



Banyuwangi Bamboo Puppets from an Ethnomathematics Perspective

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Submission

Track:

Received:

31 December 2023

Final Revision:

22 April 2024

Available online:

24 April 2024

ABSTRACT

Ethnomathematics denotes mathematical phenomena entrenched within cultural contexts. Bamboo puppetry emerges as an intriguing cultural enclave ripe for investigation, distinguished by unique material composition, crafting techniques, and character portrayal in contrast to conventional puppetry forms. An exploratory inquiry unfolded within the precincts of Gintangan village, Banyuwangi, facilitated by a selective triad of informants. Employing qualitative methodologies, data accrual entailed a blended approach integrating observational scrutiny and in-depth interviews. Insights gleaned from the investigation unveil that the craftsmanship of bamboo puppets entails a gamut of mathematical undertakings, encompassing enumeration, categorization, measurement, and strategic planning. Furthermore, the genesis of bamboo puppetry production intricately intertwines with ethnomathematical dimensions, elucidating the utilization of numerical operations, geometric principles, statistical analysis, and probability considerations. These findings portend the transformative potential to transmute into a bespoke educational resource for contextualized mathematics pedagogy, leveraging the craft of bamboo puppetry as a conduit for experiential learning.

Keywords: bamboo puppetry, ethnomathematics, mathematical activities

DOI: 10.23917/varidika.v35i2.23317

INTRODUCTION

Indonesia is a country that has a diversity of customs and culture. One of these cultural variations is woven crafts. Weaving is a skill inherited from our ancestors, which is still widely used in everyday life. The Using tribe is an ancient Javanese tribe native to Banyuwangi district (Fajar et al., 2018) who still preserve the weaving tradition. As an agricultural society, the Using tribe is attached to traditions inherited from their ancestors, both related to individual and social life cycles. Woven is a product that is widely used by the Using tribe people in their daily lives according to their traditions and needs.

Wicker craft is a community skill activity in making goods or works of fine art by means or techniques of overlapping (crossing), interlacing, and folding the lungsung (or lungsi) and pakan together so that they strengthen each other (Patria & Mutmaniah, 2015; Riski et al., 2020; Susilo et al., 2019). Woven materials can be made from dried plants, such as sticks, rattan, roots and leaves to make

a strong grove (Patria & Mutmaniah, [2015](#)). Especially in Banyuwangi, bamboo is the main material used for crafts and various other purposes such as walls/gedhek (Hariastuti et al., [2021](#)).

Bamboo plays a very important role in the lives of rural communities, because it is known to have properties that are good for use, such as stems that are strong, straight, even, hard, easy to split, easy to shape, and easy to work with, as well as light so they are easy to distribute (Putro et al., [2014](#)). Woven bamboo is the result of the process of crossing bamboo threads which are formed as functional objects with certain patterns (Rahman & Mutmainah, [2015](#)). Bamboo crafts have a long history of products produced by local communities because the material is quite economical, the craft products also vary (Susilo et al., [2019](#)). Some bamboo crafts are products that can be used for containers, decorations and various necessities that support various activities.

Previous research revealed the existence of interesting ideas or concepts in woven work. Research by Fajar et al. ([2018](#)), Murti & Murwandani ([2018](#)), and Zazilah & Mecha ([2020](#)) in Gintangan village, Banyuwangi, show the exploration of various forms of bamboo woven crafts. Exploration of woven bamboo in Banyuwangi was also carried out by Hariastuti et al. ([2021](#)) on making gedhek (woven bamboo walls) and by Hariastuti & Nurmahmudy ([2022](#)) on making besek (baskets). Several studies related to bamboo weaving in Banyuwangi show that there has been no exploration regarding bamboo puppets. This shows that the bamboo puppet craft is not yet well known by the public, so it needs to be explored.

Bamboo puppet is part of puppets that developed in Indonesia. Bamboo puppets are different from puppets in general which are made of leather or wood. Bamboo puppets are made from bamboo as the basic material in such a way as to produce unique puppet characters. The first exploration of bamboo puppets was carried out by Rachmiati ([2019](#)) in Bogor. The results of her exploration revealed that bamboo puppetry was an art created by Ki Drajat, who was also the mastermind behind the performance. It also explains the bamboo material used for almost the entire body and face of the puppet with a manufacturing technique that requires precision and skill to form a perfect and complete puppet. Apart from its unique physical form, bamboo puppets have distinctive icons or figures in each performance. The typical bamboo puppet characters are made in a unique and interesting way, with an appearance like a golek puppet. The characters that are characteristic of the bamboo puppet performance differentiate it from other puppet, but do not reduce the artistic value of the puppet performance.

