Infinity Journal of Mathematics Education
Volume 14, No. 2, 2025
https://doi.org/10.22460/infinity.v14i2.p513-530

p-ISSN 2089-6867
e–ISSN 2460-9285

Ethnomathematics study: The use of modulo concept in Kampung Naga

Uba Umbara[1*], Sufyani Prabawanto[2], Agus Saeful Anwar[3]
[1]Department of Mathematics Education, Universitas Muhammadiyah Kuningan, West Java, Indonesia
[2]Department of Mathematics Education, Universitas Pendidikan Indonesia, West Java, Indonesia
[3]Department of Primary Teacher Education, Universitas Muhammadiyah Kuningan, West Java, Indonesia
[*]Correspondence: uba.bara@upmk.ac.id

Received: Nov 15, 2024 | **Revised**: Jan 3, 2025 | **Accepted**: Feb 3, 2025 | **Published Online**: Mar 5, 2025

Abstract

This article discusses the ethnomathematics study of the Kampung Naga community in Tasikmalaya, Indonesia. Ethnomathematics can investigate the application of mathematical notions in these cultural activities. The study explored the forms of ethnomathematics in their ideas and activities in living their daily lives. This study uses an ethnomethodological approach with a realistic ethnographic design to show facts and provide broader meaning. Data were collected from five respondents through in-depth interviews. The study results show that the Kampung Naga community uses the modulo concept to determine the criteria for days that can be used to start various activities, such as building or repairing houses, working, farming, and other social activities. This exploration proves that mathematical concepts are integrated into cultural values in everyday life.

Keywords:
Cultural contexts, Ethnomathematics, Mathematical ideas, Mathematical modelling, Mathematical practice

How to Cite:
Umbara, U., Prabawanto, S., & Anwar, A. S. (2025). Ethnomathematics study: The use of modulo concept in Kampung Naga. *Infinity Journal*, *14*(2), 513-530. https://doi.org/10.22460/infinity.v14i2.p513-530

1. INTRODUCTION

Indonesia is the fourth most populous country after China, India, and the United States. Based on the results of the population census conducted by the Central Statistics Agency of the Republic of Indonesia in 2010, Indonesia has around 1,340 ethnic groups. With so many ethnic groups, Indonesia is rich in cultural diversity, customs, and languages. One of the largest ethnic groups in Indonesia is the Sundanese. The Sundanese are second after the Javanese in terms of population and have many customs and beliefs. One of the beliefs that emerge in Sundanese society, in general, is about the habits of people in making calculations. This is shown in previous ethnomathematics research, which discussed how the Cigugur Indigenous community, which is part of the Sundanese community, uses calculations to determine the best day to build a house (Umbara et al., 2021b), determine

wind direction for good luck based on lunar parameters (Umbara et al., 2021a), and predicting good days for farming (Umbara et al., 2021c).

Ethnomathematics research explores mathematical concepts rooted in the community's ideas and activities. Introduced by D'Ambrosio in 1985, ethnomathematics is a research program that can show applications in studying the application of mathematics in human life (D'Ambrosio & D'Ambrosio, 2013) both conceptually and practically as the result of human thought and information processing based on the results of their social interactions (Umbara et al., 2023). Ethnomathematics can be defined as a part of mathematics and is modelled with cultural anthropology (Orey & Rosa, 2006). Culture is broadly understood as studying the relationship between mathematics and culture (Johnson et al., 2022). Ethnomathematics sees various mathematical knowledge as interconnected with the context of communal knowledge. In this scenario, ethnomathematics uses cultural capacities to provide instruments for reconceptualization by rearranging the political, epistemological, and practical dimensions of mathematics (Chahine, 2020). In short, ethnomathematics is interested in the relationship between the abstract world of mathematics and everyday life (Rodríguez-Nieto & Alsina, 2022; Sunzuma & Maharaj, 2020).

Ethnomathematics is a study that can be used to investigate aspects of culture and mathematics carried out by a cultural group (Rosa et al., 2016) through the discovery of unique mathematical ideas, procedures, and practices (Rosa & Orey, 2013), thus providing insight into the social role of mathematics in everyday life (Orey, 2000). Based on this, ethnomathematics is a technical step in investigating the forms of mathematics a cultural group uses based on their local knowledge. Ethnomathematics is mathematical knowledge that develops in the culture of a country (Massarwe et al., 2012; Verner et al., 2019; Zhang & Zhang, 2010) which combines anthropology, history, pedagogy, linguistics, and philosophy of mathematics in different sociocultural environments (Rosa & Gavarrete, 2017). In other words, ethnomathematics investigates the complex relationships and interconnections between mathematical concepts and other cultural components such as architecture, crafts, art, education, and even language (Gerdes, 2009). As a result, several things related to traditional rituals, dwellings, games, art, clothing, crafts, and language all contain mathematical knowledge used in a culture.

The wide geographical scope of the Sundanese tribe makes the socio-cultural environment increasingly rich in values and knowledge. This makes the Sundanese people, who are spread across several regions, have values that are connected to each other, but each has its own uniqueness. Several ethnomathematic studies that have been conducted by several researchers on the Indigenous groups in the Sundanese tribe include those conducted in Kampung Kuta which examines the concept of flat shapes (Wijaya et al., 2023); application of Kampung Kuta culture on the flat shape concept (Adilaturrahmah & Suparni, 2021); the application of geometric concepts to traditional houses in Kampung Pulo (Nurhasanah & Puspitasari, 2022); the use of the modulo concept in calculating good days in Kampung Pulo (Maryani et al., 2022); the use of geometric concepts, number operations, arithmetic, and modulo in traditional houses in Kampung Naga (Mulyani & Prabawati, 2023); the use of odd-even calculations to determine the rice seeds to be planted (Apiati et al., 2019); the use of geometric concepts in buildings in Kampung Naga (Arini et al., 2023);

the use of symbolic measurements in Kampung Cigugur (Umbara et al., 2021d), the use of the modulo concept in determining a good day to build a house in Kampung Cigugur (Umbara et al., 2021b), the use of the modulo concept in determining the direction of the wind to seek fortune in Kampung Cigugur (Umbara et al., 2021a); the use of the modulo concept in determining a good day for farming in Kampung Cigugur (Umbara et al., 2021c); the use of the geometry concept in Baduy traditional houses (Sekarpandan et al., 2022); the use of the algebraic concept in determining the date in Baduy (Eliza & Pujiastuti, 2022); the use of the arithmetic modulo concept and the algebraic concept to determine a good day in Baduy (Sopiah, 2020); and the use of the geometry concept in the traditional house of Urug Village (Bahagia et al., 2022). Several studies that have been conducted in several Sundanese traditional villages have focused on ethnomathematics forms that are relevant to geometry and algebra, so it is necessary to study whether the ethnomathematics forms in Naga Village are relevant to the ethnomathematics forms in other traditional villages. Meanwhile, two studies conducted in Naga Village explored the concept of geometry and the concept of numbers, with a focus on flat shapes in the architecture of buildings in the Naga Village area and agriculture.

