21ST CENTURY SKILLS LEARNING USING *LEMMANG* LEARNING RESOURCES: A STUDY OF ETHNOMATHEMATICAL BUGIS MAKASSAR

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Abstract:

21st century learning demands the application of skills and knowledge that are relevant to everyday life. While mathematics is a subject taught at all levels of education, it remains challenging for many students. Often perceived as disconnected from culture, students may find learning mathematics less meaningful. This perception is partly due to the lack of integration between mathematics education in schools and cultural context. However, mathematics is inherently connected to culture, and one approach recognizing this connection is called ethnomathematics. This approach emphasizes a culture-based learning process, and has the potential to improve students' learning outcomes. One example of how culture can be used as a source of mathematics learning is through the study of the traditional food of the Bugis-Makassar ethnic heritage called "*lemmang*". The process of making *lemmang* involves mathematical creativity, and researchers have used a descriptive qualitative research method with an ethnographic approach to explore this creativity. This involved collecting data through interviews, observation, and documentation. The research results showed that in *lemmang* making process, there is mathematical creativity related to the concepts of division, cylinder, and the principles of the Pythagorean theorem. This demonstrates that culture can be a valuable source of mathematics learning for teachers and students.

Abstrak:

Pembelajaran abad 21 menuntut penerapan keterampilan dan pengetahuan yang relevan dalam kehidupsn sehari-hari. Matematika adalah mata pelajaran yang diajarkan di semua tingkat pendidikan, tetapi tetap menjadi tantangan bagi banyak siswa. Mereka sering memandang matematika sebagai mata pelajaran yang terputus dari budaya dan kurang bermakna. Hal ini disebabkan karena pendidikan matematika di sekolah belum mengintegrasikan mata pelajaran dengan budaya. Matematika secara inheren terhubung dengan budaya, dan satu pendekatan yang mengakui hubungan ini disebut etnomatematika. Pendekatan ini menekankan proses pembelajaran berbasis budaya, dan berpotensi meningkatkan hasil belajar siswa. Salah satu contoh bagaimana budaya dapat dijadikan sebagai sumber pembelajaran matematika adalah melalui pembelajaran tentang makanan tradisional peninggalan etnis Bugis-Makassar yang disebut lemmang. Proses pembuatan lemmang melibatkan kreativitas matematis, dan peneliti telah menggunakan metode penelitian kualitatif deskriptif dengan pendekatan etnografi untuk menggali kreativitas tersebut. Pengumpulan data dilakukan melalui wawancara, observasi, dan dokumentasi. Hasil penelitian menunjukkan bahwa dalam proses pembuatan lemmang terdapat kreativitas matematika yang berkaitan dengan konsep pembagian, silinder, dan prinsip teorema Pythagoras. Hal ini menunjukkan bahwa budaya dapat menjadi sumber pembelajaran matematika yang berharga bagi guru dan siswa.

Keywords:
Ethnomathematics, Traditional Food of Bugis-Makassar, *Lemmang*

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INTRODUCTION

21st century learning has demanded a paradigm shift in education, emphasizing the application of skills and knowledge that are pertinent to everyday life. School-based mathematics education can also foster 21st century skills in students, particularly critical and creative thinking abilities (Hernández-Fernández, 2022). Mathematics is closely intertwined with daily life (Maryati & Prahmana, 2018; Muhtadi, Sukirwan, & Warsito, 2017; Nurhasanah, Kusumah, & Sabandar, 2017). For this reason, mathematics succeeds a compulsory subject at every level of formal education (Tanujaya, Prahmana, & Mumu, 2017). However, mathematics is still a scourge for most students. In addition, they view mathematics as a subject that is not relevant to culture. They also consider learning mathematics less meaningful. It is because mathematics learning taught in schools had not yet integrated mathematics with culture. It affects reasoning and thinking skills of students in solving mathematical problems in real-life contexts (Prahmana et al., 2021). Thus, in learning mathematics, it is necessary to apply meaningful learning and relate it to everyday life, such as integrating with culture (Ahsani, 2020; Rahayuningtyas, Rizqi, & Putri, 2021). It is in line with the purpose of education, namely educating humans so that they are cultured (Harianto, Rusijono, & Masitoh, 2020; Syafaruddin, 2017; Zafi, 2017) and can maintain cultural values during the challenges of globalization (Bito, Fredy, & Setyawan, 2021).