Banyuwangi, especially Gintangan village, is also a developer of bamboo puppet art. Bamboo puppets are made as works of art that are usually used for performances or sold as children's toys and souvenirs.

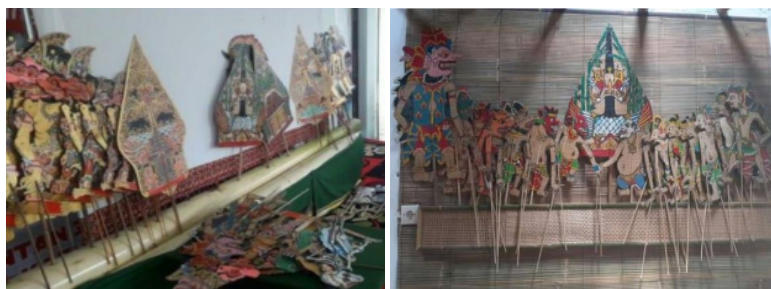


Figure 1. Bamboo Puppet in Gintangan Village with Unique Characters (Researcher Documentation)

Bamboo puppets must be protected and improved so that they do not become extinct because of technological advancement. One way to preserve bamboo puppets is to pass them along to the next generation, either directly through performing arts or by incorporating them into education. Mathematics is one subject that can be utilized to teach students about bamboo puppets. However, first you must understand the mathematical concepts included in bamboo puppets.

Bamboo puppets are formed of woven bamboo strips arranged in parallel, intersecting, and perpendicular positions. This position is designed to keep the strings together, robust, and from coming apart when employed, particularly during performances. A clamp in the middle of the bamboo puppet is also required to stiffen it even further. Apart from stiffening the webbing on bamboo puppets, the clamps also help to balance the puppets during performances. This demonstrates the relationship between lines in the fundamental weaving of bamboo puppets and establishing the center location.

The existence of mathematical concepts in bamboo puppet art is part of ethnomathematics. D'Ambrosio explains that ethnomathematics is mathematics that is practiced among identifiable cultural groups, national communities, tribes, labor groups, children or certain age groups and professional classes (D'Ambrosio, [2001](#); Rosa & Orey, [2016](#)). Ethnomathematics are various results of mathematical activities that are owned or developed in society, including mathematical concepts found in historical heritage and handicrafts in the form of temples and inscriptions, pottery and traditional equipment, local units, batik cloth motifs and embroidery, traditional games, and patterns, community settlements (Riski et al., [2020](#)). Ethnomathematics is a combination of mathematical approaches between culture and mathematics (Fajar et al., [2018](#)), which studies how to convey mathematical concepts that can be adapted from the culture of the local community (Ilmiyah et al., [2020](#)) so that it contains a reciprocal relationship between education, culture, and mathematics (Mahmuda et al., [2019](#)). Apart from mathematical concepts, in culture you can also find mathematical activities. Bishop has identified six mathematical activities in culture, namely counting, locating, measuring, designing, playing, and explaining (Hariastuti et al., [2022a](#)).

Several previous studies have shown the existence of ethnomathematics in bamboo weaving. Prabawati's ([2016](#)) research shows that there is a principle of tessellation in several bamboo woven crafts

in Rajapolah. Riski et al. (2020) revealed the existence of geometric concepts in bamboo crafts in the tourist village of Brajan, Yogyakarta. Wahyuni (2021) explains that there is a concept of building flat and building space in bamboo woven crafts in Sukabumi. In Banyuwangi, ethno-mathematical identification was also carried out on woven bamboo products, such as gedhek (walls made of woven bamboo) which contain the concepts of numbers, number patterns, geometry, sets, fractions, measurements with non-standard units, congruence, transformation and arithmetic (Hariastuti et al., 2021), and besek (a container made of woven bamboo) which contains five mathematical activities (counting, locating, measuring, designing, and explaining) as well as the concepts of permutation, counting, social arithmetic, sets, number counting operations, fractions, time, number patterns, measurements with non-standard units, sequences, two and three dimensional geometry, relationships between lines, transformations, and comparisons (Hariastuti & Nurmahmudy, 2022).

