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Study of Lampung Local Wisdom for the Development of Science Learning Materials in the Context of Environmental Conservation

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Abstract: Local wisdom is built from the existence of social values that are upheld in the social structure of the community taught from generation to generation. Some of them can be used in implementing science learning commonly called ethnoscience. However, not all local wisdom can be used as science learning materials. This study aims to examine the local wisdom of Lampung that can be used for the development of science learning materials that are in accordance with the nature of science, which must have rational, empirical values, and can be verified or proven scientifically. This research is a literature study by looking for relevant research references. The research procedure is carried out in stages, namely collecting library materials, reading, recording, studying, collecting concepts or manuscripts and then elaborating from the data collected. The results obtained are 5 local wisdom that can be elaborated with science learning in the context of environmental conservation, namely Nyalau, repong damar, bubu, ngelahang and the ban on mangrove clearance.

***Keyword**:* Ethnoscience, Lampung Local Wisdom, Science Learning, Environmental Conservation

INTRODUCTION

Local wisdom as a community culture is taught to the next generation through non-formal institutions (not formally taught). Local wisdom is built from the existence of social values that are upheld in the social structure of the community itself and has a function as a guide, controller, and signpost for behavior in various dimensions of life both when dealing with others and with nature (Oktarina, 2022).

Ethnoscience is a science learning approach that implements local wisdom (regional culture) using certain cultural products (Silla et al., 2023). The utilization of local wisdom in science learning has become an innovative approach that can enrich students' learning experiences and improve their understanding of scientific concepts. By integrating local culture into the science curriculum, students can relate abstract theories to a more real and relevant context.

The ethnoscience approach shows great significance in the context of science education because it recognizes and values local knowledge and traditional wisdom of

the community as a foundation for scientific learning. Science education with an ethnoscience approach not only provides academic content, but also provides added value in exploring and appreciating local cultural heritage. Through integrating traditional knowledge in the science curriculum, students can relate science concepts to the reality of their daily lives.

Ethnoscience prioritizes meaningful learning based on a constructivist perspective, and meaningful learning is learning that is packaged according to student characteristics. Meaningful learning allows students to learn by "learning by doing." Learning by doing causes students to make connections that create meaning when they are able to connect and find meaning between the content of academic subjects and the context of their lives (Johnson, in Wahyu, 2017: 140).

However, it needs to be recognized that not all aspects of local wisdom can be directly used as learning materials in Science. It is important to understand the nature of science from three key aspects, namely ontology, epistemology, and axiology, to assess the feasibility and relevance of local knowledge in the context of science education.

In terms of ontology, science is an attempt to understand and explain natural phenomena through the study of objects that can be observed and measured. Therefore, the selection of learning materials must pay attention to the objectivity and repeatability of observations to achieve scientific validity. The nature of science is rational and empirical knowledge. Rational here can be interpreted as a rational reason or known as a hypothesis. While empirical means tested for truth. The hypothesis will be tested following the scientific method procedure (Tafsir, 2017).

In terms of epistemology, science has certain methods of obtaining knowledge, such as the scientific method which involves observation, hypothesis testing, and conclusion drawing. Understanding these methods helps identify the extent to which local knowledge can be adapted to scientific procedures and research methods that are universal. Basically, the way science works is the search for cause-and-effect relationships or the search for the effect of something on something else, known as the scientific method. Prove that it is logical and rational, then propose a hypothesis based on that logic, and prove the hypothesis empirically (Tafsir, 2017).

In terms of axiology, science holds the principles of freedom and objectivity of value. This requires that the knowledge conveyed in science learning is neutral and not bound to certain values. Therefore, the assessment of local wisdom in science is not only based on its scientific accuracy, but also on its relationship with ethical principles and justice values (Tafsir, 2017).

By considering these three aspects, a holistic approach can be applied in selecting and integrating local wisdom in science learning. This ensures that science learning not only supports the understanding of scientific concepts, but also encourages respect for cultural diversity and local wisdom, while maintaining the integrity and nature of science itself. So, Lampung local wisdom that can be used as science learning must have rational, empirical, and verifiable values or be proven scientifically.

This research aims to elaborate on Lampung local wisdom that can be used for the development of science learning materials that are in accordance with the nature of

science, which has rational, empirical, and can be verified or proven scientifically in the context of environmental conservation.

