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ETHNOMATHEMATICS RESEARCH IN THE BALEO CULTURE (WHALING) IN LAMALERA AND ITS INTEGRATION INTO MATHEMATICS EDUCATION

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ABSTRACT

Culture refers to the acquired knowledge that people use to interpret knowledge and give birth to social behavior. This research was conducted to describe ethnomathematics in Baleo culture and its integration in mathematics learning. The research used is exploratory qualitative research with an ethnographic approach through data collection by observation, interviews and documentation. Data validity uses source triangulation and the subjects of this study were 4 subjects. The results showed the existence of ethnomathematics in Baleo culture. In explaining activities which include the concept of mathematical logic (implication), measuring activities related to the concept of measurement with non-standard units, designing activities related to the concept of geometry and geometry of transformation (reflection and translation), counting activities related to the concept of addition, subtraction and multiplication operations. Thus, the various concepts of school mathematics in baleo culture can be developed by designing an appropriate learning tool so that it can be used in learning mathematics at school.

KEYWORDS: Baleo Culture, Ethnography, Local Wisdom, Ethnomathematics, Mathematics Learning.

1. INTRODUCTION

Culture plays an important role in social life. It is such an integral part of human beings that many people tend to think of it as genetically inherited (Levin & Mamlok, 2021). Culture is something that will affect the level of knowledge and includes the system of ideas and ideas contained in the human mind. Culture refers to the acquired knowledge that people use to interpret knowledge and give birth to social behavior (Legare, 2024). Mathematics is a socio-cultural construction where mathematics is contained in history and human activities (Dominikus et al., 2016; Zeny, 2021). Whether we realize it or not, many daily human activities are always related to mathematics, so it is said that mathematics is a human activity, whether published or not. Practicing mathematical concepts in the learning process by using local cultural wisdom can be a knowledge used to understand mathematical concepts. In mathematical activities is a process from real life experiences into mathematics or vice versa, including counting, measuring, classifying, designing buildings, making patterns, determining locations, playing and so on.

The idea of utilizing socio-cultural elements into mathematics learning has been initiated since 1977 by a Brazilian mathematician, Ubiratan D "Ambrosio. Ethnomathematics describes teaching for everyone that should be adapted to their culture. Ethnomathematics is termed as the mathematics which is practiced among identifiable cultural groups, such as national - tribal societies, labor groups, children of certain age brackets and professional classes (Cimen, 2014; Dominikus & Madu, 2025; Sarah & Batiibwe, 2024). Ethnomathematics includes mathematical ideas, thoughts and practices developed by all cultures (Purnami, 2022; Yanti, 2025). Ethnomathematics can also be considered as a program that aims to understand, articulate, process, and finally use mathematical ideas, concepts, and practices that can solve problems related to their daily activities (Rosa & Orey, 2013). Ethnomathematics is a study that discusses the relationship between mathematics and culture (Kholid & Husodo, 2025; Wibawa et al., 2025). Based on the above description of ethnomathematics, it can be concluded that ethnomathematics is mathematical ideas, mathematical thinking and practices based on the culture of a particular group, and is considered a study of mathematical ideas.

One interesting example of this cultural richness is the Baleo tradition or culture in Lamalera. Lamalera, a fishing village located on the southern coast of Lembata Island, East Nusa Tenggara, Indonesia, upholds the Baleo tradition that is rich in cultural values and local wisdom. Baleo, a deeply rooted tradition or culture in Lamalera, a fishing village located on the coast of Lembata Island, East Nusa Tenggara Province, Indonesia, has been a highlight for researchers, anthropologists, and tourists for years. Lamalera is known not only for its stunning natural beauty, but also for its rich and unique cultural heritage. In the Baleo tradition, Lamalera fishermen traditionally pursue whales using small wooden boats called "kaelo" and specially made arrows called "mamati". This activity has been an integral part of the Lamalera people's lives for centuries and symbolizes courage, strength and local wisdom passed down from generation to generation. It is important to understand that Baleo is not just an ordinary fishing activity; it is a mirror of the deep connection between people, the sea, and nature.

Baleo is not just about catching whales for sustenance, but also about the beliefs, rituals, and values upheld by the Lamalera people. In the view of the Lamalera people, Baleo is not just a job, but also a spiritual calling. As part of this tradition, fishermen must adhere to a strict set of procedures and customs, including ritual preparation before sailing, as well as a ceremony of respect after successfully catching a whale. This reflects a deep spiritual piety and a profound belief in the power of nature. However, while Baleo has been part of the identity and daily lives of the Lamalera people for centuries, it is also faced with challenges and changing times. Climate change, modernization, and external pressures have affected the way of life and livelihood of the Lamalera people, including their Baleo tradition. For example, climate change has led to irregular whale migrations, making Baleo increasingly uncertain and unprofitable. In addition, the introduction of modern technology such as boat engines and more efficient fishing equipment has changed the traditional whaling landscape, threatening the survival of the Baleo tradition.

Nevertheless, the Lamalera people continue to try to maintain their Baleo tradition, not only as a livelihood, but also as an integral part of their identity and cultural heritage. They realize the importance of preserving this tradition for future generations, as well as fighting for their right to continue the traditional Baleo tradition in the face of modern challenges. In this context, further research and documentation of the Baleo tradition in Lamalera is crucial. Through a better understanding of the values, practices and challenges faced by this tradition, we can better appreciate this rich and complex cultural heritage, and seek sustainable solutions to maintain the sustainability of Baleo and the Lamalera community as a whole. In the whaling culture of the Lamalera people, mathematical concepts can be explored, not only in the whaling process but also in the equipment used, the norms performed before the hunt, and after obtaining the game. Thus, the use of culture in mathematics learning will certainly make the learning process more meaningful.

This research combines two different fields of study, namely ethnomathematics and the local culture of Lamalera. Ethnomathematics is the study of how people use mathematical concepts in their daily lives, while Lamalera is a fishing village with typical Baleo traditions. This merger creates the potential for a deeper understanding of the way Lamalera people use mathematical concepts in their cultural context. In addition, this research offers an opportunity to explore aspects of mathematics in the daily lives of the Lamalera people, which have similarities or differences with conventional mathematical concepts. The integration of ethnomathematics research results in mathematics learning is an innovative aspect of this research. By understanding how the Lamalera people use mathematical concepts in their lives, this research can provide new insights for educators to develop more relevant and context-based approaches to mathematics learning. The results of this study can contribute to the development of a more inclusive and diverse mathematics curriculum.

Through the merging of ethnomathematics, culture, and mathematics learning, this research has the potential to provide new insights, valuable contributions to these fields, and help promote a deeper understanding of the relationship between mathematics, culture, and education.

The novelty of this study lies in its dual contribution: (1) extending ethnomathematics research to a maritime subsistence context, and (2) proposing a systematic integration model that connects Baleo-based mathematical practices with formal curriculum structures. This integration demonstrates how indigenous maritime knowledge can serve as a meaningful pedagogical resource in culturally responsive mathematics education.

2. LITERATURE REVIEW

2.1. Ethnomathematics

Ethnomathematics is a field of study that explores the relationship between mathematics and culture (Jacob, 2021; Ratau et al., 2025). It involves understanding and analyzing how mathematical concepts are reflected in different aspects of human life, including in cultures, traditions and everyday practices. Ethnomathematics also studies the ways in which people from different ethnic and cultural groups use mathematics in their own contexts, as well as how this mathematical knowledge is passed on and maintained through the generations (Fouze & Amit, 2018; Madu et al., 2025). One important aspect of ethnomathematics is the recognition that mathematics does not only exist in textbooks or in the classroom, but also in people's everyday activities and practices (Madu et al., 2025; Sarah & Batiibwe, 2024). For example, in the traditional cultures of indigenous tribes in different parts of the world, we can find examples of the use of mathematics in activities such as determining animal migration patterns, measuring time based on seasonal changes, or planning the layout of houses and villages.

Ethnomathematics involves understanding how mathematics is practiced, understood and internalized within a specific cultural context (Madu et al., 2025; Muhaimin et al., 2023; Selepe & Mphahlele, 2025). This means recognizing that mathematics is not only limited to the concepts and applications taught in schools, but also involves the mathematical knowledge and practices that people have and use in their daily lives. Ethnomathematics has paved the way for the development of a more inclusive and context-based approach to mathematics learning (Madu, 2025; Madu et al., 2025; Yılmaz, 2020). Rather than just focusing on abstract math concepts and formulas, the ethnomathematics approach allows students to see how math is related to their daily lives, their culture and the world around them (Dominikus & Madu, 2025; Pratama & Yelken, 2024). This can help increase students' interest and motivation towards math, as well as help them understand mathematical concepts better. However, while ethnomathematics has made valuable contributions to our understanding of the relationship between mathematics and culture, the field also faces certain challenges. One of the main challenges is the difficulty in integrating ethnomathematics concepts into the existing mathematics curriculum. Many mathematics curricula are still based on conventional approaches that focus on abstract mathematical concepts and formulas, without considering the cultural context or daily lives of students.

