Ethnomathematics Exploration on Culture of Kudus City and Its Relation to Junior High School Geometry Concept

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Abstract

Mathematics is the result of human culture as a result of activities, making patterns, designing, calculating, and applying to solve problems in everyday life.Many mathematical concepts become easier for students to understand by bringing the concept to the real world.One of the ideas is ethnomatematics, the mathematical concept embedded in activities carried out in learning must incorporate cultural elements such as daily activities, cultural heritage, regional arts, traditional games, traditional foods, which is a human activity.This study aims to describe the culture of Kudus that containing junior high school geometric concepts.The results of this study are many results of Kudus culture that can be associated with the concepts of junior high school geometry such as the roof of the traditional house of Kudus, Sunan Kudus mosque tower, Awug-awug cake, etc.

Keywords: *exploration, ethnomathematics, kudus culture*

1. INTRODUCTION

Mathematics is one branch of science that is closely related to human life. According to Hudojo (2003), mathematics is a tool for developing ways of thinking, abstract, the reasoning is deductive and related to the structured idea and the relationships are logically arranged. Geometry is one branch of the field of mathematics study, it is very important to learn because geometry many Applied to everyday life. Basically geometric material has greater potential for students to understand because students have been familiar with basic geometry ideas before entering the school world, but geometry learning is still a problem in school. Prabowo & Ristiani (2011) state that problems related to geometry in schools are caused by the abstraction of high geometric objects and the ability to visualize abstract objects is still low. One way that can be done to overcome this is by using real objects. Mariani et al (2014) states that learning PBL-assisted mathematics pop-up books effective against the spatial ability of students of class VIII on the material geometry.

Culture is human activity that includes knowledge, belief, art, morals, law, and customs (Taylor in Pidarta, 2009). Mathematics is the result of human culture as a result of activities, making patterns, designing, calculating, and applying to solve problems in everyday life. Ethnomathematics is a mathematical knowledge based on local culture (Sardjiyo, 2005). The existence of ethnomathematics is often not realized by the community of its users. This is because etnomatematics is often seen more simply than the formal form of mathematics found in schools. Ethnomathematics have the potential to help students feel welcome, become more accepting of others, and fight racism (Brandit and Chernoff, 2014). Abiam et al (2016) argues that the ethnomathematical approach is not only more effective and superior than conventional approaches, but also can increase instructional acceptance on elementary school geometry materials. Kerumeh, et.al (2012) research results are the use of the ethnomathematic approach A higher retention rate for students in statistics than those taught by conventional methods. Khayriah, et al (2010) states that in learning through

lesson with ethnomatematic exercise of high school students in the Arab region in Israel shows the building up of geometry and discovering these characteristics as a meaningful and enjoyable learning experience. Students who use ETA are better in outcomes and retention than students using conventional learning methods (Emmanuel, et al, 2009). Kudus city has many cultural results that can be used as a bridge for students in the visualization of geometry objects. Based on the above description of the researchers considered need to be carried out an exploration of the form of ethnomathematics in Kudus city and its relation to the concept of junior high school geometry.

Realistic Mathematical Approach

A realistic approach to mathematics learning, looking at mathematics as a human activity. According to Gravemeijer (1994) the approach has five characteristics, namely: (1) the use of context according to life, (2) the use of learning models, (3) the use of constructs of the students themselves, (4) the interactive teaching process, between topics or subjects. Realistic mathematical learning begins with contextual problems, furthermore contextual issues are outlined so that the mathematical elements contained therein can be recognized. Through the introduction of the elements of mathematics in it, students can translate it into their own mathematical model, so students can use math to solve problems (Suherman, 2003).

Characteristics of the realistic approach according to Sembiring (2010) include: (1) students are more actively thinking, (2) context and teaching materials directly related to school and student environment, (3) teacher role more active in designing teaching materials and class activities.

The principles of realistic approach according to Suherman (2003) are (1) dominated by the problems of context, ie as a source and as an applied mathematical concept; (2) the development of models, situations, schemes and symbols (3) student contributions so that students can make learning constructive and productive and guide students from the level of informal mathematics to formal mathematics; (4) the existence of an interactive characteristic of the learning process of mathematics; (5) creating links between topics or between subjects.

The framework of learning mathematics with realistic approach has advantages, such as guiding students from concrete circumstances and using the real world as a starting point in the development of math concepts and ideas. Through a realistic approach, students are given tasks that are close to reality so that students will expand their life world. According to Traffers and Goffree in (Suherman, 2003) that the contextual problem in the realistic curriculum has functions: (1) concept formation; (2) modeling; (3) absorption; (4) specific practices and exercises in applied situations.

