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Exploration of mathematical concepts in determining good and bad days in the *Mangbillang Allo* tradition in the Enrekang community

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Abstract: This study aims to explore mathematical concepts contained in the *Mangbillang Allo* tradition in the Latimojong community, Enrekang. This tradition is a practice of determining good and bad days based on calculations rooted in local culture. The research focuses on identifying mathematical elements in the stages of the tradition, such as *pentaunan* (star observation), day and date calculations, and the *Wattu Lima* time system. The approach used is qualitative with an ethnographic method. Data collection techniques include observation, in-depth interviews with tradition practitioners, and documentation of calculation practices. Data analysis is conducted through domain and taxonomy approaches to identify mathematical concepts, which are then linked to six ethnomathematical activities according to Bishop: counting, measuring, locating, designing, and explaining. The research results indicate that the *Mangbillang Allo* tradition contains geometric concepts in the *Wattu Lima* symbol, arithmetic in number sequences and calculations of days based on the *Hijri* calendar, as well as patterns and modulo concepts. Its learning implementation includes four stages: informal, mode for mathematics, mode of mathematics, and formal. In addition, cultural values such as *sipakatau*, *sipakalebbi*, *sipakario*, and *sipangingaran* can be integrated into the learning process. These findings suggest that the *Mangbillang Allo* tradition has the potential as a context for mathematics learning that is contextual, meaningful, and based on local wisdom.

Keywords: Mangbillang Allo, ethnomathematics, local culture, geometry, arithmetic

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INTRODUCTION

Indonesia is known as a country rich in local culture and traditions. The diversity of customs in each region is an invaluable heritage that not only represents cultural identity but also contains elements of logic and order. When examined in depth, these traditions are found to have a close connection with mathematical concepts. Communities that practice certain cultural activities often unknowingly apply mathematical principles, for example in systems of time calculation, number patterns, or geometric structures

(Anam, 2024; Siregar et al., 2024).

This phenomenon has drawn attention in ethnomathematics, a field that studies how mathematical concepts are integrated into cultural practices of communities. Several previous studies have revealed that systems for calculating auspicious and inauspicious days, commonly found in traditional societies, contain mathematical regularities. For instance, the Javanese community is familiar with *Primbon*, and the Balinese have the *Wuku* system, both of which use numerical systems to determine specific days (Albani et al., 2024). Although this practice is also known in Islamic culture, studies from a mathematical perspective on traditional calculation systems are still relatively limited, with most research focusing on philosophical and anthropological aspects (Haryati, 2020; Lesmana, 2023).

Research by (Pathuddin & Kamariah, 2024) found that the Bugis community applies arithmetic operations such as addition, multiplication, and modulo in the Pananrang practice as a determinant of auspicious days for agricultural activities. Similarly, (Aryanto, 2023) shows that the Javanese use ethnomathematical activities such as counting and measuring in the house-building tradition. Similar findings were also reported by (Sawitri & Rahman, 2023), who discuss the *Accini' Allo Baji'* tradition in Makassar culture as a community effort to determine auspicious days for various activities such as weddings, harvests, and thanksgiving ceremonies. These findings indicate that cultural practices can serve as a source of contextual mathematics learning.

Although various studies have demonstrated a connection between culture and mathematics, specific research on the *Mangbillang Allo* tradition in the Enrekang community is still very limited. Most similar studies focus more on beliefs and anthropological aspects, rather than the mathematical elements of their counting system (Sawitri & Rahman, 2023; Sukirman, Nuraisyah, & Wakia, 2022). In fact, this system has the potential to contain concepts of arithmetic, number patterns, and geometry that can be analyzed scientifically (Pathuddin et al., 2023).

This gap forms the basis for conducting this study, which aims to explore mathematical concepts in the *Mangbillang Allo* tradition as a contribution to the development of ethnomathematics research, as well as a step toward documenting local cultural practices that are beginning to be eroded by modernization. Specifically, this study aims to: (1) describing the calculation process in the *Mangbillang Allo* tradition used by the Enrekang community to determine auspicious and inauspicious days; (2) identifying the mathematical concepts contained in the process; and (3) analysing the relevance of the *Mangbillang Allo* tradition in supporting culturally-based mathematics

learning. This study is expected to contribute in two aspects, namely enriching ethnomathematics studies through the exploration of arithmetic and geometric concepts in traditional calculation systems, and serving as an initial step in the preservation and documentation of local cultural practices that contain educational values. To achieve this, in-depth interviews will be conducted with customary leaders, community elders, and practitioners of the *Mangbillang Allo* tradition to comprehensively gather information about the calculation system.