Thus, ethnomathematics leads to a broader understanding of mathematical concepts in their cultural and historical context (Wahyu & Antara, 2024; I. G. A. P. A. Wulandari et al., 2024). The study of ethnomathematics not only allows us to see the different ways people use mathematics in their daily lives, but also provides valuable insights into the diversity of mathematical knowledge and skills around the world.

D'Ambrosio has defined several domains or mathematical activities in everyday life, including grouping activities, counting, measuring, and designing buildings or tools, making patterns, counting, determining location, playing, and explaining, and so on (P. Astuti, 2023; Madu et al., 2025). Some of these domains (activities) are explained as follows: (1) Counting Activities, counting activities are related to the form of the question "how many". The forming elements of counting activities can use traditional media of stones, leaves, or other natural materials (Pujianti, 2024). In addition, counting activities can also be formed with movements or strokes. Counting activities generally show the activity of using and understanding odd and even numbers and others. (2) Measuring Activity, measuring activity is related to the form of the question "how much". In ethnomathematics, traditional measuring tools are often found in the form of bamboo pieces and tree branches. This measuring activity is also related to numbers, and thus includes the activities of comparing, ranking, and qualifying the characteristics of an object. (3) Activity Determining Location, some basic concepts of geometry begin with determining the location used to determine changes in motion, or determine the displacement from one point to another. This relates to spatial ability, how spatial conceptualization and how an object is positioned in the spatial environment. Mapping, navigation, and organization of spatial objects are found in all cultures and all form important mathematical knowledge. (4) Design Activities, building design activities have been applied by all types of cultures. Building design is also concerned with large-scale things such as houses, villages, roads, gardens, fields, villages and cities. All of this is a source and part of the formation of the mathematical knowledge of members of the cultural group. (5) Playing Activities, playing activities are related to various traditional games in the community that involve types of mathematical reasoning, probability, and strategic thinking. Games contain game rules, procedures, materials used, and standardized criteria. (6) Explaining Activities, making explanations is an activity that hones human understanding related to the experiences gained from their environment with regard to one's sensitivity in reading natural situations. In mathematics, making explanations relates to the form of the question "why" geometric shapes are the same or symmetry, why the success of one is the key to the success of the other, and other things related to mathematical laws. In answering this question, symbolization in the form of real evidence is used.

The role of ethnomathematics in understanding culture and society is significant. The field provides deep insights into how mathematical concepts are reflected, used and internalized in different aspects of human life. Here are some of the key roles of ethnomathematics in understanding culture and society (Madu et al., 2025; Wulandari et al., 2024): (1) Revealing diverse cultural perspectives. Mathematical etymology allows us to see the diversity of cultural perspectives on mathematics. Every culture has a unique way of viewing and using mathematics, and ethnomathematics helps us understand this variation through cultural studies and ethnographic analysis. (2) Valuing local wisdom. Through ethnomathematics research, we can appreciate and recognize the local wisdom that exists in a particular society. Traditional mathematical practices, such as the systems of addition, measurement and calculation used by a particular society, reflect knowledge and skills that have been passed down from generation to generation. (3) Understanding the relationship between humans and nature. Mathematics also helps us understand the relationship between humans and nature. For example, mathematical practices in navigation, agriculture and astronomy reflect the ways in which humans interact with their natural environment and use mathematical knowledge to understand and manage that nature. (4) Supporting cultural preservation. Ethnomathematics can help in cultural preservation by maintaining and documenting the inherited mathematical knowledge within a particular society. This can help communities to maintain their cultural identity and promote the sustainability of their cultural heritage. (5) Providing alternatives in mathematics learning. Mathematics can provide alternatives in learning mathematics in schools. The integration of ethnomathematics concepts in the mathematics curriculum can help students to see the relevance and application of mathematics in their daily lives, and increase their interest and motivation in the subject. (6) Valuing diversity of knowledge. Mathematics helps us to appreciate the diversity of mathematical knowledge and skills across cultures. It shows that there is no one single definition of what "math" is, and that mathematical concepts can vary significantly between different cultures and societies.

Thus, the role of ethnomathematics in

understanding cultures and societies is crucial. Through this approach, we gain deeper insights into the relationship between mathematics and culture, as well as understand the mathematical values, practices and knowledge held by a particular society.

2.2. The Baleo Culture of the Lamalera People

Lamalera is a fishing village located on the coast of Lembata Island, East Nusa Tenggara Province, Indonesia. The village is famous for its unique fishing tradition, the Baleo tradition. The Baleo tradition has been an integral part of the Lamalera people's lives for centuries and is an inseparable part of their cultural identity. Geographically, Lamalera is located on the shores of the Indian Ocean, with rugged beaches and stunning ocean views. The people of Lamalera live primarily as fishermen, with their daily activities closely linked to the sea and marine products. They use traditional wooden boats called "kaelo" to chase whales off the coast. The Baleo tradition is a traditional way of catching whales that has been passed down from generation to generation in Lamalera. It involves a collaborative effort between fishermen using small wooden boats and special arrows called "mamati" to traditionally catch whales. This whaling process is not only a means of livelihood, but also a religious ritual undertaken with piety and courage.

The whaling tradition is carried out from May to October. Before the whaling process or Leva Nuang takes place, the Lamalera people always carry out several traditional rituals, namely: (1) Tobu Neme Vate. This rite is carried out by Lamalera fishermen and landlords at the whale stone located in Lamamanu Village and will be forwarded to Lamalera beach. Tobu Neme Vate usually occurs on April 29 every year. The purpose of the Tobu Neme Vate rite is to foster a sense of unity and brotherhood between the landlords and the people of Lamalera. (2) Mass of the Dead. This rite is carried out by all the people of Lamalera Village. This activity occurs on April 30 every year at the beach of Lamalera Village. The purpose of this rite is to pray for all the spirits of fishermen who died at sea. (3) Leva Mass. The Leva Mass is the opening mass of the whaling season. This rite takes place at Lamalera beach in the morning and is usually held on May 1 every year. After the Leva Mass, it will be followed by the blessing of the sea and the peledang and all the equipment that will be used when fishing.

When this rite is completed, the baleo season or hunting season begins.This whaling ritual has religious values in every aspect. Starting from preparation, shipbuilding, lifting the sail, to throwing the spear, all of them say prayers first. In the hunt (leva nuang/Baleo) is carried out using a sailing ship called a peledang which is rowed together to the middle of the sea. In a peledang Lamafa occupies a place in front as the leader as well as the stabber. Lamafa is assisted by his assistant called Breungalep, other matros (usually 9-12 people) occupied by each person called by the name Meng. At the back (stern), sits the helmsman called Lamauri. Whaling by Lamalera fishermen is carried out using simple equipment namely Layar, Tale Leo (a rope made of cotton thread, gebang leaves and waru bark fibers) to pull the captured fish, Lekk'e (tempuling made of bamboo) and Kave (a knife made of iron) to stab the fish, tena (peledang or boat) made of wood, a tool to paddle the water, a water barrel, and Faje (a tool for rowing).

Modesty is reflected in the market mechanism practiced by the Lamalera people. They still maintain the barter system in acquiring goods. Up in the mountains there is a village called (Wulandoni) where every Saturday there is a barter market. Many migrants bring goods such as corn, bananas and household goods in exchange for whale meat. Some fishermen may be practicing this system implicitly, meaning that bartering is just part of the activities that have been carried out for generations, but a closer look shows that through the barter system the Lamalera community is protected from the negative impact of the global economic battle which is largely determined by the rise and fall of currency exchange rates. The barter system contains very wise values that the Lamalera people want to preserve.

2.3. Math Learning

Mathematics learning is a complex process that involves the reception, understanding and application of mathematical concepts by students (Cotič et al., 2024; Yang et al., 2021). It includes interactions between teachers and students, the use of various learning strategies, as well as the use of relevant resources to facilitate the understanding and mastery of mathematical concepts. Mathematics learning is a teacher's conscious effort to shape the character, civilization, and improve the quality of life of students and help in learning mathematics in order to create good mathematical communication so that mathematics is easier to learn and more interesting (Dyani, 2025).

