



Ethnomathematics: Utilization of Crock, Ladle, and Chopping Board for Learning Material of Geometry at the Elementary School

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ABSTRACT

Mathematics and culture are not mutually exclusive. They work well together. It is because the help of ethnomathematics. Ethnomathematics is a learning approach of mathematics seeking a cultural approach in mathematical concepts. This study aims at exploring the shape of the crock (earthenware jar), ladle, and chopping board associated with learning materials of the two-dimensional and three-dimensional figure at the elementary school level. The research method used was descriptive qualitative, conducted adopting an ethnographic approach. The ethnographic approach consists of three stages: selection, writing and exploration. The study results found that the shape of the crock (earthenware jar), ladle, and chopping board contained mathematical elements, which are two-dimensional figure including circles and rectangles as well as three-dimensional figure including cuboid, cone and ball.

Keywords: Ethnomathematics , Exploration, 2D-Geometry, 3D-Geometry

ABSTRAK

Budaya dan matematika bukanlah sesuatu yang saling asing. Budaya dan matematika dapat bersinergi dengan baik. Jembatan sinergi tersebut adalah etnomatematika. Etnomatematika adalah suatu pendekatan pembelajaran matematika yang mengupayakan pendekatan budaya dalam proses penyampaian konsep-konsep matematika. Tujuan penelitian ini adalah mengeksplorasi bentuk tempayan, irus, dan talenan yang dikaitkan dengan materi bangun datar dan ruang pada tingkat sekolah dasar. Metode yang digunakan penelitian ini adalah deskriptif kualitatif, dilakukan dengan menggunakan pendekatan etnografi. Pendekatan etnografi terdiri dari 3 tahapan, yaitu pemilihan, penulisan dan pengeksporan. Hasil penelitian menemukan bahwa bentuk tempayan, irus, dan talenan mengandung unsur matematika, yaitu bangun datar berupa lingkaran serta persegi panjang sedangkan bangun ruang berupa balok, kerucut, serta bola.

Kata Kunci: Eksplorasi, Bangun Datar, Bangun Ruang, Etnomatematika.

INTRODUCTION

Mathematics as a scientific discipline develops and grows side by side with the development of human (Sudirman et al., 2018). Mathematics is an extremely necessary subject, but it is however considered a scary subject and difficult to understand. It becomes a problem and a challenge for



educators. Educators must be qualified to develop a more fascinating and enjoyable learning atmosphere for teaching mathematics. A fundamental aspect of creating interesting and enjoyable learning is grasping students' attention. It is in line with what was expressed by Aprilyani & Hakim (2020), to foster students' attention when learning mathematics, an interesting and effective strategy is needed.

On the other hand, the problem that is currently encountered by Indonesia is the lack of millennial generation interest in the culture, especially the traditional cooking utensils: the crock (earthenware jar), ladle, and chopping board. According to Suranny (2015), traditional cooking utensils emerged from the process of human civilization in maintaining life. It turns out that some cooking utensils, like the crock (earthenware jar), ladle, and chopping board, can be used as practical tools in learning mathematics. Utilization of cooking utensils is expected to facilitate students' understanding of the learning material of the two-dimensional and three-dimensional figure. It is because the crock (earthenware jar), ladle, and chopping board resemble three-dimensional figures.

One that can synergize between culture and education is ethnomathematics (Utami et al., 2018). According to Ambrosio (1985), ethnomathematics is "mathematics practiced among identifiable cultural groups such as ethnic-national societies, labor groups, children of certain age groups and professional classes." According to Gerdes in (Huda, 2018), ethnomathematics is mathematics applied by certain cultural groups, groups of workers or farmers/peasants, children from certain class societies, professional classes, and so on. Meanwhile, according to Albanese and Perales (2015) stated that "ethnomathematics is a study focusing on the relationship between mathematics and culture."

According to Susilo & Widodo (2018), the application of ethnomathematics as a learning approach is a strategy aiming at delivering mathematics in a more attractive manner. Ethnomatematics as a mathematics learning approach seeks a cultural approach in teaching mathematical concepts. Activities or human activities in expressing and stating their ideas on cultural objects often have mathematical value (Yanti & Haji, 2019). According to James & James as quoted by Riska et al. (2014), mathematics is the science of logic regarding form, arrangement, quantity, and concepts related to one another. It indicates that the concepts in mathematics are related to concepts outside mathematics. Many theories and other branches of science are discovered through mathematical concepts. According to Martyanti & Suhartini (2018), culture contributes to students feeling more comfortable and confident when learning mathematical concepts.