METHOD

This research is a literature review by looking for theoretical references that are relevant to the case or problem found. According to Creswell (1998), a literature review is a written summary of articles in journals, books, and other documents that describe past and present theories and information, organizing the literature into topics and required documentation. The data sources of this research are research articles that have been published previously in journals and news related to Lampung local wisdom, ethnoscience, and science learning. Documentary research is a method used to collect data or sources related to the topic proposed in the research. The data obtained was then analyzed using descriptive analysis method. Descriptive analysis is done by describing facts and then analyzing them and providing understanding and explanation. The research procedure is carried out in stages, namely collecting library materials, reading, recording, analyzing, collecting concepts or manuscripts and then elaborating and interpreting the data/texts collected (Rahayu, in Muliadi, 2022).

RESULT AND DISCUSSION

The term ethnoscience comes from the Greek word ethnos which means '*nation*' and the Latin word scientia which means '*knowledge*'. Ethnoscience more or less means knowledge that is owned by a nation or more precisely an ethnic group or a particular social group. Referring to this understanding, we can define ethnoscience as a set of knowledge owned by a community/tribe that is obtained using certain methods and following certain procedures that are part of the traditions of a particular community, and the 'truth' can be tested empirically (Sudarmin, 2014: 16).

Ethnoscience learning teaches Natural Sciences by linking the concept of local wisdom within the scope of society (Purnamasari, et al. 2021: 11). As explained above, in its understanding ethnoscience cannot be separated from local wisdom. Local wisdom that in the process of implementation or manufacture has elements of science and can be explained scientifically or tested empirically can be called ethnoscience. In Table 1 below are the characteristics that state that a local wisdom can be said to be ethnoscience.

Tabel 1. Characteristics of Ethnoscience

No.	Etnoscience
1.	Combined knowledge between culture and science
2.	Transformation between indigenous science and scientific science
3.	Obtained by certain methods empirically and the truth can be tested and accounted for.

Source: (Nuralita, 2020: 1); (Sarini, & Selamet 2019: 30); (Sudarmin 2014: 16).

Ethnoscience can be considered as a system of knowledge and cognition typical of a given culture. Various types of ethnoscience studies that have been successfully researched by anthropologists and the field of science give birth to the nature of ethnoscience, namely a culture as a knowledge system, in the form of: (a) classification through local language or local terms and local cultural categories; (b) rules or moral values based on local cultural categories; (c) description of the indigenous knowledge system (indegenous Science) contained in the culture of citizens or certain groups of people (Sudarmin, 2014: 16).

Ethnoscience prioritizes meaningful learning based on the view of constructivism, meaningful learning is learning that is packaged according to student characteristics. Meaningful learning allows students to learn while doing "learning by doing". Learning by doing causes students to make connections that produce meaning, when students are able to connect the content of academic subjects with the context of students' lives that find meaning (Johnson, in Wahyu, 2017: 140).

According to Shidiq, (2016: 235) Ethnoscience encourages teachers and educational practitioners to teach science based on culture, local wisdom and problems that exist in society, so that students can understand and apply the science they learn in the classroom can be used to solve problems they encounter in everyday life, thus making science learning in the classroom more meaningful. The implementation of ethnoscience-based learning has been proven to be able to improve the quality of science learning, foster students' critical thinking skills, and increase the activeness of students' scientific work (Kelana et al., 2021: 75).

Science learning based on ethnoscience learning resources is a lesson that aims to realize learning by linking culture and science or natural science materials based on ethnoscience. Indirectly, students are invited to interact with various kinds of local cultures and explore the knowledge (science) contained in local culture (Purnamasari et al, 2021: 12). Here are some literature reviews on local wisdom that can be categorized as ethnoscience related to environmental conservation.

Tabel 2. Local Wisdom Related To Environmental Conservation

No.	Local Wisdom	**Community Science Value**	**Scientific Science Value**
1.	Nyalau	For Lampung people who have rice fields, usually 1 month after the rice planting period, they do "cleaning" the fields, namely removing grass (weeds) that grow around rice plants.	The practice of clearing weeds reflects an understanding of the competition between rice plants and weeds. This helps farmers to manage resources (such as water and nutrients) so that rice plants can grow optimally.
2.	Repong Damar	Repong Damar management is carried out by farmers who own Repong Damar land with the age of the resin trees in the Repong being above 15 years, tapping 2-3 times a week, planting resin trees if they are getting married.	The restriction of harvesting after 15 years of age is based on consideration of the life cycle of the resin tree and when resin production reaches its peak. Tapping, which is carried out 2-3 times a week, is adjusted to the

