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Research Article

Flat Shape Concept in Kaddo' Masingkulu: An Exploration of Bugis-Makassar Culture-Based Ethnomathematics in Strengthening Culturally Responsive Teaching

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ABSTRACT

This study explores the geometric concepts embedded in *Kaddo' Masingkulu*, a triangular-shaped traditional cake rooted in Bugis-Makassar culture, and its potential in supporting Culturally Responsive Teaching (CRT) through an ethnomathematical lens. The research aims to (1) examine the flat shape properties reflected in *Kaddo' Masingkulu* and (2) analyze the integration of Bugis-Makassar cultural elements into mathematics teaching to enhance conceptual understanding and cultural awareness. Employing a qualitative exploratory case study design, data were collected from 2 teachers, 10 students, and 2 cultural practitioners in an elementary school in Takalar Regency, using interviews, classroom observations, and document analysis. Thematic analysis revealed that the triangle in *Kaddo' Masingkulu* carries both mathematical and symbolic meanings-representing harmony among humans, nature, and the divine. Students demonstrated improved understanding of flat shapes, including triangles, parallelograms, and trapezoids, by engaging with culturally familiar contexts. Teachers utilized visual, narrative, and project-based strategies to connect geometry content with students' everyday experiences. The integration of ethnomathematical content not only reduced misconceptions in geometry but also promoted student motivation and confidence. The study concludes that leveraging local cultural artifacts such as *Kaddo' Masingkulu* enhances the contextualization of abstract mathematical concepts and affirms learners' cultural identities. These findings imply the need for culturally grounded instructional models in mathematics education and highlight CRT as a viable pedagogical framework for multicultural classrooms.

Keywords: Flat Shapes; Kaddo' Masingkulu; Ethnomathematics; Bugis-Makassar Culture; Culturally Responsive Teaching

1. INTRODUCTION

Students' understanding of flat shapes in elementary school is marked by their ability to recognize, represent, and relate geometric shapes to their surroundings in a logical and meaningful way (Ponte et al., 2023), which helps avoid ongoing misconceptions (Rapa & Husniati, 2024). Students are not only able to identify the characteristics of two-dimensional shapes such as sides, angles, and symmetry, but also explain the relationships between these elements and apply them in contextual problem-solving (Hwang et al., 2020). They demonstrate good spatial visualization skills and are able to transfer understanding and provide concrete representations (Skulmowski et al., 2022). Mathematics learning in this context is active, participatory, and relevant to students' cultural backgrounds. Teachers act as facilitators who connect the material to students' real-life experiences (Rapa et al., 2021). Contextual learning materials can help students understand their surroundings (Angraeni et al., 2022; Putu Ade Andre Payadnya et al., 2023), thereby promoting the development of critical, reflective, and creative mathematical thinking (Akpur, 2020).

The contextual approach in mathematics in elementary schools serves as the foundation for linking abstract concepts to students' real-life experiences (Kolar & Hodnik, 2021{Citation}). The emphasis on Higher Order Thinking Skills (HOTS) as a new challenge in the 21st century and the integration of scientific literacy require culturally and contextually relevant teaching materials (Heffington & Coady, 2023). However, significant challenges arise in understanding two-dimensional shapes, particularly triangle-related content at the elementary school level (Rohaeti et al., 2020; Ulusoy, 2021). Study results indicate that students struggle to prove that the sum of the angles in a triangle is 180°, reflecting a disparity in deductive thinking abilities and the need for a learning approach based on visual exploration and real-world contexts (Chen et al., 2021). Furthermore, students struggle with principles such as the inability to determine relevant factors and the

incorrect use of perimeter units for area units in triangle material (Abadi & Amir, 2022), potentially indicating variations in geometric thinking levels in plane geometry concepts, which suggest disparities in the understanding of shape analysis and relationships between basic geometric properties (Tamara et al., 2023). This condition requires pedagogical innovation that can accommodate local cultural backgrounds as a source of learning, so that the exploration of flat shape concepts becomes more meaningful and simultaneously strengthens students' cultural identity.

