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Ethnomathematics Study on Bamboo Woven Crafts in Dusun Brajan, Yogyakarta and Implementation in Mathematics Learning

Cinthia Kurnia Dewi, Cyrenia Novella Krisnamurti*

Sanata Dharma University, Yogyakarta, D.I.Yogyakarta, Indonesia
*e-mail: cyrenianovella@usd.ac.id

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Abstrak. Indonesia merupakan negara yang kaya akan sumber daya alam dan budaya. Salah satu budaya yang mereka miliki adalah seni rupa. Seni rupa adalah salah satu budaya yang beragam. Penelitian ini mengkaji salah satu seni rupa dari Yogyakarta yaitu anyaman bambu. Industri kerajinan anyaman bambu yang terkenal berasal dari Dusun Brajan, Sendangagung, Kecamatan Minggir, Kabupaten Sleman, Yogyakarta. Penelitian ini bertujuan untuk mengetahui sejarah kegiatan menganyam bambu, kegiatan dasar matematika dan implementasi menganyam bambu di Dusun Brajan dalam pembelajaran matematika siswa SMP. Metode penelitian yang digunakan adalah penelitian deskriptif kualitatif dengan pendekatan etnografi yang bertujuan untuk mendeskripsikan dan mengkaji pola kelompok pengrajin bambu di Dusun Brajan. Metode pengumpulan data yang digunakan adalah observasi, dokumentasi dan wawancara dengan pengurus Desa Wisata Brajan dan pengrajin anyaman bambu Dusun Brajan. Hasil penelitian ini menunjukkan awal berkembangnya kerajinan anyaman bambu hingga kini menjadi sentra kerajinan yang cukup terkenal. Melalui anyaman bambu ini, siswa dapat belajar enam kegiatan matematika dasar: berhitung, menemukan, mengukur, merancang, bermain, dan menjelaskan. Implementasi dalam pembelajaran matematika di SMP merupakan masalah kontekstual yang dapat dijadikan bahan diskusi bagi siswa.

Kata kunci: Anyaman Bambu, Etnomatematika, Pembelajaran Matematika

Abstract. Indonesia is a country that is rich in natural and cultural resources. One of the cultures they have is fine arts. Fine art is one of the diverse cultures. This study examines one of the fine arts from Yogyakarta, namely woven bamboo. The famous woven bamboo handicraft industry comes from Dusun Brajan, Sendangagung, Kecamatan Minggir, Kabupaten Sleman, Yogyakarta. This study aims to determine the history of bamboo weaving activities, mathematical fundamental activities and implementation of bamboo weaving in Dusun Brajan in learning mathematics for junior high school students. The research method used is descriptive qualitative research with an ethnographic approach that aims to describe and assess the pattern of the bamboo craftsman group in Dusun Brajan. Data collection methods used were observation, documentation and interviews with the administrator of the Desa Wisata Brajan and the Dusun Brajan bamboo weaving craftsmen. The results of this study indicate the beginning of the development of woven bamboo crafts until now it has become a well-known craft centre. Through this woven bamboo, students can learn six basic math activities: counting, finding, measuring, designing, playing, and explaining. Implementation in learning mathematics in junior high schools is a contextual problem that can be used as discussion material for students.

Keywords: Bamboo Weaving Crafts, Ethnomatematics, Mathematics Learning

Introduction

Indonesia is a country rich in diverse natural and cultural resources. Each region in Indonesia has a different culture that has been passed down from generation to generation (Rizky, R., &

Wibisono, 2015). A culture that grows and develops in society must be maintained so that it does not experience extinction and remains sustainable. In addition, important cultural values are instilled in each individual from an early age so that each individual can understand, interpret, and realize the importance of cultural values in carrying out every activity of life. Cultivation of cultural values can be applied through family, education, and the community environment (Fajriyah, 2018).

Culture can be applied in schools through culture-based learning. Culture-based learning is a learning model that prioritizes student activities with various cultures they have (Putri, 2017). Culture-based learning is very beneficial for students. This is because students need interesting learning so that mathematics considered difficult by students can be more easily understood and makes meaningful contextual learning closely related to cultural groups through a cultural approach or another term ethnomathematics.

