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Reconstruction of Scientific Knowladge on the Shore of Sentani Lake Jayapura Using Local Knowledge of the Homfolowkhouw Tribe

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A B S T R A C T

This research aims to reconstruct natural science from the local wisdom of the Homfolowkhouw Tribe community which can be used in science learning. This type of research is qualitative phenomenological ethnoscience, set in communities living on the edge of Lake Sentani, the methods used are in-depth interviews, observation, and documentation. The reconstruction results show that ethnoscience originating from Homfolowkhouw communities on the edge of Lake Sentani can be implemented in science learning because it contains scientific science concepts. The results of ethnoscientific reconstruction were found in the use of traditional medicinal plants, applications in work tools, applications in arts, and applications in astrology and floating house technology on Lake Sentani.

INTRODUCTION

Decree No. 56 of the Minister of Education and Culture of 2022 stipulates that educational units must develop a curriculum based on the principle of diversification in accordance with the conditions of the educational unit, regional potential, and students. According to the curriculum of independent learning, education is also rooted in national culture. Local culture or local wisdom has its own place as a learning resource. The government views culture as important as national identity, so it fosters it from an early age through various aspects, including through educational levels (Kemendikbud, 2013).

In fact, local culture contains the original knowledge of the community, in fact much of it contains scientific values. Original science is built in a traditional community environment that contains scientific concepts that have not been formalized, the development pattern is passed down from generation to generation, is not structured and systematic in a curriculum, is local, informal, and is generally the knowledge of society's perception of a phenomenon. particular nature (Battiste, 2005; Duit, 2007). The local wisdom of the community, especially ethnoscience, can be used as a medium for science learning. Ethnoscience can be a contextual learning resource or science learning object.

Integrating ethnoscience in learning becomes a means of learning science that is contextual and meaningful for students. Ethnoscience-based learning will strengthen literacy (science, data and technology) because students will learn to study original science and uncover the potential of scientific knowledge contained within it. Knowledge of science and technology learned by exploring native science will give rise to a feeling of love for the culture. Therefore, it is considered important to elevate local Indonesian wisdom which contains original science into science learning, namely by exploring and identifying original science and then reconstructing it into ethnoscience, namely original science that has a scientific explanation (Sudarmin, 2015).

Papua has a lot of original science that can be used as a source of learning science, especially natural sciences, such as: the Barapen (stone burning) process, which has so far been understood only as a traditional cooking activity but actually has a scientific concept, the process of making asar fish, the *Kahwanuk* (measuring) activity. Bamboo segments when making bows also have a scientific explanation. Apart from that, the wooden paintings that are produced by many people on the shores of Lake Sentani, are visible to the naked eye only as the result of artistic production, even though in fact the selection of materials and mixing natural materials to obtain certain color patterns for wooden paintings and noken bags has a related scientific concept. with additives and addictive substances that can actually be used by students in the classroom (Lubis et al, 2022). The use of types of plants to treat disease, the use of types of plants to maintain health, making the *tifa* (a musical instrument in Papua), the choice of type of wood, size, and skin membrane covering the tifa affects the size of the sound, and there are many other examples, but science These originals have not been used as contextual learning resources in accordance with Minister of Education and Culture Regulation No. 68 of 2013. Integration of Papuan

ethnoscience, especially Jayapura Papua district, has not been carried out in science learning, especially physics.

Ethnoscience can be an alternative solution to science learning. Learning that is appropriate and appropriate to students' lives can be beneficial for students' lives. Students can learn completely, namely mastery of knowledge (content) and mastery of material (context). The learning process that is memorable for students is generally directly related to students' daily lives (Sudarmin et al, 2018).

Based on preliminary studies conducted, it shows that the use of ethnoscience-based teaching materials is not yet available for use. This condition is in accordance with the results of research conducted by Pieter (2024) and Risamasu (2024). Students at school tend to learn concepts by rote memorization. Students learn facts and concepts verbally, and have not been trained to find or process information. Students are still focused on mastering knowledge (content). Based on observations and documentation analysis of the lesson plans/teaching modules used by teachers, it is known that these tools have not integrated local wisdom or ethnoscience into learning. The observation results show that the science learning carried out does not link the teaching material with the students' real lives. Based on the results of interviews, students said they had never learned about *Barapen* (stone burning), making fish in yellow sauce, and making asar fish in Physics lessons. Students stated that Barapen, yellow sauce fish, and asar fish are typical characteristics of Papua. They don't yet know that the Barapen process, making fish in yellow sauce, and making asar fish which they encounter almost every day, can be explained by the science they learn at school, namely heat transfer by conduction, convection and radiation. In fact, local wisdom objects have scientific concepts and can be explained using the science that students learn in class (Sumarni et al, 2016; Suastra et al, 2017).

