ETHNO MATHEMATICS AT THE TRADITIONAL HOUSE OF MBARU NIANG WAE REBO, MANGGARAI

a Wara Sabon Dominikus, b Aleksius Madu, c Zacharias Angelius Krisnadi Wara Sabon, d Pryscianus Lalangi Jalo

ABSTRACT

Objective: This study aims to identify ethno mathematics in the Mbaru Niang traditional house of the Wae Rebo community, describe related mathematics concepts, and develop learning tools and learning trajectory for mathematics concepts contained in the culture of the Mbaru Niang traditional house.

Theoretical framework: Ethno mathematics is all forms of mathematical activities that are culturally based and varied and can be done every day as needed (Rosa, 2011). Ethno mathematics is a group of ideas about the history of mathematics, the cultural roots of mathematics, the mathematics implicit in everyday rules, and the learning of mathematics (Weldeana, 2016). Ethno mathematics is defined as special ways used by a certain cultural group or society in mathematical activities (Sarwoedi, 2018). Ethno mathematics is mathematics applied by a particular cultural group and studies the relationship between mathematics (mathematics education) and the corresponding social and cultural background, i.e. how mathematics is produced, transferred, disseminated, and specialized in diverse cultural systems (Gerdes, 1994; Zhang & Zhang, 2010). Ethnomathematics is a learning approach that is carried out by teaching mathematics by linking mathematics with the nation’s own cultural works and also involving the needs and lives of its people (Zaenuri, et al., 2018).

Method: The research method used is descriptive qualitative research with an ethnographic approach. The researcher is the main instrument, and data is collected through observation, interviews, and documentation, data validity using source triangulation techniques. Furthermore, the data were analyzed to describe the research findings.

Results and Conclusions: The results showed that there were mathematical activities in the construction of the Mbaru Niang traditional house. These activities include measuring activities with the concept of standard and non-standard units and designing activities related to the concept of geometry. Thus, the mathematical concepts contained in the construction of the Mbaru Niang traditional house can be developed by designing learning tools and learning trajectories that are in accordance with school mathematics. The culture of the Mbaru Niang traditional house is a source of learning mathematics that can be presented according to various contexts in learning mathematics. The study’s findings contained several mathematical aspects of the culture of the Mbaru Niang traditional house. These aspects were the concept of geometry (in the form of a conical shape) and the concept of measurement (using non-standard measurements). The measurement concept can be applied to elementary school students, and
cone geometry can be applied to junior high school. Thus, identifying and exploring Ethno mathematics in the Mbaru Niang.

**Implications of the research:** Mathematics learning strategies that are oriented towards increasing student success in learning, respecting culture, enhancing cooperation and protecting the natural environment. This is done with the “ethno math” approach through learning in schools. Difficult math concepts can be unraveled with ethno math that is real around students and supported by teacher commitment in implementing learning in the classroom.

**Originality/value:** The novelty of this research is the formation of an ethnomathematics model of mbaru niang that can be integrated in learning mathematics at school in order to provide advice for decision makers in this case teachers and government or education observers to be more pro-active in implementing learning in accordance with the culture around the student.

**Keywords:** ethno mathematics, Mbaru Niang, mathematics learning, traditional house.

---

**ETNO MATEMÁTICA NA TRADICIONAL CASA DE MBARU NIANG WAE REBO, MANGGARAI**

**RESUMO**

**Objetivo:** Este estudo visa identificar a matemática étnica na casa tradicional Mbaru Niang da comunidade Wae Rebo, descrever conceitos matemáticos relacionados e desenvolver ferramentas de aprendizagem e trajetória de aprendizagem para conceitos matemáticos contidos na cultura da casa tradicional Mbaru Niang.

**Estrutura teórica:** A matemática étnica é toda forma de atividades matemáticas que são culturalmente baseadas e variadas e podem ser feitas todos os dias conforme necessário (Rosa, 2011). Etno matemáticas é um grupo de ideias sobre a história da matemática, as raízes culturais da matemática, a matemática implícita nas regras cotidianas e o aprendizado da matemática (Weldeana, 2016). A matemática étnica é definida como formas especiais usadas por um determinado grupo cultural ou sociedade em atividades matemáticas (Sarwoedi, 2018). Etno matemática é a matemática aplicada por um grupo cultural particular e estuda a relação entre a matemática (educação matemática) e o correspondente fundo social e cultural, ou seja, como a matemática é produzida, transferida, disseminada e especializada em diversos sistemas culturais (Gerdes, 1994; Zhang & Zhang, 2010). Etnomatemática é uma abordagem de aprendizagem que é realizada pelo ensino de matemática, ligando a matemática com as próprias obras culturais da nação e também envolvendo as necessidades e vidas de seu povo (Zaenuri, et al., 2018).

**Método:** O método de pesquisa utilizado é a pesquisa qualitativa descritiva com uma abordagem etnográfica. O pesquisador é o principal instrumento, e os dados são coletados por meio de observação, entrevistas e documentação, validade de dados usando técnicas de triangulação de fontes. Além disso, os dados foram analisados para descrever os achados da pesquisa.

