

# The Exploration of Ethnomathematics of Sardine Fish Canning Process at CV. Pasific Harvest Muncar Banyuwangi

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**Abstract:** *Ethnomathematics is mathematics that grows and develops in a society that is in accordance with the local culture. It can be used as a center of the learning process and teaching method, especially mathematics learning. One of the ethnomathematics that can be applied by teachers is the process of sardines canning in CV. Pasific Muncar Banyuwangi. The objective of this study is to explore ethnomathematics and make test kit on ethnomathematics in the process of sardines canning in CV. Pasific Harvest Muncar Banyuwangi. The research method used is descriptive qualitative cultural approach. The subject of this research is the company production manager of CV. Pacific Harvest. The results of this study revealed that ethnomathematics in the process of sardines canning in CV. Pacific Harvest was found in the form of sardine cans specifically cuboid and tube. Ethnomathematics related to mathematical concepts was found when determining the ratio of material composition, namely 50% fish and 50% seasonings and water. Ethnomathematics in counting activities was there when determining the diameter of a can. The mathematical model used was by making a can code to find out the name of the can and the net weight of the can. After exploring ethnomathematics, a mathematics test kit was made with the topic of ethnomathematics in the process of sardines canning in CV. Pasific Harvest Muncar, Banyuwangi. The questions made contained material volume of sardine cans, comparisons, and prices of canned sardines.*

**Keywords:** ethnomathematics, sardine canning, test kit

## 1. INTRODUCTION

According to Susilo (2012), mathematics is an exact science that is usually in the form of numbers to improve numeracy skills and to solve problems in daily life through logical and systematic thinking. According to Astuti, Siswati & Setyawan (2018), abstract and systematic mathematical characteristics make students less interested in learning it because students have difficulty in solving mathematical problems. The teacher should create a fun mathematics learning and find the problems of students' failure in learning mathematics. One of the approaches that can be used by teachers is by applying a cultural approach. According to Koentjaraningrat (2009), culture is the whole system of ideas, actions and results of human work in the context of community life that belongs to human beings by learning. Culture cannot only be learned at the class of Cultural Arts and Crafts (SBdP), but mathematics can also be a mean of cultural learning. The correlation between culture and mathematics can be called ethnomathematics. Ethnomathematics was firstly introduced in 1977 by a Brazilian mathematician named D'ambrosio.

According to Shirley (Marsigit, 2016: 2) currently, the field of ethnomathematics, namely mathematics that grows and develops in a society that is in accordance with the local culture, can be used as a center for learning processes and teaching methods, although it is still new in the education field. Ethnomathematics is the study of things related to mathematics and culture in the form of language and activities carried out by the community so that it

becomes a habit. Every region in Indonesia has a different culture that develops in their respective regions. One of the areas that still preserves its distinctive culture is Petik Laut (Sea Picks) culture which is located in Muncar, Banyuwangi. Petik Laut is carried out to express gratitude for the abundant sea products in this area. With the abundance of marine products in Muncar, people generally preserve fish by marinating or boiling and then storing it in a place made of bamboo or commonly called besek. However, along with the development of times, there are so many ways to preserve or process fish; one of them is by processing sardines and then placing it in a can so that the processed fish will last longer. One of the sardine factories in Muncar is CV. Pacific Harvest which manages sardines in canned products every day. Sardine canning has different sizes and shapes. The size and shape of the sardine can can be used as an object in mathematics learning. Mathematical elements found or can be called ethnomathematics in canning sardines can later be utilized as the elementary school mathematics teaching material. This mathematics teaching material should be in accordance with the material and culture that is around students so that students can be pleased when learning mathematics and students can understand abstract mathematical concepts in an easier way.

