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An ethnomathematical exploration of local wisdom: a case study of the Bebegig Sukamantri costume in Ciamis

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Abstract
This research aims to explore the mathematical concepts embedded in the traditional costume of Bebegig Sukamantri, Ciamis. The study is motivated by the importance of connecting mathematics learning with local culture through an ethnomathematics approach. The research employed a qualitative case study design. Data were collected through direct observation, interviews with cultural practitioners, and documentation. The findings reveal that the Bebegig costume incorporates several mathematical concepts, including geometry, transformations (translation and reflection), arithmetic sequences, piecewise functions, and statistics. The study concludes that ethnomathematics can serve as a bridge between culture and mathematics education and has the potential to be applied as a contextual learning medium. The implications of this research highlight the importance of preserving local culture as a source of mathematics learning and the need to integrate ethnomathematics into the educational curriculum.

Keywords: Ethnomathematics; Bebegig Sukamantri; Local Wisdom; Mathematics Education.

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INTRODUCTION

Culture and education are two inseparable aspects of human life. Culture provides values and traditions that shape a society, while education transmits and develops these values for future generations. When culture evolves, education also shifts accordingly, creating a reciprocal relationship (Ruswana & Zamnah, 2023; Widyastuti, 2021). In recent years, scholars have increasingly emphasized the importance of integrating mathematics with local culture through an approach known as ethnomathematics.

The term ethnomathematics was first introduced by D'Ambrosio (1985), who defined it as the study of mathematical practices inherent within cultural groups such as societies, ethnic communities, or professional groups (Rahmawati & Muchlian, 2019). Ethnomathematics not only examines cultural artifacts but also ways of thinking, problem-solving strategies, and mathematical reasoning that emerge from daily practices (Rosa & Orey, 2011). In the Indonesian context, ethnomathematics has been identified in diverse cultural elements, including batik motifs, traditional games, and architectural heritage (Ramadan & Astuti, 2023; Zayyadi, 2021).

One of the rich traditions in West Java is *Bebegig* Sukamantri, a cultural performance using large costumes and masks made from natural materials such as ijuk (palm fibres), bamboo leaves, and forest plants (Putra & Andra, 2023; Rostika et al., 2020). Beyond its artistic and symbolic values, the *Bebegig* costume also contains mathematical structures that reflect geometry, transformations, sequences, and statistical concepts. These elements demonstrate the natural integration of mathematics into local wisdom and provide opportunities to contextualize mathematics education.

Although studies on ethnomathematics in Indonesia have explored batik patterns, traditional architecture, and local games (Qurani et al., 2024; Rachmawati, 2022), research focusing on traditional costumes as sources of mathematical concepts remains limited.

In particular,investigations into the *Bebegig* Sukamantri costume are scarce, despite its recognition as an *intangible cultural heritage* (Putra & Ismail, 2020). This research gap underscores the need to document and analyze mathematical ideas in cultural artifacts, such as costumes, which can serve as powerful and meaningful resources for mathematics learning.

The objective of this study is to explore and describe the mathematical concepts embedded in the *Bebegig* Sukamantri costume. Specifically, this research identifies geometrical structures, transformations (translation and reflection), arithmetic sequences, piecewise functions, and statistical aspects present in costume elements such as the crown, hair, mask, and clothing. By uncovering these concepts, the study aims to demonstrate how ethnomathematics can enrich mathematics education and provide contextual learning opportunities.

This study employs a qualitative case study approach (Nasution, 2023). Data were collected through direct observation, interviews with cultural practitioners, and documentation at the Sanggar Seni *Bebegig* Baladdewa in Sukamantri, Ciamis. The analysis focused on identifying mathematical concepts within costume components and connecting them to mathematics learning contexts. The research framework emphasizes ethnomathematics as a bridge between local culture and mathematics education, fostering a culturally responsive pedagogy that values both heritage preservation and academic development.

METHODOLOGY

This study employed a qualitative approach with a descriptive case study design. This approach was chosen because the research aimed to explore mathematical concepts embedded in the *Bebegig* Sukamantri costume through detailed descriptions of real-life cultural practices, rather than through statistical manipulation (Nasution, 2023).

The research was conducted at the *Bebegig* Baladdewa Art Studio, Sukamantri, Ciamis Regency, between May and June 2025. This site was selected because it serves as the central place for the preservation and making of *Bebegig* Sukamantri.

The main object of this study was the *Bebegig* Sukamantri costume, particularly its components: the crown, hair, mask, and clothing. These costume elements were analyzed to identify embedded mathematical concepts.

In qualitative research, the researcher serves as the primary instrument (Sugiyono, 2013). The researcher designed, collected, analyzed, and interpreted the data, while also acting as the main observer and interpreter in the field.

The instruments used in this study were:

1. The researcher as the key instrument.
2. Observation and interview guidelines were validated prior to use.
3. Documentation tools, including photographs, field notes, and interview recordings, were used to strengthen the data.

Data collection was carried out through three techniques (Sugiyono, 2013):

1. Observation – Direct observation of the *Bebegig* costume-making process, identifying mathematical elements in its design.
2. Interviews – Gathering in-depth information from craftsmen and cultural practitioners regarding costume construction.
3. Documentation – Collecting visual evidence, such as photos and sketches of the costumes.

Data analysis was conducted inductively following the framework of Miles & Huberman (1994):

1. Data Reduction – Filtering relevant data, focusing on mathematical concepts such as symmetry, translation, and arithmetic sequences.
2. Data Display – Organizing the results into descriptive narratives, tables, and diagrams.

