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INTRODUCING STANDARD UNIT OF VOLUME MEASUREMENT WITH ETHNOMATHEMATICS FOR ELEMENTARY SCHOOL STUDENTS

Ernawati
Yogyakarta State University, Yogyakarta, Indonesia
ernawati.ysu@gmail.com

Kurniawati
Yogyakarta State University, Yogyakarta, Indonesia
kurnia.beeateng@gmail.com

Abstract

Apperception is the main part of the learning process. It brings students to the good condition to be ready to learn something new. Meanwhile, ethnomathematics is one of the learning methods combining math with culture. It is one of learning based on contextual which is culture as the context. It can be included to make a good apperception for students. Therefore, this research aimed to present how to use ethnomathematics in the learning process in order to bridge elementary students in understanding units of measurement. This research includes as descriptive research to find ethnomathematics in the unit of measurement and how to use it in the learning process. The population of this study was areas in Central Java, whereas the research samples were randomly selected areas that represent the population. Data collection was conducted by interview method. Then, the data found were analyzed. The selected analytical

technique is a descriptive analysis describing the units used by society in measuring the volume of certain objects. The form of ethnomathematics found in Central Java is a community activity that uses several terms to give a unit of measure of volume to a particular object. These terms can be used in learning mathematics, especially in apperception, with the aim of presenting the mathematical context that is appropriate to everyday life.

Keywords

Ethnomathematics, Apperception, Volume, Unit of measurement, Elementary School Student

1. Introduction

Mathematics is an important basis of knowledge, especially in the mastery of science and technology. It is one of the compulsory subjects that is taught from elementary to upper secondary school in Indonesia. Since mathematics is a science related to abstract concepts, mathematics for children is different from mathematics for adults. This distinction arises because of children and adults have unequal cognitive development. Hence, they have the different ability to understand mathematics.

The age of the children who involve in elementary school students is between 7-12 years. According to the Cognitive Development Theory from Piaget, children in this age range included in the category of operational concrete for their cognitive development. At this stage, children are able to use their logical thinking ability, but it is limited to the concrete objects. This is contrary to the nature of mathematics that has abstract concepts. Therefore, teachers should be able to bridge students to be able to understand mathematics by providing learning that is appropriate for the stages of cognitive development of students.

Meanwhile, in the beginning of learning process, the teacher should be able to make an apperception. According to Mansur HR (2015) apperception is the main part of introduction in the learning process where alfa condition created. This condition is the best condition for students to learn because, in this phase, the neuron is in the balance condition. Therefore, they can be more prepared to receive the new material. One of the apperception activity can be a brief explanation to recall the children experience related to the material.

Ethnomathematics is one of the learning methods combining math with culture. It is one of learning based on contextual which is culture as the context. Ethnomathematics can be one of the learning methods used to bridge students in understanding mathematical concepts. In the

other words, with ethnomathematics, the teacher can provide the previous experience that students already have in order to make their psychic ready to learn the new concept.

Meanwhile, in elementary school, students have been introduced to the standard unit of measurement. One of it is the volume measurement unit. While, the Javanese people, especially Central Java people also have terms used to determine the unit of volume. Since these units come from the community that has been used frequently, surely the mention of these terms is familiar to the students. Therefore, this can be the context used by teachers to create an appropriate apperception to introduce the International unit of measurement for volumes to their students. In sum, this research objective is finding ethnomathematics in the unit of measurement and how to use it in the learning process, especially in apperception.

2. Literature Review

Each student has different characteristics and ways of learning. Therefore, the role of teachers as facilitators is very important to support the success of students' learning. Teachers should be able to choose the right method so that they can facilitate their heterogeneous students. The factors causing heterogeneity of students are because they come from differences in age, culture, academic ability, student cognitive development and so on.