Teachers can choose strategies, approaches, or learning media for students to learn mathematics (Setyawan, 2020; Supriadi & Arisetyawan, 2020). Associating mathematical concepts with cultural diversity can be used in achieving the goals of learning mathematics (Karyoto, Chasanah, & Sisbiantoro, 2019; Nurdyansyah, 2019). As stated by Setyawati, Soebagyo, & Sunni (2023) that the combination of mathematics and this culture makes it easier for students to understand the material learning. Mathematical concepts encountered in culture are called ethnomathematics (Bito, Limana, & dole, 2020; Hastuti & Setyawan, 2021; Narulita, Mardiyana, & Saputro, 2019; Widada, Herawaty, & Lubis, 2018).

Ethnomathematics is a technique for explaining and understanding mathematics using culture (Fredy, Tembang, & Bito, 2020). It can express and use cultural concepts mathematically (Hariastuti, 2017). We hope learning with ethnomathematics can foster students' love for their own culture (Bito & Fredy, 2020). Ethnomathematicians argue that basically the development of mathematics at any time is inseparable from the culture and values that have existed in society (Zaenuri & Dwidayanti, 2018). Ethnomathematics is fraught with problems in everyday life. Furthermore, Zaenuri & Dwidayanti (2018) stated that mathematics should be linked to reality, remain close to the child, and relevant to people's lives. This point of view involves mathematics not only as a subject, but as a human activity, which is very closely related to the local culture.

The involvement of mathematics in the culture of certain societies is nothing new. The penetration and influence of mathematics in people's lives does not only occur in modern human life where mathematical concepts are widely used in technological devices that are the needs of modern humans today, but mathematics has been widely applied by traditional communities and indigenous peoples since a long time ago (Akbar, 2021). According to Sunandar (2017), ethnomathematics is a bridge between mathematics and culture. Thus, by applying ethnomathematics as a learning approach, it will be very possible for a material learned to be related to their culture so that students' understanding of a material becomes easier because the material is directly related to their culture which is their daily activity in society. Of course, this helps teachers as facilitators in learning to be able to facilitate students well in understanding a material. The involvement of mathematics in the culture of certain societies is nothing new. The penetration and influence of mathematics in people's lives does not only occur in modern human life where mathematical concepts are widely used in technological devices that are the needs of modern humans today, but mathematics has been widely applied by traditional communities and indigenous peoples since a long time ago.

Ethnomathematics is very beneficial because it increases intellectual quotient and preserves culture (Busrah & Pathuddin, 2021). In the cultural context, applying ethnomathematics in the learning process creates an attitude toward the customs in society (Cheriani, Mahmud, & Tahmir, 2015). The implementation of ethnomathematics can help show that mathematics is not only related to formulas and numbers, but is also part of our culture and daily life (Yulianasari, Salsabila, & Maulidina, 2023). Ethnomathematics is very useful for teachers and students, where when ethnomathematics is increasingly known and understood by students, so teachers can invite students to identify and associate cultural parts into mathematics material with the guidance provided by the teacher (Fitriyah & Syafi'i, 2022). In addition, the way teachers deliver when communicating with students uses various techniques so that learning is not rigid (Cendana & Tamba, 2023), when collaborating through various cultural elements as an important part of multicultural education. People can explore ethnomathematics through traditional clothing and traditional games (Dwidayati & Zaenuri, 2021), forts, phinisi boats, and weaving motifs (Nur, Waluya, & Rochmad, 2020), including traditional food or cakes (Pathuddin, Kamariah, & Nawawi, 2021).