3. **C**onclusion Drawing – Interpreting the connection between *Bebegig* cultural elements and mathematical concepts to formulate the study's findings.

Mathematics is often perceived as an abstract discipline, yet many mathematical concepts naturally emerge within cultural practices (Rosa & Orey, 2011). Ethnomathematics, first introduced by D'Ambrosio (1985), is an approach that connects culture and mathematics by identifying mathematical ideas embedded in cultural traditions (Rahmawati & Muchlian, 2019).

The *Bebegig* Sukamantri costume was chosen as the focus of this study because, beyond its symbolic and aesthetic values, it embodies mathematical concepts such as geometry, transformations, arithmetic sequences, piecewise functions, and statistics. These concepts can be utilised to enrich mathematics learning through a contextual, culture-based approach (Ramadan & Astuti, 2023).

Thus, the framework of this study rests on the assumption that mathematics is not confined to classrooms, but also lives within cultural artifacts and traditions. By analyzing the *Bebegig* Sukamantri costume through an ethnomathematical lens, this research demonstrates how local culture can serve as a meaningful learning resource while simultaneously supporting cultural preservation (Putra & Andra, 2023; Rachmawati, 2022).

RESULTS AND DISCUSSION

The figure of *Bebegig* is usually presented in the form of a large doll resembling a human, which is used in cultural performances such as Thanksgiving ceremonies or folk festivals. *Bebegig* is not only a symbol of entertainment, but also represents the spiritual values and local identity of the Sukamantri community. In general, *Bebegig* consists of several main parts, namely: 1) Crown, located at the very top of the head. 2) Hair, hanging on the sides and back of the head. 3) Mask, serving as the face of the *Bebegig*, is often made to look frightening. Moreover, 4) Clothing, made from palm fibres shaped into pants or distinctive salopette-style garments that cover the entire body of the performer.

In conducting this research, the researcher followed observation guidelines. However, once in the field, it was found that during the making of the costume, craftsmen rarely created sketches or plans for the *Bebegig* Sukamantri costume, especially for the mask. According to Mr Sandi, the head of the *Bebegig* Baladdewa studio, craftsmen generally rely only on their instincts and imagination. As a result, there will never be two *Bebegig* masks or costumes that are identical, even if made by the same craftsman. Beyond this, the researcher discovered several mathematical concepts during the making process, including the following:

On the Crown of Bebegig Sukamantri

Among the four main parts of the Sukamantri *Bebegig*, the crown is one of the most prominent elements in its appearance. This crown is traditionally arranged using natural materials. *Waregu* leaves serve as the main material, complemented by bamboo leaves, *pipicisan* leaves, *hanjuang* leaves, and *caringin* leaves as additional elements. The combination of these various types of leaves gives the *Bebegig* a majestic, natural, and sacred impression.

Figure 1 Crown of *Bebegig* Sukamantri

Historically, the use of *waregu* leaves as the crown of *Bebegig* is believed to have existed since the early 1930s, when *Bebegig* first appeared. The local community chose this leaf because of its availability in the forests around Mount Sawal, its flexibility when arranged, and its durability against heat and rain during processional performances.

Philosophically, the *waregu* leaf symbolizes wisdom and the strength of nature. Since it grows wild, remains green, and survives through various seasons, *waregu* is interpreted as a symbol of resilience, protection, and the continuity of life. When arranged in the form of a crown on the *Bebegig* costume, *waregu* represents that the strength of the guardian figure (*Bebegig*) comes from harmony with nature.

Each arrangement of leaves is attached using tying techniques or inserted between palm fibres (*ijuk*), reflecting the craftsmen hip of the local people and their love for cultural heritage and the surrounding environment. The crown is not merely an accessory, but a symbol of strength and respect for nature and ancestors.

When observing the *Bebegig* crown, craftsmen place 10–15 stalks of *waregu* leaves for a large *Bebegig*, or even more, depending on its size, arranged in a specific pattern. The leaves are positioned so they appear to shift from a higher placement, then lower, and then rise again in sequence. This shifting indicates a geometric transformation pattern: translation, in which each leaf moves by a specific distance and direction.

From a mathematical perspective, the arrangement of *waregu* leaves on the crown, as shown in Figure 1, demonstrates a translation pattern or positional shift. For example, let us assume the first stalk of *waregu* leaves is placed at point A. The second leaf (point B) is then placed with a shift of 1 unit to the right and 1 unit downward from point A. This translation pattern continues through the 8th leaf, where each stalk undergoes the same directional and distance shift. After the 8th leaf, the direction of translation changes. The subsequent stalks are placed with a translation of 1 unit to the right and 1 unit upward, until reaching the 15th leaf. This arrangement forms a symmetrical "V" shape when viewed from the front.