In the learning process, cognitive development becomes one thing that must be considered by teachers. Given that mathematics is a science that contains abstract concepts. So, the teacher should be able to anticipate this situation in order to make their students accurately understand the concepts of mathematics. Just as elementary students who learn math, because of their cognitive development is still on the operational concrete phase, the teachers need to present the learning using media. This is emphasized by Yvette d'Entremont (2015), who says that since we have no direct way to be in touch with the thought process of someone, we must use the method, whether visual or auditory, to communicate. Therefore, the cognitive development of students becomes a consideration for teachers to choose the appropriate method or mathematical learning strategy for their students.

The use of learning aid is one of the learning methods that teachers can use. By using it, the teacher can present the context relating to the material that is being taught. The main function of learning aids is to reduce the abstractness of the mathematics concept so that children are able to grasp the true meaning of the concept being taught (Sukayati & Suharjana, 2009). Thus, using

the learning aids can bridge students from concrete thinking stage to the abstract thinking stage and students tend to understand math concepts more easily.

In the other hand, the use of contexts creates an opportunity for teachers to integrate mathematics with other disciplines such as social studies and art (Snipes & Moses, 2001). This is in accordance with the statement Wijaya, Heuvel-Panhuizen, Doorman, & Robitzsch (2014) stating that contexts are important levers for mathematics learning because they provide various opportunities for students to learn mathematics. Thus, the use of context in mathematics helps students to understand that mathematics is closely related to life. This is supported by Glorin in (Yusuf, Ibrahim Saidu, & Halliru, 2010), who states that mathematics is the human activity that deals with patterns, problem-solving, logical thinking, and so on, aiming to understand the world. This statement shows that abstract concepts in mathematics can be translated into real form in accordance with everyday life. It will be one motivation for students to perceive that mathematics has a great advantage in life as well as a part of their lives (Abi, 2016). By knowing the benefits of mathematics, students will find it is important to learn math. This awareness will foster motivation for students to learn math.

Meanwhile, Ethnomathematics is one of the learning methods that can be used in mathematics learning. The media used in ethnomathematics is culture. François (2009) said that ethnomathematics refers to the cultural diversity in mathematics education. According to Glorin and Ascher in (Yusuf, Ibrahim Saidu, & Halliru, 2010), ethnomathematics refers to the study of mathematical practices of specific cultural groups in the course of dealing with their environmental problems and activities. While M.Balamurungan (2015) explain about ethnomathematics as follows::

"Ethno refers to members of a group within a cultural environment identified by their cultural traditions, codes, symbols, myths, and specific ways used to reason and to infer. Mathema means to explain and understand the world in order to transcend, manage and cope with reality so that the members of the cultural groups can survive and thrive, and 'tics' refer to techniques such as counting, ordering, sorting, measuring, weighing, ciphering, classifying, inferring, and modeling."

Ethnomathematics can facilitate students in understanding the concept of mathematics with cultural context which is very close in everyday life. Thus, they do not need to imagine what they have not experienced before, instead of understanding something that they have engaged in (Abi, 2016).

According to Yvette d'Entremont (2015), it is important to link the cultural reality of the students to the learning of mathematics because using familiar objects and contexts to teach mathematics can facilitate learning. M.Balamurugan (2015) also said that ethnomathematics has a vital contribution to the society and school mathematics for the learning and further progress of the students. Meanwhile, in Indonesia, there are a lot of cultures that can be explored. Some of them contain mathematical elements. According to this, mathematics teachers should take the advantage of the cultural diversity of students to enhance the mathematics learning through cultural activities (Yvette d'Entremont, 2015). Therefore, actually, teachers in Indonesia have a great opportunity to create a contextual learning. Through ethnic and cultural background students can have the opportunity to learn mathematics in a meaningful and relevant context instead of relying on memorized algorithms (Yvette d'Entremont, 2015). *Making connections* among ideas is needed in learning mathematics with understanding; these connections are considered to facilitate the transfer of prior knowledge to novel situations (Stylianides & Stylianides, 2007). Apperception is one of the phase where the teacher can provide these connections to be engaged in the learning process.

3. The Research Methodology

This research includes as descriptive research which aimed to describe a phenomenon that occurs in a particular region and how to use it in the learning process. The population of this study was areas in Central Java, whereas the research samples were randomly selected areas. Data collection was conducted by interview method to the community in selected areas in Central Java that is representing the study population. Then, the data found were analyzed. The selected analytical technique is a descriptive analysis that is describing the units used by society in measuring the volume of certain objects.