Ethnomathematics research that explores the concept of algebra in Kampung Naga is rarely conducted. Thus, we see a research gap in ethnomathematics research conducted so far. Therefore, in this study, we intend to conduct comprehensive research by conducting a field study to find forms of ethnomathematics in the Kampung Naga Community that focus on algebra. This study will focus on the Kampung Naga community, a sub-culture of the Sundanese tribe, and how it recognizes and operates numbers in daily activities. Therefore, this study aims to show the activities of the Kampung Naga community in terms of operating numbers and counting activities to determine the category of days used by the community to start various activities. The introduction of numbers and their operations can trigger the emergence of other more complex abilities so that the question will guide this study: is there a number system arrangement used by the Community to determine the category of time that is believed to be a good time to start various activities? If a society uses a number system arrangement, can the concept be arranged into a mathematical model? This study's results are expected to trigger the integration of ethnomathematics perspective into mathematics learning in schools.

2. METHOD

This study uses an ethnomethodology approach with a realist ethnographic design. The ethnomethodology approach was chosen because this study focuses on observing the community's social activities. Ethnomethodology is the study of community habits using the characteristics of an organized order (Garfinkel, 2005) related to how people interpret everyday life, especially the mechanisms for achieving and maintaining interactions between social encounters and the assumptions they make, the conventions they use, and the practices they adopt (Cohen et al., 2002). Ethnomethodology explains reality by studying common sense carried out continuously through social engagement with the environment based on concepts and social interactions. Meanwhile, a realist ethnographic design is used to make this study more focused based on a clear concept to guide the research. Realist ethnography

is a third-person objective report of a scenario and information collected from individuals in a location (Creswell, 2012). Ethnography was chosen as the research design because it aligns with ethnomathematics' objectives, namely studying ideas, methods, and techniques in a particular culture (Shirley & Palhares, 2016), carried out by researchers as third parties outside the community.

Technically, the researcher found the focal point of the ethnomathematics study to be conducted in Kampung Naga, namely whether there is a community custom in determining the criteria for days that can be used to start various activities. After that, the researcher began to identify who the informants were who could provide information about the custom. The information gathering was carried out through in-depth interviews. Researchers collected information from informants sequentially and systematically based on the type of informant selected so that the validity of the research data could be guaranteed because the clarification process could be carried out quickly to informants. The informants interviewed consisted of Kuncen (leader of the traditional institution), Punduh (who was assigned as a leader in carrying out traditional ceremonies), and elders (elderly community leaders). The main reason for selecting these informants was because they were seen as having an understanding of the culture and customs maintained in Kampung Naga. Interviews were conducted to explore the knowledge systems held by most people, the habits they often do, environmental support, and their beliefs about their activities by responding to knowledge and construction-forming questions about community habits in determining the time considered good for various activities. In the interview, researchers also asked experience, behavioral, knowledge, constructive, and contrast questions. Contrasting questions were asked to respondents to distinguish one thing from another so that cross-checking of information (triangulation) occurred which could guarantee the validity and reliability of the research data. All informants were interviewed three times at different times and places, with the concession time of each informant varying between 1-2 hours for each session. Data collection was carried out directly by the researcher using an audio recorder. Based on several general questions, the stages of this research were compiled by adopting the ethnomathematics research design that was carried out by Alangui (Umbara et al., 2019). The stages of the research are arranged in Table 1.

Table 1. Ethnomathematics research design

Generic Question	Initial Answer	Critical Construct	Specific Activity
Where to find the focal point of ethnomathematics studies in Kampung Naga.	Cultural activities in a cultural atmosphere, namely determining the time category for building/repairing a house.	Culture	Conduct interviews with people who know how to determine day categories.
How to see the focus of ethnomathematics research in Kampung Naga.	When selecting day categories, explore and investigate the QRS (Qualitative, Relational, and Spatial) components.	Alternative Thinking	Determining which QRS idea is contained in the activity determines the time category.

Generic Question	Initial Answer	Critical Construct	Specific Activity
What is it (finding possible mathematical concepts)?	Alternative Conceptual Proof	Philosophical Mathematics	Identifying the factors that justify customary rules in activities to determine day categories regarding science and belief.
What does it imply (create a mathematical model based on the findings)?	Significant cultural and mathematical value	Methodology anthropology	Explaining the relationship between two types of knowledge (mathematics and culture). A new mathematical idea is discovered when choosing a category of the day.

Technically, this research begins by determining informants who know the culture, customs, and habits carried out by the Kampung Naga Community every day, especially their activities in determining the time category for building/repairing houses. The research team then digs up information about the procedures used to determine the time category for building/repairing houses from informants through in-depth interviews. After the research team obtains saturated data, the research team identifies factors that justify the customary rules in the activity of determining the day category related to science and the beliefs of the Community as users of the calculation results. Based on the results of this identification, the research team then conceptually formulates an alternative concept based on the concept of mathematics that can be used and explains comprehensively the relationship between mathematics and culture contained in the activity of determining the time category for building/repairing houses carried out by the Kampung Naga Community.