The results of the research in the previous paragraph show that exploration has been carried out on woven bamboo-based products in various regions and ethno-mathematical identification. Bamboo products that have been explored include bamboo crafts, bamboo walls (gedhek), and bamboo containers (besek). These results show that there has never been an exploration of bamboo puppets and their ethno-mathematical identification. This shows the novelty of the research from the object of exploration.

Apart from containing the value of novelty, this research is also hoped to be able to bridge the gap in cultural conditions which are generally still enjoyed by certain groups. The younger generation (in this case students) still seems reluctant to get to know culture such as bamboo puppetry. This is supported by Andriani et al. (2023) who stated that currently it is rare for young people to be proud and diligent in studying and preserving their own culture. For this reason, instilling love and cultural values must be carried out from school (Hartatik & Pratikno, 2023).

Teachers have an important role in cultivating local wisdom values in culture. However, unfortunately not all teachers have the understanding to introduce culture to students from an early age. This is related to the connection between a culture and the subjects taught by teachers, one of which is mathematics. Shirley (2015) emphasized that mathematics learning for students must be adapted to their culture, so that students are helped in understanding mathematics at school through connection with real life in the form of culture. For this reason, teachers need to understand culture and identify mathematics in culture so that it can be used as an effective and efficient means of learning mathematics.

Based on the description above, this research aims to explore bamboo puppets in Banyuwangi and identifying ethnomathematics in bamboo puppets. It is hoped that the research results can be a means of conveying mathematical concepts in schools in an effective and efficient form. Apart from that, with culture-based mathematics learning, it is hoped that students will know and love their culture better.

METHOD

The research was conducted qualitatively-descriptively with the aim of exploring bamboo puppet making and identifying mathematical activities and ethnomathematics in it. The research area was determined purposively because only in Gintangan village there were bamboo puppet craftsmen. Respondents in this research were also determined purposively by selecting a gallery owner who made bamboo puppets and two craftsmen.

Data was collected by observation and interviews. Observation using participant techniques was carried out based on exploration indicators: (1) selection of materials; (2) bamboo weaving; and (3) forming woven bamboo into puppets. Participatory observation was carried out by directly following and practicing making bamboo puppets. Respondents showed the process of making bamboo puppets and researchers were involved in this activity.

Observations were carried out together with the interview process. Interviews were conducted based on semi-structured interview guide instruments. Interviews were structured and in-depth with the same indicators as observations. The data obtained was then triangulated and then analyzed qualitatively.

The analysis was carried out in three stages, namely data reduction, data presentations, and drawing conclusions. The data resulting from triangulation is then reduced according to exploration indicators. Data reduction was carried out by organizing the results of observations and interviews into categories of mathematical elements and activities. Information that does not fit into either category can be removed.

The reduction results are presented in the form of pictures and narratives. Figures of the research results are displayed according to the process of making bamboo puppets. The descriptive narrative is written as a summary of the results of the interview transcript and the conclusion of the observation process. Conclusions are drawn based on Bishop's indicators related to mathematical activities in culture as well as elements of mathematics learning content in the independent curriculum (BSKAP, [2022](#)).

RESULTS & DISCUSSION

It is hoped that the results of this research can answer research questions, namely how is the process of making bamboo puppets in Gintangan Banyuwangi and ethnomathematics in bamboo puppet culture. This research was carried out at a bamboo production house in Gintangan Banyuwangi because it is the only bamboo production house that makes bamboo puppet crafts. The research was carried out from December 2022 to January 2023. The research results were obtained from the exploration of making bamboo puppets which was determined by the process of selecting materials, weaving bamboo, and forming the woven bamboo into puppets. The identification of mathematical activities in culture is based on Bishop's theory which contains six activities, namely counting, locating, designing, measuring, playing, and explaining. Identification of ethnomathematics is based on five (plus one) mathematics

learning content in the independent curriculum, namely numbers, algebra, measurement, geometry, data analysis and probability, and calculus.

Result

The results of the participatory observation process and in-depth interviews which have been transcribed and reduced, are then presented in this sub-chapter in the form of figures and narratives. Data analysis is carried out at the end of each step in making bamboo puppets, namely the steps for selecting bamboo, weaving bamboo, and forming the woven material into bamboo puppets.