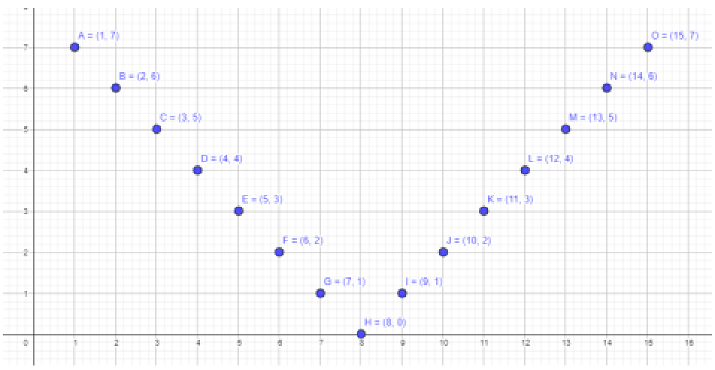

Figure 2 Translation on the Crown of Bebegig

Figure 2 shows the shift of *waregu* leaves on the *Bebegig* crown, represented by points on the Cartesian coordinate plane forming a pattern resembling the letter "V." The points are labelled from A to O, each with coordinates following a specific translation pattern. Starting from point A = (1, 7), the points move sequentially to the right and downward, with a fixed translation pattern of 1 unit to the right and 1 unit downward. This pattern continues until point H = (8, 0), which becomes the base point or the vertex of the "V" shape. After that, the direction of translation changes: the next points from I to O undergo a translation of 1 unit to the right and 1 unit upward, until returning to the original height at point O = (15, 7).

In addition to the concept of translation, the figure also illustrates reflection and arithmetic sequences. The reflection concept shown in Figure 4.2 indicates that the line x = 8 serves as the mirror line. The distance from point A to the line x = 8 is 7 units, and the same applies to point O. The ordinate (y) values remain the same, while the abscissa (x) values change symmetrically relative to the mirror line. The points on the left side of the line have symmetric counterparts on the right side, for example:

- Point A = (1, 7) has a symmetric counterpart at point O = (15, 7)
- Point B = (2, 6) has a symmetric counterpart at point N = (14, 6)
- Point C = (3, 5) has a symmetric counterpart at point M = (13, 5)
- Point D = (4, 4) has a symmetric counterpart at point L = (12, 4)
- Point E = (5, 3) has a symmetric counterpart at point K = (11, 3)
- Point F = (6, 2) has a symmetric counterpart at point J = (10, 2)
- Point G = (7, 1) has a symmetric counterpart at point I = (9, 1)
- Point H = (8, 0) is the axis of symmetry itself

From the perspective of arithmetic sequences, Figure 2 illustrates the change in the coordinates of the points based on a regular sequence of numbers, particularly in the ordinate (y) values of each point. There is a decreasing arithmetic sequence (from point A to H). For points A = (1, 7) to H = (8, 0), the y-values decrease regularly by 1 unit at each step. This forms the decreasing arithmetic sequence:

7, 6, 5, 4, 3, 2, 1, 0

This sequence has the first term (a) = 7 and common difference (b) = –1. The general formula for the nth term of this arithmetic sequence is:

$$\begin{aligned} Un &= a + (n-1)b \\ &= 1 + (n-1)(1) \\ &= 1 + (n-1) \end{aligned} \tag{1}$$

Thus, the y-values of the points on the graph follow two consecutive arithmetic sequences, creating a symmetrical shape that can be mathematically explained as two linear arithmetic sequences meeting at a single minimum point, namely at point H = (8, 0).

On the Hair of Bebegig Sukamantri

The hair on *Bebegig* Sukamantri is one of the most striking and distinctive elements of its appearance. This hair is made from rattan flowers, locally known as *bubuay*. The rattan flowers are first dried, then arranged in rows and allowed to hang long around the head and neck of the *Bebegig*.

Historically, the use of *bubuay* as the hair of *Bebegig* has been passed down from generation to generation since this tradition developed in the early 20th century. The community chose rattan flowers because they are natural materials with a light and flexible texture. Local craftsmen usually harvest *bubuay* during the dry season so that it dries faster and becomes more durable when used. In the past, *bubuay* was used not only for *Bebegig* but also for rituals to ward off misfortune and for the making of protective home decorations. Therefore, *bubuay* has a close connection with spiritual and protective functions in local culture, in line with the role of *Bebegig* as a guardian of the environment.

Symbolically, *bubuay* represents resilience, simplicity, and the interconnectedness of humans with nature. Bebegig's long, thick hair portrays a guardian of nature, both strong and majestic.

The hair of *Bebegig* Sukamantri, composed of strands of rattan flowers (*bubuay*), not only reflects the richness of local culture but also contains mathematical concepts. When observed closely, the length of the *Bebegig's* hair shows a regular pattern, especially in the Eagle-type *Bebegig*: the closer to the sides (edges), the shorter the hair strands become compared to those in the middle.

Figure 3 The Hair of Sukamantri *Bebegig* – Eagle Type

This pattern can be explained using mathematical concepts such as arithmetic sequences, piecewise functions, and statistics. The length of the hair strands (*bubuay*) at the centre (the midpoint) reaches 100 cm. Then, every five strands toward each side decrease by 10 cm from the previous group. That means the 6th strand is 90 cm long, the 11th 80 cm, and so on until the edge is reached. If represented as a number pattern, it looks like this (grouped by fives):

100, 100, 100, 100, 100, 90, 90, 90, 90, 90, 80, 80, 80, 80, 80, 70, 70, 70, 70, 70, 60, 60, 60, 60, 60

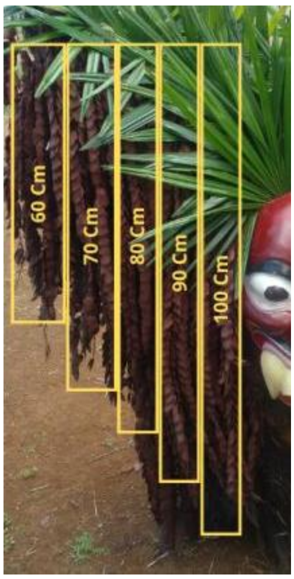

Figure 4 The Hair Length of Sukamantri *Bebegig* – Eagle Type

Each value in the sequence appears five times in a row, forming one group. Each group decreases by 10 units from the previous group, thus forming a decreasing arithmetic sequence:

100, 90, 80, 70, 60

The first term of the arithmetic sequence above is a = 100, and the common difference (b) is – 10. Therefore, the formula for the nth term of this sequence is:

$$\begin{aligned} Un &= a+(n-1)\times b \\ &= 100+(n-1)(-10) \end{aligned} \quad (2)$$

In addition, the arrangement of the hair, which forms a symmetrical pattern on both sides of the central line (the *Bebegig* mask), reflects the concept of symmetry in geometry. This arranges the *Bebegig's* hair as a visual representation of mathematical order within a local cultural element.