METHOD

This study uses a qualitative approach with ethnographic research methods. This approach was chosen because it allows the researcher to explore the meanings and cultural values contained in the *Mangbillang Allo* tradition, as well as to identify mathematical concepts integrated within it. The research was conducted in depth within the context of the community's daily life, enabling a holistic and contextual exploration of cultural practices.

This study was carried out in Latimojong Village, Buntu Batu District, Enrekang Regency, South Sulawesi (Figure 1). This location was selected because it is an area where *Mangbillang Allo* practices are actively carried out. The research took place over one month, from May 9 to June 9, 2025. During this period, the researcher conducted direct observations, in-depth interviews, and documentation of the traditional practices.

Figure 1. Research location

The subjects in this study are indigenous people who are directly involved in the implementation of the *Mangbillang Allo* tradition, particularly the elders (cultural figures), parents who participate in the procession, and community members who use the results of the calculations. The research subjects were selected purposively based on three criteria: (1) having experience or a direct role in carrying out the tradition, (2) recognized by the community as custodians of cultural knowledge, and (3) willing to provide information openly. The number of informants was determined until reaching the saturation point, with a total of 8 main informants, consisting of 3 cultural figures, 2 procession participants, and 3 community members who use the calculation system.

The researcher positioned themselves as a participant-observer to build closeness with the subjects and gain a deeper understanding of the socio-cultural context. Data collection techniques were carried out through participant observation, in-depth interviews, and documentation. The instruments used included observation sheets, semi-structured interview guidelines, and documentation forms containing checklists and visual notes. The data collected consisted of verbal data (interview results), nonverbal data (gestures, symbols, aids), as well as documentary artifacts such as photos, calculation sheets, and traditional symbols. Data validity was tested through source and technique triangulation, that is, by comparing results from various informants and methods. Meanwhile, reliability was reinforced by conducting member checks and repeated observations to ensure consistency of field data.

The data analysis technique in this study used the domain and taxonomy analysis model. Domain analysis was used to identify cultural categories related to mathematical concepts, such as day count after the domain is established, a taxonomic analysis is conducted to organize the structure of relationships among elements within the domain in order to deepen understanding of the cultural context and its connection with mathematical concepts.ng systems, time symbols, and local measurement units.

RESULTS AND DISCUSSION

Latimojong Village is located in the Buntu Batu District, Enrekang Regency, South Sulawesi. This area is situated in a mountainous region with fairly limited access, making it relatively remote but rich in cultural values that are still preserved. The inhabitants are an indigenous community living in harmony with nature and uphold local wisdom passed down from generation to generation. The social system in this village still heavily relies on the role of traditional elders (*dukun adat*), who hold a central position in decision-making, including determining the timing of important activities through the *Mangbillang Allo* tradition.

Mangbillang Allo, which literally means 'counting days,' is one of the important traditions still actively practiced by the Latimojong community today. This tradition is applied in various contexts, such as determining auspicious days for weddings, moving houses, starting a business, or traveling. The process involves three stages of calculation: (1) pentaunan or the annual cycle, (2) the counting of dates and days (*Billang* or *Mangbillang Allo*), and (3) the *wattu lima* system as an indicator of daily time quality. This knowledge is usually mastered by certain traditional leaders, who then serve as the main reference for the community when guidance on good and bad days is needed.

Even though modernization continues to reach remote villages, the *Mangbillang Allo* tradition remains resilient because it is practiced not just as a habit, but also as a meaningful spiritual and social expression. Many residents, including the younger generation, still respect the calculations of the customary leaders, even though they do not always fully understand the process. This indicates that the continuity of the *Mangbillang Allo* tradition is not only about preserving culture, but also about respecting collective values and spiritual connections that have become deeply rooted in the life of the Latimojong community.

The Process of Determining Days in the *Mangbillang Allo*

Pentaunan Tradition is the initial step taken by the indigenous Latimojong community to determine important times of the year. This process is based on direct observation of constellations that have been known through generations. In practice, *pentaunan* is carried out on clear, moonlit nights, without the aid of modern tools, relying only on the naked eye and local knowledge passed down from generation to generation.

There are four main constellations that serve as references in *pentaunan*, namely *Bungah*, *Sadang*, *Muane*, and *Manuk*. *Bungah* (Figure 2), known in astronomy as Crux or the Southern Cross, appears around February to June. Its shape resembles a kite, and its appearance marks the end of the rainy season and the beginning of the dry season.

Figure 2. *Bungah* (Crux)

Sadang (Figure 3), which consists of the stars Alpha and Beta Centauri, appears aligned and usually appears together with *Bungah* from April to May. This constellation serves as a direction guide, as well as an indicator of the coming dry season.