The research results show that bamboo is the main raw material for making bamboo puppet crafts. The bamboo selection process is the first stage in making bamboo puppet crafts. Only bamboo tali can be used as material because it is flexible and easy to shape. The bamboo tali chosen must be mature and aged 4-5 years. The length of one bamboo pole is around 25-30 segments with the average length of 1 segment being 37.5 cm, so the total length of 1 pole is around 9-12 meters. Next, the bamboo is split starting from the second node or around 70-80 cm from the roots. So one bamboo strips can be cut into 8-10 pieces.



Figure 2. (a) Measurement of the Diameter of Bamboo to be Used as Puppet Material; (b) Measurement of the Width of Bamboo Splits After Splitting One Bamboo Lodge into 8-10 Parts (Researcher Documentation)

The bamboo sections are cut into 2-3 segments or around 75-115 cm in length and 7-8 cm in diameter, as shown in Figure 2(a). Each piece of bamboo that has been cut is then split into 10-12 slits. The average bamboo split has a width of 2.4 cm with an average thickness of 0.4 cm, as shown in Figure 2(b). The total width of all the bamboo splits is not the same as the circumference of the bamboo surface because there are parts that must be trimmed in the process of splitting the bamboo.

The bamboo splits are then dried in the sun or stored in a cool place for 5-6 days. Bamboo that has been dried in the sun will shrink slightly from its previous size due to the hot effect of sunlight which results in a reduction in the water content in the bamboo. This can be seen from the diameter of the bamboo that has been split from initially having a thickness of 0.4 cm, decreasing to 0.2 cm, as shown in Figure 3.



Figure 3. Measurement of Bamboo Split Thickness (a) Before Drying and (b) After Drying (Researcher Documentation)

Making puppets uses the middle part of bamboo by removing the cangkang (outer skin) and welad. Welad is the part of the bamboo that still has protrusions. The middle part was chosen because it has a flat shape, making it easier to process ngirat (sharpening the bamboo into thin slits) and easy to shape. Next, the bamboo must be sharpened so that it becomes smooth, thin, and easy to weave, as shown in Figure 4 (a). One piece of bamboo is sharpened into approximately 15 strips. Each wedge has a thickness of about $1/15$ of the previous thickness, as shown in Figure 4 (b). After the sharpening is no longer dried in the sun, weaving can be carried out straight away.

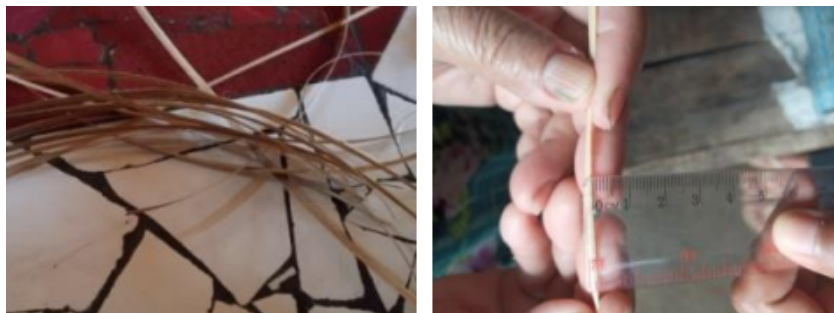


Figure 4. (a) Aharpening Results from One Bamboo Split; (b) Bamboo Slice Thickness Measurement (Researcher Documentation)

From the process of selecting bamboo, it can be seen that there are mathematical activities such as counting in the process of determining the number of pieces and splits of bamboo iratan; and measuring activities in the process of selecting the age of bamboo dan determining the distance from the cutting to the root.

Weaving is done to make it easier for the puppet to be formed. The weaving process is carried out using a pipil pattern, which a motif of small squares that are parallel and intersecting with a tight distance between the weaves in 1 cm, so that the resulting weave is strong and does not come off easily.

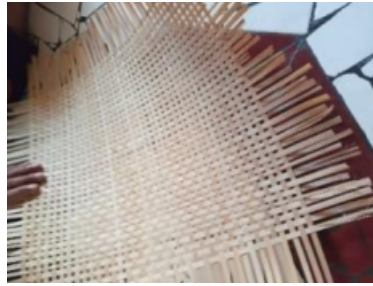


Figure 5. Results of Bamboo Woven with Pattern 1-1 (Researcher Documentation)

Weaving begins by taking one strip positioned horizontally and one strips positioned vertically then weaving in a 1-1 pattern. The pattern continues to the right and down. One sheet of woven bamboo requires 30 iratan each arranged horizontally and vertically. The woven result is a rectangular sheet with a length and width of 100 cm each, as shown in Figure 5.