3. RESULTS AND DISCUSSION

3.1. Results

Most Sundanese people, including the people of Kampung Naga, use the Gregorian and the Javanese calendars. The Javanese calendar combines the lunar cycle, the Saptawara period, and the *Pancawara* period. One year in the Javanese calendar consists of 12 months, with the number of days in one month ranging from 29 to 30 days. *Saptawara* and *Pancawara* are two day cycles in the Javanese calendar that are used to count the days in a week. *Saptawara* is another term for seven days (seven-day cycle) in a week, consisting of *Ahad* (as *Minggu*), *Senen* (as *Senin*), *Salasa* (as *Selasa*), *Rebo* (as *Rabu*), *Kemis* (as *Kamis*), *Jumaah* (as *Jumat*), and *Saptu* (as *Sabtu*). Meanwhile, *Pancawara* is another term for one week, which consists of five days (five-day cycle), consisting of manis, pahing, puhun, wage, and kaliwon. *Pancawara* is also known as market day because on that day was the operational day of the traditional market in ancient times. In addition, these five days have meaning about a person's fate, including love, joy, anger, sorrow and happiness.

Based on the *Saptawara* and *Pancawara* periods, two kinds of names are attached to one day. For example, *Ahad Manis, Senen Pahing, Rebo Puhun, Kemis Wage, Jumaah*

Kaliwon, *Saptu manis*, etc. The combination of the *Saptawara* and *Pancawara* periods is shown in Figure 1 (Umbara et al., 2019).

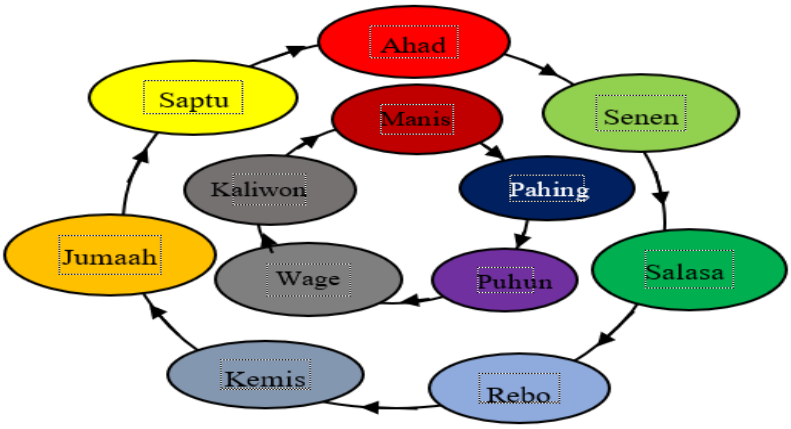

Figure 1. The cycle of *Saptawara* period and the *Pancawara* period

Based on Figure 1 it can be understood that the *Pancawara* period repeats every five days while the *Saptawara* period every seven days and is a unit, for example: *senen manis, salasa pahing, rebo puhun, kemis wage, jumaah kaliwon, saptu manis, ahad pahing*, etc. In mathematics, this cycle can be interpreted as a relationship between two successive sets, which in one day (*Saptawara period*) have one pasaran days (*Pancawara period*). Both are paired sequentially so that they can be defined; for example, A is a set of *Saptawara* and B is a set of *Pancawara*, so it can be written A = {*Senen, Salasa, Rebo, Kemis, Jumaah, Saptu, Ahad*} and B = {*Manis, Pahing, Puhun, Wage, Kaliwon*}. More formally, we have definitions, for A and B are set. The Cartesian products of A and B are sets {A x B=(a,b)|a∈A,b∈B}. The *Saptawara* period, and *Pancawara* period have a certain value called *naktu*. The value for each month is shown in Table 2.

Table 2. The sequence of days for the *Saptawara* period, the *Pancawara* period, and their values

***Saptawara* period**	
The name of *hari*/day	**Value/*Naktu***
Ahad (Sunday)	5
Senen (Monday)	4
Salasa (Tuesday)	3
Rabu (Wednesday)	7
Kemis (Thursday)	8
Jumaah (Friday)	6
Saptu (Saturday)	9
***Pancawara* period**	
The name of *pasaran*	**Value/*Naktu***
Manis	5
Pahing	9
Puhun	7
Wage	4
Kaliwon	8

This value is then used as a formula to determine a good day. The calculation is based on the sum of the values attached to the name of the month, the *Saptawara* period, and the *Pancawara* period. People use a formula to determine a good day to hold a party or celebration.

$$A = \frac{Sv + Pv}{3}$$

Explanation:
A : Time category
Sv : *Saptawara* value
Pv : *Pancawara* value
*) Category of days, which is the remainder of the division number

The time categories that the Naga village community can choose are shown in Table 3.

Table 3. Category day

The criteria of *hari*	Remaining of Division
Bismillah	1
Alhamdulillah	2
Astagfirullah	0

In accordance with the previous explanation, the categories used to determine a good time to build/repair a house consist of 3 criteria. Therefore, it can be seen that the modulo concept is used in this calculation. If you pay attention, if the combined value of the month, the *Saptawara* period, and the *Pancawara* period from the formula above is divided by 3, then this can be called modulo 3. Integers a and integer b are said to be congruent in modulo *n* if and only if when *a* is divided by *n* the remainder is *b*, where $\boldsymbol{n \in Z}$. Symbolically expressed with $\boldsymbol{a \equiv b \bmod (n)}$ so that the mathematical model can be formulated as follows.

$$a \equiv c \ (mod\ 3) \ \ or\ a = 3q + c$$

Where *a* is the determinant of the criterion for months, *Saptawara*, and *Pancawara* periods, and *c* is the division's residual. For example, if a is used to search for the time category for building/repairing a house, then:

(1) For those with no remaining division/0 (Astagfirullah), then:

$b \equiv 0 \ (mod\ 3)$ or $b = 3q + 0$

The criteria of *Astagfirullah* gives the equation:

$b = 3q$

If $q = 1$, then $b = 3\ (1) \rightarrow b = 3$

If $q = 2$, then $b = 3\ (2) \rightarrow b = 6$

If $q = 3$, then $b = 3\ (2) \rightarrow b = 9$

(2) For the remaining division 1 (Bismillah), then:

$b \equiv 1 \ (mod\ 3)$ or $b = 3q + 1$

The criteria of *Bismillah* gives the equation:

$b = 3q + 1$

If $q = 1$, then $b = 3\ (1) + 1 \rightarrow b = 4$
If $q = 2$, then $b = 3\ (2) + 1 \rightarrow b = 7$
If $q = 3$, then $b = 3\ (3) + 1 \rightarrow b = 10$

(3) For the remaining division 2 (Alhamdulillah), then:
$b \equiv 2\ (mod\ 3)$ or $b = 3q + 2$
The criteria of *Alhamdulillah* gives the equation:
$b = 3q + 2$
If $q = 1$, then $b = 3\ (1) + 2 \rightarrow b = 5$
If $q = 2$, then $b = 3\ (2) + 2 \rightarrow b = 8$
If $q = 3$, then $b = 3\ (3) + 2 \rightarrow b = 11$

Bismillah criteria (see Table 3, the remaining number = 1) is a category used to start the activity of building/repairing a house with the hope that all work will run smoothly. The relationship between the *Saptawara* period and *Pancawara* period can be observed in the matrix presented in Table 4 to make it easier to understand.

Table 4. Day category determination results

Days (*Saptarawara Period*) and their values		***Pasaran* (*Pancawara Period*) and their values**					**Number of day categories**
		Manis	***Pahing***	***Puhun***	***Wage***	***Kaliwon***	
		5	**9**	**7**	**4**	**8**	
Ahad	5	10	14	12	9	13	2
Senen	4	9	13	11	8	12	1
Salasa	3	8	12	10	7	11	1
Rebo	7	12	16	14	11	15	1
Kemis	8	13	17	15	12	16	2
Jumaah	6	11	15	13	10	14	1
Saptu	9	14	18	16	13	17	1
				Total			9

Based on the Table 4, it can be concluded that there are 35 pairs between the day cycle and the market cycle; of the 35 pairs, there are only 9 days that are considered good that can be used to start building or repairing a house consisting of *ahad manis, ahad kaliwon, senen pahing, salasa puhun, rebo pahing, kemis manis, kemis kaliwon, jumaah puhun, and saptu puhun*. Of the 9 days that are considered good, 2 days have 2 good days, namely ahad and kemis, which each fall on *ahad manis, ahad kaliwon, kemis manis, and kemis kaliwon*. These concepts can be assessed as dimensions of basic universal mathematical activities: calculating, finding, measuring, designing, and explaining.

3.2. Discussion

The Kampung Naga community's mathematical ideas and practices in determining good days are classified as inclusive calculations/enumerations. Inclusive enumeration is an

enumeration that is usually carried out by the community in enumerating days in the calendar. Enumeration activities are relatively old in mathematical practice because they relate to basic arithmetic operations such as addition, multiplication, subtraction, and division. Meanwhile, enumeration rules include correspondence, permutation, and combination. The study results show that mathematical concepts cannot be separated from the practices and activities of people's daily lives, especially in calculation activities. In this case, mathematics is the knowledge that is inherent in life activities (Nurhasanah et al., 2017), so it is believed that the relationship between mathematical conceptuality and culture are two integrated concepts in human life that are difficult to separate from each other (Umbara et al., 2019). The arrangement of values (*naktu*) associated with *Saptawara* and *Pancawara* periods is a symbol that provides a standard configuration. This arrangement is used to determine the most appropriate time to perform circumcision. The compilation of Table 4 by researchers is intended to facilitate an understanding of how the community uses the calculation. The matrix can help explain the relationship between the day and previously established criteria (Umbara et al., 2021b).

The results of the exploration of mathematical concepts in determining the categories of days carried out by the community show that the people of Kampung Naga have used mathematical concepts in their lives. These results are in accordance with the results of interviews with all informants who stated that people in Kampung Naga are accustomed to performing calculations using operations on numbers every time they will carry out various activities. Some of the mathematical ideas in this study include number operations, remainder theorems, sets, relations, congruence, modulo, and mathematical modelling. As exemplified in the previous section, mathematical modelling can be arranged based on modulo 3. This is similar to the findings of other studies, which show that Sundanese people are generally accustomed to doing mathematical calculations, modelling, anticipating phenomena (Abdullah, 2017), estimating, measuring, and generating patterns (Muhtadi & Prahmana, 2017) which can be classified into the fundamental dimensions of universal mathematics (Umbara et al., 2021b) which are used to initiate various activities (Umbara et al., 2019). Therefore, the research results on the Sundanese community show that they are accustomed to carrying out mathematical activities from generation to generation (Umbara et al., 2023). Furthermore, several studies that have produced several mathematical ideas relevant to this study have also been conducted by other researchers, such as the use of Javanese Primbon for matchmaking (Utami et al., 2019), the use of Palintangan to determine the time for planting and harvesting rice (Umbara et al., 2019), determining a good day to start building a house (Umbara et al., 2021b), determining the direction of the wind in seeking fortune (Umbara et al., 2021a), determining the best time to plant (Umbara et al., 2021a) by the Sundanese people, determining the time for the implementation of the tedhak siten traditional ceremony in the Javanese community (Primaniarta & de Mattos, 2022), the use of pranatamangsa in determining the season and carrying out birth-death ceremonies in Yogyakarta (Prahmana et al., 2021), and the use of Pananrang in determining the planting season by the Bugis community (Pathuddin et al., 2023).

The study's results support the view that calculating and recording time (calendar) is a good example of ethnomathematics (D'Ambrosio, 2006). The activity of calculating is

closely related to beliefs and reflects caution in planning activities. Mathematical ideas and practices carried out by the community are included in inclusive enumeration. Inclusive enumeration is a census commonly carried out by the community to calculate calendar days. Enumeration activities are considered ancient in mathematical practice. According to Eves (1964), based on archaeological evidence, humans have been conducting censuses since 50,000 years ago (Umbara et al., 2021b). The findings of this study indicate that mathematical concepts cannot be separated from the lives of ordinary people, especially when carrying out computational tasks. All human actions, consciously or not, are based on calculations in accordance with their inhabitants' natural conditions.