Mathematics learning is the process of providing learning experiences to students through a series of planned activities so that students gain competence on the mathematical material studied (Nasitha & Utama, 2025; Sinar & Azmil, 2024). Mathematics learning needs to be given to students to equip them with the ability to think logically, systematically, critically, and creatively as well as the ability to work together (Nurtamam & Jannah, 2024; Sabrina, 2018). The development of mathematics learning in Indonesia cannot be separated from the historical journey of the curriculum (Abidin et al., 2023; Yuberta & Firmanti, 2025), starting with traditional mathematics (before 1975), modern mathematics learning (curriculum 1975), contemporary mathematics learning (curriculum 1984), mathematics learning in the 1994 curriculum, mathematics learning in the competency-based curriculum (curriculum 2004), and mathematics learning at the education unit level curriculum (curriculum 2006). The government is trying to improve the curriculum, namely improving the curriculum implemented in 2006 or better known as the Education Unit Level Curriculum (KTSP) which was later developed into the 2013 Curriculum and is currently the Merdeka Curriculum.

As a subject that has a communication function, mathematics can be used in everyday life and can also be used to serve various disciplines, including physics, chemistry and economics. By studying mathematics, students are expected to have a fairly reliable ability to deal with various kinds of problems that arise in real life. The purpose of studying mathematics at school is to emphasize the structuring of reasoning and the formation of student attitudes and also to emphasize skills in the application of mathematics (Rohati et al., 2023; Umar et al., 2024).

Mathematics learning aims to help students understand mathematical concepts in depth. This includes an understanding of numbers, mathematical operations, geometry, algebra, statistics and other mathematical topics (Janna et al., 2025). There are various approaches that can be used in math learning, including constructivist, problem-solving, investigative and problem-based approaches. These approaches focus on building deep and sustained understanding, as well as encouraging students to think critically and creatively in solving math problems (Gen et al., 2025; Putri & Jamaan, 2025). In addition, Technology, such as graphing calculators, math software and math apps, can be used as aids in math learning. Technology can help visualize mathematical concepts, provide interactive exercises, and give instant feedback to students.

Mathematics learning also aims to develop mathematical thinking skills in students, such as the ability to think logically, analytically, and critically (Afifah et al., 2025; Nuraini et al., 2022). This includes the ability to identify patterns, make generalizations, solve problems, and present valid mathematical arguments. It is important to present math in a real context that is relevant to students' daily lives. This certainly helps students understand the usefulness and application of mathematics in everyday life, and motivates them to learn (Panjaitan, 2020; Ridwan, 2024). Each student has different needs and levels of understanding in mathematics. Therefore, it is important to implement adequate differentiation of learning to meet the individual needs of each student. This includes providing customized tasks, providing additional support, or offering higher challenges according to students' skill levels.

Learning mathematics also includes developing mathematical communication skills. Students need to learn to articulate their thinking, explain the problem-solving process, and present solutions in a clear and organized manner (Bogaart & Ginkel, 2026; Haˇ, 2024). The mathematics learning process involves continuous evaluation to monitor student progress. Teachers provide constructive feedback to help students refine their understanding and identify areas where they need additional help (Silva-didier et al., 2025; Tutunaru, 2023). Learning mathematics can be a meaningful and fulfilling experience for students, helping them develop a deep understanding of mathematical concepts and preparing them to face challenges in the real world.

3. RESEARCH METHODS

This research used exploratory qualitative research to explore, identify, and describe the mathematical knowledge that exists in the Baleo culture of the Lamalera community with an ethnographic approach (Dominikus & Madu, 2025; Indah et al., 2023; Lyany & Julie, 2025). This approach focuses on finding and describing how the Lamalera community organizes Baleo culture, and uses the culture in life, and develops the mathematics contained in it. The location of this research was Lamalera Village, Wulandoni District, Lembata Regency, East Nusa Tenggara (NTT).

The research subjects amounted to 5 people where they were fishermen and the Lamalera Village community who often applied the baleo culture. The subjects were selected using Purposive Sampling Technique (Campbell et al., 2020; Khalid, 2024) where these subjects were selected based on the researcher's own considerations. The selection of the research subjects was based on the provisions, namely 1) the person concerned is a Lamalera community and has lived for a long time in Lamalera, Lembata Regency. This is adjusted to the baleo culture still being practiced by the people in the area, 2) the person concerned works as a fisherman who often performs baleo in the Lamalera market, 3) the age of the person concerned is an adult, 4) the person concerned is physically and mentally healthy, 5) the person concerned has a broad understanding of baleo culture and 6) the person concerned has sufficient time to be interviewed. The research instruments used were interviews, observation, documentation, and field notes (Hamilton et al., 2020; Phillippi & Lauderdale, 2018).

Research procedures with mechanisms (1) Determining informants or research subjects, (2) Preparing research instruments in the form of open or semi-structured interview guidelines and observation guidelines, (3) Collecting data on subjects through observation interviews, documentation and field notes, (4) Testing data validity using source triangulation, (4) Testing the validity of the data was done using source triangulation, where the researcher tried to check the validity of the data that had been obtained from previous interviews with other informants, observation results, and documentation related to data on the baleo culture of the Lamalera community, (5) Analyzing the data, (6) Obtaining ethnomathematics findings on the baleo culture of the Lamalera community, (7) Designing learning tools based on ethnomathematics obtained on the baleo culture of the Lamalera community as an opportunity for its use in mathematics learning. The data or information obtained is then analyzed.

The data analysis stage begins with preparing and organizing data in the form of text data such as transcripts and image data (Ahmed et al., 2025). At this stage, the researcher makes a transcript by converting the interview results from the recorded form into written form verbatim. Then proceed to read and interpret the interview transcript as a whole and sort out the data. At this stage, the researcher traced cultural themes, summarized, and wrote memos or important concepts that emerged in the researcher's mind during the research process. Furthermore, the researcher described in detail the data obtained through interviews and observations, developed the themes of trading culture and farming culture, and provided interpretations according to the researcher's point of view based on the literature review. In the last stage, the researcher presented the data by packaging all the data obtained in the form of text, tables or images.

4. RESEARCH RESULTS

4.1. Ethnomathematics in Baleo Culture

The characteristics of mathematics in culture depend on the environment, context, focus of interest, motivation, forms of communication, interests, and goals of each group. According to Yudha (in Maima. 2021), there are 4 main topics in the study of mathematics in schools consisting of numbers, algebra, geometry, and measurement, as well as statistics and opportunities. Each number concept in the counting culture where number is defined as a concept or idea that comes from the results of the mind (abstract) and gives an idea of the number of objects. While for the Baleo culture of the Lamalera community, the concept of geometry is found from the tools used in Baleo, and other mathematical activities are found in the Barter culture of the Lamalera community.

The Lamalera people's Baleo activities start from preparing themselves and their equipment, continuing to Baleo (whale hunting), to the bartering process at the market. The Baleo activity contains mathematical activities in it, this connection can be an opportunity for the creation of mathematics learning with mathematical concepts in schools.

This series of processes is defined using the characteristics of ethnomathematics. The following is a description of the mathematical concepts contained in Baleo culture. (1) Explaining. This activity is related to the Leva nuang culture. Activities carried out before Leva nuang are related to the concept of mathematical logic. Leva Nuang occurs if the Ritual of tobu neme vate, misa arwah and misa leva are performed. This statement contains the concept of bi-implication, i.e. if the first statement is expressed as p and the second statement is expressed as q, where p means 'Leva Nuang happens' and q means 'Rituals of tobu neme vate, misa arwah and misa leva are performed', then we get 'Leva Nuang happens if and only if Rituals of tobu neme vate, misa arwah and misa leva are performed'.

The first ritual to be performed is Tobu Neme Vate.If Tobu Neme Vate has been performed, then the spirit mass and leva mass can be performed. This statement contains the concept of implication, i.e. if the first statement is expressed as p and the second statement is expressed as q, with p meaning 'Tobu Neme Vate has been performed' and q meaning 'the spirit mass and leva mass can be performed', then we get 'if Tobu Neme Vate has been performed then the spirit mass and leva mass can be performed'.

Table 1: Mathematical Logic in Leva Nuang.

No	Customary rules before leva nuang	Mathematical logic
1	P = *Leva Nuang* occurs Q = The *Tobu Neme Vate* ritual, the Mass of the Spirits and the *Leva* Mass are performed	Biimplications (p <=> q) *Leva Nuang* occurs if and only if the *Tobu Neme Vate* Ritual, Mass of the Dead and *Leva* Mass are performed.
2	P = *Tobu Neme Vate* has been done Q = Requiem Masses and *leva* Masses can be performed.	Implication (p => q) If *Tobu Neme Vate* has been performed then the spirit mass and *leva* mass can be performed.