**Resultados e Conclusões:** Os resultados mostraram que houve atividades matemáticas na construção da casa tradicional Mbaru Niang. Essas atividades incluem atividades de medição com o conceito de unidades padrão e não padrão e atividades de design relacionadas ao conceito de geometria. Assim, os conceitos matemáticos contidos na construção da casa tradicional de Mbaru Niang podem ser desenvolvidos projetando-se ferramentas de aprendizagem e trajetórias de aprendizagem que estejam de acordo com a matemática escolar. A cultura da casa tradicional Mbaru Niang é uma fonte de aprendizagem de matemática que pode ser apresentada de acordo
com vários contextos em aprendizagem de matemática. Os achados do estudo continham vários aspectos matemáticos da cultura da casa tradicional Mbaru Niang. Esses aspectos foram o conceito de geometria (na forma de uma forma cônica) e o conceito de medida (usando medidas não-padrão). O conceito de medição pode ser aplicado a estudantes do ensino fundamental, e a geometria de cone pode ser aplicada ao ensino médio. Assim, identificando e explorando a matemática étnica no Mbaru Niang.

**Implicações da pesquisa:** Estratégias de aprendizagem de matemática orientadas para aumentar o sucesso dos alunos na aprendizagem, respeitando a cultura, melhorando a cooperação e protegendo o ambiente natural. Isso é feito com a abordagem "ethno math" através do aprendizado nas escolas. Conceitos matemáticos difíceis podem ser desvendados com matemática étnica que é real em torno dos alunos e apoiada pelo compromisso do professor na implementação do aprendizado na sala de aula.

**Originalidade / valor:** A novidade desta pesquisa é a formação de um modelo etnomatômico de mbaru niang que pode ser integrado na aprendizagem de matemática na escola, a fim de fornecer conselhos para os tomadores de decisão neste caso professores e observadores do governo ou da educação para ser mais pró-ativo na implementação de aprendizagem de acordo com a cultura em torno do aluno.

**Palavras-chave:** matemática etno, Mbaru Niang, aprendizagem de matemática, casa tradicional.

1 **INTRODUCTION**

Indonesia is rich in culture, and each region has its cultural diversity. Culture is one of the unique things and becomes a habit of society that exists from generation to generation in the order of social life. Cultural communication has been widely discussed, especially regarding the adaptation of ethnic groups in different regions, generating substantial interest and research (Yusalia, et al., 2023). Ethno mathematics is a learning approach that connects mathematics with tradition or culture in the environment around students, following the needs and lives of the students. Ethno mathematics is a learning approach carried out by teaching mathematics by linking mathematics with the nation's cultural works and the needs and lives of its people (Dwidayati & Suyitno, 2018). Ethno mathematics is defined as the unique ways a particular cultural group or society uses mathematical activities (Sarwoedi, et al, 2018). Using Ethno mathematics in learning can be a turning point for the success of the mathematics learning process (Wulan, et al., 2021). Ethno mathematics addresses mathematical knowledge, languages, values, behaviors, knowledge, and practices that cultural groups spread in particular environments (Vasquez, 2017). Implementing learning will be meaningful for students if they can further construct the knowledge they have gained through experience with the culture into learning at school. Ethno mathematics as a learning approach will make the learning environment fun (Abroriy,
2020) because ethno mathematics-based learning makes learning mathematics fun, bringing students closer to their culture and increasing their interest and motivation in learning mathematics (Taneo & Madu, 2022).

The house is one of the primary needs and a symbol of one's social status for every human being; therefore, everyone will try to have a decent house, more specifically, everyone who is married. The house, for society, has a significant position in terms of culture and meaning. The opinion reinforces that the house occupies a central position in the world order and social order in the culture of the Timor region, the eastern part of Indonesia (Timo, 2006). A traditional house is a gathering place for a particular family or tribe in a specific community order. The traditional house, as a form of unique architectural work that was established by the community, is a manifestation of the culture and community life system that was born and developed from the values that grew in the local community without being influenced by standard norms in the international architectural repertoire (Bukit, et al., 2012).

The Mbaru Niang traditional house, as one of the traditional houses in Wae Rebo, Manggarai Regency, has a very high cultural value and has been preserved to this day. Mbaru Niang comes from two words, namely Mbaru, which means house and Niang, which means tall and round, so Mbaru Niang means a conical house. Mbaru Niang, for the Wae Rebo community, is not only a place to live. Mbaru Niang is a part of themselves. Every corner of Mbaru Niang has a particular function, all of which have value and meaning (Lobo & Dagur, 2018). The characteristics of Mbaru Niang are found in its conical shape with a fused roof and body. The walls of the building are composed of a bamboo frame covered with a tangle of dry weeds and palm fibers to protect the occupants from the cold temperatures typical of the mountains. Apart from being conical in shape, Mbaru Niang also has a circular and terraced pattern of space with different spatial functions.