			natural production cycle of the resin tree to maximize production yields.
3.	Bubu	Traditional fishing tools for rural communities.	Bubu is an environmentally friendly fishing tool because bubu is generally made from natural materials such as bamboo. Bubu placed at the bottom of the water does not damage coral reefs.
4.	Ngelahang	Ngelahang is the activity of picking up cloves from the tree on Pisang Island. The cloves that have fallen from the tree do not belong to the owner of the clove plantation, but the cloves can be taken by any residents who are looking for them.	The ngelahang activity reflects the principle of zero waste or not wasting natural resources. By utilizing fallen cloves, the community can reduce waste and maximize the use of available natural resources
5.	Prohibition of Mangrove Clearance	Pahawang Island Village has a Village Regulation (Perdes) to Save Mangroves which contains prohibitions and sanctions for villagers and migrants who cut down mangrove trees.	Mangrove forest conservation aims to preserve, maintain and protect mangrove forest ecosystems from the negative impacts of human activities.

1. Nyalau

Rice farming is one of the livelihoods of Lampung people. Weed disturbance is one of the factors causing low rice yield (quality and quantity). Weeds as plant pest organisms are an important obstacle that must be overcome to increase rice yields in Indonesia (Pitoyo, 2006). Weed control is needed to reduce the risk of damage caused by weeds. Weed control can be done by weeding, i.e. mechanical, uprooting, or chemical methods. However, chemical control can cause environmental pollution and weed resistance to herbicides (Marpaung & Sodikin, 2013).

For the people of South Lampung who have rice fields, usually 1 month after the rice planting period, they "clean" their rice fields, namely removing the grass (weeds) that grow around their rice plants. This weed removal activity is called "Nyalau". Nyalau is usually done by farmers every 1 month after the rice planting period and can be repeated if deemed necessary. The method of nyalau is by removing weeds from the plot of land or sinking the weeds to the bottom of the rice field mud with the aim that the weeds die and become fertilizer for rice plants, who help nyalau usually their own relatives/family but not infrequently the owner of the rice field hires several neighbors with a wage system. Local wisdom traditions can reduce weed resistance to herbicides so as to maintain the ecosystem of rice fields. In addition, this activity can also strengthen the relationship and tradition of mutual help between community members.

In science learning, nyalau or cleaning weeds on rice fields has a science value that reflects an understanding of the interaction between biotic components, namely the competition of rice plants with weeds. This helps farmers manage resources, such as water and nutrients, so that rice can grow optimally because weeds can absorb nutrients

and water faster than the main crop, namely rice (Gupta 1984). In rice, the cost of weed control can reach 50% of the total cost of production (IRRI, 1992).

Clearing weeds also helps control pests and plant diseases. Clean plants will be more protected from pests and diseases that threaten growth and yield. According to Rijn (2000), weeds reduce crop yields because they compete for light, oxygen, carbon dioxide and food. Reduced crop yields are caused by weeds that reduce growth activities, including stunted plant growth, chlorosis, nutrient deficiencies, and reduced number and size of plant organs. Symptoms of nutrient deficiency in rice plants can result in total plant seedling failure, severe plant stunting, typical leaf symptoms, and plant tissue abnormalities (Antralina, 2012).

2. Repong Damar

Repong Damar is a piece of dry land that is home to various types of productive plants, including various types of wood, fruits such as duku, durian, mangosteen, and the resin tree itself. Repong Damar is overgrown with resin trees with a height of approximately 65 meters and a diameter of 1.5 meters. This resin forest is called repong because this forest is dominated by resin trees. Repong Damar is also a customary forest that has existed since ancient times and is commonly known as Puyang (Fahrizal, 2017). Repong Damar is managed by landowning farmers in Repong Damar whose resin trees are more than 15 years old. Repong Damar farmers apply inherited values, one of which is ethics in the management of Damar trees. The ethical rule in tapping resin is to tap 2-3 times a week. This is because if the harvesting of nira is less than 2 weeks, it will produce poor quality nira and the selling value is lower than if the harvesting is more than 2 weeks (Oktarina, 2022).

The people of Pekon Pahmungan, Pesisir Tengah Subdistrict, West Pesisir Regency, have local wisdom that resin trees should not be cut down and anyone who violates will be penalized by planting a new resin tree, even everyone who will become a resin tree. The bride-to-be must plant the tree before her wedding. According to residents, the reason why the damar repong Pahmungan survives is because residents are afraid of "kualat" and will cause disasters if the damar trees planted by their ancestors are cut down. The awareness of the importance of preserving repong damar goes back hundreds of years. Their ancestors taught them traditional values in managing repong damar (Anasis & Sari, 2015). The community believes that by maintaining customs and ethics in the process of managing repong damar, the resin trees will produce quality and abundant sap. That way, repong damar will prosper the community there (Oktarina et al., 2022). There is also a customary law in the management of Repong Damar, namely that people who want to cut down resin trees must comply with the criteria agreed upon by the ancestors, namely resin trees that are over 15 years old (Sirait & Kusworo, 2000). On the

other hand, the community believes that destroying the forest will cause disaster with the result that the resin produced will decrease (Oktarina, 2022).