In the activity of explaining, we can know that in barter activities there is a mathematical concept, namely the concept of Linear Equation One Variable. It is explained that 1 bundle (3 pieces) of whale / stingray is priced at Rp 20,000, - then 1 bundle or 3 pieces of whale / stingray can be expressed as x, so the equation is x = 20,000 or 3x = 20,000 and if it is explained that 1 bundle (4 fish) of flying fish is priced at Rp 10,000, - then 1 bundle or 4 flying fish can be expressed as x, so the equation is x = 10,000 or 4x = 10,000. (2) Measuring. In measuring activities in Baleo activities, the lamalera community uses non-standard measurements in the form of using limbs, such as jengkal (the length from the tip of the thumb to the tip of the little finger) and fathoms (the length from the tip of the middle finger of the right hand to the tip of the middle finger of the left hand). To stab a whale, a spear (tempuling) and a tied kave are used. Lamalera people use fathoms to measure the length of the spear (tempuling) that will be used to stab the whale. Meanwhile, jengkal is commonly used by the Lamalera community to measure the length or width of woven sarongs and measure the height of dese/baku or balls as containers in bartering.

The use of non-standard units includes cubits, inches, fathoms or can also use other objects. Abroad, there are also non-standard units that have been standardized based on certain values, such as feet (Feet), thumbs (Inch), and arms (yards) which are still used in several European countries.

Table 2: Conversion of non-standard units to standard form.

No	Nonstandard Form	Standard Form
1	1 arch	25 cm
2	1 cubit	50 cm
3	1 fathom	250 cm
4	1 feet	30,48 cm
5	1 *inch*	2,54 cm
6	1 *yard*	91,44 cm

The containers used in bartering vary in size. The dese or baku used is usually 1-2 inches high. While the ball is 3-4 inches high and 1 hug big. So it can be converted into standard units into:

Dese or Baku = 2 inches = 2 x 25 cm = 50 cm

Ball = 4 inches = 4 x 25 =100 cm

The length of bamboo wood used as a spear (kave/tempuling) to stab a whale is 3 fathoms. It can be converted into standard units to:

3 fathoms long = 3 x 250 cm = 750 cm = 7.5 meters.

Thus, this can be a reference for students to understand the concept of measurement by converting non-standard units to standard units.

(3) Designing. In this activity, the designing activities carried out include designing the shape of traditional whaling tools or equipment which is a cultural product of the Lamalera community. The equipment for fishing is a canoe (peledang), sail, rope (tale), spear (tempuling), hook (kave), rower (fai). Some of the tools used for fishing are related to the concept of geometry.

In ancient times, the Lamalera people used sails in fishing. This sail is made with the top side parallel to the bottom side and equal in length while the left side is parallel and equal in length to the right side. The angles formed are 900. The top and bottom sides are tied to a straight bamboo that is shaped like a straight line.

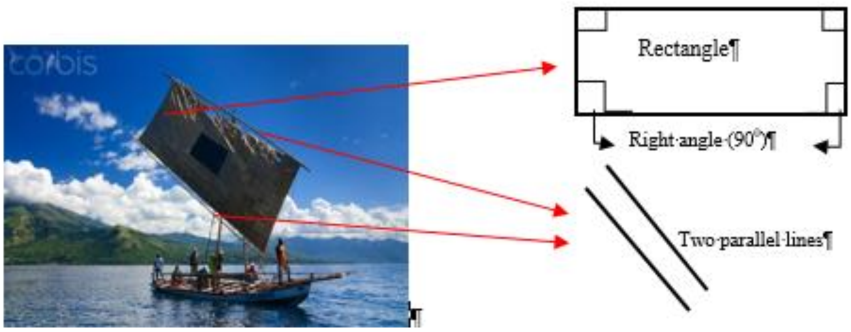


Figure 1: Concept geometry on a sailboat.

On the kave (hook), the upper iron tip and the lower iron tip are joined or meet at a point (intersect) and form an angle with an angle of less than 900. If the side in front of the corner is given an iron, a triangle will be formed.

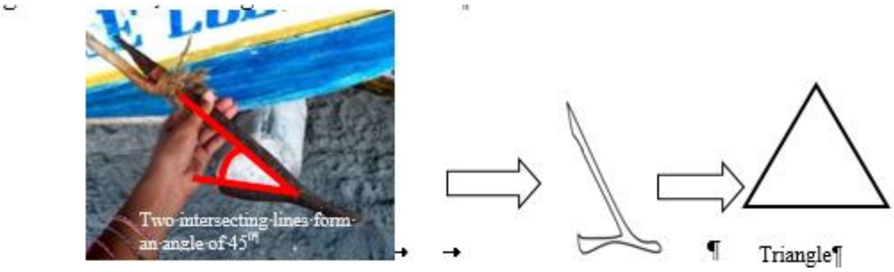


Figure 2: Conceptual geometry of the kave

At the bottom of the rower a circle is formed with the angle formed is 360^0 which is then connected to a straight wooden handle in the form of a straight line.

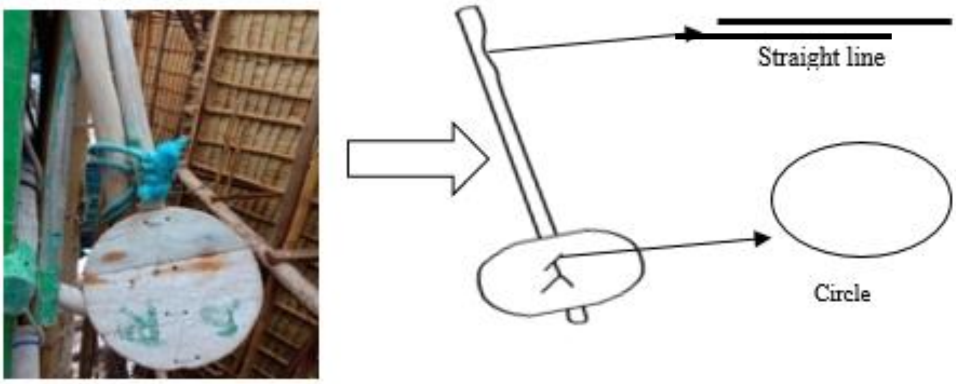


Figure 3 Concept geometry on the rower (fair).

In the use of *peledang* as the main tool in fishing, it can be seen that the upper side is parallel to the lower side and a trapezoid is formed.

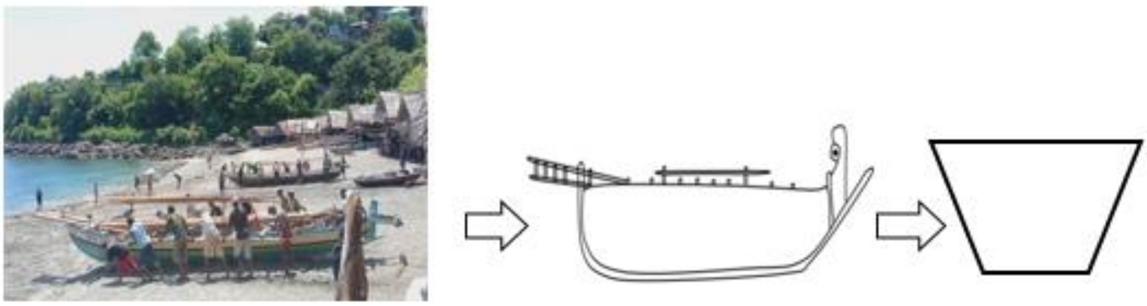
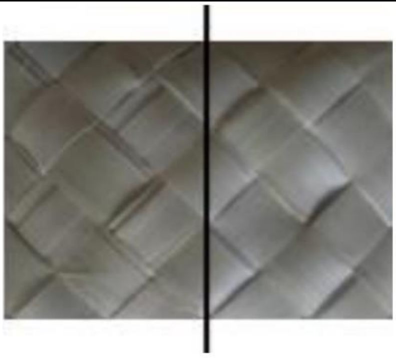
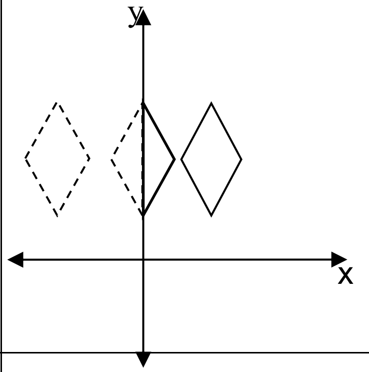
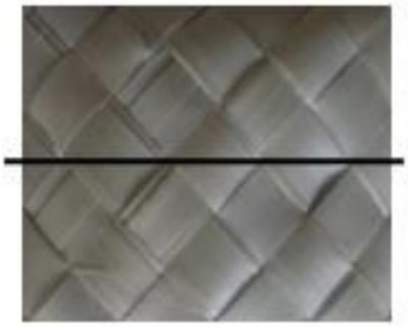
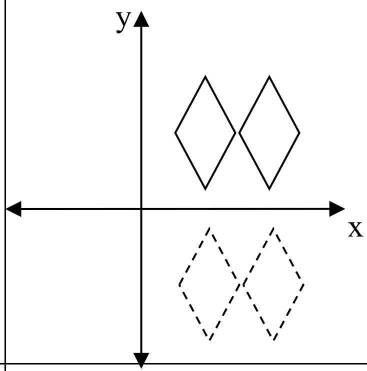
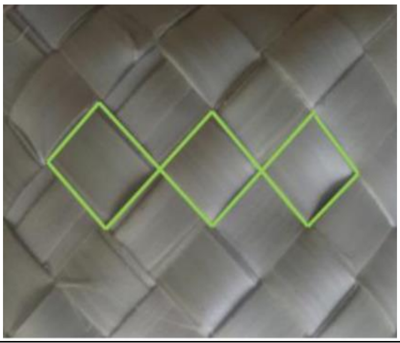
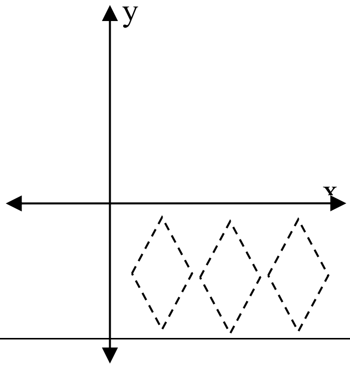