It is known that in the process of forming woven bamboo puppets, there are several sizes of bamboo puppets that are usually made, namely : (1) bamboo puppets with lengths of 20 cm and 30 cm for buying and selling and made as children's toys; (2) bamboo puppets for performances with a length of 50 cm, making it easier for the puppeteer to present and display visible to the audience; and (3) bamboo puppets with a length of 100 cm which are usually made at certain times, for example if there is an order from an agency for souvenirs or as decoration.

From the process of weaving bamboo, it can be seen that there are mathematical activities such as counting in the process of determining the number of iratan to be woven; locating activities in the process of arranging iratan in a woven pattern; measuring activities in determining the size of woven products; and designing activities in the process of arranging the iratan to be woven.

The formation of the woven material into a puppet is carried out in several stages. Exploration was carried out on making bamboo puppets with a length of 50 cm. The manufacturing process begins by preparing the sponge, which is the material that functions as the base or place for the bamboo woven material to be attached. The sponge also functions as a support for the bamboo woven material so that it doesn't come off easily. The sponge used must be a hat sponge with a size of 1×2 meters so that it can be attached to the bamboo webbing. With this size, you can make 4 bamboo puppets with a length of 50 cm. The sponge is measured with a meter according to the size of the bamboo puppet being made. The sponge is shaped into a square using a marker, then the sponge is cut using scissors.

The sponge and woven bamboo are given yellow glue which is useful so that the bamboo puppets don't come off easily when held and moved. One container of yellow glue containing 185 grams is enough to make one 50 cm Bamboo puppet. The process of applying yellow glue is carried out on one sheet of woven bamboo, which is smeared starting from the end of the bamboo woven sufficiently according to the size of the sponge that has been cut previously. The process of applying glue is shown

in Figure 6. Next, the woven bamboo is dried in the sun. While waiting for the drying process, yellow glue is applied to the sponge.



Figure 6. Process of Applying Glue to Strengthen Woven Bamboo and Sponge (Researcher Documentation)

Next, the sponge is attached to the woven bamboo where the glue has dried. The attachment process is carried out with precision, so that each end of the two parts must match each other. The gluing process is done carefully because once attached, it cannot be separated again. The remaining woven bamboo that is not attached with the sponge is then cut, smeared with yellow glue, and dried in the sun. After it dries, attach it to the opposite side of the sponge which has not yet been attached to the bamboo woven material. So the sponge is located between two bamboo weaves.

The depiction of the puppet shape is adjusted to the desired character or according to the buyer's order. The drawing process must be carried out by someone who is good at drawing and understands the characteristics of puppet so that no mistakes occur. The drawing process is carried out by making an initial design using a permanent marker so that the initial design of the puppet is not easily erased.



Figure 7. The Process of Drawing Bamboo Puppet Figures (Researcher Documentation)

Once the puppet design is complete, white glue is applied to the woven bamboo. The glue is attempted to penetrate between the bamboo weaves so as to increase the adhesive power of the bamboo puppets. The purpose of applying white glue is also to bind the paint so that it doesn't fade easily. Use one piece of white plastic glue containing 700 grams. White glue is applied to the entire surface of the woven bamboo that has been given a design. After applying glue, puppets are cut according to design.

The bamboo weave is cut following the lines in the previous design. Cutting requires a strong hand because the object being cut consists of 3 layer, namely the bottom woven bamboo, the sponge,

and the upper woven bamboo. The remaining pieces of woven bamboo can be used to make puppet hands. Bamboo puppet trinkets consists of hands, tongs and hand grips on bamboo puppets. Bamboo puppet hands are made from remaining pieces of woven bamboo that have been attached to sponge. Next, draw puppet hand measuring 5-10 cm. The hand image is cut with scissors and holes are made to be attached to the using strings. The clamps and hand grips on the puppets are done using prepared bamboo measuring 30-50 cm. Clamps are attached to bamboo puppets that have been hollowed out using scissors, then strings are tied. The same thing happens when installing handrails, namely by making holes in the hands and then tying strings. The string used is 100 cm long. The strings are tied and then strengthened using pliers.