Repong damar in science learning has a contribution to the preservation of the resin forest environment. Dammar trees require a certain amount of time to reach maximum production maturity. The restriction of gluing after 15 years of age is based on consideration of the life cycle of the resin tree and when resin production reaches its peak. The resin tree has a sap production cycle that is related to factors such as weather, season, and tree condition. Tapping 2-3 times a week may be adjusted to the natural production cycle of the resin tree to maximize production.

Maintaining older resin trees for up to 15 years can help maintain ecosystem balance, including soil nutrient cycling and water cycling. Older trees play an important role in maintaining ecological balance.

Repong damar can also be an example of a source of carbon stock in Indonesia. Repong Damar is a mixed stand of vegetation dominated by cat's eye resin (Shorea javanica), which includes 65% of other tree species. Bhaskara's (2022) findings show that the cat's eye resin tree (Shorea javanica) is the dominant plant species at each stadia. This is because the cat's eye resin plant is able to survive and thrive well in its environmental conditions. Repong Damar is classified as a forest with higher carbon stocks ranging from 174.22 tons/ha to 254.09 tons/ha so that it can be classified as a forest in good condition. The potential for carbon dioxide absorption ranges from 639.37 to 932.52 t/ha (Bhaskara et al. 2018).

3. Bubu

The regulation of the Minister of Maritime Affairs and Fisheries Regulation No. 02 of 2015 which prohibits the use of Trawls and Seine Nets in the fisheries management areas of the Republic of Indonesia is an awareness-raising campaign launched by the government through the Minister of Maritime Affairs and Fisheries. The Ministry of Maritime Affairs and Fisheries asks the wider community to be more careful in managing and utilizing marine natural resources whose potential is very large. One solution to protect marine fish resources requires a breakthrough in the design of environmentally friendly fishing gear. Bubu (fish trap) is an environmentally friendly fishing tool.

Bubu is a rectangular fishing tool made of wire or wood/bamboo. Bubu is designed in such a way that fish can enter but difficult to get out. Fishermen set the trap 10-20 meters deep, use stones as ballast, and pull it to the surface after 3-12 hours. The method of operation is environmentally friendly and does not damage the sustainability of the marine ecosystem.

Bubu can be utilized in Science learning because it is an environmentally friendly fishing tool. Bubu meets the criteria of environmentally friendly fishing technology because it has high selectivity, is not destructive to habitat, does not endanger fishermen, produces good quality fish, products do not harm consumers, minimal wasted catch, minimum impact on biological resource diversity and does not catch protected species (Hariyanto, et al. 2008). Bubu placed on the bottom of the water do not damage coral

reefs. They are designed to catch fish selectively. This helps to maintain the sustainability of fish populations by providing opportunities for fish that have not yet reached reproductive size to breed.

Fishermen on Lampung's east coast experienced an increase in income after switching from trawling gear to bubu. In addition to making the marine environment more sustainable, bubu has slowly and successfully improved the economy of local fishermen. Besides being more environmentally friendly, fish traps are also more fuel-efficient. Bubu operation using 100 liters of fuel lasts for 5 days. Meanwhile, when using Trawl, it is only enough for 1 day (Agustinus Purba, 2022)

4. Ngelahang

Ngelahang is the activity of picking cloves from the tree. On Lampung's Pisang Island, cloves that have fallen from the tree do not belong to the owner of the clove plantation. Instead, the cloves can be taken by any resident who is looking for them.

The activity of melahang, which is picking up cloves that have fallen from the tree and are considered not the property of the owner of the clove garden, reflects the values of science related to the preservation of nature. By picking up cloves that have fallen from the tree, the community can minimize the waste of resources and make a positive contribution to biodiversity conservation. This action allows the utilization of cloves without disrupting the natural growth of the plant and still maintains the sustainability of the population in nature.

The melahang activity also reflects the principle of zero waste. By utilizing fallen cloves, communities can reduce waste and maximize the use of available natural resources. Melahang can be part of local agricultural practices that strengthen the community's carrying capacity of its environment. It empowers the community to participate and share in the utilization of natural resources.