Figure 4: Geometry concepts on the peledang

The concept of geometric transformation is also found in the trading container which includes reflection and translation. Reflection can be seen in the hemispheres of webbing that face each other will have the same shape and size. While translation is the shape and size of the webbing that shifts does not change the shape and size, only the location changes. In other words, the coordinates of the webbing after experiencing a shift will change from the original coordinates.

Table 3: Geometry transformation on baku.

Webbing Picture	Illustration	Geometry Transformation

		Reflection about the y-axis
		Reflection about the x-axis
		Translasi terhadap sumbu x

(4) Counting. This activity is related to counting the number of peledang participating in fishing, the number of people in the peledang. The math concepts found in this activity are addition and multiplication operations. 1 whale can be hunted by 12 peledang (pulok rua tena). This 12 is obtained from adding one 12 times (counting the peledang one by one), namely 1+1+1+1+1+1+1+1+1+1+1+1 = 12. Or 12 x 1 =12. But not all of the punters get the whale. Usually there are only 3 or 4 peledang who get a whale. These 4 peledang are obtained from the sum of one by 4, namely 1+1+1+1 = 4 or 4 x 1 = 4.

One peledang can be ridden by 5-12 people. A large peledang is usually filled by 12 people, a medium peledang is filled by 8 people while a small peledang is filled by 5 people. The math concepts in this activity are addition and multiplication operations. The big peledang is filled with 12 people obtained from adding 1 12 times, namely 1+1+1+1+1+1+1+1+1+1+1+1 = 12 or 12 x 1 =12. These 12 people occupy their respective positions where the frontmost position is 1 lamafa followed by 1 breung alap, then 1 matros, followed by 2 matros, behind him 2 more matros, then 2 matros, 2 more matros and the last is 1 lama uri. When viewed from its position, these 12 people are obtained from 1+1+1+2+2+2+2+1 = 12 or (3 x 1)+(4 x 2)+1 = 12. In this activity, comparing is also inseparable from counting. The results of measurement are expressed in numbers and therefore can be followed by comparing. From counting the number of people in a peledang, 3 types of peledang are known. These three types of peledang are: first, a large canoe (peledang bele/tena bele) with 12 people; second, a medium canoe (tena/sape) with 8 people; third, a small canoe or small jonson (tena krete/sape krete) with 5 people.

Counting activities are also related to barter transactions in the market. The math concepts found are addition, subtraction and multiplication operations. There are types of goods that are sold with prices calculated per standardized and unstandardized measure, such as ikat(ui), so students will be able to count money in larger amounts such as thousands.

Suppose 1 piece of stingray/whale can be bartered with 12 corn/bananas and someone wants to exchange 2 pieces of whale/stingray, then the number of corn or bananas that will be obtained is 24 pieces obtained from the results of the addition and multiplication operations. If the price of 1 bunch (3 pieces) of whale/stingray is Rp 20,000 and someone wants to buy 2 bunches, the amount of money that must be paid is Rp 40,000. If the money given to pay for 2 bundles of whales/stingrays is Rp 50,000, the subtraction operation is used to find the amount of change

4.2. Mathematical Concepts Related to Ethnomathematics

Based on the description of the use of Baleo culture ethnomathematics in mathematics learning in accordance with the characteristics of ethnomathematics as described earlier, the corresponding mathematical concepts can be presented in the following table 4.

Table 4: Baleo cultural activities and Barter Activities that match the Concept of School Mathematics.

No	Ethnomathematics of Baleo Culture	School Mathematics Concepts	Basic Competencies	Education Level
1	*Leva Nuang*	Math Logic	3.22 Analyze contextual problems related to mathematical logic (simple statements, negation of simple statements, compound statements, negation of compound statements and inference) 4.22 Solve contextual problems related to mathematical logic (simple statement, negation of simple statement, compound statement, negation of compound statement and inference)	Senior High School (Grade XI)
2	*Baleo* tools and Traditional trading platform	Geometry	3.12 analyze various flat shapes based on their properties 4.12 classify various flat shapes based on their properties	Elementary School (Grade II)
		Measurement	3.8 recognize and determine length and weight with non-standard units using concrete objects/situations 4.8 perform length and weight with non-standard units using concrete objects/situations	Elementary School (Grade I)
		Geometry transformation	3.5 explain geometric transformations (reflection, translation, rotation and dilation) connected with contextual problems 4.5 solve contextual problems related to geometric transformations (reflection, translation, rotation and dilation)	Junior High School (Grade IX)
3	*Baleo* Activities and Sale and purchase transactions and barter culture	Operations of addition, subtraction, multiplication, division	3.3 explain and perform addition and subtraction of numbers involving up to 999 in daily life as well as relate addition and subtraction 4.3 solve addition and subtraction problems involving numbers up to 999 in daily life and relate addition and subtraction 3.4 explain multiplication and division involving integers with product up to 100 in daily life and relate multiplication and division to it 4.4 solve multiplication and division problems involving integers with product up to 100 in daily life and relate multiplication and division	Elementary School (Grade II)
		Linear equation of one variable	3.6 explain linear equations and inequalities of one variable and their solutions 4.6 solve problems related to one variable linear equations and inequalities	Junior High School (Grade VIII)

Thus, mathematical knowledge in the baleo culture of the Lamalera community contains mathematical concepts that can be used in mathematics learning in accordance with the basic competencies and educational levels.

The baleo culture is one of the cultures of the Lamalera community that has its own uniqueness because it still uses traditional equipment, as well as a barter culture that is still maintained until now. One of the efforts to preserve this culture is by teaching it in mathematics learning. This contextual learning is expected to be able to bring students to get to know more closely about the baleo and barter culture and be able to build their understanding of the mathematical concepts contained therein.

4.3. Discussion

Each culture develops its own form of mathematics according to the needs of its environment and the goals of its people (Rosa & Orey, 2011; Umbara et al., 2021). The characteristics of mathematics in a culture depend on the environment, context, focus of interest, motivation, forms of communication, interests, and goals of each group. Each cultural group produces different ethnomathematics. Bishop suggests that there are six universal mathematical activities that can be found in every cultural group, namely: counting, locating, measuring, designing, explaining and playing (Alfachrudinaa & Zahroh, 2022; Aspin et al., 2025; Macdonald, 2025).

This study found that Baleo culture in Lamalera has unique mathematical patterns in various aspects of daily life, especially in whaling practices. These patterns include the use of counting, geometry, proportion and other mathematical concepts that are naturally integrated in their traditional activities (Busrah et al., 2023; Krisdiana et al., 2025; Wangge & Dasari, 2025). Various forms of ethnomathematics in the Baleo culture of the Lamalera community in the form of mathematical activities owned or developed in the Lamalera community, including explaining activities, measuring activities, designing activities, counting activities. The four characteristics of ethnomathematics found in Baleo can then be seen how they relate to the concept of school mathematics. Ethnomathematics related to school mathematics concepts that have been found are then integrated in mathematics learning (Rodríguez-nieto & Bonyah, 2024; Simbolon, 2024).

The concepts made in the learning tools are the concept of Counting (addition, subtraction, and multiplication), the concept of non-standard measurement and the concept of designing (Abarquez, 2020; Hartman et al., 2023; Odonkor & Dagadu, 2025). The learning tools are made by looking at the experience of people's daily activities so that they can be easily understood, more effective for students and learning becomes more meaningful (Contrino et al., 2024; Haleem et al., 2022; Parwata & Sudiatmika, 2020). The learning materials developed based on the findings of this research show that the integration of ethnomathematics from Baleo culture can significantly improve the relevance, contextuality and authenticity of mathematics learning in schools. Students can more easily understand abstract mathematical concepts through direct experience with mathematical practices in their own culture.