The integration of local culture and mathematics is a field of study related to ethnomathematics (Rodríguez-Nieto et al., 2025). Ethnomathematics is the study of how communities formulate, organize, and apply mathematical knowledge in their daily cultural practices. Its core principle emphasizes that mathematics is not universal without context but is manifested through local values, symbols, and activities (Marlissa et al., 2025). Meanwhile, Culturally Responsive Teaching (CRT) emphasizes the importance of recognizing, appreciating, and integrating students' cultural backgrounds in the learning process to increase relevance and engagement (Copeland Solas & Kamalodeen, 2022). In a multicultural context, CRT encourages teachers to design strategies that value cultural diversity, validate students' identities, and utilize cultural resources as a foundation for learning. The connection between ethnomathematics and CRT lies in their shared effort to bridge the scientific world and cultural experiences (Nolan & Xenofontos, 2023). Ethnomathematics provides contextually relevant content rooted in local traditions, while CRT offers a pedagogical framework to integrate this content inclusively, ensuring that these concepts hold relevance and meaning for students (Jojo, 2024).

A culture in Indonesia that can be integrated with ethnomathematics and is relevant to the concept of flat shapes is the triangular cake *Kaddo' Masingkulu*. *Kaddo' Masingkulu* is a cultural manifestation rich in meaning in the Bugis-Makassar community. Historically, the tradition of making this cake has been passed down orally and from generation to generation during traditional ceremonies and family celebrations, reflecting the values of togetherness and gratitude of the community. Its triangular shape is not merely an aesthetic composition, but also symbolizes social structures, such as the three important elements in society: humans, nature, and the Creator. Each side and angle of the triangle in *Kaddo' Masingkulu* embodies the philosophy of balance, equality, and interconnectedness among elements. Its geometric characteristics, including bilateral symmetry along the vertical axis, proportional side lengths, and the ratio between height and base, demonstrate that this tradition naturally integrates fundamental mathematical concepts. *Kaddo' Masingkulu* is not only a traditional food but also a symbolic medium containing mathematical and cultural meanings, making it a valuable educational resource (Busrah & Pathuddin, 2021).

The potential of *Kaddo' Masingkulu* as a medium for learning mathematics lies in its ability to connect abstract concepts with students' cultural experiences. When the *Kaddo' Masingkulu* triangle is used as a study object, students are encouraged to explore symmetry, proportion, and ratio in context, making their understanding of flat shapes more concrete and meaningful. Additionally, the representation of this traditional cake facilitates interdisciplinary dialogue, combining mathematical studies with cultural anthropology and local aesthetics. The use of Kaddo' Masingkulu in teaching material design supports the principle of *Culturally Responsive Teaching* (CRT), which is to critically reflect on the cultural identity of students and utilize local resources and connect this integration into teaching practices (Acquah & Szelei, 2020). The integration of cultural elements is expected not only to enhance engagement and motivation but also to strengthen students' cultural identity and enrich mathematical pedagogical practices in elementary schools.

A contextual approach in mathematics education emphasizes the importance of linking instructional content to students' real-life experiences, including their cultural background and daily experiences. In this case, the integration of local culture through an ethnomathematics approach is highly relevant to improve the understanding of abstract mathematical concepts and make them more concrete and meaningful. The use of cultural representations, such as the triangular shape in *Kaddo' Masingkulu*, enables students to understand flat shapes through objects that are familiar in their lives. Through the Culturally Responsive Teaching (CRT) approach, teachers not only deliver material in a conventional manner, but also facilitate a learning process that values students' cultural identities, thereby impacting self-awareness, increasing cultural emotions, and developing instructional practices for cultural sensitivity (Berlian & Huda, 2022). This research stems from the urgency to develop a mathematics learning model that is not only cognitively effective but also rooted in the local social and cultural context to support more inclusive, meaningful, and sustainable learning at the elementary education level.

Although various studies have revealed the important role of ethnomathematics in bringing mathematical concepts closer to the local cultural context, its application in elementary school learning is still not optimal, especially in the Bugis-Makassar cultural context. Most of the mathematics curriculum and teaching materials are still general and abstract, without accommodating the specific cultural backgrounds of students (Meeran & Van Wyk, 2022). In addition, there is still little research that specifically explores the relationship between local geometric shapes, such as triangles in Kaddo' Masingkulu, and the strengthening of Culturally Responsive Teaching (CRT) due to the lack of procedures for implementing the ethnomathematics context that has been explored (Prahmana, 2022). This gap indicates a need to design learning approaches that integrate local cultural elements into mathematics instruction to make it more contextual and meaningful. Based on a literature review, this study aims to (1) explore the concepts of flat shapes in the Kaddo' Masingkulu tradition as part of Bugis-Makassar culture-based ethnomathematics and (2) analyze the extent to which the application of Bugis-Makassar culture-based ethnomathematics can improve students' understanding of flat shape concepts.