The uniqueness of Mbaru Niang, which is enriched with mathematical concepts, can be seen from the structure of the building in the form of geometric shapes so that it can be used as a medium for researchers in learning mathematics. However, this is not realized by some Wae Rebo people, especially students and students who are still fixated on understanding mathematical concepts through something abstract or they have never experienced. Hence, students learn to
understand mathematical concepts still patterned in books. Understanding students' mathematical concepts are still abstract because it is independent of the culture relevant to their experiences. Mathematics is a cultural phenomenon, found in every culture, embedded or hidden in every culture, shaped by every culture, influenced by culture and has a unique form according to the needs and goals of society (Dominikus, 2018). Thus it can, and attics cannot be separated from activities.

There are many different interpretations of organizational culture, such as: Corporate culture consists of basic values and beliefs that provide (Nguyen, et al., 2023). Culture exists in society, so in learning mathematics, it is necessary to involve culture in the learning process. The success of a learning process is not only realized by the achievement of student learning outcomes at school. However, a learning process is if the process has acted on students so that they can develop and apply what has been accepted in their lives.

Mathematics learning requires an approach so that in its implementation, it provides effectiveness. Mathematics learning is a learning process provided by students so that students can find relationships between concepts and mathematical structures in it and can solve problems. Cultural integration in mathematics learning following the 2013 curriculum can bring up the meaning of the material studied so that it can touch aspects of students' daily lives and local culture (Dominikus, 2014). Integrating Ethno-mathematics into the formal mathematics curriculum is one way to overcome students' difficulties learning mathematics (Ubayani, 2016).

There are several previous studies that have implemented an ethno-mathematics approach to learning mathematics in schools. These studies, including (Herna & Masrura, 2020), show that implementing an ethno-mathematical approach to learning mathematics can improve student learning outcomes. Furthermore, (Sirate, 2012) the results of his research concluded that applying Ethno mathematics as a means to motivate and stimulate students can overcome boredom and give new nuances to learning mathematics. While (Sunzuma, et al., 2021) findings showed that learners taught using an ethno mathematics approach achieved significantly higher in the test than those taught consumer arithmetic using the traditional approach and (Aritsya, & Hamidah, 2018) use of mathematics materials-based Ethno mathematics are better than the learning that does not use mathematics materials-based ethnomathematics. From some of these studies, the implementation of mathematics
learning in the classroom with an ethno mathematics approach can improve learning outcomes. Besides, it can motivate and stimulate students to learn to eliminate boredom in learning mathematics.

This also shows that the ethno mathematics approach can be applied to all levels of education, from elementary to upper secondary level, because there are mathematical concepts at every level in culturally based mathematics learning. So the role of the teacher must adjust between the material topics to be presented with an ethno mathematics approach. Which culture will be integrated into learning and is directly related to mathematical concepts that can improve student learning activities.

Learning mathematics will be more fun if it provides opportunities for students to be creative following their actual experiences in everyday life following their socio-cultural life. Mathematics can be successful if various components are considered in the pedagogical aspect, including the student (Nur, et al., 2020). Ethno mathematics is closely related to mathematics education and socio-cultural backgrounds (Zhang & Zhang, 2021). Students already have a cultural background that they have implemented daily based on real life. If integrated into mathematics learning, this cultural background will give students a good meaning of learning, where students will more quickly understand mathematical concepts. This has become one of the strengths of Ethno mathematics in learning mathematics in schools.

The unique habits of counting activities and the shape of the space used in building or constructing the Mbaru Niang traditional house can be predicted. Why is it unique? Because Mbaru Niang is known not only by the people of Wae Rebo or Manggarai but also the entire Mbaru Niang has become a tourist attraction. So this is the advantage of this research. Based on this, the research aims to find out what mathematical concepts the Wae Rebo indigenous people use in counting activities in establishing the Mbaru Niang traditional house in the form of geometric shapes that can be adopted into mathematics learning at school. The researchers' success in conducting research activities with an ethno mathematics approach to strengthen the development of the school mathematics learning curriculum. The practical application of ethno mathematical-based learning can be used to re-contextualize learning approaches that focus on culture-based learning.
2 LITERATURE REVIEW
2.1 ETHNO MATHEMATICS

Mathematics is the study of structures or patterns of order that are closely related to undefined elements into defined elements and proof of axioms. Because it deals with abstract concepts that are hierarchical in nature, mathematics emphasizes rational activities and reasoning. Therefore, mathematics is actually very closely related to everyday life. One of the mathematics studies that is closely related to everyday life is the study of mathematics from a cultural perspective or what is often called ethnomathematics.

Ethno mathematics is all forms of mathematical activities that are culturally based and varied and can be done every day as needed (Rosa, 2011). Such daily activities include building houses, exchanging money, weighing produce, and calculating recipe proportions that involve numbers, calculations, and precise geometric patterns are all ethno mathematics (Weldeana, 2016; Umbara, et al., 2021). Ethno mathematics is a group of ideas about the history of mathematics, the cultural roots of mathematics, the mathematics implicit in everyday rules, and the learning of mathematics (Weldeana, 2016). Ethno mathematics is defined as special ways used by a certain cultural group or society in mathematical activities (Sarwoedi, 2018). Ethno mathematics is mathematics applied by a particular cultural group and studies the relationship between mathematics (mathematics education) and the corresponding social and cultural background, i.e. how mathematics is produced, transferred, disseminated, and specialized in diverse cultural systems (Gerdes, 1994; Zhang & Zhang, 2010). Ethno mathematics is a field that studies the ways in which people from different cultures understand, verbalize and use concepts from their culture related to mathematics (Hariastuti, 2017).