4. Research Finding and Discussion

4.1 Research Finding

Based on the results of interviews with several speakers in several areas in Central Java, the researchers found a various term to say the unit measurements of volume. Each of it used to tell the volume of certain objects. Some units of volume found are as follows:

Table 4.1: *Research Finding*

No	Unit of Measurement	The Measured Object	Description
1	Sabathok	Rice	The volume of rice that is in one coconut shell (half coconut shell). Sabathok is approximately equivalent to 250 cc of rice (depending on the size of the coconut shell).
2	Sacandik	Oil	The volume of oil in a 200 ml.
3	Sacempluk	Rice	The volume of rice that is in a container of milk cans. In one can of milk about ¼ kg.
4	Sagayung	Oil	The amount of oil / water / rice / sand in the space formed by the container. The container is given a grasp or a handle to take / mencidhuk / terrier from oil / water / rice / sand which is estimated some sizes including 1L, 500 cc, and 250cc.
		Water	
		Rice	
		Sand	
5	Sagegem	Small fruit or small stuff	The sum of objects such as stones, money, small fruits that can be grasped by one fist. It is estimated that one hand has a size of 100 grams. Depending on the size of the hands of small children, adolescents, adults.
6	Sagelas	Water	The amount of water / oil / sand / sugar / milk / rice / flour in the room formed by glass, plastic, ceramic, aluminum or wood containers are generally cylindrical. It is estimated that water has a volume of 250 ml.
		Oil	
		Sugar	
		Milk	
		Rice	
		Wheat	
7	Sagembel	Bread	Small pieces of an object that uses the hand and the magnitude of less than half the objects in the form of units, such as bread 0.2 cm3
8	Sagendul	Water	The amount of liquid (water / soy / sauce / syrup) in the bottle.
		Sauce	
		Syrup	
			The size depends on the size and type of bottle, the unit used is liter.
9	Sagoni	a. Potato	The number of potatoes / cassava / other ingredients in the burlap sack, which is made of jute cloth. Depending on the size of the burlap, it is estimated ± 50 liters
		b. Coffee	
		c. Beans	

10	Sajedhing/ kulah	Water	The volume of water contained in kolah / bak. The size of the kolah varies, for example for bakmandi capacity 1 m3 (1000 liters), then for the pool also vary.
11	Sacawuk	Water Sand Sugar Rice	The amount of water / sand / soil / flour / sugar in the room formed by the curved palms with all the fingers docked. Estimated 5- 20 cc, according to the size of the palm of the hand: children / adolescents / adults.
12	Sakakap	Water	Shows the volume of water in a two-handed palm and curved container with fingers docked. The size is about 50 - 100 cc according to hand size.
13	Sakati	Rice	The amount of rice in the room is limited by an open container called kati. It is estimated that the volume of rice contained within the container is 0.5 kg.
14	Sakhendi	Water	The amount of water in the room formed by a container made of clay with two holes, one to enter the water and the other to remove water. It is estimated that the volume of water present in the pitcher is 0.6 L.
15	Sakendhil	a. Rice b. Water c. Food	The amount of water / rice / food in the traditional kendhil cookware room. Kendhil resembles a traditional pot, made of clay, and also there is made of aluminum alloy iron. Kendhil has many sizes and is often used for cooking rice (liwet) and as a food place like gudheg kendhil.
16	Saklenthing	Water	The amount of water in the space formed by a container made of clay resembles a kendil.
17	Sakubik	a. Wood b. Sand c. Soil d. Water	Volume of wood / sand / soil / water the size is estimated 1 m3.
18	Salayah	a. Sauce b. Vegetables c. Rice	Volume / contents of chilli / vegetables / rice contained on a cake / cobek that has a small size, medium, large.