2. RESEARCH METHOD

This study uses a qualitative approach with an exploratory case study design to explore the application of Culturally Responsive Teaching (CRT) in the context of Bugis-Makassar ethnomathematics. The research was conducted at an elementary school (SD) in Takalar Regency with subjects consisting of 2 teachers, 10 students (grades V and VI), and 2 cultural practitioners. The focus of the research was on the integration of local culture in teaching flat shapes through the representation of triangles in Kaddo' Masingkulu. Data collection was conducted through in-depth interviews, observation of the learning process, and analysis of teaching materials. Data were analyzed using a thematic approach to identify patterns and themes that reflect the effectiveness of CRT in improving students' understanding and engagement. Data validity was strengthened through triangulation of sources, methods, and theory. Source triangulation involves comparing data from teachers, students, and cultural practitioners; method triangulation is conducted through a combination of interviews, observations, and documentation; and theory triangulation refers to literature related to CRT and ethnomathematics. This study aims to contribute to contextual learning practices that are responsive to cultural diversity and the development of teaching materials that support meaningful mathematics learning. This research involved three groups of subjects, namely students, teachers, and cultural actors who were selected based on certain criteria in accordance with the objectives and qualitative approach used. The details of the subjects and their selection criteria are presented in **Table 1.**

Table 1. Subjects and Selection Criteria

Research Subject	Total	Selection Criteria	Role in Research
Cultural Actors	2	Community leaders or individuals who understand the making and symbolic meaning of *Kaddo' Masingkulu*	Explaining the cultural value and philosophy of the *Kaddo' Masingkulu* form
Teacher	2	High-grade elementary school teachers who teach math and understand the local cultural contexts	Provides a perspective on cultural integration in mathematics learning
Students	10	Grade V and VI students who are directly involved in learning using *Kaddo' Masingkulu*	Responding to learning and understanding the concept of flat building

The data in this study were analyzed using thematic analysis to identify patterns, meanings, and interrelations that reflect the effectiveness of Culturally Responsive Teaching (CRT) in geometry instruction based on local culture. The process began with transcribing interview recordings, classroom observations, and teaching material documentation, followed by open coding to extract meaningful segments related to cultural representation, instructional strategies, and students' responses to the contextual media of *Kaddo' Masingkulu*. These initial codes were then categorized into broader themes such as cultural integration in teaching, conceptual understanding of flat shapes, and the symbolic meaning of triangles in the Bugis-Makassar context. Subsequently, a thematic synthesis was conducted across the three subject groups (students, teachers, and cultural practitioners) to ensure consistency of meaning and strengthen data validity through triangulation of sources, methods, and theory. The findings revealed that using *Kaddo' Masingkulu* as a contextual learning medium enhanced students' understanding of flat shape concepts while reinforcing their cultural identity. The integration of ethnomathematics into lesson design fostered students' affective engagement and enabled more meaningful mathematical interpretations, positioning CRT as an effective pedagogical approach in multicultural elementary education settings.

3. RESULTS AND DISCUSSION

3.1 Identification of Cultural Elements in Kaddo' Masingkulu

The shape and pattern of Kaddo' Masingkulu represents a typical simple geometric structure, which is triangular. This representation reflects the local wisdom of the Bugis-Makassar community and is a starting point in examining the relationship between cultural elements and the concept of flat shapes in the context of ethnomathematics learning.

Figure 1. Kaddo' Masingkulu Triangle

The Kaddo' Massingkulu triangle comes from the tradition of the Bugis-Makassar people in South Sulawesi, Indonesia. In the context of Bugis-Makassar culture, this triangle has a very important meaning related to their philosophy of life. Kaddo' Massingkulu itself means "three sides that come together" or "a triangle that comes together". This triangle symbolizes the concept of balance and harmony in the social and spiritual life of the Bugis-Makassar people, who view that a balanced life will create peace and harmony in various aspects of life, both in the family, community, and relationship with God. The following analysis of in-depth interview data with cultural actors produced four main themes and a number of sub-themes describing the perceptions, values and symbolic meanings of the Kaddo' Masingkulu triangle in Bugis-Makassar culture:

