Ethnomathematics of Tumpeng and Banyuwangi Tumpeng Sewu

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ABSTRACT

Mathematics is very closely related to the habits that exist in society. The habits that exist in society can be called a culture. The concept or aspect of mathematics related to culture is called ethnomathematics. Ethnomathematics can also be used as teaching materials that can attract students’ interest in mathematics, because students will find it easier to learn science that is directly related to real life. Thus, ethnomathematics is very important in mathematics learning activities so students can learn between mathematics and culture, and know the cultural activities that exist in the surrounding community. In this study, the ethnomathematics of the tumpeng and the Tumpeng Sewu Banyuwangi ritual, which is one of the cultures in Indonesia, will be described as well as utilizing the results of their research into ethnomathematic Students’ Worksheets (LKS). Ethnomathematics obtained are activities of counting, counting, and measuring, as well as some mathematical concepts such as algebra, arithmetic, and geometry.

Key Words: Ethnomathematics; Tumpeng Sewu Rituals; Students’ Worksheets

INTRODUCTION

Mathematics is a source of other sciences [1][2][3]. Mathematics is formed from human experience which is processed in ratios, processed in analysis with reasoning in cognitive structures so that mathematical concepts are formed [3]. Education and culture are closely related, so it is possible to make culture one of the sources of teaching materials in learning [4][5]. Similarly, mathematics and culture have a very close relationship with life [6][7].
The mathematical elements that are contained or practiced among cultural groups are called ethnomatatics [8]. Thus, ethnomathematics can be used as learning so that it can facilitate students in understanding mathematical material because it is directly related to real life [9][10]. Therefore mathematics learning should link elements of culture and everyday experience [11][12].

One of the cultures in Indonesia is the Tumpeng Sewu Banyuwangi ritual. The ritual of Banyuwangi Tumpeng Sewu is a village clean salvation which is held once a year every first week of the month of Hajj [13][14]. The *tumpeng* is rice in the form of a cone with a typical side dish, *pecel pithik* (grilled chicken wrapped in grated coconut which has the meaning of instructions to serve the Creator, besides the obligation to love fellow human beings in the natural environment [15].

This research is a type of descriptive research with a qualitative approach. The research area is in Kemiren Village, Glagah Subdistrict, Banyuwangi Regency which is the place for the Tumpeng Sewu Banyuwangi ritual. Data collection methods used are the method of observation, interviews, and documentation.

In this study the ethnomathematics of the *tumpeng* and the Tumpeng Sewu Banyuwangi ritual which included the concepts of algebra, arithmetic, and geometry, as well as mathematical activities such as counting/measuring, and measuring contained in the ritual. Then, the data that has been obtained regarding ethnomathematics on the *tumpeng* and the Tumpeng Sewu ritual are made LKS regarding the research. Students’ Worksheets that have been created, are intended for class IX which are based on KI and KD which are contained in the syllabus of the Ministry of Education and Culture in the revised 2013 curriculum in 2017.

**METHODOLOGY**

This research is a type of descriptive research with a qualitative approach. In this study, the ethnomathematics of the tumpeng and the Tumpeng Sewu Banyuwangi ritual will be described. The research area is in Kemiren Village, Glagah Subdistrict, Banyuwangi Regency which is the place for the Tumpeng Sewu Banyuwangi ritual. Data collection methods used are the method of observation, interviews, and documentation. Observations were carried out by 3 observers. Interviews were conducted on 3 speakers, namely the traditional leaders of Kemiren Village as the first subject, Banyuwangi cultural observer as the second subject, and tumpeng maker as the third subject. Documentation was obtained from the Kemiren Village office and other sources. Data that has been obtained regarding ethnomathematics on tumpeng and Tumpeng Sewu rituals will be analyzed, then LKS will be made regarding the research.