Various cultures have become objects of ethnomathematics research. Kastolani (2021) researched the old mosque of Tosora associated with the geometric concept of a plane figure. Agustina, Gazali, & Chairani (2021) use the panning musical instrument as a learning resource related to mathematical concepts such as cones, plane figures, and congruences. Malalina, Putri, & Zulkardi (2021) conducted research regarding food menus and traditional boat payment systems when traveling on the Musi river. Akbar, Haidar, & Hidayati (2021) reported the use of Bugis agricultural tools associated with the concepts of plane figures. Whereas, Pathuddin, Kamariah, & Nawawi (2021) associated barongko cakes with mathematical concepts such as division, congruence and similarity, triangular prism, and half spheres.

In contrast to previous research, this research explores the concepts of mathematical creativity which is one of the 21st-century skills, with making *lemmang* as the traditional food of the Bugis-Makassar tribe. *Lemang* is sticky rice mixed with coconut milk and then burned in bamboo, so that it is round elongated and served in the form of a small tube. This food is always served in every resident's home. Usually accompanied by *opor*, *coto*, or various meat preparations. The process of making *lemmang* involves mathematical creativity. The reason for this research is because the process of making *lemmang* involves mathematical creativity. As revealed by Fitroh (2020) that in the process of making lemang one can express a broader conception of mathematical calculations, it illustrates that mathematics based on culture will generate mathematical knowledge to adjust to the goals and objectives of the community that is expected to solve problems and to determine rules in their lives.

RESEARCH METHOD

This research is a qualitative descriptive study with an ethnographic approach. The ethnographic approach in this research is to identify and further analyze the process of making *lemmang*. The researchers performed lengthy fieldwork to explain the group's culture being investigated, becoming a participant-observer in the investigation, and presenting a cultural interpretation of the occurrence exemplify typical characteristics (Merriam, 2002). Ethnography is a helpful tool for ethnomathematical studies since it has social and cultural implications (Alangui, 2010). This research design connects with the dimensions of Ethnomathematics and Ethnochemistry, which are cognitive, conceptual, education, epistemology, history, and political (Rosa, D'Ambrosio, & Orey, 2016).

Additionally, this study is expected to contribute to the understanding of the cultural and mathematical aspects of making *lemmang*, as well as to provide insights into the cultural knowledge and practices of the community involved. The research is also expected to highlight the significant role of mathematics in the traditional culinary practices of communities and the mathematical creativity involved in the process of making *lemmang*.

Those dimensions are conceptualized in table 1 by modifying the framework from Alangui (2010) by generating four generic questions, namely where, how, what, and what is it. To ensure the validity and reliability of the research results, the researchers used a multi-source data collection technique, involving observation, interviews, and documentation. The data triangulation method was applied to check the consistency of the data and ensure the accuracy of the results. The data was analyzed and interpreted qualitatively to uncover the cultural and mathematical aspects of making *lemmang*. The results of the study are presented in the form of descriptions, explanations, and interpretations of the data collected.

Table 1. Research Design

General Question	Topic	Required Answer	Activity
Where	Culture	Being able to find mathematical concepts in *lemmang* making	Conducting interviews with *lemmang* makers
How	Idea	Aspects that make the process of making *lemmang* a source of learning mathematical concepts	Determining ideas by conducting observations and interviews regarding concepts related to the process of making *lemmang*
What	Philosophy of Mathematics	Proof	Characteristics of making *lemmang*
What is it	Anthropology	Culture and mathematics	Describe the mathematical creativity that arises in the process of making *lemmang*

RESULTS AND DISCUSSIONS

This research focuses on making a typical food of the Bugis-Makassar tribe, namely *lemmang*. It is closely associated with mathematical concepts. It can be found several mathematical concepts when collecting data regarding the process of making *lemmang*, such as division, similarity, hypotenuse, and cylinder.

a. Division

Before making *lemmang*, the maker prepares the bamboo to use. An interview regarding the concept of division appears in the following dialogue.

