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Reyog Ponorogo art exploration as mathematics learning resources: An ethnomathematics study

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Abstract. The combination of culture and mathematics is called ethnomatematics. Ethnomatematics is used to determine the role of mathematics in a society's culture. This research is to explore ethnomatematics on Reyog Ponorogo art as a source of learning mathematics. The method used in this study is descriptive ethnographic. The results showed that Reyog's art contained mathematical concepts contained in musical instruments, the rhythm of music, makeup, and dance movements so that it was interesting as a medium for learning mathematics for students.

1. Introduction

Education and culture are integral, because they cannot be separated from one another. That nature applies in a society in developing the noble values of our nation. Education without a culture will stagnate and not develop. Culture without education will cause damage. So something in this world is always intact, comprehensive and complementary to one another. Culture-based education emphasizes more on achieving an integrated understanding. This integration will provide a comprehensive understanding of the knowledge learned.

6 One that can bridge between culture and education is Ethnomatematics. Ethnomatematics is perceived as a lens for viewing and understanding mathematics as a cultural product. The culture referred to here refers to language, society, place, tradition, ways of organizing, interpreting, conceptualizing and giving meaning to the physical and social world [1].

Ethnomatematics as a learning approach will greatly enable a material by students to become easier because the material is directly related to their culture which is their daily activities in society. Of course this helps the teacher as a facilitator in learning to facilitate students well in understanding a material [2].

Reyog Ponorogo Art is one of the learning media that combines elements of mathematics and culture. This learning 6 one way of being perceived to be able to make meaningful and contextual mathematics learning that is believed to stimulate children to use their thinking abilities which give rise to rich and reflective learning. Cultural context is used to stimulate children's adventures because they are easy to remember, children observe and are directly involved in them and are directly related to children's daily lives [3].

Based on previous research, several studies have been conducted on culture-based learning that are used in order to improve the quality of education, integrate cultural values in learning, develop educational models with cultural values, and transform culture through mathematics learning that can be



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reached by the author, among others [2-10]. However, in the previous study there were no research that explores ethnomatematics activities in *Reyog* Ponorogo art and learning.

Based on previous research, the newness in this research lies in the form of ethnomatematics activities in *Reyog* Ponorogo traditional art and its concept of defense. So the purpose of this study is to explore the results of ethnomatematics activities on *Reyog* Ponorogo traditional art, the concept of learning and documenting the culture of Ponorogo society with regard to mathematics so as not to disappear.

2. Theoretical framework

2.1. Ethnomatematics

Ethnomatematics was introduced by D'Ambrasio, a Brazilian mathematician in 1977. The definition of ethnomatematics according to D'Ambrasio [11] is:

“The prefix ethno is today accepted as a very broad term that refers to the socialcultural context and therefore includes language, jargon, and codes of behaviour, myths, and symbols. The derivation of mathema is difficult, but tends to mean to explain to know, to understand, and to do activities such as cciphering, measuring, classifying, inferring, and modeling. The suffix tics is derived from techne, and has the same root as technique”

More broadly, if viewed from a research standpoint, ethnomatematics is defined as cultural anthropology (Cultural anthropology of mathematics and mathematics education). Furthermore, D'Ambrasio [12] said that Ethnomatematics is a study of mathematics that takes into account cultural considerations in which mathematics emerge by understanding the reasoning and the mathematical system they use. Ethnomatematics studies in mathematics learning cover all fields: architecture, weaving, sewing, agriculture, kinship, ornamentation and spiritual and religious practices are often in harmony with patterns that occur in nature or order abstract systems.

2.2. *Reyog* art as a learning resource

Reyog Ponorogo art is a ballet which consists of various elements such as fashion, music, makeup, dance and mask art. The combination tells the story of the *Bantarangin* royal legend which is very interesting. This art is full of moral values contained in it. In addition there are several elements of mathematics that are rarely known by the general public, whereas this art can help students learn mathematics with fun about the values in mathematics learning. So that with the integration of culture-based mathematics learning can be an alternative method of learning mathematics in school with everyday life they know as local wisdom so that students are expected to explore the material delivered by the teacher more, which in the end students will feel more happy and interested in mathematics.

3. Method

This study aims to explore the elements of ethnomatematics in *Reyog* Ponorogo art which can be used as a source of student learning. In connection with this, researchers try to dig up information through literature studies, observations and interviews with several artists to find out the object of research. This study aims to describe the results of Ponorogo people's ethnomatematics exploration in the form of mathematical concepts in *Reyog* Ponorogo art through several stages, among others. Establish informants who are directly involved in ethnomatematics activities by digging up information through interviews. Researchers make ethnographic notes by recording, recording, and documenting. Researchers make domain and taxonomic analyzes to create categories of cultural symbols. The researcher then gives a narrative explanation about the essence of the findings that are examined and gets the meaning of the informant's experience.