This culture-based learning is carried out as an effort to preserve culture and contextual learning is carried out in the hope that it can help students to get to know more closely about the Baleo culture and the barter culture of the Lamalera community and students are able to build their understanding of the mathematical concepts contained therein. In a culture-based learning activity, teachers can involve students in forming their knowledge from the culture that students have or the culture around students so that learning will be more effective and meaningful and students do not feel alienated in their learning (Azhary & Fatimah, 2024; Khusna & Adji, 2024; Maftuh et al., 2025).

In culture-based mathematics learning, students are expected to be able to construct knowledge from experiences related to Baleo culture. One of the benefits of using ethnomathematics is the emergence of emotions in learning, motivation, spiritual awareness, and cultural identity (Fouze & Amit, 2023; Mahmudi & Wijaya, 2025). The application of ethnomathematics concepts in mathematics learning faces a number of challenges and opportunities that need to be understood and addressed to achieve effective and inclusive learning goals (Selepe & Mphahlele, 2025; Sulistyowati et al., 2024). In this context, these challenges and opportunities form an important foundation for the development of better and more diverse learning strategies.

One major challenge is to ensure understanding and acceptance of ethnomathematics concepts among educators, students, and other educational stakeholders (Luga et al., 2024; Nur et al., 2021; Sunzuma & Maharaj, 2019). Some people may have a narrow view of what constitutes legitimate mathematics, and changing this perception can be a challenging process. Formal mathematics curricula often have a tightly defined scope and structure, leaving little room for the integration of ethnomathematics concepts (Madu et al., 2025; Wulandari et al., 2024; Zainovi & Mariana, 2025). This can be a barrier to incorporating ethnomathematics content into existing mathematics learning. The availability of resources and training for teachers needed to integrate ethnomathematics concepts in learning is also a challenge (Kyeremeh et al., 2025; Nursyahidah et al., 2025). Adequate training is needed to enable teachers to design and implement ethnomathematics-inclusive lessons (Astuti et al., 2024; Deva, 2024). The adoption of ethnomathematics concepts in the traditional curriculum may face resistance from various parties, including teachers, administrators or parents. The change may be perceived as an additional workload or threatening the status quo.

However, amidst these challenges, there are also great opportunities in applying the concept of ethnomathematics (Yanti, 2025) in learning where by recognizing and utilizing cultural diversity in the classroom, the concept of ethnomathematics allows students to understand that mathematics (Wibawa et al., 2025) is not universal but can vary according to their respective cultural contexts. In addition, the integration of ethnomathematics allows students to see the relevance of mathematics in their daily lives. It can increase interest and motivation to learn and strengthen understanding of mathematical concepts by providing a more concrete context. Ethnomathematics-based learning can increase students' engagement in learning, as they feel connected to the material and see value in the application of mathematics in their own culture (Aulia et al., 2019; Zainal & Krismanto, 2025). Through the exploration of ethnomathematics concepts, students can develop critical and analytical thinking skills as they consider the differences and similarities between the mathematical concepts they are learning and mathematical practices in other cultures (Angga et al., 2024; Sundari et al., 2023). By understanding the challenges and capitalizing on the opportunities, educators can design more inclusive and meaningful learning experiences for students. In the process, they can help build an appreciation for cultural diversity and its values, while reinforcing understanding of fundamental mathematical concepts.

This research is novel in its exploratory and integrative approach to the local cultural practices of the Lamalera community, particularly the Baleo culture, as a source of mathematical concepts relevant to mathematics learning in schools. To date, ethnomathematics studies in Indonesia have mostly focused on cultural activities such as weaving, traditional architecture, or folk games, while the exploration of mathematical concepts in traditional maritime culture, especially in Baleo practices in Lamalera, is still very limited (Priska et al., 2025; Tambunan et al., 2025). Therefore, this study presents a new perspective by examining Baleo cultural activities as a space for the birth of various mathematical ideas that are used practically by the community.

The novelty of this research also lies in the process of identifying and analyzing mathematical concepts that arise in various Baleo cultural activities, such as traditional boat building, the use of fishing gear, sea navigation techniques, and the system of dividing the catch. These activities contain various mathematical concepts, including geometric concepts in the shape of boats and fishing gear, measurement concepts in determining the size of boats and ropes, ratio and proportion concepts in the distribution of catch, and pattern and strategy concepts in the whale hunting process (Ma et al., 2024; Muna et al., 2023; Pitaloka & Aini, 2025). Thus, this study not only describes culture as a social phenomenon but also interprets culture as a source of mathematical knowledge that develops in the practices of community life.

In addition, the novelty of this research is also evident in its efforts to integrate the results of ethnomathematics exploration of the Baleo culture into mathematics learning in schools. This study seeks to develop a learning context that links formal mathematical concepts with students' local cultural experiences, so that learning becomes more contextual, meaningful, and relevant to their lives. This integration is expected to help students understand mathematical concepts more deeply while fostering awareness and appreciation of local culture.

The main novelty of this research lies in three important aspects, namely: (1) exploration of mathematical concepts contained in the cultural practices of the Lamalera people's Baleo, (2) interpretation of maritime cultural activities as a source of mathematical knowledge from an ethnomathematics perspective, and (3) development of the integration of the results of this exploration into mathematics learning based on the local cultural context. This research is expected to contribute theoretically to the development of ethnomathematics studies and practically to innovations in mathematics learning based on local wisdom.

5. CONCLUSION

Based on the results of the research and discussion previously described, it can be concluded that there are several mathematical concepts contained in Baleo culture, namely in activities before baleo, designing equipment used in baleo to the barter process in the market. Some of these mathematical concepts include the concepts of geometry, geometric transformation, multiplication, addition, subtraction, measurement, and mathematical logic.

In the activities before Leva Nuang, the concepts of mathematical logic of implication and biimplication were found. Meanwhile, the concepts of multiplication, addition, subtraction and linear equations of one variable were found in the barter culture of the Lamalera community. The concepts of geometry and geometric transformation were also found in the containers used in trading or bartering.

The mathematical concepts found in Baleo culture and Barter culture of Lamalera community are then made into learning tools. Thus, it can be concluded that the Baleo culture of the Lamalera community contains school mathematics concepts that can be integrated in mathematics learning through the development and design of appropriate learning tools, so that they can be used in learning mathematics at school.

REFERENCES

Abarquez, E. B.-. (2020). The Use of Manipulative in Teaching Elementary Mathematics. 0299(c), 18–32. https://doi.org/10.32996/ijllt

Abidin, D., Retnaningrum, E., Parinussa, J. D., & Kuning, D. S. (2023). Curriculum Development in Indonesia from a Historical Perspective. 4(2), 443–451.

Afifah, N. W., Rahaju, E. B., & Surabaya, U. N. (2025). MATHE dunesa. 3. https://doi.org/10.26740/mathedunesa.v14n3.p957-971

Ahmed, S. K., Mohammed, R. A., Nashwan, A. J., Ibrahim, R. H., Abdalla, A. Q., Ameen, B. M. M., & Khdhir, R. M. (2025). Using thematic analysis in qualitative research. Journal of Medicine, Surgery, and Public Health, 6(March), 1–6. https://doi.org/10.1016/j.glmedi.2025.100198

Alfachrudinaa, N., & Zahroh, U. (2022). Ethnomathematical Analysis of Piano Playing and Its Implementation in Mathematics Learning.

Angga, R., Tuğba, P., & Yelken, Y. (2024). Effectiveness of ethnomathematics - based learning on students' mathematical literacy : a meta - analysis study. Discover Education. https://doi.org/10.1007/s44217-024-00309-1

Aspin, L., Lessy, D., & Sopamena, P. (2025). Binongko Multiplication : An Ethnomathematics Method to Adress Mathematical Challenges Among the Butonese Ethnic Group in Masohi City. 13(2), 124–140.

Astuti, E. P., Wijaya, A., & Hanum, F. (2024). Teachers ' Belief in Ethnomathematics-Based Numeracy Learning Scale : A Rasch Model Analysis. 13(2), 992–1006. https://doi.org/10.18421/TEM132

Astuti, P. (2023). Ethnomathematical Study on Indigenous Fish Trap : Example from Kijang , Bintan Regency. 17(1), 21–36.

Aulia, F., Dianti, S. P., Utami, W. B., & Sina, I. (2019). Jurnal Pendidikan MIPA. 20(November), 39–45.

