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Indonesia Etnomathematics: Study on the Form of Buildings Worship and Traditional Housing as a Source of Learning Mathematics

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ABSTRACT

This descriptive study aims to know further about the impact of the sports facilities construction towards both for users and communities who live around the arena. 20 samples derived from people who live around the arena, and are within 50 meters, 50 samples derived accidently from ordinary people who use the sports facilities in Tri Lomba Juang. 64 items of questionnaire used to describe 4 factors, which are ecology, health, sociocultural, and economics. The results showed, 40% participants answered that the quality of the environment is disrupted by the construction and the use of sports facilities. Only 36% said, the availability of access to sports facilities has an impact on the quality of health. 48% of participant states that the existence of sports facilities and activities in their neighbourhood give a positive impact on social interaction and communication. And 48% said that the activities in the sports facilities are markets that provide economic benefits. It can be concluded that the existence of the sports arena in the middle of the settlement is less beneficial for the environment and does not directly impact the health quality of the surrounding community, but beneficial for the establishment of social interaction and economic improvement.

Keywords: *Indonesian ethnomatematics, building forms, places of worship, traditional house, learning resource*

1. INTRODUCTION

Teacher quality is one of the important keys, as formulated by [1] UNESCO (1988), Indonesia can immediately get out of the condition of the quality of human resources (which is very alarming) if it focuses on 3 important keys, namely: the curriculum, the quality of teaching, and the effectiveness of pedagogy and method of work. This UNESCO formulation has close links with the cultural values that develop in society because education is a process of culture and education is also seen as a tool for cultural change. In the context of mathematics learning, various cultural values that grow and develop in society should be optimized. Mathematical concepts can be found in cultural heritage, such as: (1) places of worship or houses, (2) pottery and traditional equipment, (3) local units, (4) motifs of batik cloth and embroidery, and (5) traditional games .

Various local cultural products found in everyday life. This is in line with the views of Freudental and Gravemeijer, that mathematics as a human activity [2] (Athar, 2012). According to Freudenthal [3](Heuvel & Panhuizen, 1996), mathematics must be connected with reality, stay close to children and relevant to people's lives. This perspective involves mathematics not only as a subject, but as human activity, which is very closely related to local culture.

The learning process in schools is a formal civilizing process (acculturation process). The acculturation process is not merely a cultural transmission and cultural adoption but also a cultural change. The character of students can be strengthened continuously by integrating ethno-mathematical values. This is in line with the view of Knijnik (1994)[4], mathematics is a cultural knowledge that grows and develops to connect human needs. Bishop (1994) [5] argues, "Ethnomathematics refers to any form of cultural knowledge or social activity characteristic of a social and / or cultural group, as mathematical knowledge or mathematical activity"

Bishop (1994) revealed, all formal mathematics education is a process of cultural interaction and every student experiences culture in the process. Thus, formal mathematics education in schools cannot be separated from the various cultural phenomena that surround it. Freudenthal (1991) [6] said, "Mathematics must be connected to reality" (mathematics must be close to students and must be linked to everyday life situations) ".

Schoenfield (1987 and 1992) [7],[8] emphasized, "the world of mathematical culture" will encourage students to think about mathematics as an integral part of daily life, enhance students' ability to make or make connections between mathematical concepts in different contexts, and build understanding in the student environment. through solving mathematical problems either independently or together.

Pewewardy and Hammer (Nicol, 2010) [9] noted that culture-based learning grew rapidly during the 1980s and early 1990s as a result of diversity and concern over the lack of success of students from ethnic / racial minorities. The mathematics teacher must implement the principle of cultural suitability; they must have knowledge and respect for the various cultural traditions and languages of the students in their class.

2. METHOD

The research design is quasi-experimental. The study was conducted at various schools at the junior secondary level in Java and outside Java. The research sample is students of SMPN 1 Delanggu Klaten, Central Java Province and students of SMPN 1 Malaka Tengah, East Nusa Tenggara Province. Sampling using cluster-random-sampling technique. The experimental class students were taught using the MEA model while the control class students were taught with the conventional model.

Data was collected using the method of observation, interviews, and tests. Data were analyzed descriptively and inferentially using t-test (independent samples t-test).

3. RESULTS AND DISCUSSION

Ethnomatematic forms of research are focused on places of worship and residential houses. The place of worship includes the religion that developed in Indonesia, as follows.

Borobudur Temple

Borobudur Temple is the largest Buddhist temple in the world, which is one of the world's cultural heritage in Indonesia. Borobudur Temple was built by King Samaratungga of the House of Syailendra and was recently completed by his daughter, Ratu Pramudawardhani, in the 9th century based on the Karangtengah Inscription.

The Borobudur temple called UNESCO as the grandest and largest monument and complex of stupa complexes in the world is indeed amazing. Borobudur Temple is composed of 2 million blocks (55,000 m3) of andesite rock which interlock like a giant puzzle (Figure 1). Borobudur Temple in its best moments, sunrise and Vesak (Figure 2).

