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Exploring Ethnomathematics in The Process of Making Deppa Tori' as A Contextual Resource for Mathematics Learning in Schools

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Abstract

Mathematics is often perceived by students as a difficult and abstract subject that is disconnected from their everyday experiences and cultural environment. This situation highlights the importance of providing contextual learning resources that enable students to connect mathematical concepts with familiar activities and local cultural practices. Ethnomathematics offers an approach that integrates mathematical ideas found in cultural activities into the learning process. One cultural practice that has potential as an ethnomathematical context is the making of Deppa Tori', a traditional cake of the Toraja community. This study aims to explore the mathematical concepts embedded in the process of making Deppa Tori' and to examine its potential as a contextual resource for mathematics learning in schools. This research employed a descriptive qualitative method with an ethnographic approach. Data were collected through observation, interviews, and documentation of the process of making Deppa Tori'. Data were analyzed through triangulation by comparing information obtained from observations, interviews, and documentation. The findings indicate that the making of Deppa Tori' involves several mathematical concepts, particularly ratio and proportion in the preparation and measurement of ingredients, as well as plane geometry in the shape of the finished cake, particularly the rhombus. These mathematical concepts are applied naturally by members of the Toraja community without formal mathematical instruction. The findings suggest that Deppa Tori' can be utilized as a meaningful contextual resource for mathematics learning because it connects mathematical concepts with students' familiar cultural experiences. The integration of local cultural practices into mathematics learning can also contribute to strengthening students' appreciation of their cultural identity.

Keywords: Ethnomathematics; Deppa Tori'; Toraja Culture; Ratio and Proportion; Plane Geometry; Contextual Learning

INTRODUCTION

Education and culture are two closely interconnected aspects of human life. Education is not only a process of developing knowledge and skills but also a means of transmitting values, traditions, and cultural knowledge from one generation to another. Culture, meanwhile, is reflected in the ideas, practices, habits, and products developed by a community through continuous social interaction and learning. Therefore, integrating local culture into education can provide meaningful learning experiences while helping students recognize and appreciate the cultural environment in which they live.

Mathematics is closely related to human life and can be viewed as part of cultural development. Various mathematical ideas are naturally embedded in everyday activities, including counting, measuring, comparing, estimating, designing, and organizing objects. However, students often perceive mathematics as a difficult subject because mathematical concepts are frequently presented through abstract symbols, formulas, and procedures. As a result, students may be able to perform mathematical calculations without fully understanding the meaning of the concepts or recognizing their applications in everyday situations. This condition indicates the need for learning approaches that connect mathematical knowledge with students' real-life experiences.

The use of meaningful contexts can help students develop a better understanding of abstract mathematical concepts. Contextual mathematics learning provides opportunities for students to connect mathematical ideas with situations that are familiar to them. Febrianti et al. (2024) emphasize the importance of context in mathematics learning because meaningful situations can help students construct mathematical understanding based on experiences that are close to their lives. Mathematics learning can therefore become more meaningful when teachers provide opportunities for students to explore mathematical concepts through their surrounding environment and cultural practices.

One approach that connects mathematics and culture is ethnomathematics. Ethnomathematics refers to the study of mathematical ideas, concepts, and practices that are embedded in particular cultural environments. Mathematical activities can be found in various cultural practices, such as traditional games, architecture, handicrafts, patterns, traditional foods, and other community activities. Fajriyah (2018) explains that ethnomathematics has an important role in revealing mathematical concepts within cultural activities and can support students' mathematical literacy. Through ethnomathematics, students can understand that mathematics is not limited to formal knowledge taught in classrooms but is also present in the cultural practices of their communities.

Ethnomathematics can provide a bridge between formal mathematical knowledge and students' everyday experiences. The integration of cultural contexts into mathematics learning can make abstract concepts more concrete and meaningful because students encounter mathematical ideas through objects and activities that are already familiar to them. Previous studies have identified mathematical concepts in various cultural objects and activities. These include geometric concepts in traditional handicrafts and architecture, as well as number, measurement, probability, and fraction concepts in traditional games and foods (Fauzi & Setiawan, 2020; Irmayanti & Danial, 2019; Subekhi et al., 2021).