Table 2. Thematic Analysis of Cultural Actors

No.	Main theme	Sub-theme	Code	Quote (cultural actor)
1.	History and cultural evolution	Historical roots and form transformation	Historical	*"The kaddo' masingkulu triangle has long historical roots and an evolution that reflects social change."*
		Adaptation to modern times	Modern evolution	*"now this triangular shape is often used in modern design, such as paintings, graphics, and architecture."*
2.	Symbolic and philosophical meanings	Three relations of life	Symbol three	*"This triangle symbolizes man's relationship with God, with others, and with nature."*
		Value of balance and harmony	Harmony	*"Our philosophy is to maintain balance in all aspects of life-that's what the triangle represents."*
3.	Cultural practices and representations	Carving, architecture and textiles	Cultural visuals	*"This triangle can be found in traditional house carvings, fabric motifs, and even traditional musical instruments."*
		Traditional ceremonies and rituals	Traditional ceremony	*"It is used in religious rituals, as a symbol of gratitude and unifying community values."*
4.	Relevance in education	The potential of contextualized learning media	Contextual media	*"This triangular cake could be a good introduction to teaching geometry to children."*
		The relationship between math and culture	Interconnect	*"By looking at this triangle, children can learn that culture and math are connected."*

Cultural historians explain that the Kaddo' Massingkulu triangle has long historical roots, reflecting the social and cultural changes of Bugis-Makassar society. Although the shape of this triangle may have changed over time, the cultural meaning contained within it has retained its symbolic power. Understanding the history of this triangle helps people understand how math and culture interact and evolve in society. Symbolically, the Kaddo' Massingkulu triangle illustrates the close relationship between three important elements in their lives, such as the relationship between humans and God, humans and fellow humans, and humans and nature. These three elements are interrelated and form an inseparable unity. Thus, this triangle is not only considered a geometric shape, but also a philosophical symbol that illustrates the Bugis-Makassar people's view of life which prioritizes balance and order in all aspects of life. Historically, the Kaddo' Massingkulu triangle was widely used in the daily lives of the Bugis-Makassar people. This triangular shape can be found in various aspects of their culture, such as in traditional house designs, carvings, weaving, and even in their social structure. For example, the Kaddo' Massingkulu triangle is often used in Bugis-Makassar traditional house carvings, which have deep philosophies, as well as in traditional textile motifs such as Bugis woven fabrics, which often feature triangular patterns. This triangle is also often used in traditional ceremonies and religious rituals, where the symbolism of balance and harmony is an important aspect. In this case, the Kaddo' Massingkulu triangle serves as a reminder of the importance of maintaining balance in life, both in spiritual, social and natural relationships. Over time, the Kaddo' Massingkulu triangle has evolved in its use in Bugis-Makassar society. In the beginning, this triangle may have been more focused on symbolic aspects in spiritual and customary contexts. However, with the development of the times and the influence of globalization, the use of this triangle is increasingly widespread and applied in various fields, including modern art and design.

3.2 Mathematical Pattern Analysis

a. Identify the Concept of Flat Buildings

The understanding of flat building concepts is explored through the identification of geometric elements, properties, and visual representations relevant to the cultural context of Kaddo' Masingkulu.

Figure 2. Kaddo' Masingkulu is triangular in shape

Figure 2, shown that one Kaddo' Masingkulu seed in the shape of a triangle. This shape has three sides and three angles. This triangle shows a simple flat shape that can be introduced to elementary students to understand basic geometry shapes. From here, students can learn to recognize the characteristics of triangles such as the number of sides, angles, and symmetrical shapes. This triangle shape can also be used to contextually explain the types of triangles based on their sides or angles.

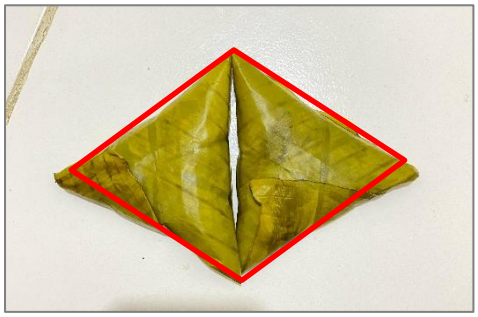

Figure 3. Jajargenjang-shaped Kaddo' Masingkulu

Two congruent Kaddo' Masingkulu triangles are arranged side by side on the base side, forming a jajenjang. In a jajargenjang, both pairs of sides are parallel and have the same length. For example, if each triangle has a base of 5 cm and a height of 4 cm, then the base of the jajenjang is also 5 cm, and the height remains 4 cm. The area of a parallelogram is equal to the base times the height (5 cm × 4 cm), which is equivalent to the sum of the areas of two triangles (2 × ½ × base × height). Thus, students can understand that joining two isosceles or equilateral triangles produces a jajargenjang, as well as recognize the properties of parallel, equal length, and how to calculate the area.