From the perspective of the piecewise function concept, this function consists of several different formulas defined over specific intervals or domains. The number pattern above remains constant within each fixed interval (5 steps), and each piece shows a decrease of 10 units. It can be defined as follows:

$$f(n)=\begin{cases} 100, & 1 \le n \le 5 \\ 90, & 6 \le n \le 10 \\ 80. & 11 \le n \le 15 \\ 70, & 16 \le n \le 20 \\ 60, & 21 \le n \le 25 \end{cases} \quad (3)$$

In the function above, the x-axis represents the nth order, and the y-axis represents the value of *f*(*n*). The graph will appear as a descending staircase (step graph), with each step spanning 5 units. This concept can introduce students to non-linear functions visually and help them understand that not all functions form straight lines or smooth curves.

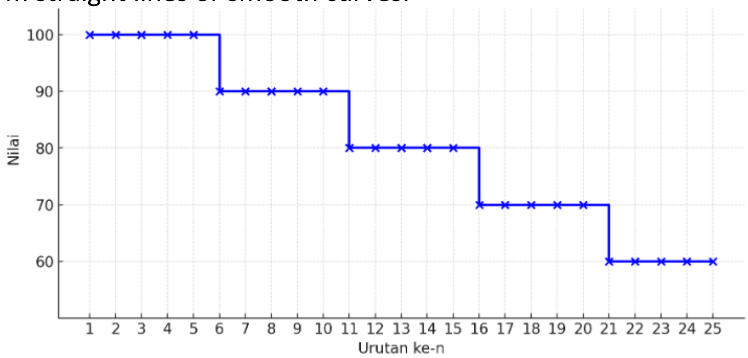

Figure 5 Piecewise Function Graph of the Hair of Sukamantri *Bebegig* – Eagle Type

The sequence is an example of a constant piecewise function, where the function value remains constant within a certain range, then suddenly changes in the next interval. This provides a good foundation for introducing discrete functions, step graphs, and their applications in both real-life contexts and local culture.

Finally, there is a statistical concept in the hair of the Eagle-type *Bebegig*. Based on the number pattern found in *Bebegig's* hair, the values can be treated as data in statistics. From this data, one can calculate the mode, median, mean, and range, and visualise the results in a statistical graph. The data obtained consists of 25 values, divided into 5 groups.

Table 1: The Hair Length Table of Sukamantri *Bebegig*

Hair Length	Frequency
100	5
90	5
80	5
70	5
60	5

- **Finding the Mode**

The mode is the value that appears most frequently in a data set. However, in this case, all values appear with the same frequency (5 times each), so the data has multiple modes (*multimodal*):

Mode = 100, 90, 80, 70, 60

- **Finding the Median**

The median is the middle value of the ordered data. Since the total number of data is 25 (odd), the median is the 13th value.

$$\text{Median} = 13^{\text{th}} \text{ data} = 80 \quad (4)$$

- **Finding the Mean**

The mean is calculated by summing all the data values and then dividing by the number of data points.

$$\begin{aligned} \text{Sum of all values} &= (5 \times 100) + (5 \times 90) + (5 \times 80) + (5 \times 70) + (5 \times 60) \\ &= 500 + 450 + 400 + 350 + 300 \\ &= 2000 \\ \text{Number of data values} &= 25 \end{aligned} \quad (5)$$

$$\text{Mean} = \frac{2000}{25} = 80$$

- **Finding the Range**

$$\begin{aligned} \text{Range} &= \text{Maximum Value} - \text{Minimum Value} \\ &= 100 - 60 \\ &= 40 \end{aligned} \quad (6)$$

From a statistical perspective, this data shows that both the mean and the median are equal to 80, indicating a balanced distribution, while the mode has multiple values because the frequencies are equal. The following is a pie chart representing the statistical data above.

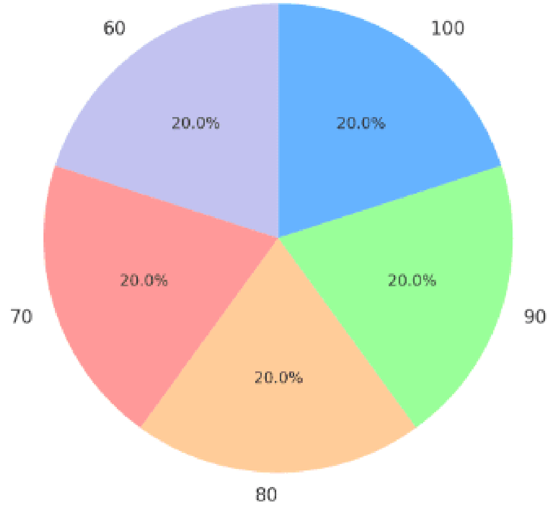

Figure 6: Pie Chart of the Hair Length Data of *Bebegig*

Each value (100, 90, 80, 70, and 60) appears 5 times, so each represents 20% of the total data. This diagram shows that the data is evenly distributed among the five values.

