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Application of the reflection concept in majejahitan activity

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ABSTRACT

This research is qualitative research with case study method. The focus of this research is to explore the value of ethnomathematics in the culture of the Bali Mula society in the Kintamani sub-district, Bali Province. The research starts from the exploration phase of ethnomathematics, mapping ethnomathematics with school mathematics, explores aspects of pedagogy in the preservation of ethnomathematics and concludes on how ethnomathematics is applied to mathematics learning in schools. Data collection was carried out through observation of mejejahitan activities carried out by Bali Mula women. Data from observations are then linked to the results of documentation analysis and strengthened by the results of interviews. The triangulation method is carried out to check the validity of the research data. Based on the results of data analysis there is a relationship between the activities of mejejahitan with school mathematics. The mathematical concepts contained in the majejahitan activity that is reflecting (reflecting) and predicting or predicting patterns. Because there is a relationship between majejahitan activities with school mathematics, it can be said that there are ethnomathematics values in the culture of the Bali Mula society in Kintamani District, Bali Province.

INTRODUCTION

Ethnomathematics has become a hot topic for discussion in recent years. The use of the word ethno exists in several other fields, such as ethnobotany, ethnomethodology, etc. The addition of the word ethno refers to the cultural aspect. Therefore, ethnomathematics itself can be interpreted as the relationship between mathematics, cultural anthropology, and mathematical modeling (Orey & Rosa, 2006). D'Ambrosio (in Scott, 2011) states that ethnomathematics consists of three parts namely Ethno+Mathema+Tics. Each part of the word is related to certain aspects. Ethno is related to culture, Mathema is concerned with mathematical activities including explaining and understanding, and Tics means art or technique. Referring to the definition of every word of ethnomathematics, it can be interpreted that ethnomathematics is a technique in the culture of the society that uses mathematical concepts.

Along with the increasing frequency of research related to ethnomathematics, understanding and naming of ethnomathematics experiences differences in various countries and various studies. In Indonesia, ethnomathematics is better known as ethnomatematika. Mathematics education practitioners and practitioners conduct various studies in the field of ethnomathematics studies.

Generally, the research conducted is basic research that discusses ethnomathematics in various regions. Therefore, the research findings that have been published are ethnomathematics research types that are found in several regions in Indonesia.

This phenomenon is still ongoing today. This is natural because of the diversity of cultures that exist in Indonesia. Thousands of islands inhabited by various tribes and each tribe is divided into diverse sub-tribes. Each sub-tribe has its local wisdom which is not impossible to have cultural values related to mathematical concepts. Indonesian culture that related to ethnomathematics values is a traditional children's games in East Java Province, Brebes community farming system, woven bamboo handicrafts that which can be found in Bali Island, thousands of foot houses "*rumah kaki seribu*" that which can be found in Papua, and others. It can be concluded that ethnomathematics allows to being contained in various cultural elements. Cultural elements that can be contained in ethnomathematics include the fields of language, knowledge systems, social organizations, living equipment and technology systems, livelihood systems, religious systems, and arts (Koentjaraningrat, 2015).

Noting the above statement, the researcher is interested in conducting a qualitative study, specifically for the Bali Mulia society in the Kintamani District, Bali Province. The research starts from the exploration phase of ethnomathematics, mapping ethnomathematics with school mathematics, explores aspects of pedagogy in the preservation of ethnomathematics, and concludes on how ethnomathematics is applied to mathematics learning in schools. Various findings were obtained from this study, but what is written in this article is limited to the use of the concept of reflection in majejahitan activities from Bali Mulia women's.

METHOD

This article is part of qualitative research using ethnographic methods. The research process was carried out in 10 months and obtained quite varied data. One small part of the whole study is to explore ethnomathematics in the process and results of majejahitan activities carried out by the Bali Mula society in several villages in the Kintamani District, Bali Province. Based on the considerations explained earlier, it can be said that the research method used is a qualitative with case study method. The focus of this research is the exploration of ethnomathematics values in Bali Mula society activities (especially women) in Pakraman Songan Village. Noting the unit of analysis and flow used, the approach chosen is analytical induction which has been modified (Bogdan & Biklen, 2007). Analytical induction was chosen because in principle this approach is contrary to the specific problem or statement or issue that is the focus of the study.

The selection of research subjects is done by using purposive based on the network. After the research subjects are obtained, data collection will be performed thereafter. Data collection was obtained through observation, interviews, and documentation analysis. Observations were made on a group of Bali Mula women who carried out majejahitan activities, while the unstructured interview process was carried out to strengthen the observations and documentation analysis. Analysis of the documentation in the form of a reference book on the majejahitan activities. To check the validity of the data, repeated observations, and method triangulation was carried out. The process of checking the data is an inseparable part of the research process, so those valid research findings are obtained as a basis for concluding.