4. Results and discussion

4.1. Ethnomathematics exploration at reyog property

Mathematical concepts as a result of building design activities, measuring, making patterns and counting can be revealed from the creation of *Reyog* art. Mathematical concepts in making *Reyog* art, even though the Ponorogo people of old did not know the basic material of *Reyog* art construction, as it is now taught in formal education, they have applied it to the procedures for making *Reyog* art. The exploration results are related to the *Reyog* property in the form of *Barongan* or Tiger head. *Barongan* applied the concept of the ethnomathematics branch of mathematics to geometry. *Barongan* property is the most dominant equipment in *Reyog* Property. Made from bamboo and rattan as a place to arrange peacock feathers. *Barongan* consists of Head of *Reyog* (Tiger Head) and *Dadak Merak*. The mathematical concept used in the making of the *Reyog* Head is a circular form by building a space in the form of a tube. While *Dadak Merak* uses the concept of a rectangle with a combination of semicircles. For more details, the *Barongan* mask can be seen in Figure 1.



Figure 1. The *barongan* mask

4.2. Ethnomathematics exploration on reyog traditional musical instruments

The results of exploration of the form of ethnomatatics on the art of traditional musical instruments *Reyog* uses several mathematical concepts such as the basic concepts of geometry that are applied in the manufacture of *kendang* and *ketipung*. Other concepts such as the flute and *Angklung* (Figure 2) with the concept of a circle combine to build tube space.



Figure 2. *Tipung* (Flute and Angklung)

4.3. Ethnomathematics exploration on reyog music rhythm

The rhythm of music is the result of touching a musical instrument in accordance with the instructions and notation. The music rhythm, the result of harmonization of various types of musical instruments. *Reyog* traditional musical instruments have several techniques to play them by calculating the beats and blowing patterns. To produce a melodious rhythm by referring to the key wasp pattern. Players must master the N, P, K and T techniques first. The basic technique is a punch pattern that is repeated at the beginning of the song's song. Raise is a pattern of intermittent punches or variations between song stems or the transition from song to reff. The middle key is the punch pattern of the drum, with a momentary delay.

The last closing pattern. When the pattern is played together it will form a beautiful sound harmony. The following is how to deal with the basic punch of traditional musical instruments Ponorogo *Reyog* art; *Gending Panaragan* can be explained in the following accompaniment.

Open	: -Ada ngiyah slompret			
	: -Kendang :..... nd	dt dt dg/p		
	: P P P P			
	A. tntNntn	tntNntn	tntNntn	tntNntn
	KkKkk	kkKkk	kkKkk	kkKkk
Suwuk	: n N n N	n N n N n N n N	n N n N	
	: Tk Tk Tk Tk	TgTgdgTgTk	dgTkTndg	TgTg

From these observations, the player must master the pattern of counting on each beat or punch. The ability to count quickly and precisely is needed in the *Reyog* traditional musical instrument playing technique, whether repeating, adding or removing some types of blows with addition or subtraction. So it can be concluded that *Reyog's* music also utilizes the mathematical concept in the show, which uses the concept of number patterns.

4.4. Ethnomathematics exploration on reyog traditional clothing

Ethnomatematics can also be found in traditional Ponorogo traditional clothing designs, especially *wakthung*. The mathematical concept applied in traditional Ponorogo clothing is the concept of rectangular and semicircular flat building in the process of making it that can be seen in Figure 3.



Figure 3. Traditional clothing

4.5. Ethnomathematics exploration on Reyog Dance movement

Reyog Art is a ballet consisting of acrobatic movements. Dance in *Reyog* art always follows the flow of music. The dance has a philosophical meaning so it must follow the pattern of movement that is in accordance with the character and meaning of the dance that convey the message to the audience. The *reyog* dance movement applies the concept of ethnomathematics in the form of number patterns. The formation of *reyog* dance movement and formation can be seen in Figure 4.



Figure 4. Stage formation

4.6. Ethnomathematics in the art of Reyog as a learning resource

The ethnomathematics approach seeks mathematics as a cultural response to student needs by making connections between cultural and mathematical backgrounds. Mathematics is given as a cultural product developed from various activities. Mathematics becomes more relevant to students because culture is assumed to have a mathematical response to mathematical material. Ethnomathematics uses cultural experience as a means to make mathematics more meaningful and provides students with insight into the mathematical knowledge that exists in their social and cultural environment. Based on the

explanation described above, *Reyog* Ponorogo art applied the concept of ethnomatematics. without studying the theory of mathematical concepts, Ponorogo people have expected mathematics in an artistic life. The mathematical concept in *Reyog* art can be used as an interesting learning resource for students so that students do not feel bored and seem stiff when learning mathematics.

Comparison with previous studies such as those conducted by Rakhmawati [4], Hasanudin [5], and Zaenuri [13], they both study ethnomatematics but different objects of study and they have not correlated into the world of education and learning. Therefore, this article seeks to examine ethnomatematics in the world of local wisdom-based learning. This is certainly an alternative to learning mathematics with fun.

5. Conclusion

The *Reyog* art ethnomatematics concepts are contained in the *Reyog* property, traditional musical instruments, musical rhythms, traditional traditional clothing and *Reyog* dance movements. Ethnomatematics in the *Reyog* art can be applied as a learning resource, so learning mathematics by combining cultural concepts makes students more interested and fun.

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