On the Mask of Bebegig Sukamantri

The *Bebegig* mask is made from logs of mahogany or albizia trees. These two types of wood are chosen because they have a texture soft enough to be carved, yet remain strong and durable. The process begins with selecting tree logs, which are then cut and dried. After that, the wood is carved by craftsmen to form the distinctive *Bebegig* face, rich in cultural meaning.

Wood as the material of the mask symbolizes strength, resilience, and the mediator between the human world and the guardian spirits of nature. In local belief, wood is an element that grows from the earth but reaches upward to the sky, and is therefore considered a bridge between two realms.

Figure 7 Materials of *the Bebegig* Sukamantri Mask

Behind this process lies an interesting mathematical concept. The log of wood resembles a cylinder, one of the three-dimensional forms in geometry. Knowing the diameter of the base and the height of the wood allows their measurements to be analyzed. For the making of a large-sized *Bebegig*, or one intended for adults, logs with a height of about 60 cm and a diameter of 40 cm are usually used. Meanwhile, for smaller-sized *Bebegig*, the wood used generally has a height of about 30 cm with a diameter of 25 cm.

Since the log resembles a cylinder, its volume can be calculated to determine the amount of material available, and its surface area can be used to estimate the carving area that will be worked on by the craftsmen .

Figure 8 Materials for the Cylindrical Mask

- **Large-sized *Bebegig* Wooden Log**
  Given:
  Height (h) = 60 cm (7)
  Diameter (d) = 40 cm → Radius (r) = 20 cm

Volume:

V $= \pi r^2 h = \pi \times (20)^2 \times 60$
$= 3{,}14 \times 400 \times 60 \approx 75360$ cm^3 (8)

So, the volume of the large-sized wooden log is: 75398 cm^3

Surface Area:

A $= 2\pi r(r + t) = 2\pi \times 20 \times (20 + 60)$
$= 2\pi \times 20 \times 80 = 3200\pi \approx 10048$ cm^2 (9)

So, the surface area of the large-sized Bebegig wooden log is 10048 cm^2

- **Small-Sized Bebegig Wooden Log**

Given:
Height (t) = 30 cm
Diameter (d) = 25 cm → Radius (r) = 12,5 cm (10)

Volume:

V $= \pi r^2 t = \pi \times (12{,}5)^2 \times 30$
$= 3{,}14 \times 156{,}25 \times 30 \approx 14722$ cm^3 (11)

So, the volume of the small-sized Bebegig wooden log is 14722 cm^3

Surface Area:

A $= 2\pi r(r + t) = 2\pi \times 12{,}5 \times (12{,}5 + 30)$
$= 2\pi \times 12{,}5 \times 42{,}5 = 1062{,}5\pi \approx 3336{,}25$ cm^2 (12)

So, the surface area of the small-sized Bebegig wooden log is $3336{,}25$ cm^2

Ethnomathematics is not only found in the wood used to make the *Bebegig* mask, which resembles a cylinder, but also appears clearly in the framework of the *songko*. This framework serves as the base to which the entire *Bebegig* mask, including the head and surrounding decorative elements, is attached. Moreover, the framework is carefully designed to be worn on the shoulders of the *Bebegig* performer. With the right and balanced design, the framework allows the performer to carry and move the large mask freely during the performance.

Philosophically, the *songko* reflects the value of the "silent supporter"—an element that works quietly yet plays a highly significant role. The *songko* symbolizes consistency, stability, and the foundational values that uphold culture. The shape and construction of the *songko* also reflect local wisdom in understanding balance, symmetry, and stability. In practice, the community not only builds the *songko* based on inherited experience but also, instinctively, applies mathematical concepts. The shape of the *songko* makes the *Bebegig* structurally stable and reduces pressure on the performer.

Figure 9 Framework/Songko of the *Bebegig* Sukamantri

The framework (*songko*) is generally made of wood and constructed in the shape of a triangular prism, a three-dimensional solid. In this prism, the base is not located at the bottom as in most solids, but rather positioned on the left or right side of the framework. By understanding the position and function of this side triangle as the base, we can apply mathematical concepts such as the volume of a triangular prism. Based on measurements, the framework has the following dimensions:

- Length of the triangular base (a): 46 cm
- Height of the triangle (t_a): 120 cm
- Height of the prism (distance between the triangles/longitudinal side) (T): 30 cm

Figure 10 Measurement of the Bebegig Sukamantri Framework/Songko

Through these measurements, we can calculate the volume of the Bebegig framework/songko:

Volume:

$$V = \left(\frac{1}{2} \times a \times t_a\right) \times T$$
$$V = \left(\frac{1}{2} \times 46 \times 120\right) \times 30 = 2760 \times 30 = 82800 \text{ cm}^3 \quad (13)$$

So, the volume of the Bebegig Sukamantri framework/songko is 82,800 cm³.

Not only that, but the *Bebegig* mask has undergone three evolutions in terms of materials and techniques, even though the character it represents has remained consistent—resembling a human figure with a frightening expression. In the early stage, the *Bebegig* mask was made from large tree bark shaped into a terrifying human face. Over time, a patchwork technique using *bahbir* material emerged, where the mask was assembled from several small pieces of wood glued together to form a face. The latest evolution brought the *Bebegig* mask into a more artistic stage, using carving techniques. At this stage, the mask was made from solid wood, such as mahogany or *albizia*, carved with intricate details.