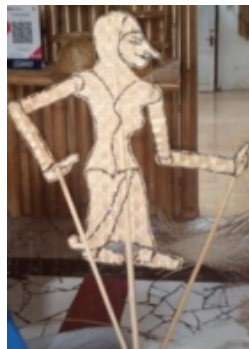


Figure 8. Bamboo Puppets that Have Been Given Trinkets (Researcher Documentation)

Coloring is done by applying paint to bamboo puppets that have been formed or before being assembled by hand. Coloring is done with the aim of making the bamboo puppets look good and attractive. The colors used are according to the needs of the bamboo puppets. The paint used must be an oil type so that it dries quickly and does not fade easily. One can of oil paint contains 25 cc.

If it is the dominant color, the paint can be used to color one bamboo puppet, while other colors are additional colors that are used with minimal requirements. However, if it is not the dominant color, then each 25 cc can of paint can be used to color 4-6 bamboo puppets. One can of paint is mixed with thinner according to the size of the paint can. Coloring is done using a brush which is useful for evening out the colors so that the bamboo puppets look nice and attractive.



Figure 9. Colored Bamboo Puppets (Researcher Documentation)

Making bamboo puppets takes 1-3 days depending on the skill of the maker and the difficulty of forming the bamboo puppet figures. Ordinary bamboo puppets made like children's toys only need 1 day. Bamboo puppets made for performances or orders that have a certain shape and character with a fairly high level of difficulty take between 2-3 days.

From the process of forming woven bamboo into puppets, it can be seen that there are mathematical activities such as locating in the process of adjusting the precise position of the sponge and bamboo woven; measuring activities in determining the amount of sponge needed, determining the length of bamboo for the handle, and determining the amount of glue needed; as well as design activities in drawing wayang characters on woven bamboo in precise positions

Making bamboo puppets contains numerical content, one of which is contained in the information needed for each of the 30 *iratan* arranged horizontally and vertically to make one sheet of woven bamboo. This means that there is a counting process starting from 1 to 30 (whole numbers). Whole numbers are a set of non-negative integers or a set of natural numbers plus 0 (Abdussakir, 2014).

The number content is also contained in the information that one bamboo pole has can be cut into 8-10 pieces. This condition shows the existence of the form $\frac{1}{8}, \frac{2}{8}, \frac{3}{8}, \dots, \frac{8}{8}$ or ninth or tenth fractions in the process of cutting bamboo. Fractional numbers are numbers that have the form $\frac{a}{b}$, where a and b are whole number and $b \neq 0$ (Abdussakir, 2014).

Exploration of making bamboo puppets also shows the existence of measurement content. This content is in the information about the length of one length of bamboo, which is around 25-30 segments, with each segment being equal to a size of around 37.5 cm. Apart from that, the woven product is a sheet that shows a length and width of around 100 cm each. This condition shows the existence of length measurements using non-standard units and their relationship to standard units commonly used in everyday life. Non-standard units are comparative measures that are not fixed and are not recognized internationally, while standard units are comparative units that are fixed, do not change, and can be used generally anywhere.

Making bamboo puppets contains the concept of time. Generally making bamboo puppets takes 1-3 days. Time is the entire series during which the manufacturing process takes place. The research results also show that one small can of oil paint contains 25 cc, meaning that there is a volume of objects that occupy the space of a can of oil paint. Volume is a measure of the space that an object can occupy.

Making bamboo puppets also contains geometric content. The results of the exploration show that the weaving is done using a pipil pattern with motifs small boxes. The box shows a square shape. Weaving begins by taking one strip each that is positioned horizontally and vertically, so that the webbing can be used to indicate the position of line segments on a flat plane. Weaving is done in a parallel and intersecting pattern, so that the weaving results can be used to show the relationship between

lines on a flat shape. A woven pattern is said to be parallel when two or more wedges do not intersect, while a woven pattern is said to intersect when two or more wedges meet at an intersection point. Apart from that, the woven results also show a tessellation or tiling pattern. Tessellation is a special pattern that contains geometric shapes in an arrangement without separation or distance to cover a flat plane (Puspadewi & Putra, [2014](#); Ratuanik & Kundre, [2018](#)).