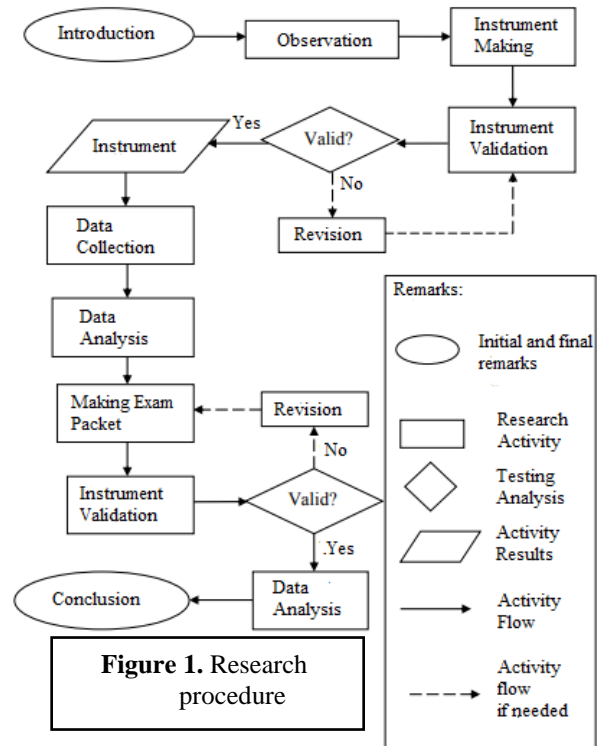
The previous research that discussed ethnomathematics was conducted by Sirate (2012). The result of the research was the implementation of ethnomathematics can be a way to motivate, stimulate students, to overcome boredom and difficulties in learning mathematics. The next research was carried out by Pratama (2017), the result showed that there was a mathematical

concept found in the form of physical form of a can used to package sardines, namely building space such as tube and cuboid. The latest research was conducted by Dahliani (2017) in which the result of this study found a mathematical concept namely CV. Pasific Harvest produced canned fish in tomato sauce in two different sizes, namely can measuring 155 grams and can measuring 425 grams with a standard complete weight of 100 grams and 275 grams, respectively.

Based on the description above, the research problems are: how is ethnomathematics in the process of sardines canning in CV. Pasific Harvest Muncar Banyuwangi? and how is the mathematics test kit as a product produced with regard to ethnomathematics in the process of sardines canning in CV. Pasific Harvest Muncar Banyuwangi.

**2. RESEARCH METHOD**

This research uses descriptive qualitative research with ethnographic approach. According to Masyhud (2016), descriptive research is a study that shows a description of a condition based on existing data objectively, while qualitative research is a research that emphasizes the aspect of in-depth understanding of a problem. The resource person in this research is the production manager, Mr. Rony Fajar Laksana, S.St.Pi who was given with the S1 code, while for observer 1 or the researcher, he was given with the P1 code. The object in this study is sardine cans which have different shapes that are in accordance with mathematical concepts, namely tube and cuboid. The place to conduct the research to get the source of information was CV. Pasific Harvest on 61 Tratas Street, Kedungrejo Village, Muncar District, Banyuwangi Regency. The data collection methods used observation and interview. Observation activities were carried out to observe the process of sardines canning at CV. Pacific Harvest which could be used as teaching materials in elementary school mathematics. In the interview activity, the researcher prepared a research instrument that was used as the main guide when conducting interviews and the researcher also brought interview guidelines in general, and it can be developed conditionally by the researchers when conducting questions and answers. The stages of the research procedure can be seen in Figure 1.



**Figure 1. Research procedure**

To examine the instrument's appropriateness, the first thing to do is to test the instrument validity by the validator. This process is carried out to determine the validity of the research instruments used. The validity test was conducted on research instruments in the form of observation and interview guidelines. Data obtained from the validation results of the research instrument will be used to determine the validity of the research instrument.

The validity level criteria of observation and interview instrument sheets according to Hobri, 2010 are if the Va value is less than or equal to 1 and less than 2, the validity level is regarded invalid; and if the Va value is less than or equal to 2 and less than or equal to 3, the validity level is regarded valid.

**3. RESULT AND DISCUSSION**

In this study, the first step to is collecting data. It is done through field observations that are in accordance with previously made observational guidelines. The observation activity was carried out by two students with the aim of getting more accurate information. When observing, the observer recorded the observations on the observation sheet provided. After making observations, the researchers conducted interviews with the company's production manager of CV. Pacific Harvest Muncar Banyuwangi who knows the process of sardines canning in this company.