Azhary, L., & Fatimah, S. (2024). The Integration of Local Cultures in English Teaching Materials in Promoting Culturally Responsive Teaching. 16(2012), 2045–2056. https://doi.org/10.35445/alishlah.v16i2.4998

Bogaart, T. Van Den, & Ginkel, S. Van. (2026). How collaborative problem solving promotes higher-order thinking skills : A systematic review of design features and processes. 59(March 2025). https://doi.org/10.1016/j.tsc.2025.102001

Busrah, Z., Pathuddin, H., & Aras, A. (2023). Mathematical ability of Bugis community in designing Lipa ' Sabbe of Sengkang. 8(1), 30–48. https://doi.org/10.23917/jramathedu.v8i1.2524

Campbell, S., Greenwood, M., Prior, S., Walkem, K., Young, S., & Bywaters, D. (2020). Purposive sampling : complex or simple ? Research case examples. https://doi.org/10.1177/1744987120927206

Cimen, O. A. (2014). Discussing ethnomathematics : Is mathematics culturally dependent ? Procedia - Social and Behavioral Sciences, 152, 523–528. https://doi.org/10.1016/j.sbspro.2014.09.215

Contrino, M. F., Millán, M. R., Villegas, P. V., & Hernández, J. M. (2024). Using an adaptive learning tool to improve student performance and satisfaction in online and face - to - face education for a more personalized approach. https://doi.org/10.1186/s40561-024-00292-y

Cotič, M., Doz, D., Jenko, M., & Žakelj, A. (2024). Mathematics education: What was it, what is it, and what will it be? International Electronic Journal of Mathematics Education, 19(3), em0783. https://doi.org/10.29333/iejme/14663

Deva, P. S. (2024). Ethnomathematics and Renewable Education in the Village of Tanjungjaya Village , Panimbang District , Pandeglang Regency , Banten. 4(4), 116–123.

Dominikus, W. S., & Madu, A. (2025). Exploration of ethnomathematics on Sasandu musical instrument in Rote Ndao Regency and its integration in mathematics learning. Ethnography and Education, 7823, 1–24. https://doi.org/10.1080/17457823.2025.2607998

Dominikus, W. S., Nusantara, T., & Muksar, M. (2016). Link Between Ethnomathematics In Marriage Tradition In Adonara Island And School Mathematics. 6(3), 56–62. https://doi.org/10.9790/7388-0603045662

Dyani, K. M. (2025). Learning Mathematics of KPK Material using Student Assignment Method Grade IV. Academic Journal Research, 3(2), 191–197.

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

Fouze, A. Q., & Amit, M. (2023). The Importance of Ethnomathematics Education. Creative Education, 14(04), 729–740. https://doi.org/10.4236/ce.2023.144048

Gen, M., Ak, M., & Karata, I. (2025). From Thinking to Creativity : The Interplay of Mathematical Thinking Perceptions , Mathematical Communication Dispositions , and Creative Thinking Dispositions.

Haˇ, L. (2024). Breaking Down the Concept of Students ′ Thinking and Reasoning Skills for Implementation in the Classroom. 1–21.

Haleem, A., Javaid, M., Asim, M., & Suman, R. (2022). Understanding the role of digital technologies in education : A review. Sustainable Operations and Computers, 3(February), 275–285. https://doi.org/10.1016/j.susoc.2022.05.004

Hamilton, A. B., Finley, E. P., Angeles, L., Sciences, B., Angeles, L., Antonio, S., Antonio, H. S., & Antonio, S. (2020). HHS Public Access. 1–18. https://doi.org/10.1016/j.psychres.2019.112516.Qualitative

Hartman, J. R., Hart, S., Nelson, E. A., & Kirschner, P. A. (2023). Designing mathematics standards in agreement with science. 18(3).

Indah, W., Mahmuda, & Listiani, W. (2023). Ethnomathematics Exploration in the Tobacco (Vol. 1, Issue 2016). Atlantis Press SARL. https://doi.org/10.2991/978-2-38476-044-2

Jacob, G. (2021). ETHNOMATHEMATICS. 9(09), 310–312. https://doi.org/10.21474/IJAR01/13409

Janna, G. F., Syarifah, K. I., Robicha, N., & Rasilah, R. (2025). Introduction To Basic Mathematical Concepts Through Learning Media. 4(1), 43–56.

Khalid, S. (2024). How to choose a sampling technique and determine sample size for research : A simplified guide for researchers. Oral Oncology Reports, 12(September), 100662. https://doi.org/10.1016/j.oor.2024.100662

Kholid, M. N., & Husodo, H. D. (2025). Ethnomathematics : Arithmetic and Discrete Mathematics Concepts in Batik Sidomukti Solo. 1040(2021), 489–508.

Khusna, N., & Adji, T. P. (2024). Integrating Local Wisdom in Independent Learning : Urgency and Innovative Strategies. 8(2), 22–39.

Krisdiana, I., Masfingatin, T., Murtafiah, W., & Fadhilla, F. N. (2025). Uncovering mathematical activities and concepts in Batik Pendekar of Madiun City through the lens of ethnomathematics. 11(May), 630–647.

Kyeremeh, P., Awuah, F. K., & Orey, D. C. (2025). Challenges regarding the integration of ethnomathematical perspectives into geometry teaching : The faculty re fl ection. 4(3), 416–430. https://doi.org/10.1177/27527263251326330

Legare, C. H. (2024). The Development of Cumulative Cultural Learning (Issue Lancy 2008). https://doi.org/10.1146/annurev-devpsych-121318-084848.The

Levin, I., & Mamlok, D. (2021). Culture and Society in the Digital Age. 1–13.

Luga, M. J. F., Samson, H. B., & Oledan, A. M. B. (2024). Exploring the Significance and Implementation of Ethnomathematics in Education : A Meta-Synthesis of Cross- Cultural Perspectives in Indonesia and Thailand. 15(7), 1–8. https://doi.org/10.7176/JEP/15-7-01

Lyany, E. G., & Julie, H. (2025). Ethnomatematics Study on Ikat Woven Fabric of The Kwatek Lamalera. 01005.

Ma, Y., Wang, X., & Meng, W. (2024). A Reinforced Whale Optimization Algorithm for Solving Mathematical Optimization Problems.

Macdonald, A. (2025). Everyday Mathematical Activities of Babies and Toddlers in Early Childhood Education Settings. Early Childhood Education Journal, 2008. https://doi.org/10.1007/s10643-025-01899-7

Madu, A. (2025). A Decade of Ethnomathematics Research (2015 – 2025): A Cross- Country Analysis of Global and Local Perspectives. 5(July), 227–248.

Madu, A., Rimo, I. H. E., Nenotaek, B., & Agil, A. F. (2025). Development of ethnomathematics-based e-modules to improve student learning outcomes on circle material. International Journal of Innovative Research and Scientific Studies, 8(4), 1347–1362. https://doi.org/10.53894/ijirss.v8i4.8069

Maftuh, B., Supriatna, M., & Anakotta, R. (2025). Promoting Cultural Literacy Through a Local Wisdom-Based Learning Model : A Research and Development Study in Elementary Schools. 6(3), 615–631.

Mahmudi, A., & Wijaya, A. (2025). International Journal of Multicultural and Multireligious Understanding

Integrating Ethnomathematics in Learning to Reduce Students ' Cognitive Load. 56–69.

Muhaimin, L. H., Kusumah, Y. S., Juandi, D., Hendriyanto, A., & Sahara, S. (2023). Mathematical Framework for Accurate Prayer Times: Insights from the Bencet Tradition. Indonesian Journal of Science and Mathematics Education, 6(3), 416. https://doi.org/10.24042/ijsme.v6i3.19790

Muna, F., Fuadi, M. H., & Nurhuda, A. (2023). Ethnomathematics exploration of fisherman activities in the Rembang community. 2(2), 41–44.

Nasitha, N. M., & Utama, C. (2025). Analysis of Mathematics Learning Process : Planning , Implementation and Evaluation Qualitative Case Study at Phase A Elementary School in Malang City.

Nur, A. S., Waluya, S. B., Kartono, K., & Rochmad, R. (2021). Ethnomathematics Perspective and Challenge as a Tool of Mathematical Contextual Learning for Indigenous People. International Journal on Emerging Mathematics Education, 5(1), 1. https://doi.org/10.12928/ijeme.v5i1.17072

Nuraini, T. F., Haditia, N. C., Hakim, A. R., & Sari, N. I. (2022). Fostering Students ' Mathematical Communication Skills in Mathematics Learning. 3(1), 15–23.

Nursyahidah, F., Wardono, Scolastika, M., & Wijayanti, K. (2025). Integrating technology, ethnomathematics, and realistic mathematics education in learning statistics:A learning trajectory. Infinity:Journal of Mathematics Education, 14(3), 633–644. https://doi.org/10.22460/infinity.v14i3.p633-654

Nurtamam, M. E., & Jannah, A. N. (2024). The Influence of Problem Based Learners on Students ' Mathematical Thinking Ability in Understanding and Applying Polya Stages. 5(1), 192–200.

Odonkor, E., & Dagadu, J. C. (2025). A Conceptual Framework for Teaching Addition , Subtraction , and Multiplication in Kindergarten Using Grid-Counting Approach *. 14(2), 274–294.

Panjaitan, B. (2020). The Outcomes of Learning Mathematics in Mathematics Classroom. 414(Iceshe 2019), 35–41.