Figure 3. *Sadang* (Alpha & Beta Centauri)

Meanwhile, the *Muane* constellation, which is part of the Scorpio constellation, consists of five stars that become visible from November to December. *Muane* (Figure 4) usually appears together with *Bungah* and *Sadang*, and when all three appear together, referred to by the community as '*tongkon tallu*', it is considered the best time to start major activities such as farming or building houses. The appearance of these three constellations serves as an important natural indicator in decision-making.

Figure 4. *Muane* (Scorpio)

Afterwards, *Manuk* (Figure 5) appeared, which consists of Sirius, Canopus, and Procyon, from December to January. When *Manuk* is visible, while the other three constellations have disappeared, the community interprets this period as an unfavourable time, as it marks the arrival of an unstable rainy season.

Figure 5. *Manuk* (Sirius, Canopus, Procyon)

Observations of these constellations are carried out continuously every year, forming a recurring and consistent annual pattern. Although not formulated in writing or using modern scientific calculations, these patterns have been internalized in the collective knowledge of the community and serve as the main basis for designing their annual life cycle. The order and regularity in the appearance of these constellations indicate a mathematically-based pattern, namely the annual cycle pattern, which is an important part of the local system for calculating auspicious and inauspicious days.

Billang or *Mangbillang Allo*

After determining the best time of the year through the *pentaunan* stage, the Latimojong community continues by specifying the exact day and date for various important activities. This determination is believed to influence the smoothness and success of an activity. Although all activities follow the same day-counting system, there

are differences in the level of precision; for example, a wedding only uses general auspicious days, whereas migrating or farming requires calculations down to the hour.

From the results of observations and interviews, two main methods for determining auspicious days were found: the *Hadi* counting method and the *Aman* counting method. Both use the fingers as a counting aid, but with different techniques and rules.

Hadi Counting Method

This method utilizes six points on the left hand, namely the five fingers and the palm (Figure 6), to calculate the Hijri date. The counting starts from the little finger as date 1 and continues in sequence, forming a circular or cyclic pattern. The final position serves as a reference for the quality of the day.

Figure 6. Illustration of the *Tarikh* position on the fingers (*Hadi* method)

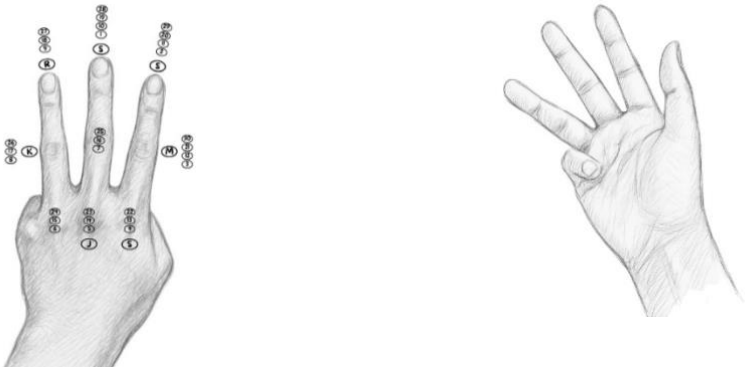
After determining the date position, the next step is to align the day of the week. For example, if the 1st falls on a Friday, then the pinkie finger represents Friday, the ring finger Saturday, and so on. Each finger position has symbolic meanings that have been passed down through generations (Table 1).

Table 1. The Meaning of Finger Positions in Determining Auspicious Days Based on the Type of Activity (*Hadi* Method)

Finger Positions	Meaning in Marriage	Meaning in Farming	General Category
Pinkie Finger	Tight sustenance, not blessed	Plants are thin, not fertile	Not Good
Ring Finger	A beautiful and handsome couple/offspring, sweet, attractive but infertile	Prone to pests/diseases	Less Good
Middle Finger	Spouse or offspring becomes *puang* (traditional figure)	Affected by pests but produce is adequate	Neutral
Index Finger	Spouse/offspring full of love, honoured in the community	Plants grow well	Good
Thumb Palm	Spouse/offspring full of love, honoured in the community	Plants are very fertile and healthy	Good

***Billang Aman* Method**

Unlike *Hadi's* method, this method uses three fingers of the left hand (index, middle, ring) as a fixed reference, and four fingers of the right hand as moving pointers (Figure 7). Dates are counted clockwise, while days are counted counterclockwise.



(a) (b)

Figure 7. (a) Illustration of date and day placement in the *Aman* Method, (b) Right hand as a pointer

Accuracy is very important in this method, because a directional error can result in an incorrect time assessment. The final position of the index finger determines whether the day is good, neutral, or bad.