Based on observations and interviews, it can be seen that the shapes and sizes of sardine cans have mathematical elements. The mathematical elements are geometric shapes, volume calculation, and mathematical models. The results of this study can be attributed to

research conducted by Pratama (2017) that only focused on the standard packaging of cans located at CV. Pasific Harvest Muncar, Banyuwangi. The can packages are club can, round can, and tall round can. The following research was conducted by Dahliani (2017) that only focused on the efficiency of fish canning production time in tomato sauce at CV. Pasific Harvest Muncar Banyuwangi. The cans are 155 gram and 425 gram with standard time from cutting to filling specifically 1.2 minutes and 1.5 minutes.

The next research was conducted by Sirate (2018), the results of the research was that ethnomathematics can be as a way to motivate and stimulate students to overcome boredom and success in learning mathematics.

#### A. Analysis of the Sardine Can Shape

Ethnomathematics found in this company is the shape of sardine cans which are used when producing sardines. Cans used are shaped like cuboid and tube of different sizes. Cuboid cans namely club can with  $206 \times 308$  code; tube cans have two types namely round can with  $202 \times 308$  code and tall round can with  $300 \times 308$  code. Based on interviews conducted with S1, the results of information obtained are in average, a machine with a capacity of 100 tons can produce 100-150 canned sardines per day. The shape of the can in this company is in the form of tubes and cuboid which have its own names and codes. Specific calculation of the can size is determined by the can code and the last number is always divided by 16. This company does not produce its own cans but uses a supplier, but it does not mean that the company will make its own sardine cans one day. The following is the script from the interview with S1 regarding sardine cans.

- P1001 : *How many cans are produced in one minute of production?*  
 S1001 : *It depends on the machine. However, the average is between 100-150 cans per minute. So, my machine has a capacity of 100 tons per day. You can see the use of fish from there. There is a factor namely production. The production factor is 1 kg of fish for how many cans, isn't it? We have a standard. The standard is observed from the results of the standard yield. The standard rendering is a portion that can be applied in canning.*
- P1002 : *What kinds of cans are used in this company?*  
 S1002 : *In canning terms, it can be called club can (cuboid-shaped can). Club can weigh 125 grams, This is a cylindrical can or some say round can. There is a tall round can and a short round can. Round can weigh 155 grams and tall round can weigh 425 grams.*
- P1003 : *How about the size?*  
 S1003 : *This is related to the dimension in canning terms. for example, this round can has dimension of  $202 \times 308$ . It has a meaning; 202 means that  $2 + \frac{2}{16}$ . How is  $2 + \frac{2}{16}$ ? how  $\frac{2}{16}$ ?  $\frac{1}{8}$ , is it? How is  $\frac{1}{8}$  if it is*

*in decimal fraction? 0,25. Means that 2,25 inches; The diameter is taken from the outside to outside. If you do not believe, you can measure it by using the caliper; please do not use a ruler. if you use a ruler, you cannot do it. That was I say  $202 \times 308$ , so what 308 is this? The height, it is.*

*For this, it is easy. It is just the diameter  $\times$  height. It is different from the trapezoid, isn't it? How is the weight? 308. It means that how is  $3 + \frac{8}{16}$ . how  $\frac{8}{16}$ ?  $\frac{1}{2}$ . It means 3,5 inches. The unit is not centimeter, but inch.*

- P1004 : *Are there special calculations in can measurements??*  
 S1004 : *As I demonstrated earlier, the can measuring  $202 \times 308$ . It means that 202 is the diameter and 308 the height. The way to calculate it is like earlier, the last digit code is divided by 16 for all.*  
 P1005 : *Are cans used to package sardines produced by your own company?*  
 S1005 : *No, we use a supplier. We plan to do it one day.*

Based on observations by P1, the results obtained are sardines can in this company are in the form of tubes and cuboid. Tube cans are tall and some are short. The cuboid cans contain sardines/lemuru, but these cans are exported abroad. For local distribution, this company uses tube can. Tall tube shaped can contain sardines/lemuru, while short tube contains tuna. The can calculation is obtained from the can code, where the last number is always divided by 16. The results of observations made are as follows.