The fourth content contained in making bamboo puppets is data analysis and opportunities. Exploration results show that the length of one bamboo segment is around 25-30 segments with the average length of 1 segment being 37.5 cm. As a result, each bamboo pole has a length of around 25 or 30 segments multiplied by 37.5 cm. The concept of average (mean) is part of the content of data analysis. The mean is a value obtained from the quotient between the total number of values and a lot of data

Discussion

D'Ambrosio translates ethnomathematics as three concepts: (1) mathematics practiced in a cultural group that can be identified according to the goals and traditions used in that group; (2) a research program related to the history and philosophy of mathematics with implications for learning; and (3) a practical approach to mathematics learning based on students' previous knowledge, background, role in the environment, as well as past and current experiences from the immediate environment (Hariastuti et al., [2022b](#)). These three concepts show that mathematics exists in culture, which can be identified through research programs, and the results can be used as an approach in teaching mathematics contextually.

The results above show that mathematics can be identified from culture through an exploration process. Bamboo puppetry is one of the cultures in Banyuwangi, especially Gintangan village. Exploration of the manufacturing process shows the mathematical activities of counting, locating, measuring and designing. These results are supported by research by Fajar et al. ([2018](#)) which shows that there are counting, measuring and designing activities in making woven bamboo crafts in Gintangan village. Research conducted in the same village with different objects did not identify any placing activity. However, the results of the exploration of making gedhek (Hariastuti et al., [2021](#)) and the exploration of making besek (Hariastuti & Nurmahmudy, [2022](#)) in Banyuwangi show that there are mathematical activities similar to this research. The results of the last two studies also show that there are explaining activities that were not found in the exploration of bamboo puppets. Gilsdorf ([2012](#)) states that explaining activities are activities that involve creating abstractions in culture.

Wicker can also be made from materials other than bamboo. Wurdani & Budiarto ([2021](#)) research shows that there are measuring activities in making rattan weaving. Penelitian Research by Patri & Heswari ([2022](#)) shows that there are counting and measuring activities in making woven pandan leaves. The results of previous research show that measuring is the main activity in the process of making

woven crafts. Gilsdorf (2012) explains that measuring activities are activities that include the process of comparing, sorting and quantifying quality.

The results show that there are mathematical concepts included in the content of numbers, measurements, geometry, as well as data analysis and probability in the process of making bamboo puppets. The number content in this research refers to the concept of whole numbers and fractional numbers. The existence of number content in making weaving is supported by research by Hotima & Hariastuti (2021) which shows the existence of the concept of fractional numbers in ketupat weaving, as well as research by Nurjamil et al. (2021) which shows the concept of arithmetic sequences and number operations in bamboo weaving. These two research results lead to an understanding that woven can be used as a contextual medium to demonstrate simple number concepts in mathematics learning at the elementary level.

The existence of measurement content in making bamboo puppets is supported by several previous research results. Wahyuni (2021)'s research results show that there are concepts of diameter and radius of circles, circumference and area of flat shapes, as well as surface area and volume of shapes in bamboo woven crafts in Sukabumi. Research by Riski et al. (2020) and Wurdani & Budiarto (2021) also show similar results. The field of measurement studies includes measuring quantities, how to measure quantities, and proving principles or theorems related to certain quantities in the sub-elements of measuring geometric and non-geometric quantities (BSKAP, 2022).

The geometric content identified in this research shows the existence of two-dimensional geometric forms that lead to the concept of tiling and relationships between lines. These results are supported by research by Puspawati & Putra (2014), Prabawati (2016), Hariastuti et al. (2021), and Hariastuti & Nurmahmudy (2022) which shows the existence of geometric shapes in various woven crafts. The results of this research show that woven crafts are a contextual form that can be used to demonstrate abstract geometric concepts in mathematics learning.

The content of data analysis and probability shows the existence of an average concept in a calculation. This condition is supported by the results of research by Hakim et al. (2022) which shows that wayang can be used as a medium to concretize the concepts of mean, median and mode. This is in accordance with the description of data analysis and probability contents, one of which is quantitative data analysis related to data concentration and distribution (BSKAP, 2022).

CONCLUSION

Exploration of making bamboo puppets in Gintangan village, Banyuwangi, is still limited to making one type of bamboo puppet with limited characters. The exploration results show that in the process of making bamboo puppets there are mathematical activities of counting, locating, measuring and designing. Ethnomathematical identification from the results of the exploration of making bamboo

puppets contains the content of numbers, measurements, geometry, as well as data analysis and probability. These limited explorations can become material for further research so that we can learn more about mathematical activities and mathematical concepts contained in making bamboo puppets.

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