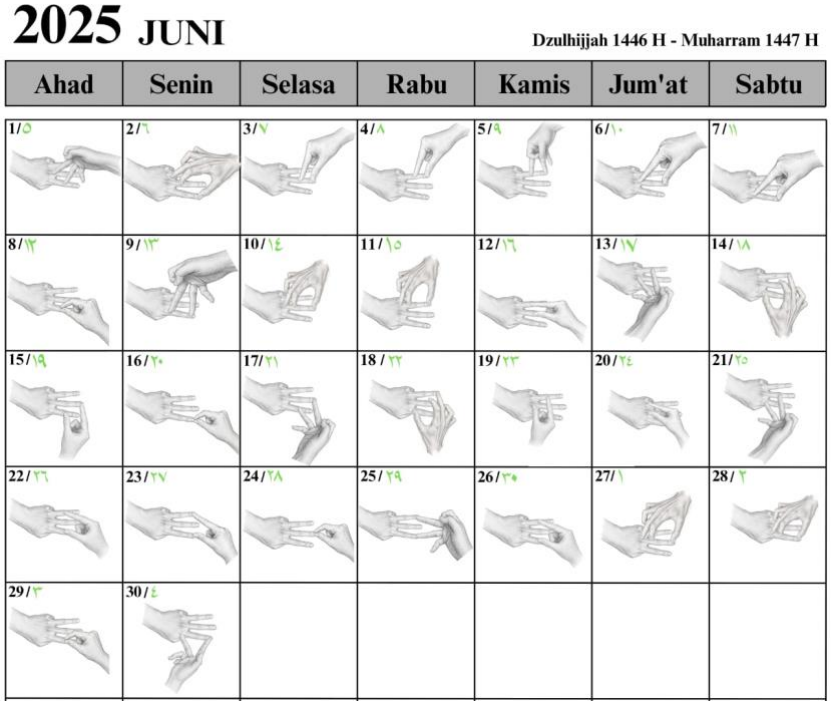


Figure 8. Application of the *Aman* Method in June 2025

The calculations for June 2025 (Figure 8), for example, show that the 8th, 16th, 24th, and 29th are categorized as *mallise'na* (good) days, while the 1st, 5th, 9th, 13th, 17th, and 21st are considered *allo sibokotan* (bad) days. The remaining days are considered

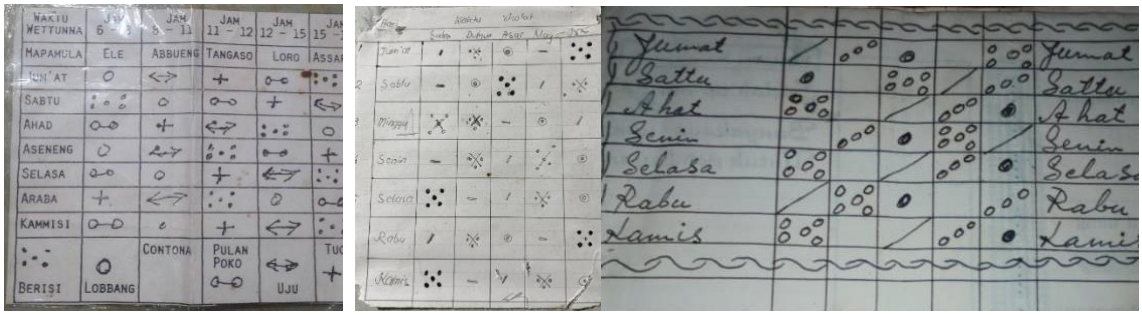
neutral, but are still evaluated based on the proximity of the finger positions—the closer, the better the quality of the day. In daily practice, people recognize *allo sibokotan* as days believed to bring misfortune and should be avoided, while *mallise'na* is considered the best and most blessed day. Neutral days can still be chosen, but are taken into account according to finger positions in the calculation method; the closer to a good position, the greater the chance of success.

In addition to using finger counting and the Hijri calendar, the people of Latimojong also divide time in the Hijri month into three main phases: *madoko bulan* (days 1–10), *matonggo bulan* (days 11–20), and *matua bulan* (days 21–end of the month). The *matonggo bulan* phase, which occurs near the full moon, is considered the most powerful and blessed time, whereas *madoko bulan* and *matua bulan* are seen as less stable. The transitional phase, *melolin bulan* (around days 15–16), is also avoided as it is believed to bring energy imbalance.

Both of these methods demonstrate regularity and a system of repetition in calculating days. The repetition of dates at six points in the *Hadi* method forms a pattern with multiples of six (modulo 6), whereas the nine points in the *Aman* method indicate a modulo 9 patterns. Although traditional and orally transmitted, this system reflects a form of local arithmetic based on modular numbers, as well as an understanding of time cycle patterns that repeat annually.