Traditional food is one of the cultural contexts that has considerable potential for ethnomathematics-based learning. The process of preparing traditional food involves various mathematical activities, including measuring ingredients, comparing quantities, determining proportions, estimating amounts, and forming objects into particular shapes. Therefore, traditional food can serve as a concrete context through which students can explore mathematical concepts that are relevant to their daily lives. Research on traditional foods in different Indonesian regions has demonstrated the presence of mathematical concepts, particularly geometry and measurement (Huda, 2018; Selvia Nur et al., 2024).

The Toraja community has a rich cultural heritage that includes traditional ceremonies, architecture, arts, and traditional foods. These cultural practices remain closely connected to the social life of the community. Traditional foods, in particular, are commonly found during various cultural and social activities. Among the traditional foods of the Toraja community is *Deppa Tori'*, a traditional cake that is widely recognized and consumed by local communities. It is commonly associated with cultural gatherings and traditional ceremonies, including *Rambu Tuka'* and *Rambu Solo'*.

The making of *Deppa Tori'* involves activities that contain mathematical ideas. The preparation of ingredients requires the measurement and comparison of quantities. For example, the use of 500 grams of rice flour, 300 grams of palm sugar, 75 milliliters of coconut milk, and other ingredients demonstrates relationships between quantities that can be interpreted through the concept of ratio and proportion. Such activities show that members of the Toraja community apply mathematical reasoning naturally in the process of preparing traditional food, even without explicitly using formal mathematical terminology.

In addition to ratio and proportion, the physical form of *Deppa Tori'* provides an opportunity to explore plane geometry. The cake can be formed into a quadrilateral shape, particularly a rhombus. This characteristic can be used as a contextual representation for introducing geometric concepts. Students can observe the shape directly and subsequently relate its characteristics to formal mathematical concepts such as sides, angles, diagonals, symmetry, and area.

Previous research has explored ethnomathematics in various cultural contexts in Indonesia. Studies have examined traditional foods, games, batik, and traditional architecture as sources of mathematical knowledge. In the context of Toraja culture, research on *Tongkonan*, the traditional house of the Toraja people, has identified various mathematical concepts, including plane geometry, solid geometry, arithmetic sequences, symmetry, parallel lines, right angles, reflection, distance, congruence, and similarity. These findings indicate that Toraja culture contains rich mathematical knowledge that can be explored for educational purposes.

However, studies specifically investigating the mathematical concepts embedded in the process of making *Deppa Tori'* and its potential as a contextual resource for mathematics learning are still limited. This represents an opportunity to expand ethnomathematical research within the Toraja cultural context. Investigating *Deppa Tori'* is particularly relevant because the food is familiar to many students in the region, allowing mathematical

concepts to be connected directly to their cultural and everyday experiences.

The use of *Deppa Tori* as a contextual learning resource also has cultural significance. Integrating local cultural practices into mathematics learning can help students understand mathematical concepts while simultaneously developing appreciation for their cultural heritage. Such an approach can contribute to preserving local cultural identity by introducing traditional knowledge within formal educational settings. In this way, mathematics learning can become not only a process of developing mathematical competence but also a means of strengthening students' connection with their local culture.

Based on this background, this study aims to explore the ethnomathematical concepts embedded in the process of making *Deppa Tori* and to examine its potential as a contextual resource for mathematics learning in schools. The study focuses particularly on the concepts of ratio and proportion found in the preparation of ingredients and plane geometry represented by the shape of the finished cake. The findings are expected to provide an alternative contextual resource for mathematics teachers and contribute to the development of ethnomathematics-based mathematics learning in the Toraja cultural context.

RESULTS AND DISCUSSION

RESULTS

This study explored the ethnomathematical concepts embedded in the process of making *deppa tori*, a traditional Torajan cake. Data were obtained through direct observation, interviews with an informant who has experience in preparing *deppa tori*, and photographic documentation of the preparation process. The data were then analyzed through triangulation by comparing the findings from observations, interviews, and documentation.

The results indicate that the process of making *deppa tori* contains mathematical concepts that can be connected to school mathematics. Two main mathematical concepts were identified: ratio and proportion and plane geometry, particularly the rhombus.

