

Ethnomathematics and Ethnoscience Analysis of Aru Culture Related to Mathematics and Science Concepts at Elementary School

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Abstract

This study aimed to describe the exploration results of ethnomathematics and ethnoscience forms of North Aru Sub-district culture to obtain the analysis results of the relationship between ethnomathematics and ethnoscience forms and their concepts at elementary school. This study was a qualitative descriptive exploration design with an ethnographic approach. The data of the study were obtained from society, their activities, and artefacts. The data collection method were observation, interviews, and documentation. The data were analyzed using triangulation techniques. The study results showed that the forms of ethnomathematics and ethnoscience of North AruSub-district culture explored were mathematics and science concepts among traditional games, traditional houses, traditional food, fishing gears, and art instruments, wickets, and tradition. The forms of ethnomathematics and ethnoscience were related to the concepts of mathematics and sciences, covering a square, rectangular, triangle, hexagon, trapezium, tube, force, and natural resources. The researchers suggested teachers (a) apply cultural-based learning so that students can recognize cultural elements in their area, (b) preserve the local culture. Cultural elements in their area, (b) to preserve the local culture.

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INTRODUCTION

Indonesia is known as an archipelagic country which has many tribes and cultures. Along with current technological developments, the cultural elements are gradually forgotten. Therefore, it is important to make the students keep loving their local culture.

Indonesia has various kinds of cultures, the cultural elements from the local area need to be integrated in the learning process. The revised 2013 curriculum prioritizes learning that emphasizes the students to be active in the learning process. Based on the functions and objectives of national education, the development of the 2013 curriculum must be rooted in the nation's culture, the life of the nation, and the life of the nation in the future (Nuralita, 2018).

Culture is considered as knowledge, beliefs and concepts. Culture as knowledge and concepts embodies in modes of symbolic communication but it is not about the technological skills, customs, habits, values, beliefs, and attitudes of the changing society (Dominikus, 2018).

Culture-based learning is also called ethnomathematics and ethnosience. Both of these approaches have links with mathematics and science. Challenges faced nowadays deal with how many cultural elements have not been explored yet and integrated in the learning process. One of the challenges was how the cultural elements in North Aru was not explored yet and integrated in learning process. The observation done by schools in North Aru showed that mathematics and science learning were still teacher-centered learning and the teachers only relied on available textbooks. They did not involve the surrounding environment in the learning process. Fun learning can be in the form of the interaction between teacher and students. Additionally, the teacher has an important role in improving the learning process. Learning in elementary schools is basically about recognizing something concrete or authentic.

Ethnomathematics may raise cultural wisdom that it can motivate students in learning mathematics (Fajriah, 2018). Specific ways used by a particular cultural group or society in math activities is definition of ethnomathematics. Ethnomathematics contain mathematics that arises and develops in society and it is in accordance with local culture. It is a core of the learning process and teaching method (Hartoyo, 2012).

Mathematics taught in schools is a concept that exists in human thought (Sunandar et al., 2018). Therefore, learning mathematics in elementary schools needs to be stated with something tangible so that it may increase the students' understanding in learning mathematics.

Ethnomathematics consists of two words, ethno and mathematics. Ethno means ethnicity and mathematics means the study of math. It was first proposed by D'Ambrosio in 1977. Rosa and Orey (2011), suggested that ethnomathematics offers students, especially minority students, to view mathematics as an important cultural tool that can facilitate their learning.

Ethnosience is an activity of transforming original science to scientific science. The original science knowledge consists of all knowledge that pertains to the facts of the society. That knowledge comes from beliefs handed down from generation to generation (Rahayu & Sudarmin, 2015).

The term ethnosience (ethnosience) comes from the word *ethnos* (Greek) which means nation, and *scientia* (Latin) meaning knowledge. In other words, it is knowledge possessed by one nation or more, precisely a certain ethnic group or social group (Sudarmin, 2014). Ethnosience learning is a strategy for creating learning environments that design and integrate the culture in primary schools (Wahyu, 2017). Therefore, it is important to integrate science in learning. Ethnomathematics and ethnosience are a combination of mathematics and science. Ethnographic-based learning is believed to be able to change learning from

teacher-centred to student-centered learning (Atmojo, 2012). Learning with ethnics-based worksheets is also expected to get positive responses from students (Ariningtyas, et al., 2017; Fajriah, 2018). The observation done in North Aru Sub-district showed that many activities done by the society were related to mathematics and science, the teacher did not understand ethnomathematics and ethnoscience, therefore the culture of North Aru Sub-district was not integrated yet in learning. North Aru Sub-district is located in the Aru Islands, Regency of Maluku. The culture of North Aru had various mathematical elements in terms of tubes, handicrafts (Titir, Nazah, and Vabiah Vaki) and there were still many forms of ethnomathematics. In addition, activities related to ethnoscience could be seen from the traditions and habits, for example they did Waba (the prohibition of extracting natural products is still believed). Therefore, The researchers were curious to explore more about North Aru Culture related ethnomathematics and ethnoscience forms as a study conducted by Prihastari and Widyaningrum (2018), linking forms of ethnomathematics and ethnoscience in Laweyan District. A study conducted by Zahyadi (2017) explored geometrical forms on Batik from Madura. It is similar to a study done by Thus Ubayanti, et al, they found forms of ethnomathematics in a trap, it had geometric shape and the measurement was done in West Papua. Juano and Jediut (2019) explored geometric forms of Manggarai culture in NTT.

