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Ethnomathematics Study: Making Oncong-Oncong In Lembah Melintang District, West Pasaman

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ABSTRACT

This research aims to examine the mathematical concepts in the process of making oncong-oncong cakes. Oncong-oncong cake is one of the traditional foods from Indonesia that is still maintained to this day as a food ingredient that has ethnomathematical elements to its manufacture which is packaged using natural leaves in the shape of a cone. The purpose of this research was to examine the mathematical concept of making the oncong-oncong cake. So that the mathematical concepts found in the process of making this oncong-oncong cake can be used as an approach in mathematics learning activities. This research includes qualitative descriptive research with an ethnographic approach by means of interviews, observations, documentation, as well as the physical form of the product, packaging materials, and processing techniques used. The results of the study show that the use of leaves as packaging provides a protective function, maintains taste, and reflects local wisdom in the use of natural materials that are environmentally friendly. The shape of the cone also has aesthetic value and becomes a visual identity that distinguishes the product from similar foods. In addition to food sources, these traditional foods have the potential to be developed as part of cultural preservation and local economic strengthening. This research is expected to be a reference in the documentation and development of traditional foods based on local wisdom.

Keyword : Traditional Food, Leaf Packaging, Local Wisdom, Local Food, Culture

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1. INTRODUCTION

Mathematics is often seen as an abstract science so that students have difficulty connecting concepts with daily life. One of the approaches that has developed to bridge this problem is ethnomathematics, which is the study of cultural practices that contain mathematical activities. The mathematical concepts that exist in the human mind are sometimes different from mathematics that exist in reality. Dwidayanti (2018) stated that mathematics taught in school and mathematics in daily life are very different. Therefore humans must connect mathematics learning with daily life. Because if the two can be connected, it can be useful to help students' understanding in learning. So that mathematics learning is easy for students to understand if mathematics learning is connected to daily life.

As professional teachers, educators are required to use various educational methods and models so that students are not bored and can also improve their learning abilities. So an educator must understand the procedures for teaching in the classroom or outside the classroom. Things that are real and related to the experience of educators every day can be used as an interesting learning resource (Lubis & Widada, 2020). If the educator in class only explains mathematical concepts without connecting them to daily life. According to Ulya and Rahayu (2017), if mathematics education is still going on like that, it will have an impact on students' low ability to learn mathematics. Because mathematics in schools has a purpose, not only to equip students to prepare for school tests and national tests, but the purpose of learning mathematics in schools is to prepare students to use mathematics in daily life, for example cultural factors (Resfaty et al., 2019).

Education and culture are very closely related to daily life, because culture as a whole is a unit that has a significant influence on social life, while education is a basic need for every aspect of people's lives. One method for connecting culture and education is ethnomathematics. Culture-based learning in mathematics is one of the innovations that aims to eliminate the assumption that mathematics is rigid, even though it is related to something to be interesting, such as culture, this will lead to a more flexible perception of mathematics (Herawaty et al., 2018).

Linguistically, ethnomathematics comes from the word "Ethno", which is interpreted as something related to socio-cultural contexts, such as people's culture, codes of behavior, myths, symbols, and others. "Matema" is defined as performing, explaining, measuring, and completing activities. "Tics" comes from the word technne, which means method. In relation to ethnomathematics, it is a form of cultural anthropology in relation to mathematics and mathematics teaching (Turmudi, 2007) or it can also be said to be an activity involving numbers, geometric patterns, calculations and so on, all of which are considered as the application of knowledge in the field of mathematics related to the local culture. (Pusvita & Widada, 2019). The goal of the ethnomathematics program is to recognize that there are many ways to do "mathematics" that take into account the different forms of knowledge that exist in different areas of society.

To overcome these problems, the ethnomathematics approach is one of the alternatives that can be used in mathematics learning. The term ethnomathematics was first introduced by D'Ambrosio (1985) who defined it as the way certain cultural groups understand, organize, and apply mathematical ideas in their lives. According to Rosa and Orey (2011), ethnomathematics examines the relationship between mathematics and culture so that students can understand that mathematics does not only originate from the classroom, but also develops in the practice of people's lives. This approach allows learners to learn math through cultural experiences that are close to their environment.

Mathematics learning through an ethnomathematical approach has a positive effect on mathematical ability. For example, mathematics skills in elementary school children include the ability to understand mathematical concepts, numeracy skills, and the ability to understand problems. Through the integration of culture into mathematics, it is hoped that students will more easily understand the principles of mathematics (Jatia et al., 2019). Ethnomathematical elements are cultural elements that contain mathematical concepts. These ethnomathematical elements include artifacts, clothing, games and food.