This study aims at exploring the shape of the crock (earthenware jar), ladle, and chopping board associated with learning materials of the two-dimensional and three-dimensional figure at the elementary school level. Ethnomathematics approach is used to achieve the research objectives in this study.

METHODS

This research design used was a qualitative descriptive research. The approach used was an ethnographic approach. Ethnography is one approach in the qualitative research seeking to explore a community culture (Windiani & Nurul, 2016). The stages themselves consist of 3 stages.

Stage 1

1. Selection of an ethnographic project

The stage starts with the selection of an ethnographic project, which is traditional cooking utensils associated with mathematical concepts.

2. Ethnographic inquiry

In the ethnography, one can ask sub-questions related to (1) a description of the context, (2) an analysis of the primary themes, and (3) the interpretation of cultural behavior.

3. The collection of ethnographic data

Data collection is carried out by observing the participants, which is by observing their activities, physical characteristics of social situations, documentary studies and what will be part of the scene during fieldwork.

Stage 2

1. Ethnographic recording

This stage includes taking field notes, taking photos, making maps, and using other means to record observations.

2. Analysis of ethnographic data

It consists of 4 analyzes: domain analysis, taxonomic analysis, conventional analysis, and cultural theme analysis.

3. Writing ethnography

Writing ethnography is associated with concepts in mathematics.

Stage 3

Exploring the crock (earthenware jar), ladle, and chopping board in terms of shapes and spaces.

Data collection technique in this study was in the form of interviews, observations, group discussions, and document analysis. This research was conducted in Panembahan Village, Cirebon Regency, West Java. Interviews were conducted with two interviewees (resource person). These interviewees are the elder of Panembahan Village: Mrs. Neni Rohaenai and Mrs. Fatimah.

RESULTS AND DISCUSSIONS

This research resulted in a description and benefits of the crock (earthenware jar), ladle, and chopping board found in Panembahan Village. The three cooking utensils are associated with the mathematical elements and values of the two-dimensional and three-dimensional figure at the elementary school level.

Stage 1

1. Selection of an ethnographic project

The stage starts with the selection of an ethnographic project, which is traditional cooking utensils associated with mathematical concepts, then the stage considers the scope of the investigation. Traditional cooking utensils selected as a discussion are traditional cooking utensils found in Panembahan Village, Plered District, Cirebon Regency, West Java. Simultaneously, the selected mathematical material is geometric including the two-dimensional and three-dimensional figure. One of the geometry discussions taught in elementary schools' level is the two-dimensional

figure. Geometry is a branch of mathematics requiring to be reviewed and studied in depth because geometry is used by everyone in everyday life. The focus of the discussion is the volume and surface area of the two-dimensional figure and outer surface.

2. Ethnographic inquiry

After selecting an ethnographic project, which is cooking utensils and mathematical learning materials, the two-dimensional and three-dimensional figure. Next is to ask sub-questions related to a description of the context, analysis of the main themes, and interpretation of cultural behavior.

Here's an ethnographic question

Description: Traditional cooking utensils

1. What do you think about traditional cooking utensils?
2. As far as you know, what traditional cooking utensils are available in Panembahan Village?
3. Does it describe the function and philosophy of this traditional cooking utensil?

Analysis Traditional cooking utensils

1. How many people in Panembahan Village still use traditional cooking utensils?
2. Nowadays, what traditional cooking utensils are still used by the community in Panembahan Village?
3. Are there any traditional cookware craftsmen in Panembahan Village?

Cultural behavior

1. What activities are the traditional cooking utensils used?
2. Do elementary school aged children know what traditional cooking utensils are in Panembahan Village?
3. What should be done to introduce traditional cooking utensils?

Description: the two-dimensional and three-dimensional figure.

1. What is meant by a two-dimensional figure?
2. What is meant by a three-dimensional figure?

Analysis the two-dimensional and three-dimensional figure.

1. How do traditional cooking utensils relate to two-dimensional figures?
2. How do traditional cooking utensils relate to three-dimensional figures?