Dialogue 1

Researcher	:	How to select the bamboo to make *lemmangs*?
Informant	:	To make *lemmang*, take the bamboo that is long enough and then cut it into small parts.
Researcher	:	How long is the bamboo used?
Informan	:	Not too long and not too short. About 2 inches (demonstrate measurement by hand)
Researcher	:	How many *lemmangs* to make with one bamboo stick?

Informant : It depends on the length of the bamboo and the *lemmang* since we use our spans to find their measure.

Dialogue 1 shows that the first step in making *lemmang* is to prepare the bamboo to be used. One needs long enough bamboo and cuts it into the desired size.

Figure 1. The Bamboo Used to Make *Lemmang*

The maker cuts it into pieces to make *lemmangs* according to the desired size. If the length of the bamboo is x, the length of the lemmang bamboo is y, and n is the number of *lemmang* bamboo, then the following equation is obtained.

$$n = \frac{x}{y} \quad (1)$$

Equation (1) shows the way of obtaining the number of *lemmang* bamboo through the length of the bamboo divided by that of the *lemmang* bamboo. It shows that mathematical creativity appears in the early process of making *lemmang*.

In addition, the division operation in equation (1) represents a basic mathematical concept that is fundamental for more advanced mathematical concepts. The use of division in making *lemmang* also emphasizes the practical application of mathematics in daily life, showing how it can be used to solve real-world problems. This highlights the importance of incorporating practical and real-life examples in mathematics education.

Moreover, the use of hand spans to measure the length of the bamboo and *lemmang* is also noteworthy. It shows that different cultures may have different units of measurement and that mathematics is not limited to a specific culture or set of units. The use of hand spans to measure length is an example of non-standard units of measurement, which can be a valuable learning tool for students to understand the concept of measurement and how it can be applied in different contexts.

In short, the preparation of bamboo in making *lemmang* highlights the presence of mathematical concepts, such as division, in traditional cultural practices. This supports the notion that mathematics is deeply intertwined with culture and can provide a rich source of contextual learning in mathematics education. The use of hand spans as a unit of measurement also highlights the cultural diversity in mathematical practices and underscores the importance of incorporating real-life and practical examples in mathematics education.

b. Cylinder

In making *lemmang*, used the pieces of bamboo where its side has a hole, while the other with the internode is left to keep it closed. An interview about the concept of the tube on the bamboo used appears in dialogue 2.

Dialogue 2

Researcher	:	Is there anything that needs to consider in cutting bamboo?
Informant	:	Yes. Apart from the length of the bamboo, there is something that needs to consider.
Researcher	:	What is it?
Informant	:	It requires much care to keep the bamboo internode closed so that the *lemmang* does not spill out and one side is without a lid.
Researcher	:	So, cutting one side by leaving the segment remains, while the other is without a lid.
Informant	:	That's correct

The use of bamboo in making *lemmang* is not only a cultural practice, but it also involves mathematical concepts. As shown in dialogue 2, the informant mentioned the importance of leaving one side of the bamboo closed while cutting the other side open, as this ensures that the *lemmang* does not spill out. From a mathematical perspective, the use of bamboo in making *lemmang* is a closed cylinder, where the bottom side is closed, while the top side is open.

The surface area of the cylinder without the lid = area of net

= area of square + area of circle

$= (p \times l) + (\pi r^2)$

$= (2\pi r \times t) + (\pi r^2)$

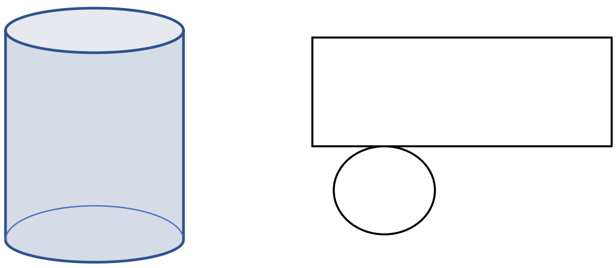


Figure 2. Closed Cylinder Picture

The volume of cylinder $= \pi r(2t + r)$ (3)

= area of base × height of the cylinder

= area of circle × height of the cylinder

$= \pi r^2 t$ (4)

The surface area of the closed cylinder can be calculated using formula (3) which takes into consideration the area of the net, which consists of the area of the square and the area of the circle. The volume of the cylinder can be determined using formula (4), which only takes into consideration the area of the base (circle) and the height of the cylinder. It is important to note that while the lid of the cylinder affects the surface area, it does not affect the volume of the cylinder.