Wattu Lima

In the tradition of the Latimojong community, *Wattu Lima* refers to the five daily prayer times in Islam, with names and times that are locally adapted to determine auspicious and inauspicious times in a day (Figure 9). Each time segment has its own symbolic meaning that affects the community's decisions regarding important activities such as farming, travelling, or conducting events.

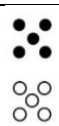
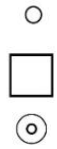
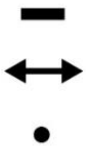


(a) (b) (c)

Figure 9. Guideline *wattu lima* (a) *Hasan 1*, (b) *Hasan 2*, (c) *Aman*

The community divides daily time into five fixed parts, and each is given an assessment as shown in Table 2.

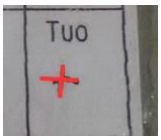
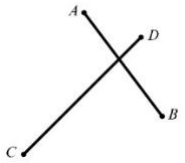
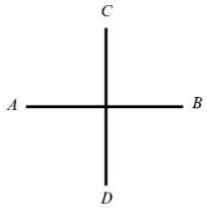
Table 2. Time Categories in the Wattu Lima Guidelines

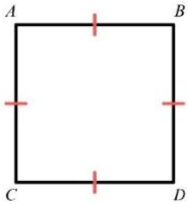
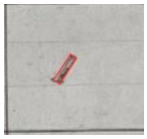
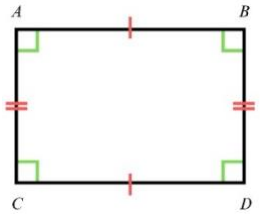
Name Time	Local Term	General Meaning	Symbol
Mallise'	Full/Occupied	This time is considered the best time, full of blessings, and highly recommended for starting important activities because it is believed to bring good results and smooth progress.	
Lobbang	Empty	This time does not bring disaster, but it also does not produce anything. It is usually avoided because it is considered pointless to use for important activities.	
Uju' /Bujuh	Corpse/Dead	This time is associated with death and dangerous things. Among the people, this time is considered potentially bringing misfortune, especially to the safety of life, so it should be avoided.	
Maddara	Bloody	This time is considered physically dangerous, potentially causing accidents, injuries, or harmful incidents.	
Pulan Poko/ Poleri Bolana	Even/Draw	This time does not contain great benefits, but it also does not bring harm. This time is considered fairly safe and can be chosen if the mallise' time is not available.	

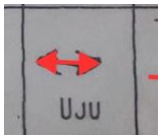
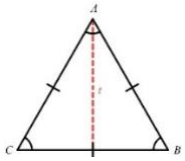
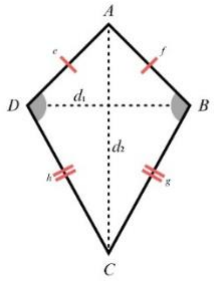
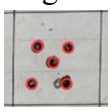
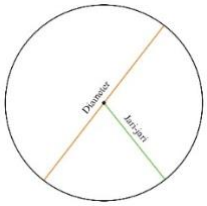
Although there are some variations among the traditional figures like *Hasan 1*, *Hasan 2*, and *Aman*, the basic principle of time division remains the same. Each time is also symbolized in geometric forms such as dots, circles, triangles, and straight lines, indicating that this system is not only practical but also has a visual and structured way of thinking (Table 3). The use of *Wattu Lima* reflects a culturally-based, consistent, and repetitive time classification system, and is actively used in daily decision-making. This system is passed down orally and remains relevant in modern contexts, serving as an integration of religious time and traditional social scheduling.

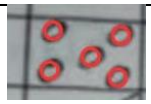
Table 3. The Concept of Geometry in the *Mangbillang Allo* Tradition

No	Geometric Shapes	Mathematical Concept	Explanation
1	The concept of points in the *mallise'* symbol and *uju*/*bujuh* in the *wattu lima* guidelines	 A point is a basic element in geometry. A point has no length,	Dots are used as symbols for the times *mallise'na* and *uju*/*bujuh* in