Figure 4. Trapezoidal-shaped Kaddo' Masingkulu

The image shows three Kaddo' Masingkulu triangles arranged to form a trapezoid. Two triangles are arranged side by side with their bases at the bottom as the long base of the trapezoid, while one triangle is placed on top to form the shorter top side. The result is a four-sided flat shape with only one pair of parallel sides, a long base and a short top side and two hypotenuse sides. Through this arrangement, students learn that combining triangles can produce a trapezoid, understand the concept of parallel sides, different side lengths, and the relationship between triangles and trapezoids in area calculations. The following are the results of the mathematical pattern analysis of Kaddo' Massingkulu.

Table 4. Mathematical Pattern of Kaddo' Massingkulu

No.	Kaddo' Massingkulu Triangle	Visualization	Generated Geometric Pattern	Teachable Math Concepts
1.	Figure 1	One triangular Kaddo' Masingkulu	Isosceles triangle	Triangle characteristics: number of sides, angles, and symmetry
2.	Figure 2	Two triangles arranged side by side	parallelogram	Area of a parallelogram, properties of parallel sides, shape relationship (proportion)
3.	Figure 3	Three triangles form a trapezoid	Trapezoid	Concept of parallel sides, different lengths, comparison (ratio)

b. Teachers' and Students' Understanding of Mathematical Representation

The concept of ethnomathematics in the Kaddo' Massingkulu Triangle has the potential to improve students' understanding of mathematics material by linking it to cultural values with which they are familiar. This allows math teaching to be more contextual, relevant and meaningful to students, and helps to reduce cultural gaps that may exist in classroom math learning. The following are the results of thematic analysis from the teachers' group based on in-depth interviews.

Table 4. Thematic Analysis of Teacher Interview Results

Main theme	Sub-theme	Code	Quote (teacher)
CRT-based teaching strategy	Project approach & practical activities	Practical project	*"I use a project-based approach and practical activities where students can model the kaddo' masingkulu triangle themselves."*
	Cultural resources	Cultural resources	*"I also invited cultural resource persons to share their knowledge."*
	Visual resources & cultural narratives	Visual narration	*"I include a variety of visual resources and cultural narratives to strengthen students' understanding."*
	Multiple contexts (culture + math)	Multiple contexts	*"I make sure to provide the background cultural and mathematical context simultaneously, so that students can see a clear connection between the two."*
	Gradual introduction	Introduction	*"I try to build a foundation of understanding by introducing cultural concepts gradually."*
Reflection & professional needs	Positive perception of CRT	CRT Positive	*"Teachers responded positively to the implementation of culturally responsive teaching (CRT), especially through the integration of local culture such as kaddo' masingkulu."*
	Assistance in designing questions	Problem assistance	*"assistance is needed in designing culture-based questions so that they remain in accordance with learning outcomes and do not obscure mathematical concepts."*
	Teaching material development training	Teaching material training	*"CRT-based contextual teaching materials development training needs to be expanded for educators."*

The math teacher revealed that one of the strategies used in teaching ethnomathematical concepts such as the Kaddo' Massingkulu triangle is through projects and practical activities. Students can model the triangle and learn about the mathematical concepts behind the shape. One of the strategies used by mathematics teachers to teach ethnomathematics concepts is through a project-based approach. In this approach, students are given the opportunity to do hands-on exploration of mathematical concepts related to their culture. For example, teaching about the Kaddo' Massingkulu triangle can be done through a project where students are asked to model the triangle using various media, such as paper, wood, or other materials. Through this project, students not only learn about the geometric shape of the triangle, but also understand how the triangle relates to deeper Bugis-Makassar cultural values, such as balance, harmony and order in the social and spiritual life of their community. The project-based approach allows students to be more active in learning, as well as providing a more real and applicable experience in connecting mathematical concepts with their culture. In addition to project-based approaches, math teachers also often use practical activities and demonstrations to help students understand ethnomathematics concepts. These activities can include creating patterns or designs that depict the Kaddo' Massingkulu triangle in various forms, such as in carvings or textile motifs. One of the biggest challenges in teaching ethnomathematics concepts is ensuring that students understand the cultural relevance of the mathematical material being taught. Teachers need to relate mathematical concepts to students' cultural contexts to make learning more relevant and meaningful. For example, in teaching the Kaddo' Massingkulu triangle, teachers need to explain how this triangle shape is not only a geometric object, but also as part of the life of the Bugis-Makassar people associated with their cultural values. Furthermore, the results of the thematic analysis of the interviews are explained in the **Table 5**.

