tradition has cultural and scientific values that can intersect in science learning. According to Salmiah, (2021) shellfish manongkah involves traditional techniques that reflect an understanding of the environment and coastal ecosystems. This activity is in the form of the process of catching shellfish in the mud field. In the process of collecting shells, people use a board which is useful as a footstool to move on the lampr. Meanwhile, the other foot of the pole is used as a paddle for the stick. Tongkah is generally made from large, intact pieces of wood, but it is not uncommon for sticks to consist of a combination of several pieces of plank. This menongkah activity has been carried out for generations and cannot be separated from the daily life of the Duanu people. The routine of picking up shellfish using a stick, which has become a tradition for the Duanu community, is still passed down to this day (Wahyuni, 2017). In the context of science learning, the clam manongkah activity can be a medium for introducing students to scientific concepts with a more practical approach. Through this tradition, students can learn holistically and understand how science relates to everyday cultural practices. However, the clam manongkah tradition has not been widely utilized in the context of formal education. One of the main obstacles is the teacher's lack of understanding about strategies for integrating local wisdom in science learning (Shofiyah et al., 2020).

3. METHODS

This research is qualitative research. In this research, surveys and interviews were conducted regarding the shellfish Manongkah tradition. Next, a questionnaire was distributed, the questionnaire was filled in by 40 respondents, the respondents were science teachers and students on the coast of Indragiri Hilir. The instrument consists of 20 items for students and 28 items for Indragiri Hilir coastal science teachers. The aim is to dig up information about the Manongkah Kerang tradition, respondents' understanding of local wisdom-based learning, and find out the needs of science teachers and students for science teaching materials. The instrument was distributed online using Google Form. Research data was analyzed descriptively including percentages and pie charts.

4. RESULTS

The shellfish manongkah tradition is the livelihood of the Duano tribe. The following is a picture of the shellfish manongkah tradition.



Figure 1. Manongkah shellfish tradition

The technique in this activity is done by placing one foot on the stick board (as support) and then using the other foot as a paddle so that the stick board can move. The technique for detecting the presence of blood cockles (*Anadara granosa*) by the Duano tribe is to see whether or not there are water bubbles in the mud. This menongkah activity can be carried out when the sea water is at low tide (Vitasari et al., 2023).

This reconstruction table shows how the Manongkah Shell tradition can not only be preserved as local culture, but also become a source of contextual and meaningful science learning. By discussing these traditional activities with scientific concepts, students can learn holistically, understand scientific phenomena, while appreciating local wisdom. The following are the results of an analysis of the Duano tribe's shellfish manongkah tradition which is integrated into science learning.

Table 1. Integration of the Manongkah tradition in science learning

Aspects of the Manongkah Shell Tradition	Description	Concept of science
Manongkah equipment	Manongkah Board: Made of light wood to make walking in mud easier	- Friction Force: The friction between the wooden plank and the mud produces a small frictional force that allows the plank to move. - Push style: a light board will make it easier for a clam panongkah - Simple machine: a stick board can be a tool that can make work easier when carving shells.
	Using a boat to approach the area where the shells are. Boats are used to sail in the waters which function as a means of transportation.	Simple Machines: Pumpong as a means of transportation that uses the principle of force and effort to move on the surface of the air.
Manongkah Activities	Push the wooden plank with your feet so it slides over the mud.	The movement of pushing the board can be interpreted as work ($W = F \times s$), where the force applied produces displacement.
	Collect shells from the mud and put them in a container.	The activity of collecting shells shows the effort in moving objects from one place to another.
Manongkah Shell Results	Lifting the manongkah clams into the pompong	The activity of lifting the shellfish shells shows that there is effort and energy in this activity.

The reconstruction table shows that the shellfish manongkah tradition can be integrated into science learning. The integration of the manongkah clam tradition with learning not only enriches teaching materials but also provides contextual and meaningful learning for students on the coast. Through this contextual learning, students on the coast understand scientific concepts through local cultural phenomena in their environment, appreciate local wisdom and understand how these traditions relate to modern science, and improve critical, creative and analytical thinking skills through observing cultural phenomena.

After carrying out an analysis related to the Manongkah shellfish tradition which can be integrated into scientific concepts. Next, conduct a survey regarding obstacles in local wisdom-based learning. Apart from that, opportunities were also identified for implementing science learning based on local wisdom, and respondents' suggestions for developing science learning modules based on the Manongkah Shellfish tradition.

All respondents provided their knowledge regarding the shellfish manongkah tradition on the coast of Indragiri Hilir district as shown in Figure 1 and Figure 2.