In the second evolution, the making of the *Bebegig* mask shifted from a solid form to a patchwork technique, assembling facial parts from various wooden shapes. If examined closely, many geometric elements can be found in this process, such as cuboids in the general form of the mask, eyes shaped like ellipses, the nose resembling a cylinder, fangs forming bent cones, and many others. In this case, we will discuss the general shape of the *Bebegig* mask from this second evolution, which is a cuboid.

Figure 11 *Bebegig* Sukamantri Mask – Second Evolution

From the *Bebegig* in the picture above, we can clearly see that the *Bebegig*'s face takes the shape of a cuboid. Based on measurements during the research, this second-evolution mask has a width (*w*) of 5 cm, a length (*l*) of 25 cm, and a height (*h*) of 40 cm. From this information, we can calculate the mask's volume, surface area, and the perimeter of its base. Below is the explanation:

Volume:

V = $w \times l \times h$

V = $25 \times 5 \times 40 = 5000\ cm^3$ (14)

Surface Area:

A = $2(lw + lh + wh)$

A = $2((25 \times 5) + (25 \times 40) + (5 \times 40) = 2(125 + 1000 + 200)$ (15)

= $2(1325) = 2650\ cm^2$

So, the volume and surface area of the second-evolution *Bebegig* mask, which has a cuboid shape, are 5,000 cm³ and 2,650 cm².

On the Bebegig Sukamantri Costume

Historically, *ijuk* (fibres from the sugar palm tree) was chosen because it is strong and protects the dancer's body during performances. Philosophically, *ijuk* symbolizes protection and resilience, due to its coarse and thick fibers. Its black color reflects strength and courage, while its weaving pattern represents togetherness and unity, in line with the values of cooperation (*gotong royong*) in the Sukamantri community. *Ijuk* also symbolises simplicity and human connection with nature.

Figure 12 Costume of the Sukamantri *Bebegig* Performer

The *ijuk* pieces shown in this picture are used by the *Bebegig* performer to cover the lower part of the body, which is generally shaped like pants or overalls. The *ijuk* is sewn by hand with raffia strings along the sides, adjusted to fit the performer's body. From this, we can see several mathematical concepts, including measurement, where the length and width of the *ijuk* must be tailored to the performer's body for comfort.

For example, a *Bebegig* performer has a height from heel to hip of 110 cm and a waist circumference of 90 cm. When making the costume from *ijuk*, the measurements can be based directly on these results. For the *ijuk* height, it simply matches the length from heel to hip, which is 110 cm. For waist circumference, the size is half the total waist measurement, i.e., 45 cm, because the costume is made from two layers of *ijuk* sewn at the front and back.

In addition, there is also the concept of an arithmetic sequence in the sewing pattern of the *ijuk* edges, where the distance between knots is made repeatedly and regularly. Mathematically, this can be represented as follows:

- The first stitch is at 0 cm
- The second stitch is at 5 cm
- The third stitch is at 10 cm
- And so on…

Figure 13 Stitching Position Scheme on the *Bebegig* Sukamantri Costume

Using the n-th term formula, the costume maker can determine the number of stitches needed for a given length or find the position of the n-th stitch. This stitching pattern forms an arithmetic sequence with the first term (*a*) being 0 and the common difference (*b*) being 5 cm. The n-th term formula for this sequence is:

$$\begin{aligned} Un &= a + (n-1) \times b \\ Un &= 0 + (n-1) \times 5 \\ Un &= 5(n-1) \end{aligned} \tag{16}$$

From the formula above, the costume maker can determine the position of the n-th stitch or, for example, estimate the length covered by 10 stitches. For instance, if we want to know the position of the 10th stitch:

$$U_{10} = 5(10-1) = 5 \times 9 = 45\ cm \tag{17}$$

So, the 10th stitch is located 45 cm from the edge of the fabric.

Additionally, we can also determine how many stitches are needed for the entire length of the *ijuk*. Given that the length of the *ijuk* side is 110 cm, then:

$$\text{Number of Stitches} = n = \frac{length}{spacing} + 1 = \frac{110}{5} + 1 = 23 \text{ Stitches} \quad (18)$$

So, the number of stitches needed for the *Bebegig* costume measuring 110 cm is 23.

In addition to the four aspects mentioned above, during interviews, the researcher also found several mathematical concepts already applied by the craftsmen and cultural art practitioners of the Sukamantri *Bebegig*, including:

Ratios/Proportions

In the interview with source N_1, some topics contained mathematical concepts, including proportion. In the Sukamantri Bebegig, the shapes and sizes of *Bebegig* are not always the same. There are small-sized *Bebegig*, usually performed by children as part of the entourage, and there are also large-sized *Bebegig*, used by adults as the main characters of the performance.