1. The Concept of Ratio and Proportion in the Preparation of Ingredients

The concept of ratio and proportion can be identified from the quantities of ingredients used to prepare *deppa tori*. The recipe observed in this study consisted of 500 grams of rice flour, 300 grams of palm sugar, 75 milliliters of coconut milk, 100 milliliters of water, and half a teaspoon of salt.

The use of specific quantities of ingredients demonstrates an implicit mathematical relationship among the ingredients. For example, the ratio between rice flour and palm sugar is 500:300, which can be simplified to 5:3. Similarly, the quantity of coconut milk and water can be compared to determine their proportional relationship. These relationships demonstrate that mathematical concepts are naturally applied in everyday activities, even when the people involved do not explicitly use formal mathematical terminology.

The process of measuring and combining ingredients requires accuracy and consistency. If the quantity of one ingredient is changed, the quantities of other ingredients may also need to be adjusted to maintain the desired composition of the dough. This activity provides a meaningful context for introducing ratio and

proportion because students can observe and analyze mathematical relationships through a familiar cultural activity.

Therefore, the preparation of *deppa tori* can be used as a contextual learning situation for teaching ratio and proportion. Instead of introducing ratios solely through abstract numerical examples, teachers can use the quantities of ingredients in the recipe to encourage students to identify, compare, simplify, and apply ratios in real-life situations.

2. The Concept of Plane Geometry in the Shape of *Deppa Tori*

In addition to ratio and proportion, the study identified a geometric concept in the shape of *deppa tori*. During the process of forming the dough, the cake is shaped into a quadrilateral form resembling a rhombus.

The shape of the cake provides an opportunity to introduce students to the properties of plane figures. Students can observe the sides, vertices, angles, and overall form of the cake and relate these characteristics to the properties of a rhombus. The traditional cake therefore provides a concrete object through which students can recognize geometric concepts that they may otherwise encounter only through drawings or textbook illustrations.

The use of *deppa tori* as a geometric context also allows teachers to connect students' cultural experiences with formal mathematical concepts. Students who are familiar with the cake may find it easier to recognize and discuss geometric characteristics because the learning object is part of their everyday environment and cultural heritage.

3. *Deppa Tori* as a Contextual Source for Mathematics Learning

The findings demonstrate that *deppa tori* is not only a traditional food but also contains mathematical activities that can be explored for educational purposes. The process involves measuring ingredients, comparing quantities, maintaining proportions, and forming the dough into a particular geometric shape.

These activities provide opportunities for teachers to design contextual mathematics learning based on local culture. For example, students can be asked to determine the ratio between ingredients, simplify ratios, calculate the quantities required for different serving sizes, or identify the geometric properties of the cake.

Using *deppa tori* as a learning context may also help students recognize that mathematics is closely related to their everyday lives. Mathematics is not limited to symbols, formulas, and calculations presented in textbooks but is also present in cultural practices and community activities.

Furthermore, integrating local culture into mathematics learning may contribute to the preservation of cultural knowledge. When students learn mathematical concepts through a traditional Torajan food that they recognize and encounter in their community, they are simultaneously introduced to the cultural significance of that food. Thus, mathematics learning can serve not only a cognitive purpose but also contribute to students' appreciation of their local cultural heritage.

DISCUSSION

The findings of this study indicate that the traditional process of making *Deppa Tori* contains mathematical ideas that are applied naturally by the Toraja community. Although the people involved

in preparing the traditional cake may not explicitly refer to formal mathematical concepts, their activities demonstrate mathematical reasoning through measuring, comparing, estimating, and determining proportions. This finding supports the view of ethnomathematics as an approach that recognizes mathematical ideas embedded in cultural practices and everyday activities.

Ratio and Proportion in the Preparation of Ingredients

One of the mathematical concepts identified in the making of *Deppa Tori* is ratio and proportion. The preparation of ingredients requires the maker to determine appropriate quantities of rice flour, palm sugar, coconut milk, water, and salt. The relationship between these ingredients needs to be maintained to obtain the desired texture, taste, and quality of the cake.

For example, the use of 500 grams of rice flour and 300 grams of palm sugar represents a quantitative relationship between two ingredients. This relationship can be expressed as a ratio of 500:300, which can be simplified to 5:3. Such a situation provides a meaningful context for introducing the concept of ratio to students. Students can be encouraged to compare ingredient quantities, simplify ratios and determine the amount of an ingredient needed when the recipe is increased or decreased.