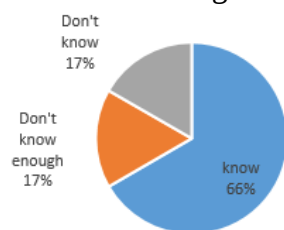


Figure 2. Knowledge about the shellfish manongkah tradition

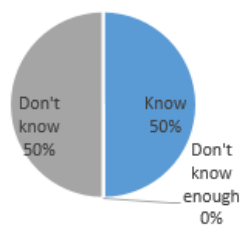


Figure 3. Knowledge about local wisdom-based learning

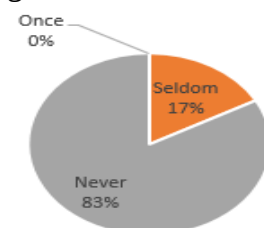


Figure 4. Application of local wisdom-based learning

The results from Figure 1 show that the majority of respondents are familiar with this tradition as one of the cultural activities carried out by the Duano tribe, although there are still a small number who do not know or have limited understanding. Then in Figure 2 it can be analyzed that there are still some teachers who do not know about local wisdom-based learning. This is in line with research (Shofiyah et al., 2020) which states that teachers' understanding of local wisdom-based learning is still low. For this reason, it is necessary to know that there are several factors that are the cause of teachers' low understanding regarding local wisdom-based learning, such as information about the importance of integrating ethnoscience in learning and the absence of demands that require the integration of ethnoscience in learning (Rikizaputra et al., 2021), lack of training in making ethnoscience-based lesson plans, there is limited learning time if all subjects are carried out with ethnoscience-based learning because schools have to achieve material targets provided by the Education Office, students are too active when they are outside the classroom, and the preparation of students' sentences is less structured so it is difficult for teachers to carry out evaluations (Alfiana & Fathoni, 2022). As a result of teachers'

lack of understanding of ethnoscience, in the coastal areas of Riau as many as 83% (figure 3) of teachers tend to never carry out learning based on local wisdom. Even though learning based on local wisdom has many benefits, such as scientific literacy and learning outcomes (Rusmansyah et al., 2023), understanding of concepts (Ardianti & Raida, 2022), critical thinking (Mitha Gita Isvida et al., 2024; Wulandari et al., 2023).

In line with the results of teacher responses to the needs analysis questionnaire, it is known that as many as 71.9% of students on the coast know about the shellfish manongkah tradition. This happens because students have been trained since childhood to carry out manongkah kerrang activities with their families and take part in festivals held by the local government. Apart from that, 81.3% of students on the coast have a great desire to study traditions in the context of science because so far the science lessons they have studied have never been linked to their culture.

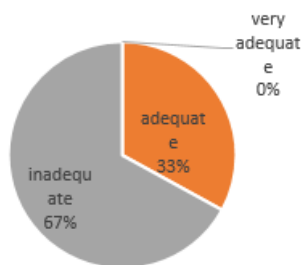


Figure 5. Availability of teaching materials

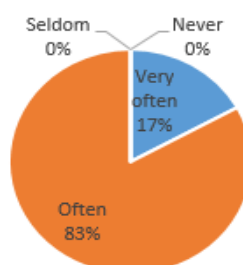


Figure 6. Use of teaching materials

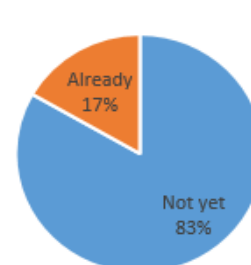


Figure 7. Relationship between learning and local culture

Figure 4 shows data related to the availability of teaching materials in learning. Based on the circle diagram, it can be seen that 67% of respondents stated that the availability of teaching materials was inadequate. This data shows that the majority of respondents experienced limited teaching materials available. In the context of science education, adequate teaching materials are an important component to support an effective and meaningful learning process (Mishra et al., 2020). If teaching materials are inadequate, learning tends to be undirected, students have difficulty understanding the material, and teachers have difficulty conveying complex science concepts. Limited teaching materials are often caused by a lack of innovation in developing learning materials that are relevant to students' needs. Contextual teaching materials, such as those based on local culture, can increase students' learning motivation and help them understand science in the context of everyday life (Hidayat et al., 2024; Rismaningtyas et al., 2019; Sujiono et al., 2023). However, if locally based teaching materials are not developed, these opportunities cannot be exploited. Figure 4 confirms that the availability of teaching materials is still a significant challenge in learning. There is a need to develop teaching materials that are adequate, contextual and based on local culture so that

learning becomes more effective, relevant and supports increasing students' scientific literacy.

Figure 5 illustrates the level of use of teaching materials in the learning process. Based on the data obtained, 83% of respondents stated that they often used teaching materials, but the teaching materials used were only limited to textbooks. This was proven from the results of the questionnaire that had been distributed. As many as 100% of teachers used textbooks and worksheets in learning so that the material taught tends to be more abstract. The use of intensive but less innovative teaching materials can cause boredom and reduce students' learning motivation. According to effective teaching materials, they must be able to attract students' attention, integrate visual and text aspects, and be relevant to the material being taught. If teaching materials are not packaged in an interesting way or are not relevant to the context of students' lives, then their use tends to be just a formality.