**RESULT AND DISCUSSION**

Based on the results of the research that has been done, data obtained on the *tumpeng* and the Tumpeng Sewu ritual contain elements of mathematics. Some elements of mathematics obtained are related to branches of mathematics in algebra,
arithmetic, and geometry. In addition, there are also mathematical activities which are counting and measuring when making *tumpeng* in the ritual of Tumpeng Sewu Banyuwangi.

1) Counting Activities

Counting activities occur in several observations that have been made. Counting activities occurred when observing the needs of the materials used for making *tumpeng* and *pecel pithik*, determining the costs needed for making *tumpeng* and *pecel pithik*, many *tumpeng* served, lots of torches, and portions for one *tumpeng* package in the Banyuwangi Tumpeng Sewu ritual.

In observing the material needed for making *tumpeng* and *pecel pithik*, mathematical activities were carried out in determining the many ingredients needed for making *tumpeng*, namely the activity when mentioning many ingredients such as *satu kilo nasi* means 1 kg of rice, *telung sewur* means 3 scoops, *sak sendok* means 1 tablespoon, *dua bungkus* means 2 small plastic wrap. Observation of the material used for making *tumpeng* and *pecel pithik* is when measuring rice with coconut shells. The dosage for one coconut shell peres is 1 kg of rice, so if more than one peres then the quantity of rice is also more than 1 kg. In addition, the activity shows the concept of comparative mathematics, namely 1:1 for every 1 kg of rice with 1 coconut shell. Mathematical activity also occurs when comparing the quantity of rice with water used to cook rice. If using 1 kg of rice, 3 scoops of water are needed, so that it has a ratio of 1:3 for every 1 kg of rice with 3 scoops water. But if you use 1 kg more rice, use 3.5 scoops. This means that the possibility of rice for 3.5 scoops is $x = \frac{1}{3} \times 3.5; x = 1.167$. Another activity of counting is when determining how many coconuts are used for 1 native chicken. The first subject stated that for 1 native chicken can use 1 large size coconut or 2 smaller size (medium) coconuts, while the third subject stated for 1 free-range chicken to use 3 smaller coconuts or 2 larger (medium) coconuts. In this observation, the second subject did not mention the matter of calculating the many coconuts needed. From the statement, it can be seen that 1 large size of coconut is comparable to 2 medium-sized coconuts, and 2 medium-sized coconuts are comparable to 3 small-size coconuts. This shows a ratio of 1:2:3 with a scale of 1 showing large size coconut, scale 2 shows medium size coconut, and scale 3 shows small size coconut.

Counting activities also exist in determining the costs needed for making *tumpeng* and *pecel pithik*. The mathematical activity that is carried out is when the *tumpeng* maker mentions the price for materials needed such as 2,000; 2,500 and 11,000. The *tumpeng* maker (third subject) also mentions several price numbers in Osing language, ewu, which means 6,000 when the third subject mentions the price of coconut, *sangang ewu* which means 9,000, and *sepuluh ewu* which means 10,000 when mentioning the kinds of rice prices. In this observation, the *tumpeng* maker also mentions the price of 2 packs of peanuts, which is IDR 2,000,00; so for the price of 1 packet of peanuts, namely: $\frac{2000}{2} = 1000$. For the price of 2 candlenut packs, which is
IDR 2,500.00; so the price of 1 packet of candlenut is: \( \frac{2500}{2} = 1250 \). For the price of 1 small coconut, which is IDR 1,500.00; so the price of 3 small coconuts is: \( 3 \times 1500 = 4500 \). For the price of 1 kg of rice which is IDR 9,000; IDR 10,000.00; or IDR 11,000.00; so the price of 1.5 kg of rice is: \( 1.5 \times 9000 = 13500 \) or \( 1.5 \times 10000 = 15000 \) or \( 1.5 \times 11000 = 16500 \).