FINDINGS AND DISCUSSION

The people of Bali are known for their unique customs, traditions, and culture. The combination of culture and natural beauty makes Bali is a favorite tourist destination for domestic and foreign travelers. This fact is like two sides of a coin. It can be beneficial because it is very beneficial for the Balinese economy and foreign exchange, but on the other hand, a large number of visitors with various cultural backgrounds can be a threat to the preservation of Balinese culture itself. Therefore, massive and structured efforts are needed to maintain its sustainability, including in the field of education. Regulation of the Ministry of Education and Culture of the Republic of Indonesia number 106 of 2013 concerning intangible inheritance mandates to inventory all intangible

inheritance in Indonesian culture and preserve it, including intangible inheritance in Balinese society. The Balinese people can now be divided into two groups, namely: The original Balinese or Balinese who live in mountainous areas, and the Balinese Dataran which is the largest part of the Balinese tribal lineage all descended from Majapahit (Budihardjo, 2013). Several other sources write that between Bali Asli and Bali Mula are two different groups.

Based on this information, the Balinese people are generally divided into three groups, namely Bali Mula, Bali Aga, and Bali Arya. This is confirmed by the statement that the community that originally existed in Bali was referred to as Bali Mula. Immigrants from India who entered Bali were referred to as Bali Aga or Bali Pegunungan. When Bali was ruled by the Majapahit kingdom in the 14th century, the Majapahit people entered Bali, which was then called Bali Arya (Aryanti & Nuryanto, 2009). Although there are specifically three tribes in Balinese Hindu society, the process of assimilation and cultural acculturation has taken place between the three or with other ethnic communities. This causes the occurrence of cultural activities that appear to be visually similar. For example, in preparing ceremonial facilities and ceremonies by Balinese women. The process, which is better known as majejahitan's activities, produces various types of majejahita*n* as a means of supporting the implementation of traditional and religious ceremonies in Bali, such as canang sari, sampian, flat, tamas, wakul, ituk-ituk, and various other types.

Specifically, for majejahitan activities, based on interviews with Jero Penyarikan Apun (one of the traditional elders) in Sanggah Kaja Kangin, Pasek Celagi in Pakraman Songan Village, explained that in the past Pakraman Songan villagers used to only use genten canang. Genten canang is a canang sari made from banana leaves, shaped like kojong and decorated with flowers, betel leaves, and pamor. But along with the times, Pakraman Songan Village people are getting to know canang sari. Canang sari itself is a canang made from the main ingredient of janur and made a pattern that enhances the appearance aesthetically. The simplest canang sari is made in the form of blocks with a square base and the height is as wide as the janur which is used as material. The length of the base is about 8-12 cm. Its contents are similar to the contents of the canang genten. However, now various canang sari variations have been found, ranging from simple shapes to complicated shapes, and have a high artistic and aesthetic value.

Canang sari as explained earlier is one of the many results of majejahitan. As an initial activity to carry out traditional ceremonies or religious ceremonies, majejahitan is performed by Balinese women, both Balinese women who live on the island of Bali or outside Bali. Majejahitan comes from the basic word "sewing" which is the process of assembling. Assembling or sewing in the case of majejahitan is an effort in producing ceremonial facilities. Majejahitan is generally carried out by women who are carried out in groups while humming or having small talk. However, because Majejahitan has entered into a series of sacred religious activities, some villages such as the ancient villages in the Kintamani area require a situation that is physically and spiritually born.

Holy both physically and mentally means that Balinese women may not carry out majejahitan activities if they are in a state of deformity. Cuntaka is a physical or mental dirty condition caused by menstruation, a family member who dies, or after attending a funeral. Also, majejahitan activities are expected to guard thoughts, words, and good deeds. As far as possible do not talk about the ugliness of others, do not fight, do not blaspheme others, avoid saying dirty and disrespectful to others, and avoid dressing immodestly. This is logically done considering that majejahitan activities themselves have entered the stage of the Yadnya ceremony. Where the ceremony of Yadnya has been interpreted as a holy sacrifice.

The material needed for majejahitan is in the form of leaves that grow in the surrounding environment. The most commonly used leaves are janur (young coconut leaves), slepan (old coconut leaves), ambu (young palm leaves), ron (old palm leaves), ental (rontal leaves), and banana leaves. To assemble it, use semat or biting. Semat is made by slicing dry bamboo into a size that is quite small, smaller than a toothpick. The document analysis results obtained information that there are several forms of jejahitan commonly made as a means of ceremony, including tangkih, ituk-ituk, celemik, aled, ceper, pesucian, duras, aled sesayut, tamas, sampian sodan bundar, sampian peras, and sampian gantung. There are interesting things in the military, especially in terms of size. Making jejahitan using the size of the fingers of the maker called lengkat (Raras, 2008).