This context is relevant to mathematics learning because ratio and proportion are often presented to students through abstract numerical exercises. By using a familiar traditional food-making activity, mathematical relationships can be represented through situations that students can observe and understand in their daily lives. Therefore, the making of *Deppa Tori* provides an opportunity to transform an everyday cultural activity into a meaningful mathematical learning context.

Plane Geometry in the Shape of Deppa Tori

In addition to ratio and proportion, the study identified a geometric concept in the shape of the finished *Deppa Tori*. The cake is commonly shaped in a form resembling a rhombus or diamond. This shape can be used to introduce students to the characteristics of plane figures, particularly the rhombus.

Through this cultural context, students can identify the sides, vertices, diagonals, and symmetry of the shape. They can also explore mathematical properties such as the relationship between the sides and diagonals of a rhombus. Furthermore, students may be asked to estimate or calculate the perimeter and area of a rhombus based on measurements of an actual *Deppa Tori*.

The use of the cake's shape as a learning context demonstrates that geometry is not limited to textbook illustrations. Geometric forms can be found in objects and products created by communities. Similar findings have been reported in ethnomathematical studies involving traditional food, handicrafts, buildings, and cultural objects. Thus, *Deppa Tori* can provide students with a concrete representation of geometric concepts while connecting mathematics to Toraja cultural practices.

Ethnomathematics and Local Cultural Context

The findings also demonstrate that mathematical knowledge is closely related to cultural practices. The Toraja community applies mathematical ideas in the preparation of *Deppa Tori* as part of their traditional knowledge. The process has been passed down through generations and is generally learned through observation, participation, and experience rather than through formal mathematical instruction.

This condition illustrates an important characteristic of ethnomathematics: mathematics can emerge from the practical activities of a particular cultural group. The community does not necessarily use formal mathematical terminology such as “ratio,” “proportion,” or “rhombus,” but the underlying mathematical relationships are present in their activities.

Integrating these practices into mathematics education can therefore provide students with an opportunity to recognize mathematics within their own cultural environment. This approach may also help students develop a greater appreciation of local traditions because their culture is positioned not only as an object of cultural study but also as a source of academic knowledge.

Deppa Tori as a Contextual Resource for Mathematics Learning

The results suggest that *Deppa Tori* has potential to be developed as a contextual resource for mathematics learning. The process can be adapted into various learning activities, particularly for topics involving ratio, proportion, measurement, and plane geometry.

For example, students can be given a recipe and asked to determine the new quantities of ingredients when the recipe is prepared for a larger number of people. Students can also compare ingredient quantities and express them in simplified ratios. In geometry lessons, students can observe the shape of the finished cake, identify its geometric characteristics, and calculate its perimeter or area.

Such activities can make mathematical concepts more closely connected to students' experiences. Rather than learning mathematical formulas independently from real-life situations, students can begin with a familiar cultural activity and gradually identify the mathematical ideas contained within it. This can support meaningful learning and encourage students to see mathematics as a subject that exists in their everyday environment.

Furthermore, the use of *Deppa Tori* as a learning context can contribute to the preservation of local cultural knowledge. Mathematics learning can become a means of introducing students to traditional practices while simultaneously developing their mathematical understanding. In this sense, ethnomathematics provides a bridge between formal school mathematics and the cultural knowledge of the community.

Implications for Mathematics Education

The findings have implications for teachers, particularly those who teach mathematics in culturally diverse environments. Teachers can use local cultural practices as starting points for designing contextual learning activities. Traditional foods such as *Deppa Tori* can provide authentic situations through which students explore mathematical concepts rather than encountering mathematics solely through abstract exercises.

However, the findings of this study should be interpreted within the scope of a qualitative exploration. The study identifies and describes mathematical concepts contained in the making of *Deppa Tori*, but it does not empirically measure the effectiveness of using *Deppa Tori* in improving students' mathematical achievement. Therefore, further research is needed to develop learning materials, lesson plans, or ethnomathematics-based learning activities using *Deppa Tori* and to examine their effectiveness in actual classroom settings.