The next activity of counting is when determining a lot of *tumpeng* which is presented in the ritual of Tumpeng Sewu Banyuwangi. The three research subjects used a benchmark of 1,000 for many *tumpeng* that was presented because the number was related to the name of the ritual, namely "Tumpeng Sewu" which means "Tumpeng Seribu". But a lot of *tumpeng* is actually not exactly 1,000 *tumpeng*. The activity of counting on this observation occurs when calculating a lot of *tumpeng* with the average of each KK in Kemiren Village making 5 *tumpeng*. Many families in Kemiren Village are 1,100 households. Thus, a lot of *tumpeng* if every KK makes 5 *tumpeng*, namely: \( 5 \times 1100 = 5500 \). These results indicate that many of the *tumpeng* served at the Tumpeng Sewu ritual are more than 1,000 *tumpeng*. Counting activities also occur when the third subject mentions a lot of *tumpeng* made by third subject family namely 2 made by the third subject, 2 made by the first daughter of the third subject, and 2 made by the daughter of the third subject, so \( 2 + 2 + 2 = 6 \) *tumpeng* made by third subject family.

The next activity is counting lots of torches during the Tumpeng Sewu Banyuwangi ritual. In this observation, the research subjects did not do the activity of counting directly. However, based on the answers from the first subject which stated that each *tumpeng* there is an oncor shows that many torches are the same as many *tumpeng*. This proves that many torches are comparable to many *tumpeng*.

The next activity of counting/ calculating is the observation of portions for one package of *tumpeng* in the ritual of Tumpeng Sewu Banyuwangi. Counting activities were carried out to find out the many *tumpeng* needed for some people with certain criteria for one portion of a *tumpeng* package. From the results of the interview, the first subject gave an example for the calculation of the criteria for the portion for one package of *tumpeng*, namely 5 people. If there are 30 people, then the *tumpeng* needed is \( 30 \div 5 = 6 \). So for 30 people with a portion of a package of 5 people *tumpeng*, it takes 6 *tumpeng*. If there are 50 people, then \( 50 \div 5 = 10 \), 10 *tumpeng* is needed. The second subject gives an example with the criteria for serving a package of *tumpeng*, which is 5-8 people. The second subject gave an example for over 100 people. In this case, the second subject does not give an example of the number clearly. It's just that the second subject stated that many of the *tumpeng* needed were around 15 *tumpeng*. Therefore, if there are 100 people, and there are 15 packages of *tumpeng*, then it is likely that \( 100 \div 15 = 6 \) is more than 10. So the portion for one package of *tumpeng* is 6-7 people. In this observation the two research subjects did not mention the exact answer because each person's portion was different. But both subjects use the same benchmark number, which is 5 people for one portion of a *tumpeng* package.
2) Measuring Activities

Activities measure that is related to the measuring instrument used to determine the length, width, height, time/amount, number/lot, and so on. Measuring activities occurred in observing the needs of materials used for making tumpeng and pecel pithik, a tool used for making tumpeng and pecel pithik, pedestal and lid tumpeng, containers used for tumpeng and pecel pithik, tumpeng in Tumpeng Sewu Banyuwangi ritual, torch, and arrangements to enjoy the tumpeng in the ritual of Tumpeng Sewu Banyuwangi.

The first measuring activity is in observing the ingredients used for making tumpeng and pecel pithik. This is related to the use of measuring instruments in measuring rice for tumpeng using kilograms or using coconut shell units, measuring a lot of water with units of sewur (scoop), measuring lots of candlenuts and peanuts in packs, measuring a lot of salt, brown sugar or sugar with tablespoons.

The next measuring activity is the observation of tools for making tumpeng and pecel pithik. In this case the measuring activity is when the tumpeng maker measures the dandang which will be used to cook tumpeng rice. Based on the results of the observations, the stand used was for the capacity of 1.5 kg of rice. So, the dandang size used by the tumpeng maker is based on the capacity of the rice to be cooked. The lower part of the dandang serves as a place to hold rice water, so if the dandang for the capacity of 1.5 kg of rice is used for 3 kg of rice, the dandang will not be enough to hold water. The shape of the dandang itself is like two cones that are cut and connected to each other at the intersection. Its top diameter is bigger than its lower diameter.