These differences in size indirectly involve the concept of proportion in mathematics, which can be explained more clearly as follows:

Table 2 Comparison Between Large and Small *Bebegig*

Aspects	Small *Bebegig*	*Large Bebegig*	Mathematical Comparison
Size of the Wooden Log to Be Used for the Mask	*h* = 30 cm	*h* = 60 cm	30 : 60 = 1 : 2
	d = 25 cm	d = 40 cm	25 : 40 = 1 : 1,6
The mask-making process	5 days	7 days	5: 7
waregu leaves	5 Stalks	15 stalks	5 : 15 = 1 : 3
Bubuay	4 set	10 set	4 : 10 = 1 : 2,5
Price of the Mask	Rp. 400.000	Rp. 1.000.000	400.000: 1.000.000 = 1: 2,5
Price of the Mask and Costume	Rp. 1.000.000	Rp. 2.000.000	1.000.000:2.000.000 = 1: 2

Based on the comparative data between small and large *Bebegig*, it can be seen that the larger the *Bebegig*, the more materials, time, and cost are required in the production process. This is reflected in the comparison of the height and diameter of the wooden logs, the number of *waregu* leaves and *bubuay* fibres, the time spent, and the selling price. These size differences demonstrate the practical application of the mathematical concept of proportion within local culture.

a. Social Arithmetic

In the process of making the Sukamantri *Bebegig*, not only are artistic and cultural values embedded, but there is also an interesting traditional economic practice that can be studied through mathematical concepts, particularly social arithmetic. Through this study, we can understand how the community applies mathematical concepts contextually in cultural activities such as the production and sale of *Bebegig.*

Table 3 Interview Results With N_1 (Mr Sandi)

P	Approximately how many Sukamantri *Bebegig* have been produced in Ciamis? Are they all sold?

N_1	Around 70 *Bebegig*s have been produced at this studio. Some of the masks are sold, while others are kept in the studio's collection.
P	What is the price range for selling *Bebegig*?
N_1	For small-sized *Bebegig*, the mask alone costs around Rp. 400,000, and a full set with the costume is around Rp. 1,000,000. For large-sized *Bebegig*, the mask alone is approximately Rp. 1,000,000, and a full set with the costume can reach Rp. 2,000,000.
P	How much profit is usually made from these sales?
N_1	Typically, the profit reaches around **50%** of the selling price, depending on the production time and materials used.

The following is an explanation of the social arithmetic concept from the sale of *Bebegig*, assuming that the profit for each *Bebegig* is 50%:

$$\text{Profit} = \text{Selling Price} - \text{Cost Price (Capital)} \tag{19}$$

$$\text{Capital} = \frac{Selling\ Price}{1+presentase\ Profit} \tag{20}$$

So:

- Small *Bebegig*
  Selling Price = Rp. 1.000.000
  If the profit is 50%, then:

$$\text{Capital} = \frac{Selling\ Price}{1+presentase\ Profit} = \frac{1.000.000}{1+50\%} = \frac{1.000.000}{1,5} = Rp.666.667$$

$$\rightarrow \text{Profit} = \text{Selling Price} - \text{Capital} = \text{Rp. } 1.000.000 - \text{Rp. } 666.667 = \text{Rp. } 333.333 \tag{21}$$

So, the profit obtained from a small-sized *Bebegig* is Rp. 333.333.

- Large *Bebegig*
  Selling Price = Rp. 2.000.000
  If the profit is 50%, then:

$$\text{Capital} = \frac{Selling\ Price}{1+presentase\ Profit} = \frac{2.000.000}{1+50\%} = \frac{2.000.000}{1,5} = Rp.1.333.333$$

$$\rightarrow \text{Profit} = \text{Selling Price} - \text{Capital} = \text{Rp. } 2.000.000 - \text{Rp. } 1.333.333 = \text{Rp. } 666.667 \tag{22}$$

So, the profit obtained from a Large-sized *Bebegig* is Rp. 666.667.

Probability

In the process of making Sukamantri *Bebegig* masks, various risk factors can cause failure, including wood cracking during carving. Based on interviews with the craftsmen , out of approximately 70 *Bebegig*s produced, there was 1 recorded failure caused by cracked wood

Table 4 Interview Results With N_1 (Mr Sandi)

P	Approximately how many Sukamantri *Bebegig* have been produced in Ciamis? Are they all sold?
N_1	Around 70 *Bebegig*s have been produced at this studio. Some of the masks are sold, while others are kept in the studio's collection.
P	During production at this studio, has there ever been a failure in making the costume?
N_1	Failures are very rare; in fact, the costumes have never failed. However, during mask production, one failure was recorded due to the wood cracking.

Figure 14 Example of a Failed *Bebegig* Mask

Probability is a measure of the likelihood of an event occurring, and it is expressed using the formula:

$$P(A) = \frac{n(A)}{n(S)} \tag{23}$$

Description:
$P(A)$ = Probability of event A (in this case, failure)
$n(A)$ = Number of desired outcomes (number of failures)
$n(S)$ =Total number of possible outcomes(number if trials/productions)
In this case, the probability of mask-making failure due to cracked wood is:

$$P(failure) = \frac{1}{70} \tag{24}$$

This means that, on average, one failure occurs for every 70 productions due to material factors. Although the probability value is small, this data is still important to consider in the processes of material selection, wood drying, and quality control. It also serves as a real example of how the mathematical concept of probability can be used to understand risk in local cultural practices.

CONCLUSION

This study explored the mathematical concepts embedded in the traditional *Bebegig* Sukamantri costume through an ethnomathematical approach. The findings reveal that the costume incorporates various mathematical elements, including geometry, transformations (translation and reflection), arithmetic sequences, piecewise functions, and statistics. These results confirm the research objective, namely, to identify and describe how mathematical concepts are naturally integrated into local cultural artifacts.

The contribution of this research lies in demonstrating that traditional costumes, often overlooked in previous ethnomathematics studies, can serve as valuable resources for contextual mathematics education. By bridging culture and mathematics, this study enriches current knowledge in ethnomathematics and offers new perspectives on how cultural heritage can serve as a medium for teaching and learning mathematics in meaningful ways.

For future research, further studies could expand the exploration of ethnomathematical elements in other cultural practices or integrate the identified concepts into classroom teaching experiments. Such follow-ups would strengthen the application of ethnomathematics in education while simultaneously supporting the preservation of local cultural heritage.