These mathematical concepts found in the making of *lemmang* show how mathematics and culture are intertwined. By using an ethnomathematics approach in teaching mathematics, students can see the relevance of mathematics in their daily lives and cultural practices, making learning more meaningful and enjoyable. This research highlights the importance of preserving cultural practices and incorporating them in mathematics education, as it can lead to a better learning experience for students and a better understanding of their culture.

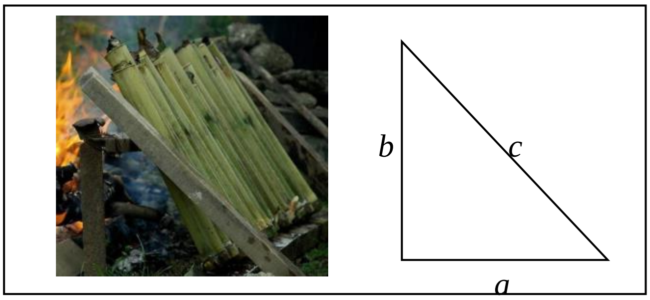
c. Pythagorean Theorem

After filling the bamboo with the ingredients then burning it at an angle. The description of the interview is in the following dialogue.

Dialogue 3

Researcher	:	What is the next step after filling the bamboo with ingredients?
Informant	:	Grilling the *lemmang* over a fire for a long time.
Researcher	:	About how long?
Informant	:	It can take up to four hours, depending on the heat of the fire.
Researcher	:	How to burn it?
Informant	:	Arranging *lemmang* over the fire in the oblique position while turning it over to make it cooks evenly.

Figure 3. *Lemmang* Burning Process and Geometry Model



Lemmang is a traditional dish in some cultures that involves cooking ingredients inside a bamboo. The process starts by filling the bamboo with ingredients and then grilling it over a fire. The informant in Dialogue 3 mentions that the cooking time can range from several hours to up to four hours, depending on the heat of the fire.

In order to ensure even cooking, the informant mentions arranging the *lemmang* over the fire in an oblique position and turning it over. The oblique position is significant because it relates to the principle of the Pythagorean theorem, which states that in a right triangle, the square of the length of the hypotenuse (the longest side) is equal to the sum of the squares of the lengths of the other two sides.

A right triangle is part of a square consisting of four right triangles. It appears in the following figure.

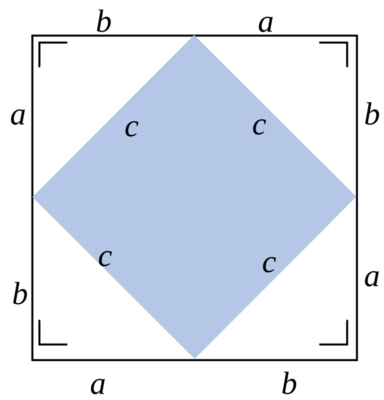


Figure 4. Proof of Pythagoras Theorem

If the area of the large rectangle is L_B, that of the small rectangle (in blue) is L_K, and that of the triangle is L_S, then it can be written mathematically as

$$\begin{aligned} L_B &= L_K + 4L_S \\ s \times s &= (s \times s) + (4 \times \tfrac{1}{2} \times a \times t \\ (a+b) \times (a+b) &= (c \times c) + (2 \times a \times b) \\ a^2 + 2ab + b^2 &= c^2 + 2ab \\ a^2 + b^2 &= c^2 \end{aligned} \quad (2)$$

This theorem has been applied in various fields including mathematics, engineering, and physics, and it is interesting to note that it may have practical applications in cooking as well.