There are 4 kinds of dandang sizes obtained during the observation activity, namely the dandang with a capacity of 1 kg of rice; 1.5 kg; 3 kg; 5 kg. The size of the dandang with a capacity of 3 kg is almost the same as the dandang with a capacity of 1.5 kg. But the dandang with a capacity of 3 kg is thinner than the dandang with a capacity of 1.5 kg. From the four dandangs, the base on the dandang with a capacity of 1 kg and 1.5 kg is slightly convex, while the base on the dandang with a capacity of 3 kg and 5 kg is flat.

Figure 1. Dandang and Sketch of Dandang Shape

The next tool is kukusan. For kukusan, the tumpeng maker does not choose a certain size because kukusan has the same size. In general, kukusan has a height of 20 cm, and a diameter of 30 cm with a shape that resembles a tumpeng. From this size, it is estimated that kukusan can accommodate rice or rice with volume:
Figure 2. Kukusan

Kekep has a number of sizes such as dandang. However, the strength used by the tumpeng maker during the observation activity was medium size kekep.

Figure 3. Kekep

The next tool is coconut shell which is used to measure rice. The coconut shell used by the tumpeng maker during the observation was coconut shell with a size of 1 kg of rice. But according to the third subject, coconut shells used by Kemiren residents vary, generally with sizes for half a kilogram, or one kilogram. In this case, it cannot be concluded that the coconut shell used for dosing is a form of half a ball or half coconut shell, because when measurements are made on coconut shell for a dose of 1 kg, the depth for coconut shell is 11 cm, with a diameter of 15 cm.

Figure 4. Coconut Shell

The next tool is bamboo bow, which serves to cook or roast chicken. Measuring activity occurs when the first subject states that the bamboo bow is about 60 centimeters long which means 60 cm, and is about 2 centimeters, which means 2 cm for the pointed part. The first subject uses a bamboo bow length in centimeters. And based on the measurements from the researchers it was found that the length of the bamboo bow used by the tumpeng maker during the observation activity was 66 cm.

The next tool is the middle or commonly called the furnace. In the middle of this there is no specific measuring activity carried out. However, the size of the middle hole at the top is generally not too large, approximately not exceeding the diameter of the
*dandang* so the *dandang* does not fall. And for the shape of the middle itself that resembles a beam with 2 holes above, and 1 hole on the side.

Figure 5. Bengahan

The next tool is sewer to measure water. *Sewur* is generally not specific to the manufacture of *tumpeng*, because sewur used can be in the form of ordinary scoop. In the observation results, the sewage used by the *tumpeng* maker has a diameter of 14.5 cm, and a depth of 8 cm, while the length of the hand sewer is around 27 cm. This sewur used is rather like half a ball.

Figure 6. Sewur

Subsequent tools are also tools that are not specifically used for making *tumpeng* in the Tumpeng Sewu ritual, and their shapes and sizes vary such as knives for peeling coconuts, being able to knead pecel spices, and *keduk* to run rice molds and take rice *tumpeng*. The knife used is a large knife because the coconut skin is hard and thick. The intellect used is medium size with a circle shape.

Measuring activities are also found when placing the base and lid of the *tumpeng*. The pedestal and lid are used in the Tumpeng Sewu ritual in the form of a rectangular banana leaf with a size that is adjusted to a *tumpeng* and also a *tumpeng* container. If the container of a *tumpeng* is large, then the leaves used are also large, and vice versa.

Based on the results of the study, the container for *tumpeng* in the ritual of Tumpeng Sewu Banyuwangi varied. However, in this study, one of the containers of *tumpeng* in the Tumpeng Sewu ritual, which is bake, is discussed, because when making observations, the *tumpeng* maker uses a container in the form of bricks. The tent used by the *tumpeng* maker at the time of the observation was medium size. There are 3 kinds of sizes that are obtained, namely small, medium and large size.