Figure 6 shows data about the connection between learning and local culture. Based on the circle diagram, 83.3% of respondents stated that learning had not been linked to local culture. If you look at the positive impact of learning based on local wisdom, then teachers should be able to implement local wisdom in learning so that learning takes place more contextually and learning can be easier to understand. The following are the results of student responses regarding the need for teaching materials.

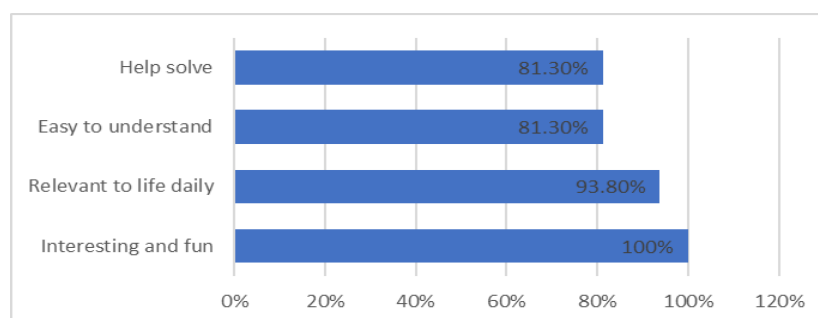


Figure 8. Teaching materials expected by students

From the results of the questionnaire, it can be seen that students want teaching materials that are interesting and also relevant in everyday life. The aim is that the material presented by the teacher can be easily understood, because the material in science learning is abstract and difficult to understand.

5. DISCUSSION

Based on the research results, the shellfish manongkah tradition of the Duano tribe has been successfully reconstructed and integrated into science learning. The reconstruction table shows that this tradition includes various scientific concepts that can be taught contextually and practically. This integration of traditions allows students to learn in a way that is more

applicable and directly related to life. Survey results show that many teachers have a low understanding of local wisdom-based learning. This lack of understanding is influenced by a lack of information about the importance of integrating ethnoscience in learning, time constraints, and a lack of training in making ethnoscience-based lesson plans. This is confirmed by research (Rikizaputra et al., 2021; Shofiyah et al., 2020) which states that teachers' low understanding of the integration of local wisdom has an impact on minimal implementation.

The clam manongkah tradition is a cultural activity that is rich in scientific concepts such as friction, simple machines, effort and power. The reconstruction of this tradition shows that these activities can be linked to contextual science learning. For example, the use of wooden planks in the Manongkah Shell tradition is related to the principle of friction, while boats as a means of transportation can be linked to the concept of a simple plane and pushing force.

Survey data shows that the availability of local culture-based teaching materials is still very limited. Teachers tend to only use textbooks and worksheets as teaching materials, which makes science learning abstract and less interesting for students. This limited teaching material causes students to have difficulty understanding scientific concepts because the material taught is not relevant to their life experiences.

There is a lack of teaching materials used by teachers and students in learning, so it is necessary to develop teaching materials. This research also identified an urgent need to develop learning modules based on the Manongkah Shellfish tradition. The use of the shellfish manongkah tradition in the module is because the shellfish manongkah tradition is a cultural activity that is routinely carried out by the Duano Tribe community and provides an opportunity to integrate scientific concepts with traditional practices such as the use of wooden boards to glide in the mud and the use of boats as a means of transportation.

Through learning that connects tradition and science, students are expected to increase their understanding of science concepts while strengthening cultural identity. This research also notes that learning based on local wisdom has great potential to increase students' learning motivation, critical thinking skills and analytical abilities. The modules developed not only function as science learning aids, but also as a medium for preserving local culture which is rich in scientific values and principles.

6. CONCLUSION

Science teachers on the Indragiri Hilir coast know a lot about the clam manongkah tradition and so do the students there. This contextual learning based on local wisdom has many benefits. However, learning based on local wisdom has generally not been implemented optimally in schools. Most of our science learning is still oriented towards achieving content or transferring knowledge through the lecture method. Apart from that, it is known that there is a shortage of teaching materials in coastal schools, where generally they only use worksheets and textbooks, and teachers who never implement local wisdom-based learning so that student literacy is low. So a science learning module based on the Duano tribe's shellfish manongkah tradition is one form of solution. The development of this module is considered capable of overcoming the problems that exist in schools on the coast.

LIMITATION

This research has limitations such as the scope of respondents being limited to teachers and students in the Indragiri Hilir coastal area, precisely in Tanah Merah, so the results may not be representative.

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