Ethnomathematics refers to mathematical concepts embedded in cultural practices and recognizes that all cultures, and all peoples develop unique and highly explicit methods to understand and transform their own reality (Orey, 2000). Ethnomathematics in this study is more about cultural findings that have cultural values and are related to mathematics that can be implemented into school mathematics learning. Cultural values with mathematical patterns in the traditional house ornaments of Mbaru Niang, At Wae Rebo, Manggarai Regency certainly have mathematical concepts that can generate enthusiasm and motivation for student
learning, especially in mathematics subjects.

2.2 ETHNOMATHEMATICS AS A CULTURAL APPROACH TO LEARNING

Various research results that have been conducted related to ethnomathematics by researchers, concluded that ethnomathematics can be applied in the classroom by using media, sources, and cultural tools in the form of values, morals, ethics, crafts, arts, folklore, and philosophy based on the belief system of a particular community.

The implementation or application of ethnomathematics in mathematics learning activities at school brings up many new things in the process of increasing student knowledge and conveying mathematical concepts carried out by teachers for students. Mathematics learning activities by implementing a variety of values and cultural diversity certainly have different treatments in each place or student learning environment, even though they discuss the same mathematical concepts.

Ethnomathematics is a learning approach that is carried out by teaching mathematics by linking mathematics with the nation's own cultural works and also involving the needs and lives of its people (Zaenuri, et al., 2018). Teachers as educators need to find problems taken from real situations of students who are able to translate their understanding into real life through the application of relevant cultural activities so that this process can enable students to put themselves in a position in socio-cultural, political, environmental, and economic life that has a relationship with the mathematics learning system at school. Cultural approaches can also build a system of cultural sustainability of the community as a producer of knowledge by creating opportunities for students to engage in interdisciplinary activities in knowledge systems that include the relationship between environment and culture (Barajas lópez, 2018).

Teachers and learners are challenged and required to shape and maintain productive mathematics learning (Brodie, 2007; Chazan & Ball, 1999). It is very important to value students' ideas and self-formation in classroom learning (White, 2003). Teachers need to be active listeners to incorporate students' ideas and further stimulate students' minds during classroom learning (Latupono, and Nikijuluw, 2022). As Heryan (2018) said that the ethnomathematics approach is a mathematics learning approach that is influenced or based on culture and that grows and develops in society and in accordance with local culture as a foundation in building concepts so that it is
believed to be able to solve the problems faced (Ajmain, 2020). Teachers need to adopt a culture-based learning approach in planning mathematics learning for school students (Owen, 2012).

Mathematics learning is basically very integrated with people's lives, especially students. This is certainly contrary to the view of the "conventional" school which assumes that mathematics is a "culture-free" and value-free science. Ethnomathematics researchers argue that the essence of the development of mathematics is inseparable from the cultural values that already exist in certain indigenous peoples in a particular region or environment as well. The results of the research of ethnomathematics researchers also contribute to the development of mathematics learning in schools. So it can be said that ethnomathematics is a culture-based learning approach in carrying out learning activities, especially learning mathematics at school. In other words, the ethnomathematics approach is a culture-based mathematics learning approach so that students can build concepts, understand and apply them in learning activities and appreciate cultural values in a particular community.

2.3 LEARNING MATHEMATICS

Students think that math is a difficult, monotonous, scary subject, and math teachers are serious because they rarely smile. Students' statements like this certainly greatly affect their learning development, especially in learning mathematics. Students begin to be lazy to go to class, and often skip class during math class hours, which is a reality that occurs in schools or educational institutions. This brief description shows the public perception of mathematics as one of the difficult lessons. Therefore, teachers as educators need to play an optimal role in designing math learning. Learning mathematics, which is considered difficult, can be done effectively and efficiently in every learning activity.

The concept of mathematics learning is an interactive process between teachers and students in developing a thinking and logical learning model that has been created by the teacher using methods so that mathematics learning develops and grows optimally, students are able to learn more effectively and efficiently (Widayati, 2022). This is certainly in line with the current learning independence curriculum. Where students and teachers are given freedom in thinking. For teachers to think about
planning, implementing, evaluating, and reflecting on all learning activities at school, on the other hand, students also think about the extent of their understanding of the activities that have been carried out in class.

Independent learning encourages the formation of an independent soul character where teachers and students can freely and pleasantly explore knowledge, attitudes, and skills from the environment (Daga, 2021). The concept of freedom of thought can also be applied by the teacher by making himself a learning friend for students. With this concept, teachers can design fun learning so that students have self-awareness and are free (independent) in determining their learning choices. This concept also provides freedom for teachers to implement mathematics learning with various approaches, methods, and learning models. Teachers can design, plan, implement, and reflect on learning activities that have been carried out simultaneously in order to improve any deficiencies that occur in each lesson. Thus the assumption that mathematics is difficult will be broken through the creativity of teachers in processing learning activities.