Figure 1. Borobudur Temple

Figure 2. Sunrise at Borobudur Temple2. Menara Kudus

The building allegedly the foundation of the temple was once found in Kudus, but was not explored further. However, there are mosque minarets which have a shape resembling a Javanese-Hindu temple and made of red bricks installed without cement glue, known as the Holy Tower (Figure 2). The 18 meter tower is decorated with 32 ceramic plates, all of which number 32. Twenty of them are blue and are painted mosques, humans with camels and palm trees, 12 are red and white are painted flowers. The Kudus traditional house (Figure 3) is also a building that is heavily laden with ethnomatematics

From Figure 3 we can identify various geometrical shapes of flat shapes, including square, rectangular, trapezoidal, triangles, samakaki triangles, samasisi triangles, pentagons, and rhombus, spatial models, including cubes and beams, mathematical properties, including symmetrical properties, and the concept of translation (shift), rotation, and dilatation

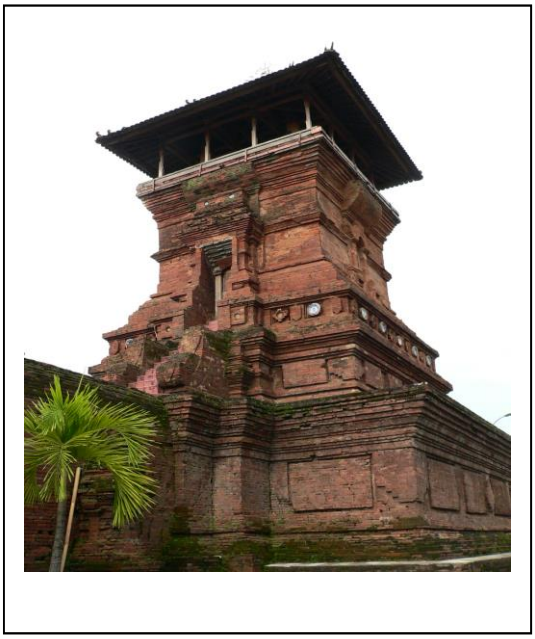

Figure 3. Menara Kudus

Blenduk Chruch

Blenduk Church has a bright red brick dome, in contrast to the pure white church body. Blenduk Church is an icon of the old city of Semarang. His real name is GPIB Immanuel Semarang. Blenduk Church was built in 1753 and is one of the oldest Christian churches in Indonesia. The neo-Gothic style of architecture shows a European touch to the construction process.

The dome is unique in the form of a blenduk, different from the church in general, with a bronze-coated dome roof. The building is hexagonal or octagonal in shape, as in Figure 4.

Figure 4. Blenduk Church

Sam Poo Kong Klenteng

Sam Poo Kong Temple is the oldest Chinese temple in Semarang. The building covers an area of 1,020 square meters and is influenced by 14th century Chinese and Javanese architectural styles. The temple is painted in a majestic red color and is crowned with a Pagoda-style three-layer roof, typical of East Asian culture (Figure 5).

Figure 5. Sam Poo Kong Temple

This building was first built by Admiral Cheng Ho, a Muslim from mainland China. After some time, Cheng Ho left Java, but many of the crew decided to stay behind and settle in the area. They were married to local residents, and until now, Simongan is inhabited by Chinese descendants

Traditional House

Several types of traditional Javanese traditional houses and NTT ethnic groups are presented in Figure 6.

Figure 6, Traditional Houses

Mathematical communication skills

The average mathematical communication skills of students at SMPN 1 Delanggu, Klaten Regency are presented in Table 1

Table 1. Average Student Communication Skills

Experimental	79.34	30
Control	66.56	16

The summary of independent t-test is presented in the following Table 2.

Table 2. Independent t-test

Class	t_{count}	Decision
Experimental and Control	4,73	H_0 rejected

A summary test of proportions is presented in the following Table 3.

Table 3 Proportion Test

Class	z_{Count}	Decision
Experimental I and Control	2.32	H_0 rejected

Value of $z_{table} 0.5 - \alpha$ earned value of z_{table} 1.64. Based on **Table 3**, the results of the proportion test of experimental class concluded that the proportion of mathematical communication skills of students who received learning with ethnomathematic MEAs was more than the proportion of students' mathematical communication skills control class. This is in line with the results of the study Kaselin, Sukestiyarno dan Waluya (2013) [11] also Ilyyana & Rochmad (2018) [10].

Research conducted at SMPN 1 Malaka Tengah, East Nusa Tenggara Province shows that the results of the mathematics literacy ability test of the experimental class students gained an average of 78.38 with 28 students while the control class students gained an average of 71.38 with 19 people. The results of the comparative test of the average difference between classes showed that t count was 2.69 and t table was 1.67 so H0 was rejected. That is, learning Model Eliciting Activities that contain effective ethno-mathematics in learning. This is in line with the research results of itrianawati, et.al, (2018), who explained that ethnomatemics-based mathematics learning is one of the ways that can be expected to make learning more interesting, meaningful and contextual.

4. CONCLUSION

Based on the results and discussion, conclusions can be drawn (1) Indonesian forms of ethnomatemics can be in the form of buildings of worship places, such as Boorobudur temple, Menara Kudus tower, Blenduk church, and Sam Poo Kong temple and various types of traditional houses, and (2) learning model of MEA with Ethnomatematics can be used to improve mathematical communication skills and mathematics literacy of junior high school students.

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