This is in accordance with the view that ethnomathematics is a study of various methods to produce epistemological reflections on the nature of mathematical knowledge in practical, social, and cultural dimensions (Albanese et al., 2017), which refers to activities related to mathematics in various contexts that are close and visible to everyone (Cervantes-Barraza & Araujo, 2023). The practical dimension is related to the capacity of ethnomathematics as a tool to understand and control the reality of mathematical knowledge possessed by a cultural group. The social dimension is a knowledge system that includes a society's rules and symbols to communicate. Meanwhile, the cultural dimension can be understood as mathematical knowledge passed down from generation to generation by a group to preserve culture. As a result, mathematics can be justified as having social and cultural value (Noyes, 2012) so that it can be explained as knowledge inherent in human activities (Nurhasanah et al., 2017).

Based on the cultural view, calculations carried out by society are closely related to the belief system that is held collectively. Collectivist cultural patterns emphasize the needs and goals of a group (Schommer-Aikins, 2004). Meanwhile, a shared belief system is an authoritative drive that can be a catalyst and glue that unites society over time (Jenkins-Smith et al., 2014). The belief system is a cultural value embraced by society so that even though the results of the calculations are only predictions that are not necessarily true, society still believes in them as cultural values. As a result of these calculations, the Sundanese people believe in opposing reasonable considerations because they hope to get the desired results and be blessed with physical and spiritual happiness (Suryaatmana et al., 1992). This belief grows because society understands it as a spiritual value. It is important to emphasize that spirituality refers to the belief in the existence of supernatural powers and the influence of religion on people's lives (Darley & Blankson, 2020). Therefore, these cultural values contain good qualities that are still embraced by the community (Hanafi et al., 2020).

On the other hand, from a mathematical perspective, numeracy skills are one of the important talents of society, with the majority functioning to assist other mathematical abilities. Bishop clearly classifies numeracy activities into six dimensions of universal basic mathematical activities (Umbara et al., 2021d). Through ethnomathematics, the research results present a different perspective on conceptual mathematics embedded in a universal part of holistic culture. Ethnomathematics researchers investigate how different cultural groups understand, express, and use concepts, procedures, and approaches recognized as mathematical practices and, therefore, more interesting than formal mathematics, which can sometimes be cold and harsh (Rosa et al., 2016). However, ethnomathematics also

contributes to academic mathematics by understanding and addressing the often perceived gap between mathematics and everyday life (Utami et al., 2020). The results presented here also show the importance of exploring the mathematical concepts used by society. Local cultural values closely attached to mathematical concepts imply that the two are strongly integrated. In everyday life, mathematics is used to meet human needs (Umbara et al., 2019).

This shows that ethnomathematics theoretically requires examining how human communities develop methods, styles, arts, and strategies to do and know, learn and explain, cope with situations, and solve challenges in the natural and socio-cultural environment (D'Ambrosio, 2018). Meanwhile, ethnomathematics in the framework of mathematics learning aims to introduce culture so that students are expected to appreciate and preserve it (Afgani & Paradesa, 2021). This shows that ethnomathematics is able to foster creativity, uphold cultural dignity, and provide a comprehensive perspective on humanity. Thus, this is in accordance with the core objectives of ethnomathematics, namely building a society free from aggressiveness, arrogance, intolerance, discrimination, injustice, prejudice, and hatred towards others (D'Ambrosio & Rosa, 2017) and has the potential to create social justice (Purniati et al., 2022).

Based on the mathematical concepts used in determining the category of the day, there is an opportunity to adopt academic mathematical concepts that can be adopted into mathematics teaching in schools. Among the academic mathematical concepts that can be adopted into mathematics teaching in schools are the concepts of numbers and their operations, sets and their relations, modulus, congruence, and mathematical modeling that can be done partially or simultaneously in mathematics learning, for example: teachers can give instructions to students to determine the remainder of a value by using contextual problems about determining the category of the day or implementing it in algebra learning, especially about the least common multiple and greatest common divisor.

This is intended as an effort to revitalize the learning approach, which is done by maximizing the teacher's efforts in bridging mathematics with the reality of everyday life and student perceptions. The ethnomathematics approach can revolutionize teachers' thinking and perspectives (Fouze & Amit, 2018), so it is advisable to develop the ethnomathematics approach as a flexible pedagogical approach (Sunzuma & Maharaj, 2019). Thus, children can comprehensively understand mathematics learning related to their culture. Finally, we would like to clarify that this article is considered incomplete, especially in terms of its implications for the learning process in mathematics classes. However, we believe that this article has contributions that can be used to help other mathematics researchers and teachers, especially in Indonesia, understand why many research projects framed in ethnomathematics programs seem to have different goals and implications for education. This is due to differences in research contexts and socio-cultural environmental needs. This interpretation provides a possible way to integrate differences and utilize them in revitalizing mathematics learning in the future. Especially to minimize students' negative attitudes towards mathematics (Choe et al., 2019) because ethnomathematics is one of the efforts that can be used to address this problem (Kusuma et al., 2024).

4. CONCLUSION

The activity of determining the category of days carried out by the community is something unique in predicting the future. This activity contains the hopes and beliefs of the community which are framed in the noble cultural values that are inherited as a cultural heritage. Mathematical concepts and techniques that have been held tightly and used by the community from generation to generation can be seen from two different perspectives. The first perspective can be seen from the cultural dimension, which can be described as local genius that fulfills the holistic idea in cultural understanding. This holistic understanding includes knowledge systems and belief systems (religion). According to this holistic approach, the knowledge and capacity of the community to apply mathematical ideas and procedures are related to what is considered acceptable today as wisdom. The second perspective can be classified into the dimension of fundamental mathematical activities in the form of mathematical modeling that is elaborated and constructed comprehensively. The mathematical model produced and described by researchers through matrices can make it easier for the community to determine the category of days more quickly. Specifically, we have shown that the activity of determining the category of time is related to operations on numbers, remainder theorems, modulo, congruence, and mathematical modeling that is relevant to formal mathematics. Therefore, the results of the study provide potential opportunities to be used as a context for mathematics learning, both in the context of developing didactic designs and in developing ethnomathematics problems. We acknowledge both as limitations of the study, as explained in the previous section. Based on this, the limitations of this study need to be followed up for future research on the implications of developing didactic designs and ethnomathematics approaches for mathematics learning that are appropriate to the topic.