According to Rosa and Orey ethnomathematics provides a broader view of mathematics (Rudhito, 2020). Mathematics can include ideas, procedures, processes, methods and practices that are rooted in different cultural environments. This aspect leads to evidence of increased cognitive processes, learning abilities, and attitudes that lead to learning processes. Ethnomathematics makes local culture a starting point for learning mathematics. Ethnomathematics can be used to explore various potentials that can be used as a means of learning mathematics, so that students become more motivated in learning mathematics (Ubayanti et al., 2016). Therefore, the ethnomathematics approach makes learning mathematics, especially in schools, more relevant and meaningful for students to improve the quality of education and view mathematics that is more culturally relevant (Noto et al., 2018).

Daerah Istimewa Yogyakarta is very thick with its culture, such as traditional dances, traditional houses, traditional parties, traditional games to fine arts (Mauluah & Putra, 2021). One of the arts that are owned is woven bamboo. Dusun Brajan is very famous for its woven bamboo handicraft industry (Riski et al., 2020). This industry continues to grow because of the legacy of expertise in the art of weaving. Skills passed down from generation to generation are inherent in the life of the craftsman community in Dusun Brajan. Weaving in Dusun Brajan has become one of the livelihoods of the local community and is a cultural asset that is very beneficial to the community. In addition to cultural assets, woven bamboo in Dusun Brajan also has a mathematical element. The mathematical elements contained in the matting in Dusun Brajan can help students learn mathematics.

Based on the description above, this study aims to determine the history of woven bamboo in Dusun Brajan, the relationship between culture and mathematics in woven bamboo crafts and its implementation in learning at the junior high school level. This is because a lot of junior high school mathematics material is a prerequisite for the next level. Developing and understanding concepts in the prerequisite material is important for students. Educators can build mathematical concepts with problems that come from the culture of students.

Research methods

The type of research used is qualitative research with an ethnographic approach. According to Creswell (2012) ethnography is a qualitative design that describes the general pattern of values, behavior, beliefs, and the same language of a group with the same culture. This is in

line with Zayyadi's opinion that ethnographic research is an attempt to describe, explain, and also analyze all elements of culture that exist in society (Zayyadi, 2017). Ethnography is one of cultural research. In this research process, a researcher must enter a community to find out directly how the community's life system itself. So that researchers can get the desired information validly (Wulandari, Diana Ayu, 2022).

The subject of this research involved three informants, namely the management of the Brajan Tourism Village and two woven bamboo craftsmen in Dusun Brajan. The research was conducted from September 2020 to April 2021 at the Brajan Hamlet Bamboo Weaving Craft Center, Sendangagung, Kecamaran Minggir, Kabupaten Sleman, Daerah Istimewa Yogyakarta.

Data collection techniques in this study include observation, interviews and documentation. The observation aims to see the fundamental mathematical activities contained in woven bamboo handicrafts. Interviews were conducted to explore historical aspects and fundamental mathematical activities in woven bamboo crafts. Documentation is done to collect photos of objects.

Data analysis techniques go through three stages, namely data reduction, data presentation, and drawing conclusions. Reduction is the process of removing data that is irrelevant to the research objective. Presentation of data is the process of presenting data so that it becomes a harmonious whole. Drawing conclusions is the formulation of conclusions on the characteristics and concepts of research objects.

Research Results and Discussion

The term ethnomathematics was first used in the late 1960s by Brazilian mathematicians. D'Ambrosio says that ethnomathematics is referred to as mathematics that is practised in a culture (Rudhito, 2020). The culture in question is the habit of human behaviour in the environment such as human behaviour in society, ethnicity, nation, worker group, and others.

According to D'Ambrosio, ethnomathematics consists of three words as follows. The prefix ethno is a term referring to a socio-cultural context including language, mottos, customs, myths, and symbols. The basic word mathema has the meaning of knowledge obtained from human learning processes such as explaining, knowing, understanding, and carrying out activities. While the tics suffix comes from the word techne which means technique or method (D'Ambrosio, 1985). Shirley argues that ethnomathematics is a mathematical science that grows and develops by following the culture of society (Wahyuni et al., 2013). Meanwhile, Marsigit say ethnomathematics is a science used to understand how mathematics is adapted from culture and serves to express the relationship between culture and mathematics (Marsigit, 2018). From the description above, it can be concluded that ethnomathematics is a science that bridges mathematics and culture that develops in the local community.