19	Salumpang	Rice	The number of objects inside the concaved parabolic container. It is estimated to be about 1 liter, depending on the size of the diameter of the mortar.
	Sasak	a. Rice b. Cement	The size of the volume of rice / cement in a sack. It is estimated that 7500-10.000 cc or if weighed can reach 25 kg, 40 kg (cement), 50 kg.
20	Sataker	a. Rice b. Sugar c. Wheat	The size of the volume of rice / sugar / flour in a commonly used dosage container such as glass, basket, etc. Usually this dose container is used to measure the dosage of rice / sugar / flour before cooking.
21	Satambir	a. Rice b. Beans	The size of the volume of rice / beans / onions in a cylindrical chamber made of bamboo with a height of approximately 2 fingers of an adult. An estimated 3000-8000 cc depending on the diameter of the container.
22	Satampah	a. Rice b. Beans	The size of the volume of rice / beans / onions in a cylindrical chamber made of bamboo with a height of approximately 4 fingers of an adult. It is estimated to be 8-12 liters depending on the diameter of the container.
23	Sacinthung	Rice	The amount of sugar in the room formed by the arched rice bucket of rice usually made of plastic or wood. Estimated 5 - 15 cc. The amount is usually one palm of the child / adolescent.
24	Saebor	Water	Water volume measured using a scoop made of coconut shells. Estimated 1000 cc.
25	Saenthik	Oil	Volume dropped of oil. Estimated 1-3 cc.

4.2 Discussion

Some units that are used to measure the volume of certain objects above can help the teacher to present the appropriate context between the material to be taught with the mathematical activities that exist in everyday life. The provided context gives students the concrete language to convey their ideas to the other students (NCTM, 1989). Thereby, it helps

students to understand the main material. The use of ethnomathematics here is providing an apperception to the students so that they can get more understanding about the meaning of units of measurement.

This is an illustration how to use the units for making an apperception in the learning process. Before introducing the international units of volume, the teacher provides an experience about measuring something with a certain unit of measurement that is usually used by the student. For instance, the teacher might give the explanation as follow:

Teacher: "Do you ever asked by your mother to cook rice? Did she ever say to cook *sakendil* rice? Yes, *sakendil* is one of unit measurement to us to measure the quantity of the rice that we use in our everyday life."

This is one example that can be recalled by the teacher. The teacher can explore more experience with another unit of measurement like the following.

Teacher: "Or, do you ever looked your father bought sand to renovate your house? Did he ever say that he bought *sakubik* sand? This also the example for measuring something especially, to measure the quantity of sand."

Teacher: "Well, *sakendil* and *sakubik* are two examples how to measure something in our everyday life. But, not all the regions use these units. Therefore, we have to know about how to measure something in *general* unit of measurement. So, we have an international unit to measure volume as well. So today, we are going to learn about the international units of measurement that have the main idea as the same as the units that usually we use."

The conversation above is just the example for apperception that might be used. The teacher can choose the other units to make another variety example. So that, the experience of the student can be recalled in order to make them more straightforward to understand the meaning of using units of measurement, especially in the International standard.

5. Conclusion

Indonesia has great potential to harness the diversity of its culture as an effort to present ethnomathematics-based learning to students. One form of ethnomathematics found in Central Java is a community activity that uses several terms to give a unit of measure of volume to a particular object. These terms can be used in learning mathematics with the aim of presenting the

mathematical context or providing the apperception that is appropriate to everyday life. One way to engage these term in the learning process is using them in apperception phase.

This research is limited to the use of ethnomathematics in providing an apperception for learning the unit of measurement material, considering that apperception is one of the important things in the learning process. For the future implementation, the teacher coming from the different region can explore their own term about how to measure something, because it will be different considering of the multicultural that every region has.

References

Abi, A. M. (2016). Integrasi Etnomatematika Dalam Kurikulum Matematika Sekolah. *Jurnal Pendidikan Matematika Indonesia*, 1-6.

François, K. (2009). The Role of Ethnomathematics within Mathematics Education. *Proceedings of CERME 6* (pp. 1517-1526). Lyon France: INRP 2010.