Table 5. Results of Thematic Analysis of Student Interviews

Main theme	Sub-theme	Code	Quote (student)
Understanding of geometry concepts	Triangle characteristics	Triangle characteristics	*"This shape has three sides and three corners..."*
	Area & comparison	Comparison area	*"the area of a jajargenjang is equal to the sum of the areas of two triangles (2 × ½ × base × height)..."*
Integration of local culture	Media familiarity	Cultural context	*"When the teacher used a picture of kaddo' masingkulu, I immediately understood... because I often see that cake at my grandmother's house."*
	Symbolic meaning	Symbolic meaning	*"I feel that the three corners are like man-nature-god, interconnected."*
Motivation & engagement	Enthusiasm & comfort	Enthusiasm	*"It makes learning more fun because it is linked to objects we are familiar with."*
	Self-confidence	Confident	*"many students claimed to be more confident answering questions because the context was familiar."*
The challenge of understanding	Abstract math terms	Difficult terms	*"some words like 'proportion' are still difficult for us to understand without real examples."*
	Concept generalization	Generalization	*"still need guidance to generalize from the cake to the triangle in the book."*

Based on the interviews, teaching also includes relevant cultural contexts and involves cultural resource persons to provide deeper insights to students. This makes students more connected to the teaching material and helps them understand mathematical concepts in real-life contexts. The use of visual resources, such as drawings, photographs or videos showing the application of the Kaddo' Massingkulu triangle in various aspects of Bugis-Makassar cultural life, is essential

to facilitate student understanding. In ethnomathematics teaching, visualization is very helpful to explain concepts that may be difficult to understand with words alone. In addition, teachers can also use cultural narratives to provide a deeper context for the symbolic meaning of the triangle. By telling cultural stories involving the Kaddo' Massingkulu triangle, teachers can bring students closer to a deep cultural understanding, while still teaching the mathematical principles contained in the triangle. It is important to remember that students in a class may come from different cultural backgrounds. Therefore, teaching ethnomathematical concepts such as the Kaddo' Massingkulu triangle should be done with an approach that is inclusive and sensitive to cultural diversity. Teachers need to ensure that this learning does not only emphasize certain cultures, but also opens opportunities for students to recognize and appreciate the diversity of cultures that exist. For example, teachers can compare the Kaddo' Massingkulu triangle with other geometric symbols from different student cultures, to show how mathematics can be found in various cultural traditions.

Students' understanding of mathematical representations in the context of local culture is an important indicator in assessing the effectiveness of Culturally Responsive Teaching-based learning. The integration of Kaddo' Masingkulu as contextual media provides opportunities for students to connect cultural experiences with the concept of flat buildings, especially triangles. Students' responses show that the use of Kaddo' Masingkulu as contextual media in mathematics learning has a positive impact on understanding the concept of flat shapes, especially triangles. The personal experience of students who are familiar with the shape of the traditional cake allows the connection between cultural knowledge and mathematical representation. This is in line with the principle of Culturally Responsive Teaching (CRT), which emphasizes the importance of students' cultural background as a resource in the learning process. Local cultural contexts not only facilitate the visualization of abstract concepts, but also increase students' affective engagement in the learning process. Thus, the integration of cultural elements such as Kaddo' Masingkulu not only enriches teaching materials, but also facilitates the construction of mathematical meanings that are more meaningful and relevant to students. Next, the thematic synthesis integrates the findings from the three subject groups of students, teachers and cultural actors to display the alignments and differences in Kaddo' Masingkulu's geometry understanding, teaching strategies and symbolic meanings. The following table maps the main themes and sub-themes of each group, revealing synergies between the local cultural context and Culturally Responsive Teaching-based learning practices.