- 1) Can measuring 125 grams



Figure 2. Club Can

Activities carried out are observing the shape of the can and measuring the height and length of the can. The results of the observation can be seen that the club can contains sardines to be exported abroad. The club can has code of  $206 \times 308$ . To find the height and length of the can, the following calculation can be done.

$$t = 2 + \frac{6}{16}$$

$$= 2,4 \text{ inci}$$

$$p = 3 + \frac{8}{16}$$

$$= 3,5 \text{ inci}$$

- 2) Can measuring 155 grams



**Figure3. Round Can**

The activities carried out are observing the shape of the can and measuring the diameter and the height of the can. The results of the observation can be seen that round cans containing sardines are distributed locally. Round can has code of 202 × 308. To find the diameter and the height of the can, the following calculation can be done.

$$d = 2 + \frac{2}{16}$$

$$= 2,1 \text{ inci}$$

$$t = 3 + \frac{8}{16}$$

$$= 3,2 \text{ inci}$$

3) Can measuring 425 grams



**Figure 4. Tall Round Can**

The activities carried out are observing the shape of the can and measuring the diameter and the height of the can. The results of the observation can be seen that the tall round can contain sardines which are distributed locally. Tall round can has a code of 300 × 308. To find the diameter and the height of the can, the following calculation can be done.

$$d = 3 + \frac{0}{16}$$

$$= 3 \text{ inci}$$

$$t = 3 + \frac{8}{16}$$

$$= 3,2 \text{ inci}$$

#### B. Analysis of Sardine Composition Comparison

Ethnomathematics found in this company is when producing sardines by making comparisons of sardine compositions so that it produces sardines in the form of cans in accordance with the standards in this company. Based on interviews conducted by S1, the results were obtained that initially S1 did not provide detailed information about the comparison of sardine composition because this is a secret formula of the company. However, S1 stated that the biggest

ingredient is fish. The composition mentioned by S1 is 50% fish and 50% water and seasoning. The ratio of these ingredients is adjusted to the volume of the can. The following is the script from the interview with S1 regarding comparison of sardine composition.

P1006 : *What is the ratio among fish, water, and seasoning in a sardine can?*

S1006 : *I cannot tell you the formula because it is the company secret. But, the ingredient, without having to mention the percentage, is fish; the biggest ingredient is fish. The percentage of the fish is 50% and the remaining 50% is for water and seasoning. That is all that I can tell. I am sorry because it is the company secret.*

#### C. Analysis of Sardine Price

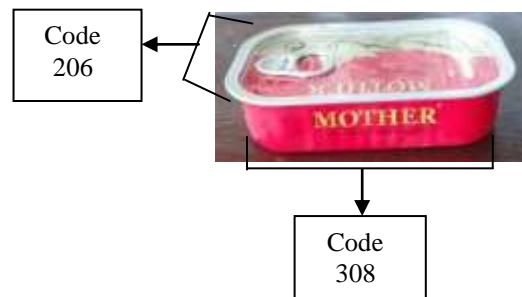
Based on interviews conducted by S1, the results showed that the company could not provide information about company prices for one carton of sardines. S1 only gave information that buying one carton is cheaper and CV. Pasific Harvest sold directly to distributors at company prices. S1 mentioned that the market price such as supermarkets for small sardine cans is IDR 7,000.00. The following is the script from an interview with S1 regarding the price of sardines.

P1007 : *How much for a carton of sardines??*

S1007 : *The price in the market, let us consider Indomaret, the small can costs IDR 7,000 - 8,000. One carton is definitely cheaper but I cannot tell you the price from here. You can calculate the retail price in the market by yourself. Here, it is not directly to Indomaret, but through the distributor. We sell it to distributors but the price is not allowed to be informed.*

#### D. Analysis of the Company's Ideal Can

Based on interviews with S1, it was found that the ideal can is flat can or club can because this can can contain 15-16 tons of raw materials in one container. When viewed from the aspect of efficiency, one carton can contain 50 flat cans while the tube can in one carton can contain 24 sardine cans.