In the Indonesian context, traditional food is one of the objects that is widely explored because it contains the concepts of measurement, comparison, pattern, and geometry. Previous studies have shown that traditional food making activities can be used as contextual mathematics learning media. Oncong-oncong is a traditional food made from glutinous rice and bananas wrapped using cone-shaped banana leaves. The shape of the wrapper shows the existence of a geometric concept that has been applied by the community for generations. In addition, the process of making it also involves measurement, comparison, and estimation activities which are part of mathematical concepts. Traditional food has great potential as a learning tool in mathematics education, both in formal settings such as schools and in informal contexts such as family and community.

Research on ethnomathematics on traditional foods has been conducted by several researchers. Fauziyah and Faridah (2021) found the concept of comparison and measurement in the process of making lontong kupang. Syahputri and Reflina (2023) also revealed the existence of the concept of geometry in the traditional food of Si Borong-Borong. However, ethnomathematical studies of the manufacture of oncong-oncong are still very limited. Based on this description, this study aims to explore the mathematical concepts contained in the making of oncong-oncong and its potential as a mathematics learning medium based on local culture.

2. RESEARCH METHOD/MATERIAL AND METHOD/LETERATURE REVIEW

The method used in this study is research using a descriptive qualitative approach with ethnographic design, where the researcher only makes observations through documentation, interviews and literature studies related to ethnomathematics in the process of making oncong-oncong so that it is clear that the relationship between mathematics and culture can be made as a learning medium in schools. According to Creswell (2014), qualitative research aims to understand social phenomena based on the perspective of participants in their natural environment. The ethnographic approach was chosen because the focus of the research is the cultural activities of the community in the process of making oncong-oncong. This research was conducted in Lembah Melintang District, West Pasaman Regency, West Sumatra. The objects studied are mathematical concepts found in the process of making oncong-oncong. The interview was conducted on the subject of the study, namely one of the wet cake traders who was also an observation place. The data analysis techniques used follow the opinions of Miles and Huberman, namely data reduction, data presentation and conclusion drawing (Ulya & Rahayu, 2020). Data reduction is carried out to select parts in the process of making oncong-oncong related to mathematical concepts. The presentation of data was carried out to see the overall picture of the results of mathematical concepts found in the process of making oncong-oncong. Then conclusions were drawn about ethnomathematics in the process of making oncong-oncong and its contribution to mathematics learning.

The research involved several stages, including the identification of the research subjects, data collection, and data analysis. The research subjects were the makers or individuals involved in producing *oncong-oncong*. Data were collected through direct observation of the *oncong-oncong* manufacturing process, documentation of the product's form and production stages, and a literature review of relevant studies on ethnomathematics and traditional foods. The collected data were then analyzed qualitatively through three stages: data reduction, data presentation, and conclusion drawing.

3. RESULTS AND DISCUSSION (10 PT)

a. Results

The description of Oncong-Oncong

Based on the observation results in the picture, the oncong-oncong is wrapped in banana leaves and shaped to resemble a cone.

Figure 1. Oncong-Oncong

Figure 2. Cone-shaped cone

Geometric Concepts in the Shape of Oncong-Oncong

The final shape of the leaf-wrapped oncong-oncong shows similarities to the cone chamber building. According to Van de Walle (2013), a cone is a spatial structure that has a circular base and a peak point.

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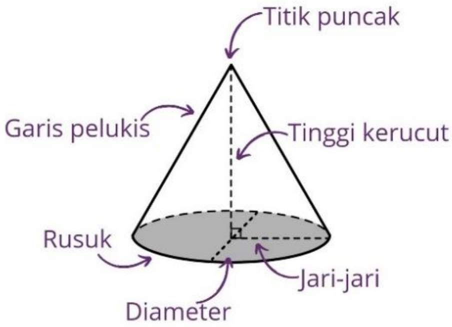

Figure 3. Build a Cone Room

In the oncong-oncong elements are found:

- Peak point = the highest point of the cone-oncong
- Height = perpendicular distance from the apex point to the center of the base
- Diameter = the length of the side of the base from end to end through the midpoint
- Radius of the base = distance from the midpoint of the base to the edge of the base
- Painter's line = sloping side from the top to the edge of the base

Cone volume:

$$V = \frac{1}{3}\pi r^2 t$$

Cone surface area:

$$L = \pi r^2$$

Remarks:

V = Volume
L = Wide
r = Radious
t = Height

In the process of making it, the community has indirectly applied the concept of geometry when determining the size of banana leaves and the amount of contents put into the package. Research on the ethnomathematics of traditional food has also found that cone shapes often appear as representations of the concept of building space in local culinary culture. This concept can be used in learning spatial geometry at the junior high and high school levels. From a mathematical point of view, the shape of the cone on the oncong-oncong is a real example of the application of geometric concepts in daily life. A cone is a spatial structure that has one curved side, one circular base, and one peak point.