This is in line with research conducted by Setiawan et al. (2017); and Sudarmin (2018) who stated that students learn science according to scientific knowledge and have not integrated local ethnoscience. Science learning becomes difficult for students to understand because there is a gap between the science learned at school and community culture (Sumarni et al, 2018). In fact, integrating culture in learning at school can increase students' learning interest and motivation which can ultimately improve their learning outcomes (Sudarmin et al, 2018). Based on the description above, it is believed that ethnoscience has great potential to be used as a science learning resource which will have an impact on developing students' competencies to become more complete/whole. Students can improve their mastery of knowledge (content) and based on local wisdom (context) so as to fulfill "Think Globally, Act Locally". Students can think broadly and follow current developments without forgetting the noble culture of their nation. This research will identify and reconstruct scientific knowledge based on local wisdom of the community on the edge of Lake Sentani. It is hoped that this identification and reconstruction results will produce information data about ethnoscience in the tribes on the edge of Lake Sentani, and will then be integrated into the teaching materials and LKPD that will be created.

LITERATURE REVIEW

Local wisdom is a view of life, knowledge, and various life strategies in the form of activities carried out by local communities in responding to various problems in meeting their needs (Rahmawati et, al, 2009). Local wisdom is human intelligence possessed by certain ethnic groups which is obtained through experience and is not necessarily experienced by other communities (Suastra, 2017). Sudarmin (2018) stated that local wisdom is customs and customs that have been traditionally carried out by a group of people for generations, and to this day its existence is still maintained by certain indigenous peoples in certain areas from previous generations.

These local wisdom values have usually been taught from generation to generation by their ancestors to the next generation (Suastra, 2018). In general, local wisdom in a community was formed when the community was not familiar with writing (*praaksara*) as an effort to immortalize their past experiences. The ancestors would convey it orally through stories and passed it down from generation to generation. Although this local wisdom has local value, the values contained in it are considered very universal, so that in terms of cultural resilience it is very important as the identity of a region.

Some of the famous local wisdom from Papua is the activity of cooking using heated stones, known as *Barapen*. Almost all tribes in Papua are familiar with this activity. Furthermore, there is local wisdom in the agricultural sector, for example *mina wen hypere*, or working together to open new gardens. Furthermore, local wisdom in the form of plants, for example red fruit (*Saik/Soih*), ant nests (*Kin Ai*). Examples of local wisdom in the form of buildings such as *Honai* houses and tree houses, local wisdom in the form of health and medicine, and many other examples of local wisdom.

The original knowledge of society or indigenous science is often called traditional knowledge or local genius (Battiste, 2005; Duit, 2007). Indigenous science is the original knowledge of a tribe or local community that contains scientific values that are embedded in that community, originating from beliefs passed down from generation to generation. According to Hardestey (Snively and Corsiglia, 2000) states that indigenous science (Indigeneous science or Indigeneous knowledge) which is developed collectively from a local cultural perspective concerns objects and activities of community reality that are related to natural phenomena. Indigenous science works through a cultural perspective, and has scientific processes such as observation, clarification, and problem solving that include all aspects of their native culture. For example, to protect rare animals or plants, Balinese people use the concept of abstinence and prohibition with the concept of "*duwe*".

The term ethnoscience comes from the word *ethnos* (Greek) which means "nation" and the word scientia (Latin) which means "knowledge", so that ethnoscience means knowledge possessed by a nation or more precisely an ethnic group or group. certain social issues as a form of local wisdom that contains the concept of science (Sudarmin, 2015). Sturtevant (Ahimsa, 2011) defines ethnoscience as a system of knowledge and cognition typical of a given culture. The emphasis is on the system or knowledge that is unique to a society, because

it is different from the knowledge of other societies. Goodenough (Sudarmin, 2018) states that ethnoscience is a form of thought in the form of objects and actions that is always preserved in order to maintain existing history. Meanwhile, according to Rahayu and Sudarmin (2015), ethnoscience is an activity that transforms original science into scientific science. The ethnoscience in question refers to the notion of local knowledge or the knowledge of indigenous peoples, so that ethnoscience is an activity that transforms or reconstructs community knowledge that has been passed down from generation to generation into scientific knowledge.