In conclusion, Dialogue 3 provides valuable information about the process of cooking *lemmang*, including the steps involved, the cooking time, and the importance of the oblique position. This dialogue highlights the connection between cooking and mathematical principles, demonstrating the versatility and relevance of mathematical knowledge in everyday life.

Mathematical Creativity in Determining the Measure of Banana Leaf through the Formula for the Surface Area of the Cylinder

The creativity aspects of the passage are related to the way *lemmang* makers use mathematics in their traditional food-making process. The process of making *lemmang* requires a green banana leaf that fits the surface area of the inner part of the bamboo. This means that the measure of the banana leaf must match the surface area of the cylinder without its base and lid. In order to determine the size of the banana leaf, the formula for the surface area of the cylinder lid, could be used.

$$L_{cylinder\ blanket} = 2\pi rt$$

However, the passage mentions that in every *lemmang* production, different sizes of bamboo are used, and as a result, *lemmang* makers often do not use the exact formula to determine the size of the banana leaf. Instead, they rely on their practical experience and intuition to make a rough estimate of the size. Despite this, the formula for the surface area of the cylinder is still a useful tool for demonstrating the mathematical creativity involved in the process of making *lemmang*.

The use of mathematical concepts such as the surface area of a cylinder, the formula for its lid, and the constant π, shows that there is a strong connection between mathematics and the traditional food-making process of *lemmang*. The fact that *lemmang* makers use their practical experience and intuition to determine the size of the banana leaf, rather than relying solely on the formula, is an example of the creativity involved in the process. This demonstrates that mathematics can be used creatively, even in everyday tasks and traditional practices.

The process highlights the creative aspects of using mathematics in the traditional process of making *lemmang*. This is supported by the results of research conducted by Fitroh (2020) that the activity of cutting bamboo where the cross-section of the cut bamboo is in the form of an inner circle and an outer circle where the difference in the radius of the two circles is the thickness of the bamboo used to make *lemmang*, while the banana leaves used to cover the inside of the bamboo are rectangular flat shapes which can also be webs from tubes. Furthermore, Fitroh (2020) said that the process of filling sticky rice and coconut milk into bamboo is a determination of the volume of an open tube, while burning lemmang that is rotated to keep the lemmang can cook properly is a transformation in the form of rotation, removing *lemmang* from bamboo after cooking is the volume of the tube and serving or serving *lemmang* is a comparative learning in mathematics lessons. The use of the formula for the surface area of the cylinder, combined with the practical experience and intuition of *lemmang* makers, demonstrates the versatility and adaptability of mathematical concepts in real-world situations. This serves as an example of how mathematical creativity can be found in the most unexpected places and can play a crucial role in traditional practices and cultures.

***Lemmang*: A Typical Food of Bugis as Contextual-Based Mathematics Learning Media**

Mathematics is an essential part of human life and has been integrated into various aspects of our daily activities. However, despite its importance, many students struggle to understand mathematical concepts, making it challenging for them to perform well in this subject. In order to make mathematics more relatable and engaging for students, it is crucial to approach it in a way that connects it to everyday life. This is where the concept of Ethnomathematics comes in, where mathematical concepts are taught in a culturally-rich context, making them more meaningful and relevant for students.