Limitations and future direction

This research was conducted as a qualitative case study focusing specifically on the *Bebegig* Sukamantri costume in Ciamis. As such, the findings are limited to the context of a single cultural artifact and cannot be generalized to other cultural traditions. The study relied primarily on observation, interviews with cultural practitioners, and documentation, which may limit the scope of interpretation compared to mixed-method approaches. In addition, the analysis concentrated on selected mathematical concepts—geometry, transformations, arithmetic sequences, piecewise functions, and statistics—while other potential mathematical elements may remain unexplored.

Future research could expand this study in several ways. First, further investigations may explore ethnomathematical concepts in other components of the *Bebegig* performance, such as choreography, music, or stage formation. Second, comparative studies could be conducted with costumes from other cultural traditions in Indonesia or abroad to enrich the theoretical development of ethnomathematics. Third, classroom-based studies can be designed to implement the identified mathematical concepts into learning activities, thereby testing the pedagogical potential of cultural artifacts as contextual teaching resources. By pursuing these directions, future research can broaden the contribution of ethnomathematics to both mathematics education and cultural preservation.

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Declarations

The author independently designed the research, collected and analysed the data, and prepared the manuscript. The supervisors provided academic guidance, critical feedback, and support with manuscript revisions. All data generated or analyzed during this study are included in the thesis and are available upon reasonable request from the corresponding author.

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REFERENCES

Nasution, A. F. (2023). Metode Penelitian Kualitatif. In M. Albina (Ed.), *Sustainability (Switzerland)* (Vol. 11, Issue 1). CV. Harva Creative. http://scioteca.caf.com/bitstream/handle/123456789/1091/RED2017-Eng-8ene.pdf?sequence=12&isAllowed=y%0Ahttp://dx.doi.org/10.1016/j.regsciurbeco.2008.06.005%0Ahttps://www.researchgate.net/publication/305320484_SISTEM_PEMBETUNGAN_TERPUSAT_STRATEGI_MELESTARI

Putra, E. S., & Andra, D. (2023). Pelatihan Desain Kostum Bebegig Sukamantri Kontemporer. *REKA KARYA: Jurnal Pengabdian Kepada Masyarakat*, *2*(2), 122–128.

https://doi.org/https://doi.org/10.26760/rekakarya.v2i2.122-128
Putra, E. S., & Ismail, D. (2020). Fungsi Dan Makna Bebegig Sukamantri Sebagai Ikon Budaya Astral Sunda. *Patanjala Jurnal Penelitian Sejarah Dan Budaya*, *12*(1), 37. https://doi.org/10.30959/patanjala.v12i1.557
Qurani, A. A., Hakim, A. R., Apriyanto, M. T., & Farhan, M. (2024). Eksplorasi Etnomatematika Pada Batik Betawi Di Cilandak Jakarta Selatan. *Teorema: Teori Dan Riset Matematika*, *09*(September), 277–290. https://doi.org/https://jurnal.unigal.ac.id/teorema/article/view/15971
Rachmawati, I. (2022). Eksplorasi Etnomatematika Masyarakat Sidoarjo. *MATHEdunesa*, *11*(2), 562–573. https://doi.org/10.26740/mathedunesa.v11n2.p562-573
Rahmawati, Y., & Muchlian, M. (2019). Eksplorasi Etnomatematika Rumah Gadang Minangkabau Sumatera Barat. *Jurnal Analisa*, *5*(2), 123–136. https://doi.org/10.15575/ja.v5i2.5942
Ramadan, N., & Astuti, H. P. (2023). Etnomatematika Kesenian Rampak Bedug Dan Keterkaitanya Pada Pembelajaran Matematika. *OMEGA: Jurnal Keilmuan Pendidikan Matematika*, *2*(3), 98–104. https://doi.org/10.47662/jkpm.v2i3.482
Rosa, M., & Orey, D. C. (2011). Etnomatemática: os aspectos culturais da matemática [Ethnomathematics: the cultural aspects of mathematics]. *Revista Latinoamericana de Etnomatemática*, *4*(2), 32–54. https://revista.etnomatematica.org/index.php/RevLatEm/article/view/32
Rostika, I., Alif, M. Z., & Cahyana, A. (2020). Transformasi Bentuk Topeng Bebegig Sukamantri di Kabupaten Ciamis. *Jurnal ATRAT*, *8*(2), 140–152. https://doi.org/https://doi.org/10.26742/atrat.v8i2.1523
Ruswana, A., & Zamnah, L. (2023). Pengenalan Etnomatematika kepada Anak-Anak di Lingkungan Keluruhan Kertaharja. *Journal of Community Service (JCOS)*, *1*(2), 1–6. https://journals.eduped.org/index.php/jcos/article/view/261
Sugiyono. (2013). *Metode Penelitian Kuantitatif, Kualitatif dan R & D*. ALFABETA, CV.
Widyastuti, M. (2021). Peran Kebudayaan Dalam Dunia Pendidikan THE ROLE OF CULTURE IN THE WORLD OF EDUCATION. *JAGADDHITA: Jurnal Kebhinnekaan Dan Wawasan Kebangsaan*, *1*(1), 54–64. https://doi.org/10.30998/jagaddhita.v1i1.810
Zayyadi, M. (2021). Eksplorasi Etnomatematika Pada Batik Madura. *Jurnal Riset Pembelajaran Matematika*, *3*(1), 27–34. https://doi.org/10.55719/jrpm.v3i1.259