In the implementation of mathematics learning in the classroom, innovation is a must for quality change in students and schools. The innovation must lead to effectiveness and efficiency as well as better results in terms of the quality of the process and student learning outcomes. Thus, teachers as educators must also innovate and be skilled in designing mathematics learning. Innovating for students can be developed through the application of innovative-based learning models (Tibahary & Muliana, 2018) because the ability to innovate is one of the 21st-century skills that students need to achieve (Redhana, 2019; Nakano & Weschsler, 2018). Mathematics learning must be developed according to student needs, and the development of knowledge and technology.

Learning mathematics with an ethnomathematical approach is one form of teacher innovation in learning. Ethnomathematics has a meaningful contribution to improving students' understanding, ability, interest, and motivation in learning mathematics and students are more familiar with and closer to the cultural values that exist in the surrounding environment as part of the implementation of national character education.
2.4 RESEARCH FOCUS

This research only focuses on the interior and roof of the traditional house of the Wogo community. Therefore, this study aims to explore and discover and describe the Ethnomathematics and mathematical concepts contained in the traditional houses of the Wogo community in Ngada Regency. Based on these objectives, this research will be tailored to the following questions as a guide: (1) what are the ethnomathematics in the traditional houses of the Mbaru Niang in Wae Rebo?; (2) what mathematical concepts contained in ethnomathematics in the traditional houses of the Mbaru Niang community in Wae Rebo can be implemented into school mathematics learning? The success of this research can support the school curriculum related to mathematics learning. The implementation of culture-based mathematics learning is an effort to improve student learning outcomes as well as the formation of children's character in appreciating cultural heterogeneity as the wealth of the nation.

3 METHOD AND MATERIALS

This article results from research conducted at the Mbaru Niang, Wae Rebo traditional house, Manggarai Regency, East Nusa Tenggara. This research was conducted in Wae Rebo, Satar Lenda, West Satar Mese District, Manggarai Regency, East Nusa Tenggara. This research was conducted for three days (27 - 29 September 2022). The method implemented in this study is a qualitative descriptive research method. The qualitative descriptive method is a research method to describe the background, ongoing processes, properties and relationships between phenomena to be investigated (Nazir, 2009). The choice of descriptive research method is because the researchers want to describe and describe in detail the ethno mathematical aspects that exist in the culture of the Wae Rebo community, especially regarding Mbaru Niang (a roundhouse shaped like a cone) and want to know the relationship between Mbaru Niang and mathematics from a cultural perspective and from a mathematical perspective as a science. Subjects in this study are; 1) the indigenous people of Wae Rebo and living in Wae Rebo, 2) the subject concerned is able to explain, 3) has a broad understanding of the Mbaru Niang traditional house, 4) is mature and physically and mentally healthy. Thus, the research subjects who meet these requirements are two people (1 male and one female). See Table 1.
Table 1. Research Subject

<table>
<thead>
<tr>
<th>Subject</th>
<th>Gender</th>
<th>Age</th>
<th>Academic qualifications</th>
<th>Occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Male</td>
<td>72 years old</td>
<td>Primary school</td>
<td>Community Deputy Chief of Mbaru Niang</td>
</tr>
<tr>
<td>B</td>
<td>Female</td>
<td>76 years old</td>
<td>No school</td>
<td>Farmer at Wae Rebo</td>
</tr>
</tbody>
</table>

Source of table 1 (Research Subject): The samples chosen by the researcher were the deputy chief (Mr. Yohanis) and a farmer (Mrs. Martha) in Wae Rebo who were at the location during data collection.

At the time of this research, the chief of the Mbaru Niang traditional house was sick and not in Wae Rebo, so the researchers chose the deputy chief of the tribe, where the deputy chief of this tribe is the sibling of the chief of the tribe. Researchers only chose these two people because they are direct descendants of the founders of the Mbaru Niang traditional house who know the origin and the process of establishing the Mbaru Niang traditional house.

The main instrument in this study was the researchers, with the support of supporting instruments in the form of interview guidelines, observation and documentation sheets, and field notes. This research procedure (1) determines the informant (data source). In determining the informant must meet several criteria set; (2) prepare interview guidelines used in collecting data related to Mbaru Niang and the mathematics contained therein; (3) conduct the process of collecting data from informants through the interview and observation process. Then the researchers made notes from the results of interviews and observations; (4) tested the validity of the data by using triangulation techniques, namely researchers comparing data from observations/observations directly with data from interviews and comparing with data from documentation; (5) perform data analysis; (6) obtaining ethno mathematical findings in the culture of the Mbaru Niang, Wae Rebo traditional house; (7) designing learning tools based on Ethno mathematics in the Mbaru Niang traditional house as integration in learning mathematics.
4 RESULT AND DISCUSSIONS

4.1 RESULT

4.1.1 Description of the culture of the Mbaru niang traditional house of the Wae Rebo community

Wae Rebo is a traditional village that has a unique culture. This research was conducted in the village of Wae Rebo, Manggarai. *Wae Rebo* is a traditional village located in the highlands of Manggarai. *Mbaru Niang* comes from two words: "Mbaru", which means house, and "Niang" which means cone-shaped. Thus *Mbaru Niang* is a conical house. Furthermore, there are seven *Mbaru Niang* in Wae Rebo Village, one of which is a traditional house in the local language called *Mbaru Tembong/Mbaru Gendang* because, in this house, there are stored heirloom objects such as gongs, drums and other objects used at the time of the ceremony. Traditional ceremonies.