5. Prohibition of Mangrove Clearance

Pahawang Island in Pesawaran Regency, Lampung Province, has very diverse natural resources, one of which is the mangrove forest located on the coast. In 1975, a foreign company in Taiwan entered the mangrove forest and carried out large-scale logging, causing coastal erosion and major damage to the mangrove forest. In addition, monkey and ape habitats were destroyed, causing attacks on local farms. In addition, fish spawning grounds have been lost and residents can no longer easily catch fish near the coast. Another problem that has arisen is that many mangrove areas have been converted into ponds by entrepreneurs, leading to a reduction in mangrove areas (Hartoyo, 2012).

The community, concerned that the cutting of mangroves would cause seawater to enter agricultural land and land erosion, formed a mentoring activity to solve the problem on Pahawang Island with the NGO Mitra Bentala in 1997. As a result of the community and NGO collaboration, a Mangrove Protection Area Management Agency (BPDPM) group was formed. Through Decree No. 04/007/KD-BPDPM/11.2/2006, the

Village Head of Pahawang Island authorized the formation of BPDPM to supervise mangrove forests on Pahawang Island (Hartoyo, 2012).

Community awareness of the importance of conserving mangrove forests has led villagers on Pahawang Island to develop local wisdom values to protect mangrove forests from damage and clearance by foreign entrepreneurs. The collective agreement is a manifestation of the growth of local wisdom about the importance of preserving the mangrove forest environment (Hartoyo, 2012).

In epistemology, the empirical or real experiences of people who experience the consequences of mangrove deforestation in the field are considered as one of the strong sources of knowledge to preserve mangrove forests. Mangrove forest conservation is based on empirical experience of the benefits of coastal ecosystems provided by mangroves, such as coastal protection from abrasion, biodiversity, and abundant natural resources. Mangrove forest conservation can be viewed as a rational and scientific response to our understanding of coastal ecosystems.

Mangrove forests need to be conserved because they have important scientific value in maintaining ecosystem balance. Mangroves provide a unique living environment for many types of flora and fauna. They serve as breeding grounds for many species of fish, crabs, mollusks and birds. The loss of mangrove forests can threaten the balance of ecosystems in the region. The complex roots of mangroves also act as wave and wind barriers, protecting the coast from abrasion and erosion caused by strong waves and winds. Mangrove forests can act as natural fortresses that protect the coast from the adverse effects of storms and tsunamis.

Mangroves also serve as carbon sinks as they have a significant ability to store carbon in their soil and biomass. The preservation of mangrove forests helps reduce carbon dioxide emissions into the atmosphere and mitigate the effects of climate change. Mangrove roots contribute to the filtration process of seawater and freshwater, cleaning the water from harmful materials and pollutants. This helps maintain water quality in coastal ecosystems. Mangroves provide a unique habitat for a variety of plant and animal species, including those unique to coastal ecosystems. Mangrove conservation supports biodiversity and helps prevent the extinction of species that depend on the ecosystem.

Local wisdom on Pahawang Island is one example of successful efforts to save mangrove forests in Lampung. The village of Pahawang Island has a Village Regulation (Perdes) on Mangrove Protection that contains prohibitions and sanctions for villagers and migrants who cut down mangrove trees.

Utilizing Lampung's local wisdom in the context of environmental conservation not only has the potential to enrich science learning materials, but can also be a strong foundation in teaching scientific concepts related to environmental conservation in social life. By exploring and integrating local values, this local wisdom not only improves students' understanding of science, but also makes a meaningful contribution in teaching responsibility for the environment. It is hoped that the results of this study can serve as a basis for developing a more holistic and relevant curriculum, as well as encouraging environmental conservation efforts through contextualized science education.

CONCLUSION

Based on the discussion that has been presented, it can be concluded that Lampung local wisdom can be used for the development of science learning materials that must be in accordance with the nature of science, namely having rational, empirical values, and can be verified or proven scientifically. In the context of environmental conservation, there are 5 local wisdoms that can be elaborated with science learning, namely Nyalau, repong damar, bubu, ngelahang and prohibition of mangrove clearing. Nyalau can be verified because pulling weeds can help farmers so that rice plants can grow optimally without weed interference. Repong damar has a harvesting restriction after 15 years of age based on consideration of the life cycle of the damar tree and when resin production reaches its peak. Bubu is an environmentally friendly fishing tool because it is made of bamboo and placed at the bottom of the water without damaging coral reefs. Ngelahang activities reflect the principle of zero waste or not wasting natural resources. Mangrove forest conservation aims to preserve, maintain and protect mangrove forest ecosystems from the negative impacts of human activities.

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