Additionally, a study conducted by Sopamena (2016) found geometric forms of ethnomathematics in Central Maluku. Laurens (2016) analyzed ethnomathematics in improving learning. Fasasi (2017) investigate the influence of Ethnoscience instruction and moderate effect of school location and parental education status on students' attitudes towards science in Nigeria.

Kumalasari et al., (2019) developed supplementary materials in teaching science containing ethnics to foster critical thinking skills of the elementary school students. In line

with that, Wahyu (2017) analyzed ethnic-based learning in the elementary school.

Based on the aforementioned explanation, ethnomathematics and ethnoscience are very effective to be integrated in the learning process. Thus, the culture of North Aru Subdistrict was integrated in learning. The aims of this study were to explore the forms of ethnomathematics and ethnoscience of North Aru Sub-district culture and to analyze the relationship between ethnomathematics and ethnoscience and the concepts of mathematics and science at elementary school

The study was expected to be useful for the students, educators and society to find out ethnomathematics and ethnoscience in relation to the concepts of mathematics and sciences while preserving the culture of North Aru.

METHOD

The design of the present study was a qualitative descriptive exploration. The aims of the study were to explore and find. Furthermore, the study used an ethnographic approach that was an empirical and theoretical approach aiming to obtain a description and in-depth analysis of North Aru culture. The focuses of the study were to explore ethnomathematics and ethnoscience of North Aru culture and to analyze its relationship with the concepts of mathematics and science. The settings of the study were in Selmona, Tasinwaha and Marlasi villages in North Aru sub-district, Maluku, Aru Islands. This study was conducted on 6 - 31 January 2020. The data obtained were in the forms of leaders, society, teachers as the original people living in those villages. The observation was done to observe the activities of the society in North Aru, In-depth interview was done by interviewing the leaders, society and teachers who understand the culture of North Aru. After that, the obtained data were analyzed based on the forms of ethnomathematics and ethnoscience of North Aru culture and then the reseachers analyzed its

relationship with the concepts of mathematics and science.

RESULT AND DISCUSSIONS

Based on the observation, artifacts and interviewing the leaders and the society, the results found were classified based on the activities of the society related to ethnomathematics and ethnoscience in terms of traditional games, traditional houses, traditional food, fishing gears, wickers, art instruments, and tradition of North Aru society.

The forms of ethnomathematics and ethnoscience of North Aru Culture

Traditional game

The traditional game played and still preserved by the society in North Aru was *gici - gici*. This game was not only played by children but also played by teenagers. The way to play it was to draw *gici - gici* on the ground, then to prepare *gaco*. There were limited players in this game. Each player had to jump with one foot by getting through each box that had been done and stopped with both feet in the middle box, then jumped back to the beginning and got the *gaco* and threw it in the second box. If the *gaco* was already in the middle box, then the player had to walk through the boxes without seeing and the player should not touch the line. When the player had taken *gaco* in the middle box, then the player returned to the mark on the desired box, meaning that the player had a house. The essence of this game was the player who had many houses the most (marks on the box) would win this game.

Traditional House

Fallow was a traditional house of North Aru people. There were several fallows that were still in traditional shapes. The roof was still made of sago leaves. The walls were made of wood planks and some were made of *gaba - gaba*. The roof of the house was in trapezoid shape and the walls were in rectangular ones.

Fishing Gears

Vuuf was a traditional fishing gear or a fish trap. It was used to catch fish and crabs.

Bubu was made of bamboo. The people in North Aru sub-district generally caught fish using fish traps, hooks and nets. Additionally, another activity done by the people in agriculture sector was gelatin cultivation.

Traditional Food

The traditional food in North Aru were *hatudu* and *pom-pom*. These kinds of food were made from sago. *Pom-pom* was food that would last a longer time. The process of making this food was putting sago into mold made from bamboo and then it was grilled. After that, it was cut into some parts. *Hatudu* was often consumed by people in North Aru.

Art instruments

The art tool used by people in North Aru was *titir*. *Titir* was made of wood and animal skin. To make a sound, this tool must be hit. *Titir* was used for welcoming traditional events, traditional dances.

Tradition

The tradition that the people in North Aru still held is *Waba* and *makaNohom*. *Waba* is a prohibition in taking natural products both on land and in the sea. While *makaNohom* is eating betel nut. It was believed that when eating betel nut, the teeth would be stronger. This tradition was still preserved.

The Relationship between Ethnomathematics and Ethnoscience of North Aru Culture and the concepts of Mathematics and Sciences.

Square concept

North Aru culture had a relationship with the concept of mathematic in terms of square shape. This concept can be seen from the shape of the box found in the game *gici - gici* (picture 1a) and *kiryaban*. It was a wicker made from *lia - lia* leaves and it was in a square shape (figure 1b).