In contrast, the other six *Mbaru Niang* are called *Niang Gena* (ordinary houses). The residents of *Mbaru Gendang* are representatives of each of the descendants of Wae Rebo's ancestors, totaling eight families. Furthermore, six *Niang Gena* is inhabited by six to seven families. In addition, *Niang Gena* is also used as a lodging house for guests and tourists visiting Wae Rebo.

Figure 1. Mbaru Niang traditional house and its name

Source of figure 1. Documentation taken and edited by the researcher

Figure 2. The pillars of the Mbaru Niang and Siri Bongkok traditional houses (middle pillar)

Source of figure 2. Documentation taken by the researcher

**Mbaru Niang**’s foundation is composed of *Hiri Haung* (pillars under the house) using *Worok* wood (one of the hardwoods that grow in the forest around *Wae Rebo*).

Figure 3. Pole under Mbaru Niang

Source of figure 3. Documentation taken by the researcher

**Mbaru Niang** has five levels in each house. The five levels have their own names and their respective functions. The first level is called *Tenda*, the second level is called *Lobo*, the third level is called *Lentar*, the fourth level is called *Lempa Rae*, and the fifth level is called *Hekang Kode*. 

Miami | v.11, n. 12 | pages: 01-28 | e01875 | 2023. 

**JOURNAL OF LAW AND SUSTAINABLE DEVELOPMENT**
Figure 4 three dimensional model of Mbaru Niang

Source of figure 4. The picture is taken from: https://bandanaku.wordpress.com/2014/02/07/membangun-mbaru-niang-rumah-tadisional-wae-rebo/

Lutur (first level) functions as a place for daily activities such as eating, cooking, receiving guests, sleeping, etc. This floor is divided into two parts, namely Molang and Lutur. Molang is a private area or place for household activities, such as cooking and resting. This area has booths (rooms) where people rest and stoves for cooking. At the same time, Lutur (public area) is a place for guests to be active and rest. The division of the area (Molang and Lutur) on the first floor shows mutual respect between local residents and immigrants. Lobo (second level), which functions as a place to store food ingredients and various items of daily necessities for the residents of the house, such as latung (corn), woja (rice), and others. Lentar (third level) serves as a place to store seeds, such as corn, beans, and rice. Lempa Rae (fourth level) serves as a place to store food reserves in the event of crop failure or drought. Hekang Kode (fifth level) serves as a place to store Langkar (square-shaped woven bamboo to store offerings to ancestors).

4.1.2 Ethno mathematics at the Mbaru Niang Traditional House

If you pay close attention, there are various mathematical activities in the culture of the Mbaru Niang traditional house, the Wae Rebo community. **They are counting activities.** The activity calculates the length of time for...
making *Mbaru Niang*. In the culture of the *Mbaru Niang* traditional house, what the Wae Rebo community does is the process of calculating the length of time for the construction of a traditional house. Based on interviews conducted with informants, the construction of *Mbaru Niang* takes seven days or one week. It takes two years or 730 days to collect the materials used before building *Mbaru Niang*, such as wood, reeds, palm fibre and bamboo—counting the number of the bamboo trunk. Counting activities in the culture of the *Mbaru Niang* traditional house are found in counting the number of bamboo books used in a *Mbaru Niang*. The number of bamboo trunks used in *Mbaru Niang* is 100 for *Niang Gena* or the six smaller houses, then for *Niang Gendang*, the number of bamboo trunks used is 150 because *Niang Gendang* is larger than the other six houses. The activity counts the number of *Wehang* weaves prepared for the *Mbaru Niang* roof. For the number of *Wehangs* used to make a *Mbaru Niang*, there are 250 weaves for a *Niang Gena*, while for *Niang Gendang*, the number of *Wehang* mats used is more than 400, because the size of the *Niang Gendang* is more significant than that of *Niang Gena*.

*They are measuring activity.* There are several measuring activities carried out by the Wae Rebo community in the *Mbaru Niang* development process: First, *Depa*. *Depa* is one of the traditional measurement techniques carried out by the ancestors of the Wae Rebo community. *Depa* is a unit of length carried out by certain adults (traditional elders or artisans of the Wae Rebo community) by stretching their hands. Wae Rebo's ancestors used the length of *Depa* as a measuring tool in building the *Mbaru Niang* traditional house. Second, *Baka*. *Baka* is one of the traditional measurements used by the Wae Rebo community in the *Mbaru Niang* development process. *Baka* is a unit of distance measurement used during the installation process of *Wehang* (roof made of reeds and fibers). *Baka* measuring instrument results from using a trusted person's palm by using the distance from the ring finger to the closed index finger.
We were designing activity. The activity of designing relates to making patterns for objects or cultural artefacts used at home, in trade, decoration, warfare, games, and religious purposes. In the culture of the Mbaru Niang traditional house, the Wae Rebo community, the design activity is shown in the form of the Mbaru Niang. The level of the house depends on the size of the house. If the house is large, then the Ngando is also long, at least 1.50 m outside, including the one wrapped around it, so it does not look too long at the top. Then the height of the traditional house is 12 meters, so the diameter of the floor of the traditional house must also be 12 meters with the aim that the traditional house is harmonious. So, so that the round shape of the traditional house is balanced, we first build Siri Ngando or the middle pole, which is tied to 4 supporting ropes. The established Ngando series was firmly tied. After establishing the Ngando series, the second, third, fourth, and fifth floors were made from bottom to top. Before the second, third, fourth, and fifth floors are made, the first four supporting poles are tied to Siri Ngando so that the round shape will be balanced and conical.) The Wae Rebo community designed a house shaped like a cone, using several beams as tools tied to Siri Ngando after Siri ngando was established to balance the house and form a house that resembles a cone.