Figure 1. *Mejejahitan* Activities

Figure 2. Wrong *Jejahitan*

An interesting thing in majejahitan activities that related to mathematics study is the thought process of "predicting" patterns to produce a final form that have an artistic and aesthetic value. The mathematical concept that compatible with majejahitan activities is the transformation of geometry. Reflection, rotation, and translation are three concepts that are often used in geometric transformations. In mathematical concepts, the reflection of the points $P(a,b)$ on the x-axis is denoted by M_x and produces the result of the reflection represented by $P'(a',b')$. These are some of the rules used in mirroring and the resulting mirroring results, namely:

Mirroring of the x-axis: $P(a,b) \xrightarrow{M_x} P'(a,-b)$

Mirroring of the y-axis: $P(a,b) \xrightarrow{M_y} P'(-a,b)$

Mirroring of the origin $O(0,0)$: $P(a,b) \xrightarrow{M_x} P'(-a,-b)$

Mirroring of the line $x=h$: $P(a,b) \xrightarrow{M_x} P'(2h-a,b)$

Mirroring of the line $y=k$: $P(a,b) \xrightarrow{M_x} P'(a,2k-b)$

Mirroring of the line $y=x$: $P(a,b) \xrightarrow{M_x} P'(b,a)$

Mirroring of the line $y=-x$: $P(a,b) \xrightarrow{M_x} P'(-b,-a)$

This concept of reflection is often used to produce two forms of *jejahitan* which have an asymmetrical shape. Generally, this reflection concept is used when majejahitan activities use basic ingredients such as *janur*, *slepan, ron*, or *rontal*. For example, to produce jejahitan as shown in figure 3, the right-hand shape of the folds (lidi/bones) is symmetrical with the left-hand shape. In other words, the right-hand side is a reflection of the left-hand side where the "lidi" part is an axis or mirror. To produce jejahitan as in Figure 4 and Figure 5, janur or ental is used, then the janur is cut along one arm. After cutting, the janur is folded through the middle part of the janur (x-axis). The janur fold pattern can be seen in one of the quadrants as shown in Figure 5. Furthermore, by opening the fold (x-axis) and unfolding according to lidi janur, will be obtained jejahitan as in figure 5.

Figure 3. Example of detailed *Jejahitan*

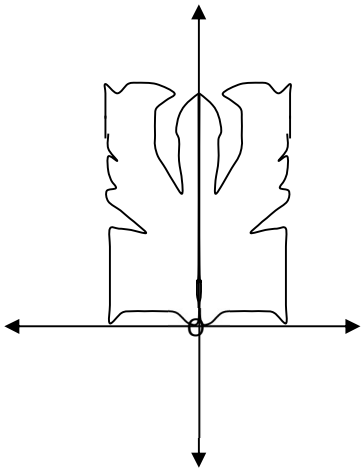

Figure 4. Illustration of *Jejahaitan* Reflection on the y-axis

The same steps were taken to make *canang sari*. However, to make *canang sari* requires at least 2 (two) *jejahitan* as shown in figure 5, and *jejahitan* are arranged perpendicular to each other (as shown in Figure 6). To make *sampian* more *jejahitan* is needed (as shown in Figure 6), to make it possible to form a circle.

Based on the observations and interviews with some Bali Mula women in Pakraman Songan Village, obtained information that to make *canang sari* or *sampian* can be done with the following steps: 1.) Make as many *jejahitan* as possible; 2.) Take two (for *canang sari*) or 4-6 *jejahitan* and then prick with *biting* in the middle (base point of coordinates); 3.) Turn one of the *jejahitan* as far as 900 (*canang sari*) or rotate each *jejahitan* in a row as far as 450, 900, 1350. This is done if you want to make a *sampian* using 4 *jejahitan*; 4.) Pull the tip of the *jejahitan* towards the center, then do the *jarit* using *biting*/*semat*; and 5.) Take step 4 to pull all the tip of the *jejahitan* to form the desired *canang sari* or *sampian*. Next add complementary materials such as flowers, *porosan*, and pandanus leaf slices to complement the *canang sari* or *sampian* that you want to make.