Table 6. Inter-subject Thematic Synthesis

Main Theme	Student Sub-theme	Teacher Sub-theme	Sub-theme of Cultural Actors
Geometry understanding	Triangle feature, area comparison	Practical project, visual narrative	Historical, modern evolution
Cultural context	Cultural context, symbolic meaning	Multiple contexts, cultured narratives	Symbol of three, harmony
Motivation & engagement	Enthusiasm, confidence	CRT Positive	Contextual media, interconnection
Challenges & needs	Difficult terms, generalizations	Question assistance, teaching material training	-

Thematic synthesis analysis between subjects revealed that the Kaddo' Masingkulu triangle representation contextually facilitated students' understanding of geometry concepts, supported by teachers' project and visualization strategies, and enriched by historical and symbolic narratives of cultural actors. The integration of local culture was shown to increase student motivation and engagement, in line with teachers' positive attitudes towards CRT, while cultural actors emphasized the power of symbolic values. The constraints of abstract terms and generalizations demanded intervention in the form of teacher assistance and vocabulary enrichment, while cultural actors emphasized the importance of maintaining cultural meaning in the design of teaching materials.

3.3 Development of Teaching Materials Based on Culturally Responsive Teaching (CRT)

Table 7. Analysis of Teacher Teaching Materials Based on Culturally Responsive Teaching (CRT)

Teaching Material Components	Development Description	Linkage to Local Culture	Impact on Learning
Problem Context	Problem using Kaddo' Masingkulu illustration and narration	Elevating traditional Bugis-Makassar cakes	Students more easily understand the concept of triangles through real experience
Image/Visualization	Inserted images of Kaddo' Masingkulu in various positions and sizes	Show the variety of triangle shapes in daily life	Assist students in recognizing the characteristics and types of triangles
Student Activity	Group discussion on triangular shapes in Bugis-Makassar culture	Invite students to explore their own culture as a learning resource	Increase student engagement and confidence
Cultural Reflection	Reflective questions about the cultural meaning of Kaddo' Masingkulu in people's lives	Strengthen cultural values and local identity	Encourage students to think critically and appreciate cultural heritage
Introduction Language	Using communicative Indonesian and inserting local terms	Strengthening local nuances in learning	Increase students' familiarity with the material

Table 2, shown that the development of teaching materials based on Culturally Responsive Teaching (CRT) is able to integrate local cultural values in mathematics learning effectively. In this context, Kaddo' Masingkulu as a representation of Bugis-Makassar culture is used as an entry point to introduce the concept of flat buildings, especially triangles. The use of problem contexts that are relevant to students' lives, visualization of local culture, and activities that explore local wisdom are proven to increase students' involvement, understanding, and sense of belonging to the material. In addition, the insertion of cultural reflections and the use of a communicative language of instruction strengthen students' emotional and affective attachment to learning. This strategy is in line with the main principle of CRT, which is to make students' cultural background the main resource in the learning process. Thus, the teaching materials developed not only facilitate cognitive understanding of mathematical concepts, but also build students' cultural awareness and local identity. This shows that the CRT approach can be an effective strategy in designing contextual, inclusive and meaningful learning in a multicultural environment like Indonesia.

3.4 Flat Shape Concepts Can Be Explored in the Kaddo' Masingkulu Tradition as Part of Bugis-Makassar Culture-Based Ethnomathematics

The Kaddo' Massingkulu triangle is a geometric symbol found in various aspects of Bugis-Makassar culture. As a flat shape, this triangle contains various mathematical concepts that can be used to teach the basics of geometry. This triangle has symmetry and proportion properties that are closely related to basic principles in mathematics, such as the sum of the angles in a triangle is always 180 degrees, and the relationship between sides and angles can be explained by geometric theory. Kaddo' Masingkulu, as a local cultural object, not only represents the symbolic values of the Bugis-Makassar community, but also contains rich mathematical structure potential. The findings show that the basic shape of Kaddo' Masingkulu is a triangle, which visually displays symmetry and balance. This symmetry reflects harmony and balance, and serves as an introduction to the concept of reflection in geometry. Additionally, through variations in the shape of Kaddo' Masingkulu, teachers can teach different types of triangles, such as equilateral and isosceles triangles. Interestingly, when two or more triangles are arranged side by side, new two-dimensional shapes like rectangles form, providing a representation of the concept of proportion and trapezoids through the concept of ratios. This opens up further exploration for students to understand the relationships between two-dimensional shapes, geometric properties, and area calculations based on shape combination (İbili et al., 2020). With this approach, students' mathematical understanding becomes not only more contextual but also culturally integrated through Culturally Responsive Teaching.