They explain the activity. The activity of explaining the culture of the Mbaru Niang traditional house can be seen in why the floors of Mbaru Niang are divided into five floors. The number of floors in Mbaru Niang, which is five pieces, are made based on their purpose. The five floors in Mbaru Niang are made based on their respective functions. The 1st floor is for daily activities and a place to sleep, while the second to 4th floors are a place to store long-term food reserves and seeds, and the fifth floor is a place to store offerings for the ancestors of the Wae Rebo community.
Mathematical Concepts Related to Ethno mathematics in the Mbaru Niang Traditional House Culture

There are several mathematical concepts based on the description of Ethnomathematics in the culture of the Mbaru Niang traditional house, including measuring activities and designing or designing activities.

Concept of Geometry (Cones).

For the concept of geometry can be seen in table 2.

Table 2. The concept of geometry in the Mbaru Niang traditional house

<table>
<thead>
<tr>
<th>No</th>
<th>Mbaru Niang</th>
<th>Cone</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Niang (shaped like a cone)</td>
<td><img src="Cone.png" alt="Cone" /></td>
</tr>
<tr>
<td>2</td>
<td>Buffalo horns on Ngando</td>
<td><img src="Cone_top.png" alt="Cone top" /></td>
</tr>
<tr>
<td></td>
<td><strong>Point t is the top of the cone</strong></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Hiri bongkok (middle pillar of Mbaru Niang)</td>
<td><img src="Point_t.png" alt="Point t is the top of the cone" /></td>
</tr>
<tr>
<td>4</td>
<td>Wehang (Mbaru Niang roof made of reeds and fibers)</td>
<td>Cone blanket</td>
</tr>
</tbody>
</table>

![Cone](Cone.png)

![Cone_top](Cone_top.png)

![Point_t.png](Point_t.png)
When the cone above is defended along the line td it will form the following conical nets

**Buku** is the roof frame of Mbaru Niang where reeds and fibers are tied as a roof. Painter's line is a line that paints a part of the cone.

In the picture above, the painter's lines are la, lb, lc, ld, le, and lf lines.

**Latur** cross section of Mbaru Niang which is shaped like a circle

The appearance of the floor on Mbaru Niang shaped like a circle with the following information:

The center point of the circle is at point O(0,0) which is the middle pole of Mbaru
The diameter \( ab \) is the elar (wood cross section) that supports the boards on the first floor of Mbaru Niang which are made of Uwu wood.

### 4.1.3 Measurement concept

The concept of mathematics in the culture of the *Wae Rebo* community related to measuring activities is measurement using non-standard units, namely *Depa* and *Baka*. *Depa* is used to measure an object's length with a measurement of 1 fathom ± 2 m. Furthermore, the mathematical concept in other measuring activities is *Baka*, where *Baka* is a non-standard unit of measurement used in building traditional houses and installing *Wehang* or *Mbaru Niang* roofs made of reeds and fibres. *Baka* is used to measuring the distance between one *Wehang* (at the bottom) and another *Wehang* (at the top), where 1 *Baka* is ± 10 cm. Non-standard units are only recognized in the local environment, even different for each individual. Likewise, the non-standard measuring tools used by the *Wae Rebo* community. Conversion of non-standard measurements into standard units used by the *Wae Rebo* community. 1 fathom = ± 1.60 m; 1 Baka = ± 10 cm

Ethno mathematical integration-integration in the *Mbaru Niang* Traditional House of the *Wae Rebo* Community

The *Mbaru Niang* traditional house is one of the traditional houses in the Manggarai area, which has been preserved until now. In order to preserve the culture of the *Mbaru Niang* traditional house, it is necessary to pass it down to the next generations by teaching it at school with the mathematical concepts contained in it. The mathematical concepts contained in the *Mbaru Niang* traditional house can be a bridge to understanding mathematical concepts in schools. The following describes the mathematical concepts contained in the *Mbaru Niang* traditional house that can be applied to learning at school.