Mathematics is a pancultural phenomenon. The term has the meaning that different cultures will produce or have different mathematics. In other words, each culture develops its mathematical form according to environmental needs and societal goals. Communities can find and explore the concept of mathematics in culture, so they realize that there is a

relationship between mathematics and culture which can later be used as a source in studying mathematics concretely and in people's daily lives (Saputra et al., 2022). According to Bishops, there are 6 fundamental mathematical activities consisting of counting, locating, measuring, designing, playing, and explaining (Rudhito, 2020).

Dusun Brajan is the name of one of the hamlets in Sendangagung, Kecamatan Minggir, Kabupaten Sleman, Yogyakarta. Dusun Brajan has 6 RT and 3 RW. The population of Dusun Brajan reaches approximately 500 people. At first, the name Brajan was taken from Kyai Braja Setiko. He was a hermit who taught woven bamboo. When Kyai Braja died, this hamlet was named Dusun Brajan. Once upon a time, most of the people of Dusun Brajan worked as farmers. In their spare time, people make kitchen utensils from woven bamboo and the products produced are still small, such as besek, wakul/cething and pincuk.

Bamboo weaving skills in Dusun Brajan continue to be passed on to their children and grandchildren. In 1991, Dusun Brajan began to develop into a centre for bamboo crafts. Over time, the community realized that they had the extraordinary potential for bamboo crafts. Then in 2016 Dusun Brajan was confirmed by the Sleman Regency Government as a tourist village of Brajan. The tourist village of Brajan has a beautiful garden made of bamboo that can be used as a photo spot and several showrooms selling woven bamboo crafts. The production of woven bamboo handicrafts in Dusun Brajan is carried out by approximately 90% of the population. Most of the people's houses work double, in addition to being a place to live, they are also used as places for the manufacture and marketing of woven bamboo handicrafts. As time goes by, the bamboo handicrafts in Dusun Brajan are getting more and more innovative and diverse.

The woven bamboo craft centre of Dusun Brajan is different from other bamboo craft centres. The woven bamboo craft in Dusun Brajan has a distinctive feature, namely products in the form of household furniture and small knick-knacks made of bamboo. The products produced are decorative lampshades, tissue holders, fruit holders, baskets, cething and others. These products are not marketed locally but have also been exported abroad from Malaysia, Australia, the Netherlands and other countries.

Mathematical fundamental activities in woven bamboo crafts in Dusun Brajan are as follows

Table 1. Mathematical fundamental activities in woven bamboo crafts

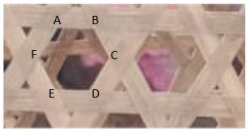
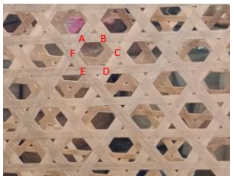
Mathematical fundamental activities	Explanation
Counting	Counts the number of bamboo, counts the number of strands, determines the production price of woven bamboo crafts, determines the selling price of woven bamboo crafts, and determines the estimated time required for the production of woven bamboo crafts.
Location	Determining where to take bamboo as the main material, placing bamboo strands on the motifs of menyan kobar, amplong, and truntum as well as determining the distribution of land for production.

Measuring	Determines the length of the bamboo strands, determines the width of the bamboo strands, determines the thickness of the bamboo strands and determines the area of land used for production.
Design	Various motifs of woven bamboo and determines the form of woven bamboo crafts.
Play	Marketing strategies and strategies to improve the quality of woven bamboo crafts.
Explain	Explain the meaning of each woven bamboo motif.