No	Geometric Shapes	Mathematical Concept	Explanation
	Mallise'   *Uju/Bujuh*	width, or height, and is usually represented by coordinates (x,y) on a flat plane.	the *wattu lima* system, shown in the visual scheme of time guidelines by customary figures as markers of the best and worst times of the day.
2	The concept of lines in the Sadang and Muane constellations in pentaunan and in the *Maddara* and *Poleri Bolana*/*Pulan Poko* symbols in the *Wattu Lima* guidelines  *Sadang*  *Muane*  *Maddara*  *Poleri Bolana/ Pulan Poko* 	 A line segment is a part of a line with two endpoints and a certain length. It is written as: $\overline{AB}$ If the coordinates of two endpoints $A\ (x_1, x_2)$ and $B\ (y_1, y_2)$ are known, the length of the segment can be calculated using the formula: $AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ where $x_1, x_2 =$ coordinates of point A, $y_1, y_2 =$ coordinates of point B, and $AB =$ length of the line segment from point A to B.  Two lines are said to be skew if they are neither parallel nor in the same plane, so they never intersect. In three-dimensional space, skew lines do not have a point of intersection. 	Straight lines appear in the Sadang constellation and the *Poleri Bolana* symbol as markers of direction and neutral time. Crossing lines are seen in the Muane constellation star formation during pentaunan. Intersecting lines are used in the *Maddara* and *Poleri Bolana* symbols, representing risky or break-even times.

No	Geometric Shapes	Mathematical Concept	Explanation
		Intersecting lines are the position of two lines that have a point of intersection because the two lines meet. Geometrically, intersecting lines occur because they have different slopes and the lengths between the lines allow them to meet.	
3	The concept of a square in the *lobbang* symbol in the *wattu lima* guidelines *Lobbang* 	 A rectangle has two pairs of parallel sides of equal length and four right angles. Here are the formulas for a square: $K = 4 \times s$ $L = s^2$ where K = Perimeter of the square, s = Lenght of a side, L = Area of the square.	The square appears in the hole symbol in the five-time system, depicted as empty time that does not bring blessings and is avoided for important activities.
4	The concept of the rectangle in the *maddara* and *uju*/*bujuh* symbols in the *wattu lima* guidelines *Maddara*  *Uju/Bujuh* 	 A rectangle has two pairs of parallel sides of equal length and four right angles. Here is the formula for a rectangle: $K = 2 \times (p + l)$ $L = p \times l$ Where K = perimeter of the rectangle, p = length, l = width, dan L = area of the rectangle.	The rectangle is found in the *maddara* and *uju*/*bujuh* symbols in *wattu lima*, used to represent dangerous times and times of death, which are traditionally avoided because they are considered to bring physical risks or disasters.

No	Geometric Shapes	Mathematical Concept	Explanation
5	The triangle concept in the bird constellation in pentagram formation and the *uju* symbol in the five-stone guidance *Manuk*  *Uju/Bujuh* 	 An equilateral triangle has three sides of equal length and three angles of equal size, each $60°$. Here is the general formula for a triangle: $K = 3s$ *W*here K = perimeter of the triangel, s = side length, L = area of the triangle, a =, and t = height.	A scalene triangle appears in the bird constellation formation during pentaunan, used as a marker for the rainy season and unfavorable times. An equilateral triangle appears in the *uju'* symbol on *wattu lima*, symbolizing a time of death that should be avoided.
6	The kite concept in flower constellation in weaving *Bungah* 	 A kite is a flat shape with two pairs of adjacent sides that are equal in length and diagonals that are perpendicular to each other. Here is the general formula for a kite: $K = 2 \times (e + g)$ $L = \frac{1}{2} \times d_1 \times d_2$ where K = perimeter of the kite, e = length of the short side, g = length of the long side, L = area of the kite, d_1 = short diagonal, dan d_2 = long diagonal.	The constellation pattern of Bungah appears to form a kite when observed in the night sky, and is used as a marker for the dry season in the calendar-making process.
7	The concept of the circle in the symbols *mallise'*, *lobbang*, and *poleri bolana* in the *Wattu Lima* guidelines *Mallise'* 		Circles are used in the symbols *mallise'*, *lobbang*, and *poleri bolana* in the *wattu lima* system,

No	Geometric Shapes	Mathematical Concept	Explanation
	   *Lobbang*  *Poleri Bolana/ Pulan Poko*  	A circle is a two-dimensional flat shape where all points on its edge are equidistant from the center point. Here is the general formula for a circle: $K = 2\pi r$ or $K = \pi d$ $L = \pi r^2$ where K = Circumference of the circle, r = radius, d = diameter, and L = area of the circle.	representing times with meanings of full, empty, or neutral, depending on the context of time quality assessment by customary figures.

Arithmetic Concept in the *Mangbillang Allo* Tradition

The concept of arithmetic in the *Mangbillang Allo* tradition appears in the practice of determining auspicious days based on the Hijri calendar. Although the community does not use formal mathematical terms, three core arithmetic concepts are found: arithmetic sequences, modular arithmetic, and number intervals.