Parwata, K. Y. L., & Sudiatmika, A. A. I. A. R. (2020). The Effectiveness Of Learning Tools In Science Learning. Journal of Physics: Conference Series, 1–8. https://doi.org/10.1088/1742-6596/1503/1/012049

Phillippi, J., & Lauderdale, J. (2018). A Guide to Field Notes for Qualitative Research : Context and Conversation. https://doi.org/10.1177/1049732317697102

Pitaloka, D., & Aini, I. N. (2025). Exploring of Ethnomathematics in the Local Culture of North Karawang Coastal Fishermen for Elementary School Mathematics. 8(2), 145–161.

Pratama, R. A., & Yelken, T. Y. (2024). Effectiveness of ethnomathematics-based learning on students' mathematical literacy: a meta-analysis study. Discover Education, 3(1). https://doi.org/10.1007/s44217-024-00309-1

Priska, M., Winardi, A., & Jupri, A. (2025). Implementation of folk games ethnomathematics in mathematics learning : A systematic literature review.

Pujianti, E. S. (2024). The Effect of Busy Box Media on Early Childhood Counting Skills. 3(3), 881–889. https://doi.org/10.58526/jsret.v3i3.443

Purnami, A. S. (2022). Ethnomathematics In the Museum of Sasmitaloka Panglima Besar Jendral Sudirman Yogyakarta In Improving Students ' Creative Thinking Ability. 5(2), 155–164.

Putri, S. J., & Jamaan, E. Z. (2025). Impact of a constructivist approach on students ' mathematical communication ability : A quasi- experimental study. 16(01), 83–94. https://doi.org/10.24042/ajpm.v16i1.26137

Ratau, A., Cholily, Y. M., Rahardjanto, A., & Effendi, M. M. (2025). Exploring ethnomathematics in the traditional houses of Tamarele , Buano Utara village , as a source of mathematics learning Eksplorasi etnomatematika rumah adat Tamarele desa Buano Utara sebagai sumber belajar matematika. 08(November), 519–530. https://doi.org/10.24042/ijsme.v8i3.29420

Ridwan, D. F. (2024). Implementation of Problem-Solving Learning with Geogebra to Improve Problem-Solving Ability and Motivation. 14(2).

Rodríguez-nieto, C. A., & Bonyah, E. (2024). Integrating ethnomathematics and ethnomodeling in Institutionalization of school mathematics concepts : A study of fishermen community activities. 15(3), 835–858.

Rohati, R., Kusumah, Y. S., & Kusnandi, K. (2023). education sciences Exploring Students ' Mathematical Reasoning Behavior in Junior High Schools : A Grounded Theory.

Rosa, M., & Orey, D. C. (2011). Ethnomathematics: the cultural aspects of mathematics Etnomatemática: os aspectos culturais da matemática. Revista Latinoamericana de Etnomatemática, 4(2), 32–54.

Rosa, M., & Orey, D. C. (2013). Ethnomodeling as a Research Theoretical Framework on Ethnomathematics and

Mathematical Modeling. 6(2), 62–80.
Sabrina, R. (2018). The Influence of Open-Ended Approach to Mathematical Creative Thinking Ability of 5th Grade Students Elementary School in Padang. 285(Icm2e), 282–284.
Sarah, M., & Batiibwe, K. (2024). The role of ethnomathematics in mathematics education : A literature review. 3(4), 383–405. https://doi.org/10.1177/27527263241300400
Selepe, M. A., & Mphahlele, R. S. (2025). Ethnomathematics in Practice : Reimagining Play- based Pedagogy in Teaching Mathematics in Early Childhood Education Ethnomathematics in Practice : Reimagining Play-based Pedagogy in Teaching Mathematics in Early Childhood. African Journal of Research in Mathematics, Science and Technology Education, 29(3), 404–416. https://doi.org/10.1080/18117295.2025.2575605
Silva-didier, L., Schildkamp, K., Visscher, A. J., & Bosker, R. J. (2025). Studies in Educational Evaluation Improving teachers ′ beliefs about using student feedback : Can professional learning communities make a difference ? Studies in Educational Evaluation, 87(May), 101534. https://doi.org/10.1016/j.stueduc.2025.101534
Simbolon, R. (2024). Literature Study : Integration of Ethnomathematics in Mathematics Learning in Schools. 3(2), 70–76.
Sinar, R., & Azmil, H. L. (2024). Problem Posing as a Learning Model to Improve Primary School Students' Mathematics Learning Outcomes in Gayo Lues. Journal of Indonesian Primary School, 1(December), 93–104.
Sulistyowati, E., Mawardi, D. N., Sunan, U. I. N., Yogyakarta, K., Pgri, U., & Sumatera, S. (2024). The Effectiveness Of Ethnomatematics Based Learning On Mathematics Ability Of Elementary School Students : A Meta-Analyis Study, 15(1), 1–26. https://doi.org/10.14421/albidayah.v15i1.879
Sundari, I., Putri, M., Yanty, E., Nasution, P., & Deswita, R. (2023). The Implementation of Ethnomathematics-Based Learning Using Blacksmith Tools on Students ′ Critical Thinking Skills. Plus Minus:Jurnal Pendidikan Matematika, 3(1), 1–17.
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). https://doi.org/10.29333/ejmste/108457
Tambunan, L. O., Dewi, I., & Sinaga, L. P. (2025). Ethnomathematics : Exploring Traditional Games in Mathematics Learning. 7(2), 463–479.
Tutunaru, T. (2023). Improving Assessment and Feedback in the Learning Process : Directions and Best Practices. 8, 38–60. https://doi.org/10.56177/red.8.2023.art.3
Umar, I., Badu, S. Q., Kobandaha, P. E., Gorontalo, U. N., Info, A., Reasoning, M., & Material, M. (2024). ANALYSIS OF STUDENTS ′ MATHEMATICAL REASONING. 3(4), 48–55.
Umbara, U., Wahyudin, W., & Prabawanto, S. (2021). Exploring Ethnomathematics with Ethnomodeling Methodological Approach : How Does Cigugur Indigenous People Using Calculations to Determine Good Day to Build Houses. 17(2).
Wahyu, I. G., & Antara, S. (2024). Balinese Traditional Literature as a Medium for Ethnopedagogy : Exploring Cultural Contexts to Improve Elementary Students ′ Concept ual Understanding. 8, 82–90.
Wangge, M., & Dasari, D. (2025). Mathematics in Culture : Revealing Hidden Secrets Behind Indonesian Traditional Ceremonies. 3(2), 152–163.
Wibawa, F. S., Hariri, D. D., Mahmudah, H., & Kania, N. (2025). Bridging mathematics and culture : A systematic review of indigenous mathematical concepts in Indonesian traditions. 6(2).
Wulandari, D. U., Mariana, N., Wiryanto, W., & Amien, M. S. (2024). Integration of Ethnomathematics Teaching Materials in Mathematics Learning in Elementary School. IJORER : International Journal of Recent Educational Research, 5(1), 204–218. https://doi.org/10.46245/ijorer.v5i1.542
Wulandari, I. G. A. P. A., Payadnya, I. P. A. A., Puspadewi, K. R., & Saelee, S. (2024). The Role of Ethnomathematics in South-East Asian Learning: A Perspective of Indonesian and Thailand Educators. Mathematics Teaching-Research Journal, 16(3), 101–119.
Yang, Z., Yang, X., Wang, K., Zhang, Y., Pei, G., & Xu, B. (2021). The Emergence of Mathematical Understanding : Connecting to the Closest Superordinate and Convertible Concepts. 12(November), 1–13. https://doi.org/10.3389/fpsyg.2021.525493
Yanti, S. (2025). THE ROLE OF ETHNOMATHEMATICS IN ENHANCING CONTEXTUAL. IJHABS | International Journal of Humanity Advance, Business & Sciences, 2(4), 321–330.

Yılmaz, N. (2020). Making the Association between Culture and Mathematics Education. Iseres Publishing, 81–95. https://www.isres.org/books/chapters/Erhmst2020-81-104_29-12-2020.pdf

Yuberta, F., & Firmanti, P. (2025). Analyzing Curriculum Change Policies in Indonesia : " A Review on Mathematics Subject ". Wahana Sekolah Dasar, 33(2), 99–114.

Zainal, Z., & Krismanto, W. (2025). Ethnomathematics-Based Missouri Mathematics Project Learning Model to Improve Learning Process and. 76.

Zainovi, P. S., & Mariana, N. (2025). Integrating Ethnomathematics in Geometry Learning to Enhance Primary Students ' Numeracy Skills : A Systematic Literature Review. 4(3), 1044–1053.

Zeny, E. (2021). Daya Matematis : Jurnal Inovasi Pendidikan Matematika. 9(March), 17–27.