One such example of this approach is demonstrated in the process of making *lemmang*, a typical food of the Bugis-Makassar tribe. The researchers found that several mathematical concepts were intertwined in the making of *lemmang*, including division, cylindrical shapes, and the Pythagorean theorem. By incorporating these concepts into the process of making lemmang, teachers can help students understand mathematical principles in a more practical and tangible way.

a. Division

The first mathematical concept found in the process of making *lemmang* is division. In order to make *lemmang*, the bamboo needs to be cut into several parts, and this stage provides an opportunity for teachers to ask questions related to division. For example, if the length of the bamboo is 2 meters and each lemmang uses 30 cm, how many *lemmangs* can be made? This question requires students to apply the concept of division and helps them understand the practical application of this mathematical principle.

b. Cylinder

Another mathematical concept found in the process of making *lemmang* is cylinder shapes. In this process, the bamboo used is cylindrical without a lid, and teachers can use this opportunity to ask students to determine the volume of the cylinder. For example, if the bamboo used to make *lemmang* is 5 cm in diameter and 30 cm high and half the volume of the bamboo is needed for each *lemmang*, then how much coconut milk is needed for 10 *lemmang*? This question helps students understand the relationship between the volume of a cylinder and its height and diameter.

c. Pythagorean Theorem

Finally, the Pythagorean theorem is also found in the process of making *lemmang*. In the final stage, *lemmang* is burned in an inclined position, and teachers can use this opportunity to ask questions related to the Pythagorean theorem. For example, if a bamboo is 30 cm in length and the distance from the tip of the bamboo to the coal is 10 cm, then how far is the other end of the bamboo from the coal? This question requires students to apply the Pythagorean theorem, helping them understand this mathematical principle in a practical and relatable way.

This research highlights the inseparable connection between mathematics and creativity in human activities. One example of this connection is the process of making *lemmang*, which showcases the close relationship between mathematics and daily life, particularly culture (Mania & Alam, 2021). Mathematics is an integral part of our daily activities (Tanujaya, Prahmana, & Mumu, 2017; Wahyu, Amin, & Lukito, 2017) and is inseparable from culture in everyday life (Putra & Mahmudah, 2021), making an ethnomathematics approach in education highly relevant.

Not only does an ethnomathematics approach in the learning process support students in developing their thinking skills (Fouze & Amit, 2018; Utami, Ponoharjo, & Aulia, 2019), but it also influences the students' interest and performance in their education (Budiharso & Tarman, 2020). In this study, the researchers identified several mathematical concepts in the creation of *lemmang*, including division, geometric shapes, congruence, and the Pythagorean theorem. These concepts can be taught to students through an ethnomathematics approach, providing a contextual learning experience in schools.

Previous research has also found various mathematical elements in different cultures. Nurjanah, Mardia, & Turmudi (2021) explored the use of marosok culture in teaching number operations, while Nisa' & Rofiki (2022) identified mathematical concepts in Bung Karno's tomb, including geometrical shapes and geometric transformations. Purniati, Turmudi, & Juandi (2021) studied the concept of geometric transformation through the analysis of mosque ornaments as a fusion of Islamic and local culture. The determination of farming times is also part of ethnomathematics and involves the concepts of numbers, sets, relations, congruence, and mathematical modeling (Umbara, Wahyudin, & Prabawanto, 2021).

There are numerous mathematical concepts in Indonesian culture that teachers can explore, and the Bugis-Makassar tribe's typical food, *lemmang*, is only one of them. This research contributes to previous studies and acts as a form of cultural preservation through education with an ethnomathematics approach.

CONCLUSION

The preserving cultural heritage is crucial for the continuation of a community's traditions, and this study focuses on the thriving Makassar Bugis community culture, which has given rise to various mathematical concepts and enhanced creativity. The process of making *lemmang*, for example, incorporates mathematical concepts like division, geometric shapes, congruence, and the Pythagorean theorem. This presents an opportunity for educators to adopt the ethnomathematics approach in math classes, integrating cultural elements into learning to enhance student engagement and learning outcomes. Not only does this approach improve students' understanding of mathematics, but it also contributes to cultural heritage preservation, fostering a deeper appreciation among students for their cultural legacy. Therefore, this research calls upon educators to embrace the ethnomathematics approach in math education, benefiting students and preserving cultural heritage. It also suggests the need for further research, especially on ethnomathematics in the Bugis-Makassar sub-community, acknowledging the challenges of incorporating ethnomathematics into centralized education systems and the importance of teacher creativity in curriculum adaptation.

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