By paying attention to step c about making *canang sari*, it can be seen that there are concrete examples of the concept of geometrical transformation used, namely rotation. In the 2013 curriculum, the concept of rotation was taught in mathematics at the junior high school level. In mathematics, the rotation of a field can be made to the turnaround point $O(0,0)$ or at any point $A(x,y)$. Rotation can be clockwise or counterclockwise. The following are some rules of rotation which are generally carried out as well as the resulting mirroring results:

- Rotation with center $O(0,0)$ with rotation amount 90^0 : $P(a,b) \xrightarrow{R_{(0,90^0)}} P'(-b,a)$
- Rotation with center $O(0,0)$ with rotation amount 180^0 : $P(a,b) \xrightarrow{R_{(0,180^0)}} P'(-a,-b)$
- Rotation with center $O(0,0)$ with rotation amount 270^0 : $P(a,b) \xrightarrow{R_{(0,270^0)}} P'(b,-a)$
- Rotation with center $O(0,0)$ with rotation amount 360^0 : $P(a,b) \xrightarrow{R_{(0,360^0)}} P'(a,b)$

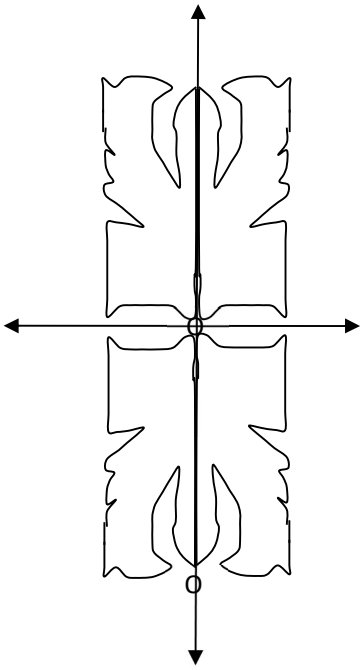

Figure 5. Illustration of *Jejahaitan* Reflection on the x-axis Followed by the y-axis

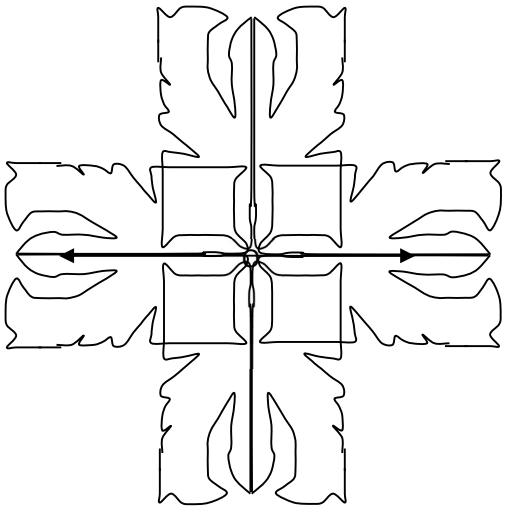

Figure 6. The basic form of *Canang Sari*

In terms of making *canang sari* or *sampian*, the more material used, the angle of rotation of the first rotated *jejahitan* will be smaller. For example, if you make *canang sari* using only 2 (two) *jejahitan*, then you only need to rotate one *jejahitan* with a rotation angle of 90º. If making sampian using four (4) *jejahitan* the first *jejahitan* are rotated by using the rotation angle of 45º. After the *majejahitan* process is completed, then proceed with *metanding*. *Metanding* has the equivalent word which is arranged into a ceremony or *banten* form. The form of *jejahitan* is a frame that arranged and added with other means, such as betel leaf, betel lime, areca nut, and then the material added with various flowers and slices of pandan leaves.

Figure 7. Yadnya Ceremony (Banten) as a result of Majejahitan and Metanding Activities

Banten as shown in Figure 7 is composed of several *jejahitan* and *anyaman*. *Jejahitan* that are often found is *tamas*, *tekor*, *canang sari*, *sampian*, and *sampayutut*. *Banten* is presented in a series of *yadnya* ceremony activities. There are two types of *yadnya* ceremonies, which can be in the form of *bhuta yadnya* (holy sacrifice for the Bhuta) and *manusa yadnya* (sacred sacrifice for events related to humans, such as childbirth, naming a newborn child, chopping teeth, memorial service for someone who has reached adulthood, and marriage ceremonies). *Banten* types vary depending on the purpose of implementation, as well as the level.

Based on previous reviews, majejahitan is a cultural element of Balinese society, including the Bali Mula community in the Kintamani region. Meanwhile, the majejahitan process applying mathematical thinking activities includes predicting patterns, using the concept of geometrical transformation, and producing geometric shapes of space as representations of beams or tubes. Therefore, it can be stated that majejahitan activities contain Ethnomathematics values. Ethnomathematics which have been successfully explored can be utilized in mathematics learning for basic, secondary, or higher education. Estuary is meaningful mathematics learning and also as a tangible manifestation of the act of preserving culture.

CONCLUSION

As one of the elements of Bali Mula's culture, majejahitan contains the values of ethnomathematics. This value is the slice between majejahitan activities with the geometry transformation and the prediction process. The transformation of the geometry and the prediction process are expected to provide benefits for the development of education, especially mathematics education. It can be concluded that ethnomathematics is a new study in the field of mathematics

education, so that the findings of ethnomathematics will enrich the context of mathematics education, both at the level of primary, secondary, or higher education.

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