*Kemarang* consists of 2 parts, namely the upper part which resembles a half ball, and the bottom is a blanket shaped tube.
The next observation is the rice *tumpeng* that is produced. The size for the *tumpeng* made must be adjusted to the size of the *tumpeng* container so that the diameter of the *tumpeng* does not exceed the diameter of the *tumpeng* container. Measurements for *tumpeng* in the observation activities are based on the amount of rice used for making *tumpeng*, which is 1.5 kg of rice. The *tumpeng* shape that is presented in the Tumpeng Sewu ritual is resembling a *tumpeng* shape. Following is the documentation of the form of a *tumpeng* during observation.

Measuring activities are also carried out for the manufacture of torches. One torch is one piece of bamboo with the small size of the upper part in the form of whole bamboo, while the lower part is in the form of bamboo which is divided into 4 equal parts. The bottom of the bamboo is a torch leg that is used to support the torch so that it can stand upright.

The position to enjoy *tumpeng* in the Tumpeng Sewu ritual is to sit in a circle or parallel into 2 rows (facing each other). For a circular sitting position, the number of people is adjusted to the portion of one package of *tumpeng*. If the portion for one package of *tumpeng* is 5 people, then one *tumpeng* is surrounded in a circle by 5 people extending along the road. For a parallel sitting position, it becomes 2 lines parallel to the opposite position along the road. Here is a sketch of the arrangement to enjoy the *tumpeng* in the ritual of Tumpeng Sewu Banyuwangi.

<table>
<thead>
<tr>
<th>Table 1. Sitting Position on Ritual Tumpeng Sewu Ritual</th>
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<tr>
<td><strong>Circle Position</strong></td>
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<td><img src="image1.png" alt="Circle Position" /></td>
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</table>
In this study, elements of mathematics that have been found are made into teaching materials in the form of Students’ Worksheets. This Students’ Worksheet raises the subject of constructing a curved side space whose arrangement refers to the mathematics syllabus in class IX, KI and KD of revised 2013 curriculum in 2017. The purpose of making LKS here is to introduce one of the cultures that exist in Indonesia, and make it easier for students to know and learn mathematics that related to real life. Students’ Worksheets (LKS) concerning building a curved side space (cone) along with the answer key regarding ethnomatematics on the cone can be seen and accessed on https://drive.google.com/drive/folders/11ziTD04SXYDseMSI-rvEPu7cR2jIWRUU.

CONCLUSION

Based on the results of data analysis and discussion, it can be concluded that there are elements and mathematical activities on the tumpeng and rituals of Tumpeng Sewu Banyuwangi. The obtained ethnomathematics is the activity of counting, and measuring. Counting activities occur when observing the needs of the materials used for making tumpeng and pecel pithik, determining the costs needed for making tumpeng and pecel pithik, many tumpeng served, lots of torches, and portions for one tumpeng package in the Banyuwangi Tumpeng Sewu ritual. Measuring activities occurred in observing the needs of materials used for making tumpeng and pecel pithik, a tool used for making tumpeng and pecel pithik, pedestal and lid tumpeng, containers used for tumpeng and pecel pithik, tumpeng in Tumpeng Sewu Banyuwangi ritual, torch on ritual Tumpeng Sewu Banyuwangi, and sitting position to enjoy the tumpeng in the ritual of Tumpeng Sewu Banyuwangi. In addition, some forms of tools used, as well as the results of the tumpeng served at Tumpeng Sewu Banyuwangi also have mathematical concepts such as mid form, cormorant, machete, and tumpeng shape. The concepts and elements of mathematics that have been found are used as Students’ Worksheets, especially for class IX with material building tumpeng. The material was considered for the main focus of this research, tumpeng-shaped tumpeng. Preparation of Worksheets Students in the material to construct curved side spaces are based on the mathematics syllabus in class IX of the revised 2013 curriculum in 2017.
REFERENCES