In Bugis-Makassar culture, balance and order are highly valued, and the Kaddo' Massingkulu triangle is often used to illustrate these values. The use of proportions in the design of this triangle can be explored in the context of ethnomathematics to teach the concepts of ratio and proportion in mathematics. For example, students can be asked to analyze how the ratio of the sides of the triangle in this design functions to create harmony. In this case, students can learn how the ratio of the sides of a triangle functions to create visual symmetry, which is often found in Bugis-Makassar carvings or textile motifs. This is relevant to the findings (Acharya et al., 2021) which revealed that elementary school teachers who taught the concepts of ratio and proportion using cultural examples were the most effective. The Kaddo' Massingkulu triangle is not only found in decorative designs, but also in other practical applications in Bugis-Makassar culture. For example, traditional house designs or building constructions use triangular elements to create stability and balance. Students can be asked to measure and calculate the area of the flat shapes formed by the triangles used in these building elements, as well as explain how geometric principles are applied in real life. By connecting geometry learning with real-life elements, such as the study by (Fauzi et al., 2022), the layout patterns and architecture of traditional Sasak houses are composed of geometric shapes, both two-dimensional and three-dimensional geometry.

3.5 The Application of Ethnomathematics Based on Bugis-Makassar Culture Can Improve Students' Understanding of Flat Shapes while Instilling an Appreciation for Local Culture

Flat shapes found in Bugis-Makassar culture, such as the Kaddo' Massingkulu triangle, repeating patterns in textiles, or traditional house designs, provide concrete examples of how geometry is applied in everyday life. In this culture, each geometric shape often has symbolic and functional meanings. For example, the triangle in the Kaddo' Massingkulu pattern is often used to represent balance and harmony in the social life of the Bugis-Makassar community. By introducing concepts such as symmetry in flat triangles, ratios in parallelograms, and proportions in trapezoids in the flat shapes of this culture, students can understand the practical applications of geometry in their lives, which in turn improves their understanding of mathematical concepts. For example, by using the Kaddo' Massingkulu triangle as a learning object, students can be taught about the types of triangles (equilateral and isosceles) and the relationship between the sides and angles of a triangle. In addition, students can be involved in practical activities such as making models of these triangles or identifying triangle patterns in carvings or other designs around them. In this way, the flat shapes taught become easier to digest and more interesting for students.

The application of Bugis-Makassar culture-based ethnomathematics also serves to in still an appreciation for local culture. By teaching mathematics through the cultural context that surrounds students, they not only learn mathematical

concepts but also appreciate and understand the cultural values contained within them. In this case, learning does not only focus on mastering mathematical skills but also on strengthening students' cultural identity. Using Bugis-Makassar culture in ethnomathematics teaching can help students feel proud of their cultural heritage. It also gives them the opportunity to appreciate how mathematics and culture can be interconnected and enrich each other. In this case, students not only become intelligent learners in mathematics but also become individuals who are more aware and proud of their local culture. In addition, a number of geometric concepts in the architectural features of the ANRI (National Archives of the Republic of Indonesia) building, such as the rectangular and trapezoidal shapes of the main structure and roof, reflect various geometric concepts (Adrian et al., 2024). Basically, mathematics is a form of culture. In this case, mathematics is seen as an entity that has been integrated into all aspects of society. The application of ethnomathematics based on local culture makes mathematics learning more contextual and meaningful. When students see the direct connection between their culture and the mathematical concepts being taught, they feel that the learning is relevant to their lives. This aligns with the recommendations from (Sachdeva & Eggen, 2021) that mathematics learning should be equipped to enable students to make choices that reflect their personal lives. This culture-based approach can also be applied through various learning projects and activities that actively involve students. For example, students can be asked to create flat models inspired by Bugis-Makassar designs or design textile patterns using geometric principles. Culture-based projects provide opportunities to explore mathematical ideas in a cultural context and help students develop mathematical ideas (Pradhan & Orey, 2021).

4. CONCLUSION

This study concludes that the integration of *Kaddo' Masingkulu* as a cultural representation of flat shapes in Bugis-Makassar ethnomathematics significantly enhances students' conceptual understanding and engagement in learning geometry. By embedding Culturally Responsive Teaching (CRT) principles into instructional design, mathematics learning becomes more meaningful, contextual, and inclusive. The exploration of the triangle's symbolic and mathematical elements provided students with relatable experiences, reduced misconceptions, and strengthened their cultural identity. These findings affirm the relevance of ethnomathematics as a pedagogical bridge between local wisdom and abstract mathematical concepts, offering a viable solution to the research problem of culturally disconnected mathematics instruction in primary schools.

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