Acknowledgments

The authors would like to express his appreciation and gratitude to the Ministry of Education, Culture, Research, and Technology for the Research Grant Fund provided in this research through the "*Penelitian Kerjasama dalam Negeri (PKDN)*" scheme in 2024.

Declarations

Author Contribution : UU: Conceptualization, Visualization, Writing - original draft, and Writing - review & editing; SP: Supervsion, and Validation; ASA: Formal analysis, and Writing - review & editing.

Funding Statement : This research was funded by the Directorate General of Research and Development Strengthening, Ministry of Research, Technology, and Higher Education of the Republic of Indonesia for its support and funding under the *PKDN* (*Penelitian Kerjasama Dalam Negeri*) scheme in 2024.

Conflict of Interest : The authors declare no conflict of interest.

Additional Information : Additional information is available for this paper.

REFERENCES

Abdullah, A. S. (2017). Ethnomathematics in perspective of sundanese culture. *Journal on Mathematics Education*, *8*(1), 1-16. https://doi.org/10.22342/jme.8.1.3877.1-15

Adilaturrahmah, F., & Suparni, S. (2021). Penerapan pendekatan matematika realistik pada materi bangun datar melalui kebudayaan kampung kuta [Application of a realistic mathematical approach to flat building material through Kuta village culture]. *Jurnal Gantang*, *6*(2), 125-132.

Afgani, M. W., & Paradesa, R. (2021). PISA-Like problems using Islamic ethnomathematics approach. *Infinity Journal*, *10*(2), 203-216. https://doi.org/10.22460/infinity.v10i2.p203-216

Albanese, V., Adamuz-Povedano, N., & Bracho-López, R. (2017). The evolution of ethnomathematics: Two theoretical views and two approaches to education. In M. Rosa, L. Shirley, M. E. Gavarrete, & W. V. Alangui (Eds.), *Ethnomathematics and its diverse approaches for mathematics education* (pp. 307-328). Springer International Publishing. https://doi.org/10.1007/978-3-319-59220-6_13

Apiati, V., Heryani, Y., & Muslim, S. R. (2019). Etnomatematik dalam bercocok tanam padi dan kerajinan anyaman masyarakat Kampung Naga [Ethnomathematics in rice farming and weaving crafts of the Naga Village community]. *Mosharafa: Jurnal Pendidikan Matematika*, *8*(1), 107-118. https://doi.org/10.31980/mosharafa.v8i1.539

Arini, R., Ulinuha, W., & Jamaludin, U. (2023). Etnomatematika bangunan Kampung Naga dalam meningkatkan literasi numerasi ditinjau dari aspek geometri [Ethnomathematics of Kampung Naga buildings in improving numeracy literacy in terms of geometric aspects]. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, *8*(3), 4918-4929.

Bahagia, B., Wibowo, R., Muniroh, L., Al-Wahid, A., Rizkal, R., & Noor, Z. M. (2022). Ethnomathematic value in traditional building in kampung budaya Bogor Jawa Barat. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *6*(2), 1659-1669.

Cervantes-Barraza, J. A., & Araujo, A. A. (2023). Design of interactive mathematical tasks that make up the reasoning and the ethnomathematics program. *Journal on Mathematics Education*, *14*(3), 469-482. https://doi.org/10.22342/jme.v14i3.pp469-482

Chahine, I. C. (2020). Towards African humanicity: Re-mythogolising Ubuntu through reflections on the ethnomathematics of African cultures. *Critical Studies in Teaching and Learning*, *8*(2), 95-111. https://doi.org/10.14426/cristal.v8i2.1845

Choe, K. W., Jenifer, J. B., Rozek, C. S., Berman, M. G., & Beilock, S. L. (2019). Calculated avoidance: Math anxiety predicts math avoidance in effort-based decision-making. *Science Advances*, *5*(11), eaay1062. https://doi.org/10.1126/sciadv.aay1062

Cohen, L., Manion, L., & Morrison, K. (2002). *Research methods in education* (5th ed.). Routledge. https://doi.org/10.4324/9780203224342

Creswell, J. W. (2012). *Educational research: Planning, conducting and evaluating quantitative and qualitative research* (4th ed.). Pearson.

D'Ambrosio, U. (2006). *Ethnomathematics: Link between traditions and modernity*. Brill. https://doi.org/10.1163/9789460911415

D'Ambrosio, U. (2018). The program ethnomathematics: Cognitive, anthropological, historic and socio-cultural bases. *Pna*, *12*(4), 229-247. https://doi.org/10.30827/pna.v12i4.7851

D'Ambrosio, U., & D'Ambrosio, B. S. (2013). The role of ethnomathematics in curricular leadership in mathematics education. *Journal of Mathematics Education at Teachers College*, *4*(1), 19-25. https://doi.org/10.7916/jmetc.v4i1.767

D'Ambrosio, U., & Rosa, M. (2017). Ethnomathematics and its pedagogical action in mathematics education. In M. Rosa, L. Shirley, M. E. Gavarrete, & W. V. Alangui (Eds.), *Ethnomathematics and its diverse approaches for mathematics education* (pp. 285-305). Springer International Publishing. https://doi.org/10.1007/978-3-319-59220-6_12

Darley, W. K., & Blankson, C. (2020). Sub-Saharan African cultural belief system and entrepreneurial activities: A Ghanaian perspective. *Africa Journal of Management*, *6*(2), 67-84. https://doi.org/10.1080/23322373.2020.1753485

Eliza, N., & Pujiastuti, H. (2022). Studi etnomatematika: Penentuan tanggal masyarakat baduy dan hubungannya dengan konsep aljabar [Ethnomathematics study: Determining the date of the Baduy community and its relationship to the concept of algebra]. *Jurnal Ilmiah Pendidikan Matematika Al Qalasadi*, *6*(1), 90-99. https://doi.org/10.32505/qalasadi.v6i1.4270

Eves, H. W. (1964). *An introduction to the history of mathematics*. Saunders College Pub. https://cir.nii.ac.jp/crid/1130282271899874304

Fouze, A. Q., & Amit, M. (2018). Development of mathematical thinking through integration of ethnomathematic folklore game in math instruction. *Eurasia Journal of Mathematics, Science and Technology Education*, *14*(2), 617-630. https://doi.org/10.12973/ejmste/80626

Garfinkel, H. (2005). *Ethnomethodological studies of work*. Routledge. https://doi.org/10.4324/9780203996867

Gerdes, P. (2009). *Geometry and basketry of the Bora in the Peruvian Amazon*. Centre for Mozambican Studies and Ethnoscience, Universidade Pedagógica.