Figure 1. Gici – Gici



Figure 2. Kiryaban

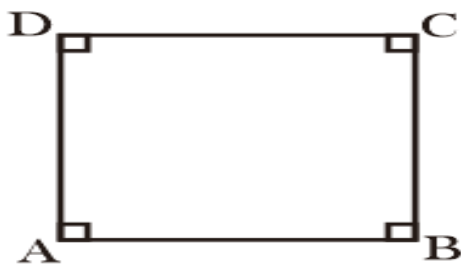


Figure 3. The relationship between ethnomathematics and square concept.

The Trapezoid Concept

The ethnomathematics related to the concept of rectangle was found in traditional buildings called fallow. It could be seen from the shape of the roof, which was in trapezoid shape



Figure 4. Fallow

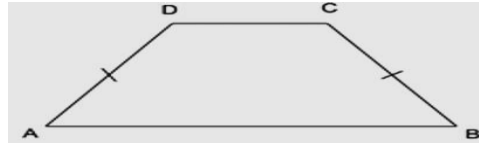
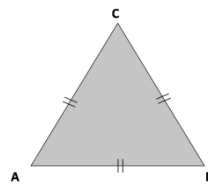


Figure 5. The relationship between ethnomathematics and rectangle concept.

Triangle concept

The ethnomathematics dealing with triangle concept can be seen from Figure 6, it was a kind of wicker called *tofah*. It was used to cover people when it rained. If it was used, it would look like a triangle.



Tofah

Figure 6. The relationship between ethnomathematics and triangle concept.

Hexagon Concept

The ethnomathematics in relation to the hexagon concept can be seen in Figure 7, *Vuuf*. This tool was used by the people to catch fish in a traditional way.



Vuuf

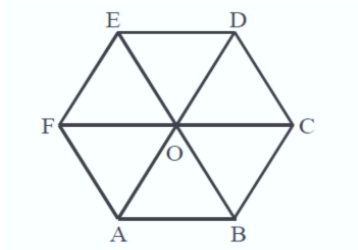


Figure 7. The relationship between ethnomathematics and hexagon concept.

Fraction Concept

The relationship between ethnomathematics and fraction concept could be seen from the food consumed by people in North Aru, *pom-pom*. The whole *pom-pom* was cut into some parts, then putting them into plastics. Each plastic had some parts of *pom-pom*. It can be seen in Figure 8.



Pom-pom

Figure 8. The relationship between ethnomathematics and fraction concept.

Tube Concept

The relationship between ethnomathematics and tube concept can be seen in Figure 9, namely *titir*, *habiah Vaki*, *nasah*. *Titir* was a beaten musical instrument, *habiah vaki* was a place to put sago and *nasah* was used to place garden products.



Nazah

Habiah Vaki



Titir

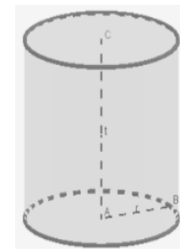


Figure 9. The relationship between ethnomathematics and tube concept.

Force Concept

The relationship between ethnosience and North Aru culture is shown in Figure 9. The game of Gici-Gici and *dauuh akau*. In Gici – Gici, the concept seen was the presence of muscle force and friction.



Dauuhaku



Gici – gici

Figure 9. The relationship between ethnoscience and force concept.

Sound Concept

The ethnoscience of North Aru society related to the sound concept in science subject can be seen in Figure 10, the *titir*, an art instrument. If someone hit it, it produced sound. *Titir* was also made of wood which was the product of natural resources.



Titir

Figure 10. The relationship between ethnoscience and sound concept

Conservation of natural resources

One of the ethnoscience relationship between the people of North Aru Subdistrict and the concept of natural resource conservation could be seen from *Waba*. It was a prohibition in taking natural products both on land and in the sea covering plants and animals. *Waba* can be seen in Figure 11.



Waba

Figure 11. The relationship between ethnoscience and the conservation of natural resources

Food and Health Concepts

The main food consumed by the people in Aru Utara was *Hatudu*. *Hatudu* was made from sago. *Hatudu* was very good for health since it was low sugar, and it produced carbohydrates. *Hatudu* can be seen in Figure 12. Beside consuming *Hatudu*, people in Aru consumed *makanohom*. It was kind of areca nut. It was believed that if people consumed it, their teeth would be stronger and healthy.



Hatudu



Makanohom

Figure 12. The relationship between ethnoscience and food and health concepts.

CONCLUSION

Ethnomathematics and ethnoscience are sources of mathematics and science that come from cultural activities. The culture obtained from the results of this study was the culture of North Aru. It was the creation of works and intentions related to traditions, arts and belief systems. The forms of ethnomathematics and ethnoscience of North Aru culture covered traditional game (*gici-gici*), traditional house (*fallow*), fishing gear (*vuuh*), art instrument (*titir*), traditional food (*porna and hatudu*), *makanohom dan waba*, *kiryaban*, *tofah* dan *nazah crafts*. The Relationship between ethnomathematics and ethnoscience of North Aru culture and the concepts of mathematics and science covered square, triangle, hexagon, tube trapezoid, fraction, force, sound, food and health, and conservation of natural resources.

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