Formation of scientific knowledge based on original science on local wisdom conceptually through identification, verification, formulation and conceptualization of scientific knowledge. The description of the stages in the formation of scientific knowledge based on local wisdom begins with identifying the selected local wisdom, conducting interviews to find all the necessary information, then analyzing the answers from the sources so that scientific concepts are known whether they are true or false. Furthermore, after the analysis and verification process, a reduction process occurs and community science is obtained which contains the concept of science. After the verification process continues with conceptualization to obtain a scientific concept. The concept is then validated, continued with documentation and integrated into relevant study materials (Sudarmin, 2018).

METHODOLOGY

Qualitative phenomenological ethnoscience is the methodology employed, namely a study of knowledge systems organized from community culture and local wisdom regarding phenomena and universe-related events that exist in local communities and local wisdom (Creswell, 2009). This research is set in tribal communities around Lake Sentani. Researchers were directly involved in the research area, namely the lives of local indigenous communities located on the outskirts of the Lake Sentani area, to carry out direct observations, in-depth interviews, discussions with key figures, as well as observing local community behavior patterns based on local local wisdom.

Data collection was carried out using several methods, namely a) the observation method which was carried out by means of collecting data through direct observation of situations or events in the field, taking into account the activities carried out by the informants in their daily lives, b) the in-depth interview method, the researcher used in-depth interviews in the form of semi-structured interviews, which according to Sugiyono (2014) were freer in implementation than structured interviews. The aim of this type of interview is to find information more openly, where the party being interviewed is asked for their opinion. In conducting interviews, the researcher uses the help of an interview guide to facilitate and focus the questions to be asked and c) documentation method, the researcher looks for information related to previous research which discusses what ethnoscience has been revealed in previous research. The informants as data sources in this research were 3 people, with

details of the Homfolokhouw tribe chief, traditional elders and senior science teachers. The three informants were native Homfolokhouw tribesmen.

The data analysis used in this research is qualitative data analysis. Data analysis in qualitative research is carried out before entering the field, while in the field, and after being in the field. Activities in qualitative data analysis are carried out interactively and continue continuously until completion until the data is saturated. The data analysis carried out consisted of data reduction, data presentation and data verification (Sugiyono, 2014). Next, the researchers held a limited discussion or focus group discussion (FGD) with judgment experts, namely colleagues or lecturers who are experts in physics material to discuss the results of this research. The FGD aims to find out whether the results of ethnoscientific reconstruction related to local wisdom mapping are in accordance with the reconstruction stages and answer the research objectives. FGD was carried out twice, at the initial stage after reconstruction and at the final stage to see the suitability of the reconstruction results with the material/topics in the independent curriculum currently used.

RESEARCH RESULT

The researcher conducted interviews with 3 key informants who were tribal heads and native people of Homfolokhouw village who were born and raised in the village, then the research expanded to a wider range of informants and ended with data triangulation. From the results of research carried out in Homfolokhouw Village and several small villages around it, the researchers provide the following scientific reconstruction results.

a. Work Equipment

Work equipment here is all goods, objects or tools used in every activity of the people on the edge of Lake Sentani in their daily lives. The work equipment found containing scientific concepts can be detailed as follows:

1) Catching tools, made from bark (*wauw*). This fishing tool consists of two types, namely *Yonggoli* and Hui (*Huisa*).
2) Sago palm tool (*Femca*)
3) Machete
4) Paddle. Paddles are divided into three types, namely those used by men (*Ropeng*) and those used by women (*Miyeareng*) and those used by children (*Renggoyouw*).
5) Spoon for turning papeda which consists of a tool that looks like a fork (*Hiloy*) and a spoon for turning papeda (*yanggalu*).

b. Tifa Musical Instrument

Tifa is a musical instrument that is played by hitting, the body of the tifa is made of lingua wood/white wood called Nale. The part of the tifa that is beaten is made of deer skin, while the part that ties the tifa drum to make it span is called *Makhu*.

c. Tassel Crafts (Gaba-gaba)

For the *Yonggoli* area, there are various types of tassels with various colors. The following describes the types of colors used in tassel crafts and the natural basic materials used to make these colors:

- Yellow color: turmeric and noni root
- Red: comes from the Mele plant. Mele seeds are also used to decorate the face during traditional events.
- Black: wood charcoal
- White: chalk from shells (*Bia*).

d. Traditional Plants that Have Medicinal Properties

1) Sago Three *(Metroxylon sagu)*

The sago plant/tree (*Metroxylon sago*) is generally a staple food for the Papuan people, especially on the edge of Lake Sentani, but apart from being a staple food, it was also discovered that raw sago can be used to treat smallpox. In the lives of the people on the edge of Lake Sentani, the sago tree is a tree with a million benefits. Sago pulp produces mushrooms that can be used as food, rotting sago stems become nests for sago caterpillars which have very high protein value. Apart from that, the stems and leaves of the sago tree can be used as basic materials for making houses (huts).