Hanafi, H., Hidayah, N., Triyono, T., Mappiare-AT, A., & Atmoko, A. (2020). Belief system on multicultural counseling: Literature review of positive belief system of nusantara culture. In *Proceedings of the 1 st International Conference on Information Technology and Education (ICITE 2020)*, (pp. 197-201). https://doi.org/10.2991/assehr.k.201214.236

Jenkins-Smith, H., Silva, C. L., Gupta, K., & Ripberger, J. T. (2014). Belief system continuity and change in policy advocacy coalitions: Using cultural theory to specify belief systems, coalitions, and sources of change. *Policy Studies Journal*, *42*(4), 484-508. https://doi.org/10.1111/psj.12071

Johnson, J. D., Smail, L., Corey, D., & Jarrah, A. M. (2022). Using bayesian networks to provide educational implications: Mobile learning and ethnomathematics to improve sustainability in mathematics education. *Sustainability*, *14*(10), 5897. https://doi.org/10.3390/su14105897

Kusuma, A. B., Hanum, F., Abadi, A. M., & Ahmad, A. (2024). Exploration of ethnomathematics research in Indonesia 2010-2023. *Infinity Journal*, *13*(2), 393-412. https://doi.org/10.22460/infinity.v13i2.p393-412

Maryani, A., Supratman, S., & Setialesmana, D. (2022). Studi etnomatematika aktivitas menghitung hari baik dalam pernikahan masyarakat Kampung Adat Pulo [Ethnomathematical study of the activity of calculating auspicious days in the marriages of the Pulo Traditional Village community]. *JP3M (Jurnal Penelitian Pendidikan dan Pengajaran Matematika)*, *8*(1), 73-84.

Massarwe, K., Verner, I., & Bshouty, D. (2012). Ethnomathematics and multi-cultural education: Analysis and construction of geometric ornaments. *Journal of Mathematics and Culture*, *6*(1), 344-360.

Muhtadi, D., & Prahmana, R. C. I. (2017). Sundanese ethnomathematics: Mathematical activities in estimating, measuring, and making patterns. *Journal on Mathematics Education*, *8*(2), 185-198. https://doi.org/10.22342/jme.8.2.4055.185-198

Mulyani, E., & Prabawati, M. N. (2023). Rumah adat Kampung Naga ditinjau dari perspektif etnomatematika [Traditional houses of Kampung Naga viewed from an ethnomathematics perspective]. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *12*(1), 1006-1017. https://doi.org/10.24127/ajpm.v12i1.6604

Noyes, A. (2012). *Rethinking school mathematics*. SAGE Publications Ltd. https://doi.org/10.4135/9781446213506

Nurhasanah, F., Kusumah, Y. S., & Sabandar, J. (2017). Concept of triangle: Examples of mathematical abstraction in two different contexts. *International Journal on Emerging Mathematics Education*, *1*(1), 53-70. https://doi.org/10.12928/ijeme.v1i1.5782

Nurhasanah, W. F., & Puspitasari, N. (2022). Studi etnomatematika rumah adat Kampung Pulo Desa Cangkuang Kabupaten Garut [Ethnomathematical study of traditional houses in Kampung Pulo, Cangkuang Village, Garut Regency]. *Plusminus: jurnal pendidikan matematika*, *2*(1), 27-38. https://doi.org/10.31980/plusminus.v2i1.1083

Orey, D. C. (2000). The ethnomathematics of the Sioux Tipi and Cone. In H. Selin (Ed.), *Mathematics across cultures* (pp. 239-252). Springer Netherlands. https://doi.org/10.1007/978-94-011-4301-1_13

Orey, D. C., & Rosa, M. (2006). Ethnomathematics: Cultural assertions and challenges towards pedagogical action. *The journal of Mathematics and Culture*, *1*(1), 57-78.

Pathuddin, H., Kamariah, K., & Mariani, A. (2023). Ethnomathematics of Pananrang: A guidance of traditional farming system of the Buginese community. *Journal on Mathematics Education*, *14*(2), 205-224. https://doi.org/10.22342/jme.v14i2.pp205-224

Prahmana, R. C. I., Yunianto, W., Rosa, M., & Orey, D. C. (2021). Ethnomathematics:" Pranatamangsa" System and the Birth-Death Ceremonial in Yogyakarta. *Journal on Mathematics Education*, *12*(1), 93-112. https://doi.org/10.22342/JME.12.1.11745.93-112

Primaniarta, M. G., & de Mattos, J. R. L. (2022). Javanese ethnomathematics: Exploration of the Tedhak Siten tradition for class learning practices. *Journal on Mathematics Education*, *13*(4), 661-680. https://doi.org/10.22342/jme.v13i4.pp661-680

Purniati, T., Turmudi, T., Juandi, D., & Suhaedi, D. (2022). Ethnomathematics Study: Learning Geometry in the Mosque Ornaments. *International Journal on Advanced Science, Engineering and Information Technology*, *12*(5), 2096-2104. https://doi.org/10.18517/ijaseit.12.5.17063

Rodríguez-Nieto, C. A., & Alsina, Á. (2022). Networking between ethnomathematics, STEAM education, and the globalized approach to analyze mathematical connections in daily practices. *Eurasia Journal of Mathematics Science and Technology Education*, *18*(3), em2085. https://doi.org/10.29333/ejmste/11710

Rosa, M., D'Ambrósio, U., Orey, D. C., Shirley, L., Alangui, W. V., Palhares, P., & Gavarrete, M. E. (2016). *Current and future perspectives of ethnomathematics as a program*. Springer. https://doi.org/10.1007/978-3-319-30120-4