Cultural behavior

1. What are the objects resembling two-dimensional figures in everyday life?
2. What are the objects resembling three-dimensional figures in everyday life?
3. The collection of ethnographic data

After completing the ethnographic questions, the subsequent step is data collection. Data collection is carried out in various ways, including:

Observing the participants and their activities. Observations were performed in Panembahan Village by conducting several visits to houses and observing the cooking activities of the community. The results of general observations are as follows; there are three categories. First, community that entirely use traditional cooking utensils; second, community who combine traditional cooking utensils with modern ones; and third, community that do not use traditional cooking utensils.

Characteristics of social situations, observing the characteristics of life in Panembahan Village. The result is that it is however profoundly affected by culture since several cultures are still practiced, like ceremony of memayu (a tradition of welcoming the rain), so that it is still sustainable. Next is to conduct interviews with two interviewees (resource person).

Stage 2

1. Ethnographic recording

This stage includes taking field notes, taking photos, making maps, and using other means to record observations.

2. Analysis of ethnographic data

It consists of 4 analyzes: domain analysis, taxonomic analysis, conventional analysis, and cultural theme analysis.

3. Writing ethnography

Ethnographic writing of crock (earthenware jar) The crock (earthenware jar) is a kind of jug made of stone or earthenware with a wide mouth. Some of its functions are as a place for traditional fermented preparation of rice (tapai), vinegar fermentation, storing food and water, and cooking. The shape of the crock (earthenware jar) resembles a tube. However, the tube is tapered at the top. The shape of the mouth of the crock (earthenware jar) is in the form of a circle, as well as the bottom of the jar in the form of a circle.

Next, Ethnographic writing of a ladle. A ladle is a large, sunken spoon made of coconut shell (traditional) and so on. The function of the ladle is the same as the function of a spoon, which is to scoop out vegetables from the pot (pot, pot, pan) and so on. The form of ladle consists of two of the three-dimensional figures. The first part resembles a cuboid, and the second part resembles a half of ball.

Subsequently, the last is the ethnography writing of chopping board. A chopping board (sometimes called cutting board) is a base for cutting or chopping. Chopping board are frequently made of wood. The shape of the chopping board resembles a flat cuboid.

Stage 3

Exploring the crock (earthenware jar), ladle, and chopping board related to two-dimensional and three-dimensional figures.

Crock (earthenware jar)

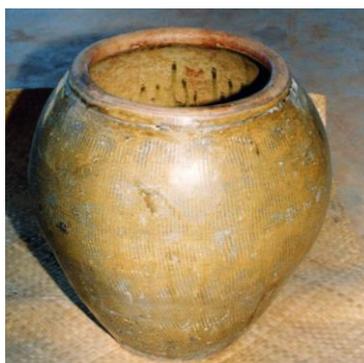


Figure 1. Crock (earthenware jar)

Students can observe and explore the shape of the crock (earthenware jar) related to the learning material of two-dimensional and three-dimensional figures. A two-dimensional figure is in the form of a circle, while a three-dimensional figure is a cone.

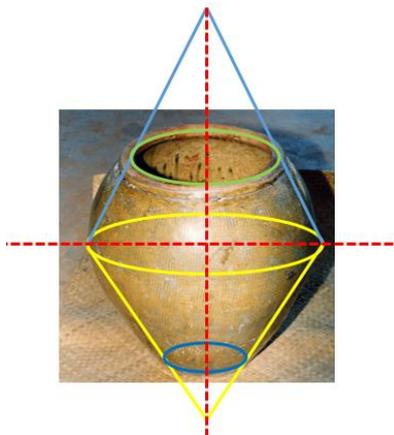


Figure 2. Exploration of the Crock (earthenware jar) Forms

Based on Figure 2, students can calculate the capacity of the crock (earthenware jar) using the cone volume formula. The following is the cone frame forming the crock (earthenware jar).