Culture

The word "culture" comes from the term *buddhayah* (Sanskrit), the plural form of *buddhi* meaning "mind" or "reason" (Koentjaraningrat, 1985). So that culture can be interpreted as matters relating to reason. While the word culture is pared as a development of the cultivated form of *budi*-daya, which means "power of the mind" in the form of cipta, karsa and rasa, while culture is the result of creation, intention and taste. However, in terms of cultural anthropology, the distinction is eliminated. The word culture is used as an abbreviation of culture with the same meaning.

Culture is a human activity that includes knowledge, belief, art, morals, law, and customs (Taylor in Pidarta, 2009). While according to anthropology, culture is the whole system of ideas, actions, and human works in the framework of community life Made man's self by learning. (Koentjaraningrat, 1985). It means that almost all human activity is a culture or culture because there is very little human action in the framework of community life that does not require learning to familiarize it. While cultural historians interpret culture as a legacy or tradition of a society.

Koentjaraningrat (1985) argues there are three kinds of the form of culture, namely 1) as complex ideas, ideas, values, norms, regulations, and so on; 2) as a complex of activity as well as the patterned actions of humans in society; And 3) as objects of human works. As for facilitating discussion, culture is divided into seven elements that can be found in all nations of the world, including:

1. Language, with the form of communication science and literature covering regional languages, poetry, novels, and so forth.

2. Knowledge system, including science (exact sciences) and humanities (literature, philosophy, history, etc.).
3. Social organization, such as ceremonies (birth, marriage, death).
4. Living equipment systems and technology, including clothing, food, ceremonial equipment, and other technological advances.
5. Living livelihood system.
6. Religious systems, both belief systems, and ideas about God, gods, spirits, hell, heaven, as well as ceremonies and sacred objects and religious objects (temples and ancestral statues) and others.
7. Art, can be art (painting), performing arts (dance, music,) theater arts (puppet), architectural art (houses, buildings, boats, temples, etc.), in the form of beautiful objects, or other crafts .

Ethnomathematics

Culture is closely related to society. According to Rosa (2011) the teaching of mathematics by linking culture and personal experience helps the students to know more about reality, culture, society, environmental issues, and themselves.

Mathematics itself is the result of human culture as a result of activities, make patterns, design, calculate and implement to solve problems in everyday life. According to Ilhan (2011) ethnomatematical perspectives are aware of and accept from cultural conventions including language, social and ideological environment for learning mathematics, it considers mathematical education a strong structure that helps students and teachers to personal, social, economic, and personal criticism and transformation other cultural patterns.

Ethnomatics is one of the new ideas that can answer the above problems. Ethnomatematics one of the ideas combines the learning of mathematics with culture, so that will create meaningful learning and understanding of students will be more leverage. New mathematical concepts both inside and outside school are cultural elements that are used as sources of learning, including works, games, posters, mathematical puzzles and building forms (Shirley and Towson, 2001). Ethnomatematics has long been introduced by Brazilian educator Ubiratan D'ambroso in 1977, the language of the prefix "ethno" is defined as something very broad that refers to the social-cultural context, including language, jargon, codes of behavior, myths, and symbols. The basic word "mathema" tends to mean explaining, knowing, understanding, and performing activities such as coding, measuring, classifying, summarizing, and modeling. The suffix "tics" is derived from techne, and it has the same means of technique.

2. METHOD

This research was a kind of research and development. This research developed a guidebook of integrated character education in the subject matters. The procedures used to develop the guidebook were described by Borg and Gall (1983). There were six stages that had been done, such as:

Stage 1: *research and data collection***:** some activities conducted in this stage were analysing the problems found in character education, identifying a successful character education in Denmark and Indonesia, and assisting character education teaching.

Stage 2: *planning*: some activities conducted in this stage were finding references for the guidebook, determining the subjects, purpose, and component of the guidebook both in Denmark and Indonesia.

Stage 3: *develop the initial product*:   some activities conducted in this stage were preparing the first draft of the guidebook and teaching instrument.

Stage 4: *initial try out:* some activities conducted in this stage were analyzing the validity of the guidebook draft and teaching instrument. The analysis of validity was carried out by some experts.

Stage 5: *main product revision***:** some activities conducted in this stage were revising the first draft and teaching instrument. The product of the first revision was the second draft of guidebook and a valid teaching instrument.

Stage 6: *main try out:* an activity conducted in this stage was trying out the second draft to some teachers to determine its practicality.

In the first year, focus research in stage 1. Research location in Kudus City Central Java Province, Indonesia. Location of Kudus City is 110 ^{o} 36 'east longitude and 110° 50' east longitude and between 6 ^{o} 51 'and 7° 16' SL. Area of 42,516 Ha. The longest distance from west to east along 16 km and from north to south along 22 km.