Rosa, M., & Gavarrete, M. E. (2017). An ethnomathematics overview: An introduction. In M. Rosa, L. Shirley, M. E. Gavarrete, & W. V. Alangui (Eds.), *Ethnomathematics and its diverse approaches for mathematics education* (pp. 3-19). Springer International Publishing. https://doi.org/10.1007/978-3-319-59220-6_1

Rosa, M., & Orey, D. C. (2013). Ethnomodelling as a research lens on ethnomathematics and modelling. In G. A. Stillman, G. Kaiser, W. Blum, & J. P. Brown (Eds.), *Teaching mathematical modelling: Connecting to research and practice* (pp. 117-127). Springer Netherlands. https://doi.org/10.1007/978-94-007-6540-5_10

Schommer-Aikins, M. (2004). Explaining the epistemological belief system: Introducing the embedded systemic model and coordinated research approach. *Educational Psychologist*, *39*(1), 19-29. https://doi.org/10.1207/s15326985ep3901_3

Sekarpandan, M., Wardani, H. E., & Setyani, C. P. (2022). Eksplorasi etnomatematika pada rumah adat Baduy di kabupaten Lebak Banten [Exploration of ethnomathematics in Baduy traditional houses in Lebak Regency, Banten]. In *PRISMA, Prosiding Seminar Nasional Matematika*, (Vol. 5, pp. 282-289).

Shirley, L., & Palhares, P. (2016). Ethnomathematics and its diverse pedagogical approaches. In M. Rosa, L. Shirley, U. D'Ambrosio, D. C. Orey, W. V. Alangui, P. Palhares, & M. E. Gavarrete (Eds.), *Current and future perspectives of ethnomathematics as a program* (pp. 13-17). Springer Open. https://doi.org/10.1007/978-3-319-30120-4_3#Sec2

Sopiah, I. (2020). Eksplorasi etnomatematika pada kepercayaan penentuan hari baik masyarakat Baduy [Ethnomathematics exploration of Baduy people's beliefs in determining good days]. *Jurnal PEKA (Pendidikan Matematika)*, *4*(1), 13-20. https://doi.org/10.37150/jp.v4i1.805

Sunzuma, G., & Maharaj, A. (2019). Teacher-related challenges affecting the integration of ethnomathematics approaches into the teaching of geometry. *Eurasia Journal of Mathematics, Science and Technology Education*, *15*(9), em1744. https://doi.org/10.29333/ejmste/108457

Sunzuma, G., & Maharaj, A. (2020). In-service mathematics teachers' knowledge and awareness of ethnomathematics approaches. *International Journal of Mathematical Education in Science and Technology*, *52*(7), 1063-1078. https://doi.org/10.1080/0020739x.2020.1736351

Suryaatmana, E., Darsa, U. A., Erlyane, A., & Wartini, T. (1992). *Paririmbon Sunda (Jawa Barat)* [Sundanese Paririmbon (West Java)]. Direktorat Jenderal Kebudayaan.

Umbara, U., Prabawanto, S., & Jatisunda, M. G. (2023). Combination of mathematical literacy with ethnomathematics: How to perspective sundanese culture. *Infinity Journal*, *12*(2), 393-414. https://doi.org/10.22460/infinity.v12i2.p393-414

Umbara, U., Wahyudin, W., & Prabawanto, S. (2019). Ethnomatematics : How does cigugur traditional community use palintangan on farming. *Journal of Physics: Conference Series*, *1265*(1), 012025. https://doi.org/10.1088/1742-6596/1265/1/012025

Umbara, U., Wahyudin, W., & Prabawanto, S. (2021a). Ethnomathematics vs ethomodeling: How does cigugur traditional community determines the direction of the wind to seek fortune based on month. *Journal of Physics: Conference Series*, *1776*(1), 012034. https://doi.org/10.1088/1742-6596/1776/1/012034

Umbara, U., Wahyudin, W., & Prabawanto, S. (2021b). Exploring ethnomathematics with ethnomodeling methodological approach: How does cigugur indigenous people using calculations to determine good day to build houses. *Eurasia Journal of Mathematics, Science and Technology Education*, *17*(2), em1939. https://doi.org/10.29333/ejmste/9673

Umbara, U., Wahyudin, W., & Prabawanto, S. (2021c). How to predict good days in farming: Ethnomathematics study with an ethnomodelling approach. *Journal of Research and Advances in Mathematics Education*, *6*(1), 71-85. https://doi.org/10.23917/jramathedu.v6i1.12065

Umbara, U., Wahyudin, W., & Prabawanto, S. (2021d). Symbolic measuring: An exploration of ethnomathematics based on people's daily communication. *Journal of Physics: Conference Series*, *1806*(1), 012075. https://doi.org/10.1088/1742-6596/1806/1/012075

Utami, N. W., Sayuti, S. A., & Jailani, J. (2019). Math and mate in Javanese Primbon: Ethnomathematics study. *Journal on Mathematics Education*, *10*(3), 341-356. https://doi.org/10.22342/jme.10.3.7611.341-356

Utami, N. W., Sayuti, S. A., & Jailani, J. (2020). An ethnomathematics study of the days on the Javanese calendar for learning mathematics in elementary school. *Ilkogretim Online*, *19*(3), 1295-1305. https://doi.org/10.17051/ilkonline.2020.728063

Verner, I., Massarwe, K., & Bshouty, D. (2019). Development of competencies for teaching geometry through an ethnomathematical approach. *The Journal of Mathematical Behavior*, *56*, 100708. https://doi.org/10.1016/j.jmathb.2019.05.002

Wijaya, R., Zakiah, N. E., & Sunaryo, Y. (2023). Eksplorasi konsep-konsep bangun datar pada budaya Kampung Kuta [Exploration of flat building concepts in the culture of Kuta Village]. *J-KIP (Jurnal Keguruan dan Ilmu Pendidikan)*, *4*(2), 509-523. https://doi.org/10.25157/j-kip.v4i2.9791

Zhang, W., & Zhang, Q. (2010). Ethnomathematics and its integration within the mathematics curriculum. *Journal of mathematics Education*, *3*(1), 151-157.