Overall, the study confirms that the making of *Deppa Tori* contains meaningful mathematical ideas, particularly ratio, proportion, and plane geometry. These findings strengthen the argument that local cultural practices can serve as valuable contextual resources for mathematics education. Integrating *Deppa Tori* into mathematics learning may not only support students' understanding of mathematical concepts but also encourage them to recognize, appreciate, and preserve the cultural heritage of the Toraja community.

CONCLUSION

This study concludes that the traditional process of making *Deppa Tori* contains meaningful mathematical concepts that are naturally practiced by the Toraja community. Through observation, interviews, and documentation, the study identified mathematical ideas particularly related to ratio and proportion in the preparation of ingredients and plane geometry in the shape of the finished cake, especially the rhombus.

The findings demonstrate that mathematical knowledge is not limited to formal classroom instruction but is also embedded in cultural activities and everyday practices. The making of *Deppa Tori* provides an authentic context in which mathematical relationships can be observed, interpreted, and connected to formal mathematical concepts. Therefore, *Deppa Tori* has potential to be developed as a contextual resource for mathematics learning, particularly in teaching ratio, proportion, measurement, and plane geometry.

The integration of *Deppa Tori* into mathematics learning can provide students with opportunities to learn mathematics through familiar cultural experiences while simultaneously developing appreciation for local cultural heritage. Nevertheless, this study is limited to identifying and describing ethnomathematical concepts and does not yet examine their effectiveness in classroom learning. Further research is recommended to develop ethnomathematics-based teaching materials or learning activities using *Deppa Tori* and to investigate their impact on students' mathematical understanding, reasoning, and appreciation of local culture.

APPENDIX

Appendix A. Observation and Documentation of *Deppa Tori* Making

The observation focused on the stages involved in making *Deppa Tori*, beginning with the preparation and measurement of ingredients, mixing the ingredients, shaping the dough, and frying the cake. Each stage was examined to identify activities that involved mathematical reasoning.

The documentation included photographs and field notes related to:

1. Preparation and measurement of the ingredients.
2. The quantities and proportions of the ingredients used.
3. The process of mixing the ingredients.
4. The process of shaping the *Deppa Tori* dough.
5. The geometric form of the finished *Deppa Tori*.
6. The traditional context in which *Deppa Tori* is prepared and served.

Appendix B. Interview Guide

The interview was conducted to obtain information about the traditional process of making *Deppa Tori* and the mathematical ideas involved in the activity. The interview questions included:

1. What ingredients are traditionally used to make *Deppa Tori*?
2. How are the quantities of the ingredients determined?
3. How do you determine the appropriate proportion of each ingredient?
4. What steps are involved in preparing *Deppa Tori*?
5. How is the dough shaped before frying?
6. Why is *Deppa Tori* traditionally made in this particular shape?
7. Has the process of making *Deppa Tori* been passed down through generations?
8. On what occasions is *Deppa Tori* usually prepared or served?
9. What cultural values are associated with *Deppa Tori*?
10. Have you ever considered the measurement, comparison, or shape of *Deppa Tori* as mathematical activities?

Appendix C. Mathematical Concepts Identified

Cultural Activity	Mathematical Concept	Mathematical Interpretation
Measuring rice flour and palm sugar	Ratio	The quantities of ingredients form a quantitative relationship.
Adjusting ingredient quantities	Proportion	Ingredient quantities can be increased or decreased while maintaining the same relationship.
Measuring coconut milk and water	Measurement	Standard units are used to determine the appropriate amount of liquid ingredients.
Shaping the dough	Geometry	The shaping process produces a recognizable plane figure.
Final shape of <i>Deppa Tori</i>	Rhombus	The cake resembles a rhombus, which can be used to discuss sides, vertices, diagonals, perimeter, and area.

Appendix D. Example of Contextual Mathematics Activities

The ethnomathematical findings from the making of *Deppa Tori* can be transformed into contextual mathematics activities. For example, students can be asked to determine the amount of each ingredient required when the original recipe is multiplied by two or three. Students can also compare the quantities of rice flour and palm sugar and express the relationship as a simplified ratio.

In geometry lessons, students can observe the shape of *Deppa Tori* and identify its characteristics as a rhombus. They may then

measure the sides and diagonals of a model and use the measurements to calculate its perimeter and area.

These activities demonstrate how a traditional cultural practice can be transformed into a meaningful context for learning formal mathematical concepts.

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