The name of the Kudus city can not be separated from the story of Sheikh Ja'far Shodiq. After returning from Palestine, Sheikh Ja'far Shoddiq established a mosque in Kudus in 1956 H or 1548 AD Originally named Al Manar or Al Aqsa Mosque, imitating the name of a mosque in Jerusalem called Al Aqsho Mosque. The city of Jerusalem is also called Baitul Maqdis or Al-Quds. From the word Al-Quds is then born the word Kudus, which is then used for the name of the Kudus city now. Before the entry of Islam to the Kudus city, the majority of the inhabitants of Kudus are Hindus. Along with the entry of the religion of Islam occurs acculturation between Hindu and Islamic culture. One of the acculturation results can be seen in the Kudus tower. The shape of the Kudus tower is very interesting to examine since the parts of the tower resemble form related to the junior geometry. In addition to the Kudus tower, the Kudus City has cultural results that need to be excavated because in the cultural results contained mathematical concepts that can used to help understanding the concept of mathematics in learning.

3. RESULT AND DISCUSSION

Flat Geometry

1. Caping Kalo
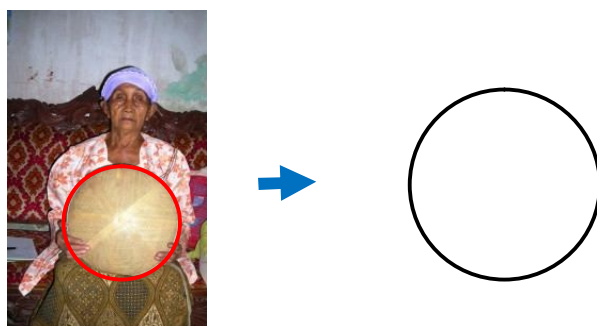
Caping Kalo is part of traditional clothing of Kudus used by women. *Caping Kalo* in the form of a circle symbolizes that every human must mandatory self and unanimously to the Creator, Allah Almighty, Caping Kalo symbolize humans to be able to close the ear (*nacapi kuping*) Against negative voices that are detrimental to life. A circle-like Caping Shape can be used to introduce students to the concept of a circle.

2. Kudus Tower
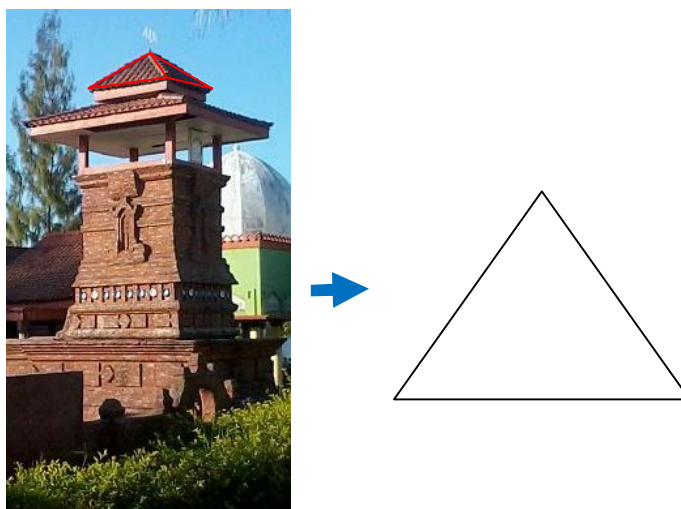
The Kudus tower is a relic of Sheikh Ja'far Shodiq or better known as Sunan Kudus, he is one of the *wali songo*. The main function of the Kudus tower is to *adzan*. The roof of the Kudus tower form four triangles. The shape of this roof can help in explaining the concept of a triangle.

3. Cungkup Sunan Kudus Tomb
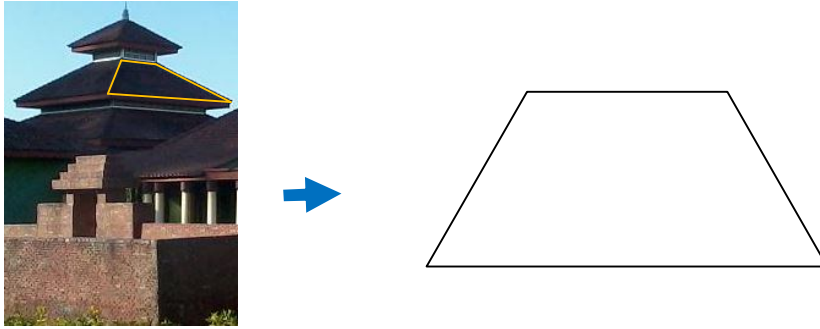
The Cungkup of Sunan Kudus tomb has a distinctive Hindu architecture. The roof of this building was built at levels. The upper part is a quadrilateral pyramid with four triangles as the upright side. If you note, the second and third level roofs each consisting of four isosceles trapezoid.