2) Forest Betel Leaves (*Piper aduncum L.*)

Empirically, red betel can cure various types of diseases such as diabetes mellitus, hepatitis, kidney stones, lower cholesterol, prevent stroke, gout, cancer, hypertension, liver inflammation, prostate inflammation, eye inflammation, vaginal discharge, ulcers, fatigue, joint pain and soften skin.

3) Sambiloto (*Andrographis Paniculata*)

In traditional medicine for the people on the edge of Lake Sentani, Sambiloto (*Andrographis paniculata*) is usually used to treat malaria, inflammation, and diabetes.

4) Red Lemongrass (*Cymbopogon Nardus*)

People usually use the Red Lemongrass plant (*Cymbopogon nardus*) to treat joint pain and gout.

5) Guava Tree Bark (*Syzgyium Aqueum*)

Generally, the bark of the water guava tree (*Syzgyium aqueum*) is used to treat stomach aches or diarrhea.

6) Guava/Giawas tree (*Psidium Guajava L.*)

People on the edge of Lake Sentani usually use guava/giawas trees (*Psidium guajava L.*) to treat stomach aches caused by diarrhea. The guava leaves (*giawas*) used are the young tops of the leaves.

7) Noni leaves (*Morinda citrifolia*)

The parts of the Noni plant (*Morinda citrifolia*) used in traditional medicine are the fruit, leaves, flowers, stems, bark, and roots. The benefits of noni leaves have been used in medicines for rheumatic pain and joint swelling, stomachache, and other types of inflammation. The benefits of noni leaves are obtained by consuming the extract or decoction.

8) Mango tree bark (*Mangifera indica*)

Mango tree bark (Mangifera indica) is generally used by the people on the edge of Lake Sentani to treat toothache. People boil the bark of the

mango tree and use it by gargling the affected tooth while the boiled water is still warm.

e. Local Wisdom Found in Society that Has the Value of Scientific Concepts

1) Use of Warm Papeda to heal Wounds.
   While papeda is generally used as food for people in Papua, in Homfolokhouw Village it was found that papeda that is still warm can be used to treat wounds, so they dry quickly. Referring to information from informants, it was found that in their concept it was found that warm papeda could attract pus and kill the development of bacteria in wounds.
2) Cooperation in society (Bhulau)
   There is local wisdom in the Homfolokhouw community in the form of cooperative activities in the community known as Bhulau. This collaboration is carried out when the community wants to build a house, build a boat or when they want to open a new garden.
3) Planting time according to the astrology of Homfolokhouw Society
   People in Homfolokhouw mastered astrology as a marker of seasons before modern society knew about calendars and dates. For example, during the crescent moon, people cannot plant in the garden, they rest. Meanwhile, during the rainy season around August, September, and October, which is marked by the round moon (full moon), Homfolokhouw people call it the planting season, where people start planting in the garden.
   This introduction to traditional astrology is synonymous with the beginning of the rainy season on the Gregorian calendar, which is the beginning of the rainy season. The rainy season has high rainfall, so the soil becomes loose and fertile. This condition marks the farming period for Homfolokhouw community and its surroundings.
4) Fishing time is based on moon conditions.
   The Homfolokhouw people also adopted their knowledge of astrology for when to catch fish. When the moon is bright (Purnama), the people of Homfolokhouww village are prohibited from fishing, while during the dark moon the people are allowed to catch fish.
   This local wisdom can be explained scientifically as follows, when the moon is bright (Purnama) the sky becomes bright due to the light from the full moon which is emitting light from the sun to the earth so that the surface of Lake Sentani becomes bright. This condition is not favorable for fishermen who net or fish in this situation, fish do not like light that is too bright so they will not rise to the surface. And fishermen's work will be in vain, so that such a prohibition (*sasi*) appears. The opposite condition occurs during the dark moon, and this situation is profitable for fishermen.
5) Local wisdom of the stilt/anchored house of the Homfolokhouw community
   People's houses in Homfolokhouw are generally houses on stilts or sailing houses, namely houses that stand on the lake. The anchored house uses iron wood as its supporting poles with a length of 4m. A crossbar is installed between the 2 poles, the crossbar is intended to place the wood

supporting the house poles. Rarely each bar is approximately 1.5 m to 2 m. According to the people of Homfolokhouw village, the shorter each bar is, the better because the bar will be stronger in supporting the weight of the house and its contents.