<table>
<thead>
<tr>
<th>No</th>
<th>The ethnomathematics of concept the <em>Mbaru Niang</em> traditional house</th>
<th>School math</th>
<th>Basic competencies</th>
<th>Tier</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Measuring activity</em></td>
<td>Measurement</td>
<td>3.8 Recognize and determine length and weight with non-standard units using concrete elementary school (first grade)</td>
<td></td>
</tr>
</tbody>
</table>
4.2 DISCUSSIONS

The culture of the *Mbaru Niang* traditional house of the *Wae Rebo* community contains mathematical meanings and concepts that can be integrated into mathematics learning. Thus, the mathematical knowledge contained in the culture of the *Mbaru Niang* traditional house of the *Wae Rebo* community, which contains mathematical concepts, can be applied in learning at school following the essential competencies and levels or levels of education. The integration of Ethno mathematics into the culture of the *Wae Rebo* community is applied in learning at school by selecting several mathematical concepts and then creating learning tools and trajectories. Such learning trajectories provide multiple educational advantages and a core around which varied educational activities can be structured (Douglas, & Julie, 2011). Mathematics learning really needs to provide content/bridging between mathematics in the everyday world based on local culture and school mathematics (Alfonsa, 2016).

Teaching mathematics without cultural context on the pretext that it is abstract and universal is the reason for the failure of students in this subject. On the other hand, when students are exposed to various cultural links and reflect upon them together, they develop a desire to learn, and their self-confidence grows (Fouze & Amit, 2018).

Implementing ethno mathematical-based learning is very helpful for students to know how they think mathematically according to their culture and traditions. In addition, students are expected to be able to help students improve their ability to count and think in various life contexts. Developing knowledge through local values and culture can be designed to be further developed and integrated into learning is excellent. This is intended so that students and learners can raise local values, which are a nation's wealth. View that Ethno mathematics aims to draw from the cultural experience and practices of the individual learners, the communities, and the society at large, in using them as vehicles to not only make mathematics learning more meaningful but, more importantly, to provide learners with insights of mathematical
knowledge as embedded in their social and cultural environment (Unodiaku, 2013).

The culture of the *Mbaru Niang* traditional house contains mathematical activities related to learning at school. The mathematical activities include measuring and designing activities. The measuring activity is seen in the process of measuring the distance between *Wehang* (roof cover) and measuring the length of an object with non-standard units. Then the activity of designing is found in the form of *Mbaru Niang*, which is designed in such a way according to the cultural meaning and value of its function so that the shape of the house resembles a cone. Ethno mathematics believe that if we examine how mathematics arises and its uses in different cultures, we may gain a better and deeper understanding of mathematics, thereby bringing about an improvement in the teaching of mathematics and the performance of students in mathematics (Aikpitanyi, & Eraikhuemen, 2017).

In Ethno mathematics, the focus lies on recognizing the mathematical actions and knowledge of people, resulting from the needs and experiences these people have. Using people's activities and knowledge in pedagogical practices may best contribute to the student's learning process since they may interact with problems and solutions and experience the culture (Biembengut, 2016). Mathematical concepts related to Ethno mathematics in the culture of the *Mbaru Niang* traditional house of the *Wae Rebo* community, namely the concept of geometry and the concept of measurement. These concepts can be integrated into learning in schools. The integration of culture in the learning activity has also been introducing the modern science aspect as it allows the interaction of the formation of the student in the relationship within themselves, others, the environment, and the world (Damianus, et al., 2017). Ethno mathematics can enrich the mathematics commonly known and studied in formal educational institutions, ultimately affecting mathematics education (Dominikus, et al., 2017).

Research (Herna & Masrura, 2020; Sirate, 2020; Sunzuma, et al., 2021; & Aritsya, & Hamidah, 2018) shows that, in general, implementing an ethno mathematical approach to learning mathematics can improve student learning outcomes. Application of Ethno mathematics as a means to motivate, and stimulate students, can overcome boredom and give new nuances to learning mathematics. Learners taught using an ethno mathematics approach achieved significantly higher in the test than those taught consumer arithmetic using the traditional approach and
use of mathematics materials-based Ethno mathematics is better than the learning that does not use mathematics materials-based ethno mathematics.

5 CONCLUSION

Effective and efficient mathematics learning is applied to students facing real situations in their environment. Learning with cultural concepts is expected to be developed in schools. In the past, there was much information about knowledge born from the concept of culture. However, changes in knowledge that impact shifting cultural values and even culture are abandoned because culture is considered a substance attached to particular groups, old, reversed and different from Science. Cultural integration in learning activities that aim to introduce culture, introduce education through its cultural values, and cultural linkages with mathematics learning is essential to encourage future generations to continue to preserve the existing culture. The culture of the Mbaru Niang traditional house is a source of learning mathematics that can be presented according to various contexts in learning mathematics. The study's findings contained several mathematical aspects of the culture of the Mbaru Niang traditional house. These aspects were the concept of geometry (in the form of a conical shape) and the concept of measurement (using non-standard measurements). The measurement concept can be applied to elementary school students, and cone geometry can be applied to junior high school. Thus, identifying and exploring Ethno mathematics in the Mbaru Niang culture provides an opportunity to find other aspects of mathematics that can be raised in learning activities. Cultural integration in learning activities is done by identifying and exploring culture to find mathematical concepts and presenting cultural aspects as an introduction to mathematics learning.
REFERENCES