Ethnomathematics gives facilities to students to construct mathematical concepts. All objects contained in woven bamboo crafts in Dusun Brajan, Yogyakarta are ethnomathematics objects that can be explored in mathematical concepts. Implementation in learning at the junior high school level is a matter of contextual mathematics as follows

Table 2. Implementation in contextual problems

Class	Basic Competencies	Contextual Problem
VII	3. 6 Explaining linear equations and inequalities of one variable and their solutions.	Indicator: Solve problems related to linear inequalities of one variable. 1. Mrs Suryati is a woven bamboo craftsman in Dusun Brajan. In making crafts, Mrs Suryati requires strands of bamboo that have been trimmed. The bamboo strands are rectangular in shape with a length of (2y-1) cm and a width of 2 cm. If the area of the bamboo strand is more than equal to 60 cm^2. Determine the minimum length of the bamboo strands! Indicator: Solving problems related to linear equations of one variable. 2. Nina and Ina went to the woven bamboo craft centre in Dusun Brajan. The price of one lampshade is four times the price of one basket. Nina bought two lampshades and 4 baskets for Rp. 360.000,00. If Ina also buys 5 baskets at the same shop and brings Rp 175,000.00 in cash. Determine the change that Ina receives!
VII	3. 9 Recognize and analyze various situations related to social arithmetic (sales, purchases, discounts, profits, losses, single interest, percentage, gross, net, tare).	Indicator: Solving problems related to social arithmetic (profit) 1. A craftsman makes 10 woven bamboo crafts in the form of a basket with a production cost of Rp. 165,000.00. Then the basket-shaped woven bamboo craft was sold at a price of Rp. 35,000/piece. How much profit does the craftsman get for one craft?  Indicator: Solving problems related to social arithmetic

		(losses) 2. Mr John is a craft seller. He bought 100 lampshades from a woven bamboo craftsman for a total price of IDR 3,500,000.00. Then 62 handicrafts were sold at a price of Rp. 40,000.00/piece. After 1 year of not selling, the 36 lampshades were sold at a price of Rp. 25,000/piece and the rest were damaged so that Mr John did not sell them. Calculate the loss and the percentage of losses borne by Mr John!
IX	3. 5 Describe geometric transformations (reflection, translation, rotation, and dilation) associated with contextual problems.	Indicator: Solving problems related to geometric transformation (reflection) 1. Bamboo woven crafts in Brajan Hamlet have many motifs. One of the motives as in the picture:  Pay attention to the flat shape ABCDEF on the motif! If on the Cartesian plane the points A, B, C, D, E, and F are (-3,3), (-2,3), (-1,2), (-2,1), (- 3.1) and (-4.2). Determine the points A', B', C', D', E', and F' which are reflected on the y-axis! Indicator: Solving problems related to geometric transformation (rotation) 2. Pay attention to the ABCDEF flat shape on the motifs of woven bamboo crafts in Dusun Brajan below:  If in the Cartesian plane, A, B, C, D, E, and F are (1,3), (2,3), (3,2), (2,1), (1,1) and (0,2). Determine the points A', B', C', D', E' and F' if they are rotated by 180° with the direction of rotation counterclockwise to the point (0.3) and draw the result of the rotation of the plane!

Conclusions and recommendations

Based on the results of the study, it can be concluded that the woven bamboo handicraft center in Dusun Brajan continues to develop and become the lifeblood of the community. In 2016, Dusun Brajan was confirmed by the Sleman Regency Government as a Tourism Village. The resulting products are increasingly diverse, creative and more modern. So that many consumers from within the country and abroad are interested in the handicraft products produced.

In woven bamboo crafts there are basic mathematical activities contained therein. There are 6 basic mathematical activities in woven bamboo crafts in Dusun Brajan including counting, finding, measuring, designing, playing, and explaining. The identified ethnomathematics has the potential to be integrated into mathematics learning. By integrating ethnomathematics

into learning as a contextual problem as well as introducing cultural elements to students. The implementation of mathematics learning at the junior high school level is in the form of contextual mathematics questions which include material on linear equations and one-variable inequalities as well as social arithmetic in class VII and material on geometric transformations (reflections, rotations, translations and dilations) in class IX. The introduction of local culture makes students more appreciative of their cultures and can take the values in them which have an impact on the formation of the nation's character (Setiana et al., 2021).

For future researchers, it is hoped that they can develop deeper, contextual problems regarding woven bamboo handicrafts. So that the resulting contextual problems are more diverse and can be implemented to students in learning mathematics.

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