Arithmetic Sequences

In the *Mangbillang Allo* tradition, the sequence of Hijri dates (1–30) is mapped onto the fingers of the hand following a hereditary pattern. Mathematically, this forms an arithmetic sequence with a constant difference of $d = 1$. This pattern demonstrates the community's understanding of the structure of number sequences, which is relevant in the study of basic arithmetic even though it is not formalized in mathematical terms. In this case, the sequence is:

$$a = 1, a_2 = 2, a_3 = 3, \ \dots, a_n = n, \text{ up to } n = 30$$

Difference (d):

$$a_{n+1} - a_n = 1$$

n-th term (general formula):

$$a_n = a + (n-1)d = 1 + (n-1)(1) = n$$

Since the numbers are used only to indicate order, not for summation, the reflected concept is an arithmetic sequence, not a series. This shows that the traditional practice of *Mangbillang Allo* reflects an understanding of the basic concept of number sequences in arithmetic.

Modulo Arithmetic

The method of calculating days in the *Mangbillang Allo* tradition involves distributing *Hijri* dates cyclically to points on the fingers. This repeating pattern can be analyzed using the concept of modulus, which is an operation to determine the remainder of a number when divided by a certain number.

$$a \bmod b = s$$

Meaning, when the number a is divided by b, s is the remainder. *Hadi's* method uses 6 points, resulting in an even distribution, where each point holds 5 dates with a multiple-of-6 pattern.

Mathematically:

$$30 \div 6 = 5, \qquad \text{with} \qquad 30 \; mod \; 6 = 0$$

This means, 30 dates are evenly distributed across 6 points, each point receiving 5 dates

$$\text{Point } k = \{a \; mod \; 6 = k\}, \qquad 0 \leq k < 6$$

On the other hand, the *Aman* method uses 9 points (3 sections × 3 fingers), resulting in an uneven distribution, where three points receive 4 dates and six points receive 3 dates. This distribution reflects the application of the modulo arithmetic concept, namely a repeating pattern based on the remainder of division.

$$30 \div 9 = 3 \text{ remainder } 3 \qquad \text{with} \qquad 30 \; mod \; 9 = 3$$

This distribution follows the modulo 9:

$$a \; mod \; 9 = k, \qquad 0 \leq k < 9$$

The repeating pattern in the *Hadi* and *Aman* methods reflects the cyclic characteristic of modular arithmetic. The *Hadi* method has a six-cycle, while the *Aman* method has a nine-cycle, according to the number of counting points. Both demonstrate the application of repeated division and modulus operations traditionally. This structured number pattern reflects a systematic understanding of number concepts within the community, even though it is not presented in formal mathematical terminology.

Number Intervals

In the tradition of *Mangbillang Allo* among the Latimojong community, the range of dates in a Hijri month (1–30) is not merely seen as a sequence of numbers but is divided into three main phases based on the visual changes of the moon. This classification determines the timing of various important activities. Mathematically, this division can be modelled as closed discrete number intervals and set partitions, which indicate the systematic grouping of numbers with specific boundaries.

Set of Hijri Days

We start by defining the set of days in one month:

$$A = \{x \in \mathbb{N} \mid 1 \leq x \leq 30\}$$

Explanation:

The set $A = \{1,2,\ldots,30\}$ represents the days in the Hijri month. In the Latimojong tradition, each element x not only indicates the date but also carries symbolic and spiritual meaning that determines the timing of important activities.

Partition of Moon Phases:

The set A is partitioned into three discrete closed intervals:

1) *Madoko Bulan* Phase (Young Moon)

$$I_1 = \{x \in \mathbb{N} \mid 1 \leq x \leq 10\} = [1,10]_{\mathbb{N}}$$

Explanation:

The beginning phase of the month, when the moon first appears as a crescent, is regarded symbolically as a period of low energy. Therefore, the community tends to avoid starting important activities such as weddings, planting, or customary meetings during this phase.

2) *Matonggo Bulan* Phase (Full Moon)

$$I_2 = \{x \in \mathbb{N} \mid 11 \leq x \leq 20\} = [11,20]_{\mathbb{N}}$$

Explanation:

The mid-month phase, when the moon is approaching or at full moon, is considered the most symbolically powerful period. This time is believed to bring blessings and full strength; thus it is chosen for conducting important activities. Mathematically, this phase represents a closed discrete number interval that is equivalent in length to other phases.

3) *Matua Bulan* Phase (Waning Moon)

$$I_3 = \{x \in \mathbb{N} \mid 21 \leq x \leq 30\} = [21,30]_{\mathbb{N}}$$

Explanation:

The end-of-month phase, when the moon starts to wane, is regarded as a period of decreasing temporal energy. Important activities can still be carried out as long as they do not coincide with days considered taboo according to local beliefs.