Mansur HR. (2015, February). *Menciptakan Pembelajaran Efektif melalui Apersepsi.* Retrieved from LPMP Sulsel: http://www.lpmpsulsel.net/v2/index.php?option=com_content&view=article&id=327:pembelajaran-efektif-

M.Balamurugan. (2015). Ethnomathematics; An Approach For Learning Mathematics From Multicultural Perspectives. *International Journal Of Modern Research And Reviews*, 716-720.

NCTM. (1989). *Curriculum and Evaluation Standards for School Mathematics.*

Snipes, V., & Moses, P. (2001). *Linking Mathematics and Culture to Teach Geometry Concepts*. Retrieved from Semantic Scholar: https://www.semanticscholar.org/paper/Linking-Mathematics-and-Culture-to-Teach-Geometry-Snipes/de16ae98aa72c9eef916e40f2e91dd17deb5a179

Stylianides, A. J., & Stylianides, G. J. (2007). Learning Mathematics with Understanding: A Critical Consideration of the Learning Principle in the Principles and Standards for School Mathematics. *The Mathematics Enthusiast*, 103-114.

Sukayati, & Suharjana, A. (2009). *Pemanfaatan Alat Peraga Matematika Dalam Pembelajaran Di Sd.* Yogyakarta: PPPPTK Matematika Yogyakarta.

Wijaya, A., Heuvel-Panhuizen, M., Doorman, M., & Robitzsch, A. (2014). Difficulties in solving context-based PISA mathematics tasks: An analysis of students' errors. *The Mathematics Enthusiast*, 555-584.

Yusuf, M. W., Ibrahim Saidu, I., & Halliru, A. (2010). ETHNOMATHEMATICS (A Mathematical Game in Hausa Culture). *International Journal of Mathematical Science Education*, 36-42.

Yvette d'Entremont, Y. (2015). Linking mathematics, culture and community. *Procedia - Social and Behavioral Sciences*, 2818 – 2824.

ATTACHMENT

Figure 1. Sabathok

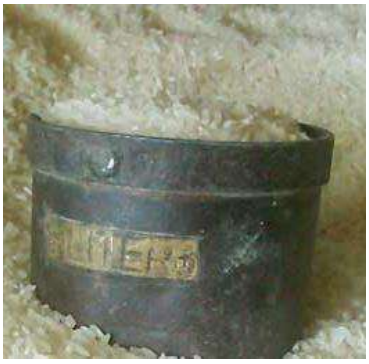

Figure 2. Sacempluk

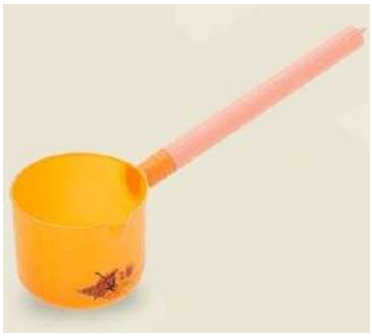

Figure 3. Sagayung

Figure 4. Sagegem

Figure 5. Saebor

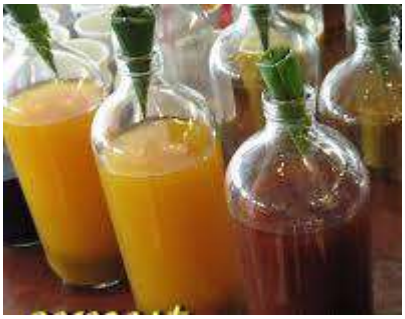

Figure 6. Sagendul

Figure 7. Sagoni

Figure 8. Sakakap

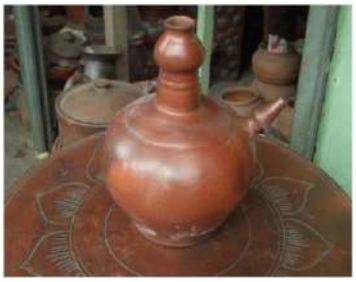

Figure 9. Sakhendi

Figure 10. Sakendhil

Figure 11. Salayah

Figure 12. Salumpang

Figure 13. Satambir

Figure 14. Satampah