Circle Concept

Before being shaped into a cone, the banana leaves used have a flat plane that is then rolled. The bottom of the wrapper forms a circle.

The mathematical concepts found include:

- Diameter = the length of the side of the base from end to end through the midpoint
- Radious = distance from the midpoint to the edge of the base
- Circumference = the length of the entire side of the base circle
- Circle area = base plane area

Formula:

$$K = 2\,\pi\,r$$
$$L = \pi r^2$$

As explained by Kennedy and Tipps (2007), circles are one of the basic forms that are widely found in daily life.

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b. Discussion

Estimated cone size on the cone

It is known that the height of the cone and the diameter of the base on the cone are as follows:

$$t = 12cm$$
$$d = 8cm$$
$$r = \frac{d}{2}$$
$$r = \frac{8}{2} = 4\ cm$$

So the radius of the cone on the oncong-oncong is 4 cm.

Determining Diameter:

$$d = 2r$$
$$d = 2\ \times 4 = 8\ cm$$

Determining the Circumference of the Base:

$$K = 2\pi r$$
$$K = 2\ (3{,}14)(4)$$
$$K = 25{,}12\ cm$$

Determining the Circle Area of the Base:

$$L = \pi r^2$$
$$L = 3{,}14\ \times\ (4)^2$$
$$L = 3{,}14\ \times 16$$
$$L = 50{,}24\ cm^2$$

Defining the Painter's Line:

The painter's line is symbolized by the letter "s", just as the painter's line would be determined by the formula of the Pythagorean theorem.

$$s = \sqrt{r^2 + t^2}$$
$$s = \sqrt{(4)^2 + (12)^2}$$
$$s = \sqrt{16 + 144}$$
$$s = \sqrt{160}$$
$$s = 12{,}64\ \approx 13\ cm$$

Measurement Concept

In the manufacture of oncong-oncong, the maker usually makes certain sizes for:

1) Banana leaf length

A banana leaf in the shape of an elongated rectangle that has been cut to be used as a wrapper. Traditionally, people do not use rulers but rather use:

a. Finger span
b. Palm length
c. Visual forecasting based on experience

Based on the general size of the finished oncongs ($\pm$ 10 – 15 cm), the banana leaves used are estimated to have:

Table 1. Cone Size

Components	Approximate Size
Leaf Length	25 – 30 cm
Leaf Width	10 – 15 cm

Emerging mathematical concepts:

a. Length measurement
b. Size estimation
c. Non-standard units become standard units (cm)

According to Bishop (1988), measuring activities (measurements) are one of the universal mathematical activities found in all human cultures.

2) Banana leaf width

The width of the leaves determines the size of the cone base that will be formed:
If the leaf width = 12 cm
So when the leaves are rolled up, they will form a conical base with an approximate diameter, D = 8 cm.

3) A lot of content

The society determines its magnitude based on the size of the cone formed:
Height (t) = 12 cm
Diameter (d) = 8 cm
Then the radius (r) = 4 cm
Volume:

$$V = \frac{1}{3}\pi r^2 t$$
$$V = \frac{1}{3}(3{,}14)(4)^2(12)$$
$$V = 200{,}96\ cm^3$$
$$V = 201\ cm^3$$

This means that the filling capacity of the oncong-oncong is around 180 – 200 grams of dough.
Emerging mathematical concepts:
a. Volume of building space.
b. Capacity.
c. Estimation.
d. Size and content comparison.

In cultural practice, society does not calculate volume formally but uses empirical experience that is passed down from generation to generation. This is the main feature of ethnomathematics D'Ambrosio, 1985).

4) Length of steaming time

In addition to physical measurement, people also measure time. The steaming time usually depends on the amount of content, the size of the cone, the rate, and the type of material used.

Table 2. Steaming Time

Size of Oncong-Oncong	Steaming Time
Small	20 – 25 menit
Medium	25 – 35 menit
Big	35 – 45 menit

The activity shows the application of the concept of measurement in daily life.

Figure 4. Banana Leaf Size

Concept of Comparison

Comparison found on:
1) Comparison of sticky rice and coconut milk

In the manufacture of oncong-oncong, the main ingredients are generally glutinous rice and coconut milk. The concept of comparison is used to keep the texture from being too hard or too soft.
For example, it is used:
Glutinous rice = 500 grams
Coconut milk = 250 ml
So the comparison:

$$Glutinous : Coconut\ milk = 500 : 250$$

Simplified to:

$$2 : 1$$

This means that every 2 parts of glutinous rice requires 1 part of coconut milk.
2) Comparison of leaf size with content
The comparison of the size of the leaves with the contents because the shape of the cone resembles a cone. So the content (volume) is influenced by the size of the base and height.
Cone volume formula:

$$V = \frac{1}{3}\pi r^2 t$$

As an illustration, we can determine the volume of the cone on the cones such as:
Small Oncongs → r = 2 cm, t = 8 cm

$$V = \frac{1}{3} \times 3{,}14 \times 2^2 \times 8$$
$$V = 33{,}5\ cm^3$$

If the size is enlarged → r = 3, t = 8

$$V = \frac{1}{3} \times 3{,}14 \times 3^2 \times 8$$
$$V = 75{,}4\ cm^3$$

Comparison of contents:

$$33{,}5 : 75{,}4 = 1 : 2{,}25$$

This means that a slight increase in size can unfortunately make the contents increase much larger, because the radius is raised in two.
3) Comparison of the height and diameter of the cone
In the shape of the cone, height and diameter determine whether the shape looks slimmer or wider.
Example:
If the height of the cone is 12 cm and the diameter of the base is 8 cm then:

$$12 : 8 = 3 : 2$$

The Concept of Symmetry
If the oncong-oncong is split through its vertical axis, it is obtained with the same relativity. This shows that there is a:
1) Folding symmetry
Folding symmetry is a state when a shape can be divided into two parts that cover each other precisely when folded on a certain line (Dewi & Gischa, 2023).
In cone-shaped cones, if observed from the front view and assumed that the shape of the cone is symmetrical, there are:
a) 1 axis of symmetry (folding symmetry), which is the line that gives the cone from the apex to the midpoint of the base.
b) If the cone is divided through the plane that passes through that axis, then the left and right sides will have the same shape.
In simple terms:

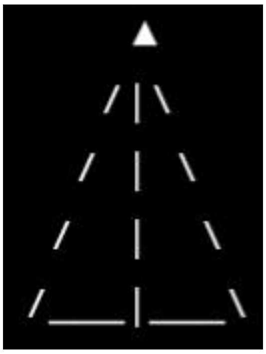

Figure 5. Folding Symmetry

The vertical line in the middle shows the axis of the fold symmetry. In the context of cone, the symmetry of folding can be seen from:

a) Both sides of tapered wrap towards the top
b) Relatively balanced left and right sizes
c) The shape of the base that follows a circle

This concept shows that oncong-oncong makers have traditionally applied the principle of balance of form without having to use formal measuring instruments.

2) Rotary symmetry

According to Sholeha (2024), rotary symmetry is the ability of a body to look the same again after being rotated at a certain center.

On cone-shaped oncong:

a) If it is rotated on its upright axis (from the top to the center of the base), it will still look the same.
b) Because the base of the cone is circular, geometrically the cone has a rotational symmetry of infinity to its central axis.

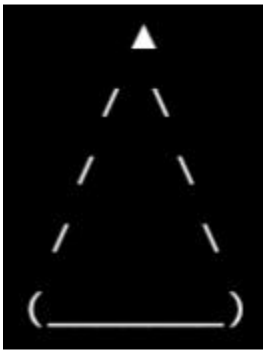

Figure 6. Rotary Symmetry

Rotated = the shape remains the same, meaning rotated 90o, 180o, 270o, to 360o still maintains the shape of the cone, and there is no change in the overall geometric appearance.

Based on the results of observations of banana leaves used as a wrapper for oncong-oncong, it was found that people apply the concept of measurement intuitively in the process of making it. Banana leaves are cut to a certain size which is estimated to be about 25 – 30 cm long and 10 – 15 cm wide. The size was chosen to form a conical chamber that can accommodate the appropriate amount of dough. In this process, the community uses non-standard units in the form of visual estimates and experiences that are inherited from generation to generation. The activity showed the application of the concept of length and width measurement.

In addition, the determination of the magnitude of the cone is related to the concept of cone volume. The larger the size of the cone formed, the greater the capacity of the contents that can be inserted. In the final stage, the community measures the time through a steaming process that lasts between 20-45 minutes depending on the size and amount of contents. Thus, the manufacture of oncong-oncong contains mathematical concepts in the form of measurement of length, area, volume, capacity, time, and comparison which are part of ethnomathematical studies.

Implementation in mathematics learning
The results of this research can be applied to the following materials:

Table 3. Implementation of Building a Cone Space

Material	**The concept of oncong-oncong**
Circle	Cone base
Cone	Main forms of oncong-oncong
Volume	Filling capacity
Surface area	Wrapping leaf area
Comparison	Composition of the material
Simetri	Cone shape
Measurement	Length, width, and height

4. CONCLUSION

The manufacture of oncong-oncong contains various ethnomathematical elements that can be identified through the production process and final shape. Emerging mathematical concepts include geometry of building spaces, measurements, comparisons, volume estimation, and geometric transformations. The integration of local culture into mathematics learning has the potential to improve conceptual understanding while supporting the preservation of regional culture.

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