The results of this study indicate that the *Mangbillang Allo* tradition practiced by the Latimojong community is not only spiritual and social in nature, but also contains mathematical reasoning structures that are naturally integrated into cultural practices. Mathematical concepts such as modular arithmetic, time measurement, number patterns,

and even symbolic geometry appear in this practice, although they are not explicitly recognized by the practitioners.

One important finding is the use of four main constellations, namely *Bungah*, *Sadang*, *Muane*, and *Manuk*, in the planting cycle stages. The pattern of the appearance of these constellations shows the existence of a sky-based calendar system that is cyclical and structured. The community utilizes this system to determine the planting season and other important times. This aligns with the concept of natural measuring in ethnomathematics as proposed by (D'Ambrosio, 2001). The use of celestial bodies as a local time system reflects the community's understanding of the concept of repetition (rotation) and the spatial prediction of time.

At the stage of calculating auspicious days, the *Hadi* number method and the *Aman* number method demonstrate the application of modular arithmetic, respectively in modulo 6 and 9 patterns. The community uses fingers as a counting aid, reflecting a concrete approach commonly used in mathematics education. This reinforces (Bishop, 1998) view that concrete experiences can serve as a bridge to understanding abstract concepts. The presence of repeated number systems in this practice indicates that the community possesses consistent and symbolic numerical logic. Although different in form, these systems resemble the Javanese *Primbon* and the Batak calendar.

Meanwhile, the division of time in a day known as '*Wattu Lima*' reveals a traditional time structure based on symbolic intervals. Each time has social meanings and functions, representing a form of scheduling based on cultural values. In the context of ethnomathematics, this is a form of time categorization that is not only functional but also meaningful. This system can be adopted as a contextual approach in mathematics learning, particularly in introducing the concept of time and the division of units. Overall, activities in the *Mangbillang Allo* tradition reflect six ethnomathematical activities according to Bishop (1988): counting, measuring, explaining, designing, locating, and although not explicitly visible, the element of playing can be seen in the creativity and cultural flexibility when adapting calculations to social contexts.

Compared to previous studies, these results expand the understanding of the diversity of mathematics in local practices. (Pathuddin & Kamariah, 2024) revealed the concept of mathematical operations in *Pananrang*, (Aryanto, 2023) demonstrated the use of number patterns in Javanese culture, and (Sawitri & Rahman, 2023) highlighted the symbolism of time in Makassarese culture. However, this study presents new aspects in the exploration of symbolic geometry of *Wattu Lima*, as well as the integration of the

Hijri calendar with local finger counting, which have not been extensively discussed in previous studies. This indicates a novelty in both the approach and the subjects examined.

The advantage of this research lies in its ethnographic approach, which allows for a deep understanding of cultural systems and the social context of communities. This study also successfully reveals the strong connection between local culture and formal mathematical concepts. However, its limitation is in the form of knowledge transmission, which is oral, resulting in possible variations between families and regions. Additionally, the limited number of informants restricts the scope of generalization.

This research makes an important contribution to two fields: education and cultural preservation. In education, these findings can serve as a basis for developing culturally-based mathematics learning models that are contextual and meaningful. Learning can be developed through four stages: informal, mode for, mode of, and formal, in accordance with the ethnomathematics education approach. In the cultural realm, documenting this system helps prevent the loss of local knowledge that holds high intellectual and spiritual value. Furthermore, integrating cultural values such as *sipakatau*, *sipakalebbi*, *sipakario*, and *sipangingaran* into mathematics learning can support contextual character education. The value of *sipangingaran* is reflected in a calculation process that is careful and consultative. The values of *sipakatau* and *sipakalebbi* are seen in the respect for customary leaders as guardians of knowledge, while the value of *sipakario* is manifested in the spirit of sharing the results of calculations for the common good. This strengthens the position of local traditions as a source of learning that is not only rich in concepts but also full of values.

CONCLUSION

Based on the objectives and research findings, it can be concluded that the *Mangbillang Allo* tradition is a cultural practice rich in activities and mathematical concepts. This tradition is carried out through three main stages, namely weaving based on the observation of constellations, adjusting the Hijri calendar, and using the *wattu lima* system to determine auspicious and inauspicious days. These three stages reflect ethnomathematical activities such as counting, measuring, determining positions, designing, and explaining as described by Bishop. Arithmetic concepts appear in the modulo counting system and time grouping, while geometric elements are evident in the form of symbols and the spatial orientation of the *Wattu Lima*. These findings reinforce the relevance of ethnomathematics in the local context and show that traditions can be a source of contextual and meaningful mathematics learning. In addition to providing

theoretical contributions to the study of ethnomathematics, this research also opens opportunities for application in culture-based mathematics education, including strengthening cultural values such as *sipakatau*, *sipakalebbi*, *sipakario*, and *sipangingaran* in learning.

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