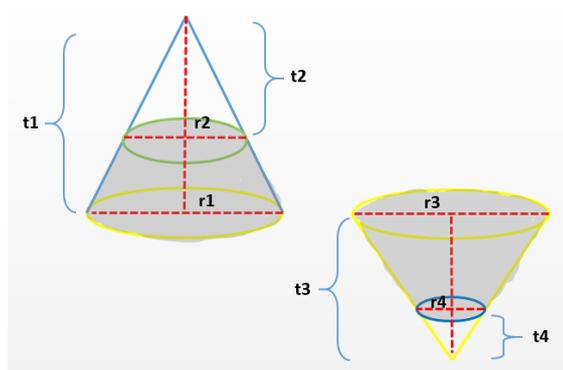


Figure 3. Crock (earthenware jar) Frame

Based on Figure 3, the cone volume can be used to calculate the capacity of the crock (earthenware jar). The crock (earthenware jar) is divided into four cones. The first cone has a height t_1 and a radius r_1 . The second cone has a height t_2 and a radius r_2 . The third cone has a height of t_3 and a radius of r_3 . The fourth cone has a height of t_4 and a radius of r_4 . Furthermore, students can calculate the volume of the first and second cones. The difference in the volume of the first and second cones represent the first gray area. For the second gray area, students can calculate the difference between the volume of the third and fourth cones. Combined the first and second grays represent the volume of the crock (earthenware jar). The volume of the crock (earthenware jar) indicates the maximum water the crock (earthenware jar) can hold. Exploration of the crock (earthenware jar) resulted in students' understanding of the three-dimensional figure of the cone and how to calculate combined and intersecting three-dimensional figure.

Ladle



Figure 4. Ladle

Students can observe and explore the shape of the ladle related to the learning material of three-dimensional figures. Ladle consists of two of three-dimensional figures, resembling a cuboid and a half of ball.



Figure 5. Exploration of the Ladle Forms

Based on Figure 5, students can calculate the volume of the ladle handle and calculate the maximum capacity of the ladle. The following is a ladle frame related to three-dimensional figures.

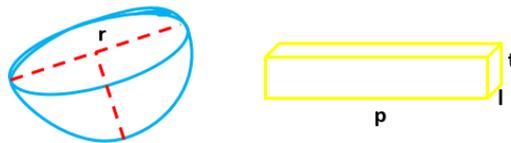


Figure 6. Ladle Frame

Based on Figure 6, to calculate the maximum capacity of soup/liquid that can be scooped by ladle, students can calculate the volume of a half of ball that has a radius of r . Meanwhile, to calculate the volume of the handle of the ladle, students can calculate the volume of the blocks that have length (p), width (l), and thickness (t). Exploration of the ladle resulted in students' understanding of the three-dimensional figure of the cuboid and ball.

Chopping Board



Figure 7. Chopping Board

Students can observe and explore the shape of the chopping board related to the learning material of two-dimensional and three-dimensional figures. A two-dimensional figure is in the form of a rectangle, while a three-dimensional figure is a cuboid.



Figure 8. Exploration of Chopping Board

Based on Figure 8, students can calculate the area used for cutting or chopping and calculate the volume of the part of the chopping board used for cutting or chopping. Here's a chopping board frame related to two-dimensional and three-dimensional figures.

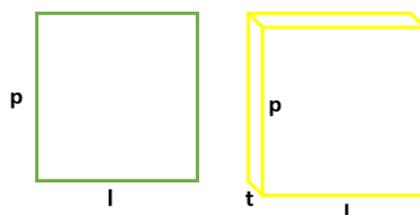


Figure 9. Chopping Board Frame

Based on Figure 9, to calculate the area used for cutting or chopping, students can calculate the area of two-dimensional figure of rectangular with length (p) and width (l). Meanwhile, to calculate the volume of the chopping board used for cutting or chopping, students can calculate the volume of the cuboid with length (p), width (l), and thickness (t). Exploration of chopping boards results in students' understanding of rectangles and cuboids.

This study reveals the concept of two-dimensional and three-dimensional figure in the form of the crock (earthenware jar), ladle, and chopping boards. It is in line with the research results of Agustin et al. (2019) concluding there is a concept of two-dimensional and three-dimensional figure in the main building of asrama inggrisan, Banyuwangi. Likewise, the results of research by Khayat (2020) stated the fort of Van der Wijck have a connection between the construction of the fort building with the concept of mathematical two-dimensional figure, including octagons, rectangles, and circles. The research results of Fauzi & Setiawan (2020) stated that there is a geometric concept in traditional Sasak crafts in mathematics learning in elementary schools. Moreover, the research results of Zaenuri et al. (2017) concluded that there is a concept of two-dimensional figure in the culture of Kudus City. Based on the aforementioned results and discussion, it is revealed that the concept of

two-dimensional and three-dimensional figure can be discovered in the existing culture of Indonesian society.

CONCLUSIONS

Based on the results and discussion, it can be concluded that the shape of the crock (earthenware jar), ladle, and chopping boards contains elements of two-dimensional figure (circles and rectangles) and three-dimensional figure (cones, cuboids, balls). This exploration also reveals how to calculate the volume of combined and intersecting three-dimensional figure.

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