From the perspective of modern science, the crossbars attached to the two pieces of wood conform to the concept of center of mass or center of gravity. The center of mass and center of gravity of an object have the same meaning, namely a point where the mass/weight of the object is centered. The difference is that the location of the center of mass of an object is not influenced by the gravitational field, so its location does not always coincide with the location of the center of gravity. As the center of mass gets closer, the load distributed will become smaller, this condition causes the iron wood which is a pole that sticks to the bottom of the lake to be lighter in sharing the weight of the building's load.

Interviews with research informants

Sago palm tool (*Femca*)

Hiloy and *yanggalu*

Paddle (*Ropeng*)

Tifa from crocodile skin

The wooden structure of the anchored house

DISCUSSION

From the results of the research, it was found that there was a number of local wisdoms of the people on the edge of Lake Sentani which after reconstruction turned out to have scientific values, for example the use of local plants as medicine, the use of scientific concepts in machetes, sago sticks, tassels, musi tifa tools and many others. . However, it is also acknowledged that local wisdom has also been found that does not contain scientific concepts.

As explained by Taylor et al. (Sudarmin, 2018) which states that there are two conceptions of science, namely: (1) scientific science, which can only be understood scientifically and is based on scientific work and how to obtain it using scientific methods, because it is objective, universal and a value-free

process, and can be accounted for. Scientific science is in the form of concepts, principles, theories or laws that are reproducible, that is, they have been tested experimentally in the laboratory and have been recognized by the scientific community. (2) Meanwhile, original science or community science is still in the form of knowledge, concrete experience (concrete experience knowledge). Original science is transformed through oral traditions or told orally by parents to the next generation and concrete experiences in interacting with their environment.

Papua has a lot of local wisdom which is still local science (local genius) which has not been reconstructed to get the original scientific concept. Therefore, the existence of ethnoscience is very important to be developed to explore various local riches that have the potential to support modern science and link the daily lives of students with scientific concepts accepted in educational institutions.

In connection with the potential of local wisdom of the Homfolowkhouw tribal community on the edge of Lake Sentani, the use of natural and cultural resources in the learning process allows teachers to design ethnoscience learning using learning models, media, instruments and teaching materials in materials that are appropriate to the surrounding context can help increase literacy. science students (Sumarni & Kadarwati, 2020). Students' engagement with natural and cultural resources not only helps them understand the material better but also allows them to relate it to their everyday experiences. When students' literacy and understanding of science concepts or principles at school increases, this also has a positive impact on the way they think and live in their daily lives.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based on the results of triangulation of research data from various sources and in-depth studies, it was concluded that ethnoscience, which is the original knowledge of the Homfolowkhouw tribal people who live on the shores of Lake Sentani, can be implemented in science learning because it contains science concepts that can be integrated into learning. The application of ethnoscience in science learning can be carried out by reconstructing ethnoscience into scientific science whose truth must be tested. In science learning, students can build their knowledge through discovery activities using certain methods which are part of society's traditions and can be tested empirically. Ethnoscience in the Homfolowkhouw tribe community on the edge of Lake Sentani includes traditional medicinal plants which have been used by local people to treat sick people, for example treatment with sago leaves (*Metroxylon sago*), forest betel leaves (*Piper aduncum L.*) , Sambiloto (*Andrographis paniculate*), Noni leaves (*Morinda citrifolia*) and use warm Papeda to heal wounds. Work tools are found in fishing tools made from bark (*wauw*), sago sticks (*femca*), paddles (*ropeng*), use of stone axes, machetes, in the field of art found tifa and tassel cloth, astrology to determine the start of the farming season and when fishermen catch fish and traditional technology that enables local people to build floating houses on Lake Sentani which has scientific value, and many other examples.

Recommendations

a. It is necessary to carry out a broader and more consistent reconstruction of the various local wisdoms held by the people around Lake Sentani in particular and Papua in general to determine the original science and scientific science that exists in the community.
b. District, city and provincial education offices need to collaborate with LPTK and educational institutions to introduce and train scientific knowledge in the community in learning activities at school.
c. Scientific knowledge as a result of reconstruction from local science that has been discovered in this research should be consistently used in classroom learning so that it has a derivative impact in the form of preserving the culture of the Sentani Community.

ADVANCED RESEARCH

Referring to the research results and conclusions that have been presented, the author suggests that in future research it can focus on technology that exists in society which has not been utilized optimally in this research. Furthermore, future research should develop media or science teaching materials that adapt the local wisdom of the Homfolowkhouw tribe, this is done so that science learning becomes more meaningful and still maintains the wisdom of the Homfolowkhouw tribe.

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