**Figure 5. Club Can**

The following are the results of interviews with S1 regarding the company's ideal can.

- P1008 : *Is there an ideal shape of can in this company?*  
S1008 : *If I link it with the best shipping aspect, it is the flat can or the club can because it fits best with the containers because it is flat. In one container, a small can fits at least 15 tons, 16 tons of raw material. The club can is 20 tons. The club can contains 50 cans which is almost two times from cylinder cans for efficiency aspects The ideal is the club can, however, unfortunately, it is for exports. For local coverage, it is small one measuring 155 grams.*

### Ethnomathematics as the Elementary School Mathematics Test Kit

Based on the results of the study, it can be seen that ethnomathematics found can be used as mathematics teaching materials in elementary school. Ethnomathematics found in this research is ethnomathematics in the material of geometry and arithmetic (profit) in the form of test kit.

#### A. Geometry Material

Geometry material obtained in this study can be used as teaching material in the form of test kit in the elementary school level. Ethnomathematics of this geometry can be used as a learning medium in the form of sardine cans which are easily found in the environment around students so that learning is more enjoyable and closer to students' daily lives. The following is the example of geometry material test kit.

##### Question 1.

Deva cuts a piece of aluminum into a tube. The base circumference is 88 cm and the height is 30 cm. What is the surface area that the tube has?

To answer the question, the first step that students must do is write down what is known and what is asked. Then, students firstly search the radius by writing the formula around the base of the tube. After the radius is known, then the surface area of the tube is searched.

##### Question 2.

A sardine can has a volume of  $1584 \text{ cm}^3$  and radius of 6 cm. If of the can is filled with seasoning, What is the height of the can not filled with seasoning?

To solve the question, the first step that students must do is write down what is known and what is asked. Then, students firstly search the height of the tube by writing down the volume formula of the tube. After the tube volume is known, then the height of the seasoning is searched with the formula of  $\frac{1}{4} \times V \text{ tabung}$ . If the height of the seasoning is already known, then the height of the can not filled with seasoning can be found by reducing the height of the can.

##### Question 3.

A carton has a volume of  $19250 \text{ cm}^3$ . The carton will be filled with cans with diameter of 7 cm and height of

10 cm. How many cans can be included in the carton?

To answer the question, the first step that students must do is write down what is known and what is asked. Then, students search the can volume first by writing the tube volume formula. After the volume of cans is known, then the number of cans can be found by writing the formula for the volume of carton divided by the volume of cans.

#### B. Arithmetic Material (Profit)

The arithmetic material (earnings) obtained in this study can be used as teaching material in the form of test kit in the elementary level. The questions to be made are regarding the profits related to the price of sardines that exist in the environment around students so that learning can be more fun and closer to the students' daily lives. The following is the example of arithmetic material (profit) test kit.

##### Question 4.

Mrs. Nurul bought 50 cans of sardines directly from the manufacturer. The price of one can of sardines is IDR 13,000.00. Mrs. Nurul will resell the sardines at a retail with price of IDR 15,500.00 per can. How much profit does Mrs. Nurul get if all the sardines can be sold out?

To answer the question, the first step that students must do is write down what is known and what is asked. Then, students search the capital first expended by Mrs. Nurul. Then, the students calculate the profit gained by Mrs. Nurul with the formula: the money gained minus the capital spent by Mrs. Nurul.

### 4. CONCLUSION

Ethnomathematics in the process of sardines canning at CV. Pacific Harvest is found in the form of sardine cans in the form of cuboid and tubes. Ethnomathematics related to mathematical concepts is found when determining the comparison of material compositions. The comparison is 50% fish and 50% seasonings and water. Ethnomathematics in counting activities occur when determining the diameter of a can. The mathematical model used is by making a can code to find out the name of the can and the net weight of the can.

It is to make elementary school mathematics teaching material in the form of test kit with the topic of ethnomathematics in the process of sardines canning at CV. Pacific Harvest Muncar, Banyuwangi. The questions made include the subject of sardines canning, comparisons, and canned sardines prices.

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