4. Jenang Kudus
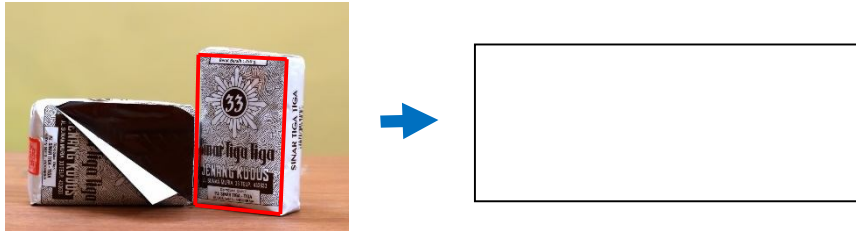
Jenang is a kind of food made from rice flour and sugar. The origin of jenang Kudus begins from the story of the Syeh Jangkukng who tells the mothers in the area of Kaliputu to make "gamping" porridge to save the grandson of one of the residents. One of the jenang Kudus presentations is packed using paper in cuboid form. Each side of the cuboid is a rectangle.
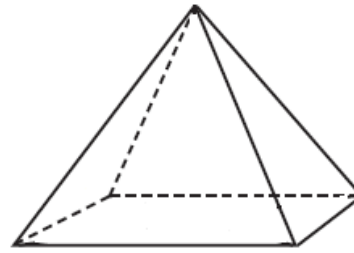
5. Gentong Well

Gentong well were discovered by sand diggers in 1989 in the village of Loram Wetan. The uniqueness of this well is the well is made of four pieces of water tubs made of soil. The lips of this gentong well are circular with a circumference of 188 cm and diameter 60 cm.
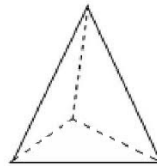
Space Geometry

1. Cungkup of Sunan Kudus Tomb

Cungkup of Sunan Kudus Tomb is located not far from the Kudus Tower. This Cungkup is built on the tomb of Sunan Kudus in order to protect the pilgrims from the heat and rain. A hindu-style hideous building with a tiled roof. The top of the roof is a rectangular pyramid.

2. Awug-awug

Awug-awug is one of the traditional cakes of the Kudus city. This cake is based on glutinous flour and coconut with red sugar stuffing when we bite it. Awug-awug cake is usually served on the custom event. This cake is wrapped using banana leaves and formed into a triangular pyramid.

3. Puli Cake
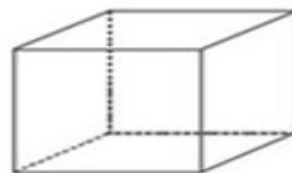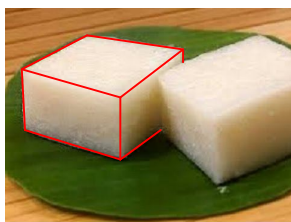
Puli cake is a typical cake based rice. Usually the pulleys are served together with Apem cakes at the "Ruwahan" event held every 15th of Sha'ban month. Puli and apem are usually eaten using palm sugar sauce and coconut milk. In Puli presentation is usually presented in the form of blocks so this cake can be used to explain the concept of Cuboid.

4. Joglo Kudus House
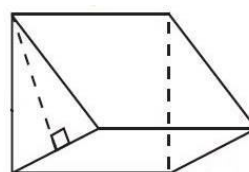
Traditional house of Kudus Joglo shaped. In general, the traditional house of Kudus has a section called "pawon". For the people of Kudus pawon is a place to cook and also become a dining room. Different from the main part of Kudus house, this pawon roof looks front and rear like triangle. Overall this pawon roof is triangular prism look liked.

4. CONCLUSIONS

Based on the results of research and discussion that have been described previously, it can be concluded that the Kudus society has unconsciously applied mathematical knowledge in their daily lives. This ethnomatmatically charged community activity can be developed as a learning resource for school math. Concepts that have been used by the Kudus society include the concept of flat geometry and space geometry. The concept of flat geometry includes: the circle contained in Caping Kalo, the triangle contained on the roof of the Tower of the Kudus, the trapezoid contained on the roof of the *cungkup* of the Sunan Kudus tomb, the rectangle contained in the Jenang Kudus, the circle contained in the Gentong well. Concept space geometry includes: a quadrilateral pyramid contained on the *cungkup* of the Sunan Kudus tomb, the triangular pyramid contained in the Awug-awug cake, the cuboid contained in the Puli cake, and the triangular prism contained on the roof of the Kawas traditional house. In the Kudus culture in one shape there is not only one concept of geometry but also there are various concepts used..

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