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Ethnomathematics Exploration of Traditional Bugis-Makassar Food Based on The Mathematization of Iceberg Realistic Mathematics Education

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Abstract*. This study aims to explore geometric ideas in traditional food called Tumpi-Tumpi, a typical Bugis Makassar cuisine, and to develop problem-solving abilities using the Iceberg Realistic Mathematics Education (RME) model. This study used a qualitative study with descriptive exploration. Data was collected through observation, interviews, and documentation. Based on the design of Miles and Huberman, the data analysis technique consisted of data reduction, data presentation, and conclusion/verification. According to data collection results, the traditional Bugis-Makassar cuisine Tumpi-Tumpi contains ethnic mathematical components (geometrical concepts), namely, the plane figure of an equilateral triangle, and is used to solve mathematical problems. The Iceberg RME math technique utilized "the model of" and "the model for" to determine an equilateral triangle's features, area formula, and perimeter. Iceberg-based ethnomathematics collaboration may enhance high school student's interest in learning.*
Keywords: *Ethnomathematics; Realistic Mathematics Education; Traditional Food; Bugis-Makassar*

INTRODUCTION

The establishment of mathematics with diversity issues (ethnomathematics) would substantially help mathematics learning in schools since the education system is a foundation of society, unlike most other schooling that enables cross-cultural socialization (Jurdak, 2016). Additionally, ethnomathematics is the consequence of different mathematical activities that the community maintains or conducts. Traditional dwellings, clothing, games, dances, regional linguistic heritage, and traditional cuisine are all still present. Ethnomathematics is the consequence of ethnic behavior in which society sometimes disregards mathematical elements (Zayyadi et al., 2018).

According to D'Ambrosio (1985), ethnomathematics may be found in mathematical notions used throughout daily existence. Amongst this is the concept of geometry, which mainly exists in national attire and cuisine routines. Therefore, the focus of ethnomathematics in this study is on daily community activities for which both a mathematical concept and a geographical culture exist. As a result, ethnomathematics evolves from investigating and examining native customs.

In geometry, applying mathematics to native cultures is ubiquitous among various nationalities in Indonesia (Rosa et al., 2016), such as becoming the Bugis community in Makassar. Bugis Makassar is one of Indonesia's ethnolinguistic communities (Qamar et al., 2017). It is placed on the Indonesian island of Sulawesi. Local culture is an essential and significant component of the existence of the individuals who live locally. The Bugis of Makassar place enormous importance on traditional ethics and persistently preserve the historical tradition that has existed since the earliest. Traditional cuisine is a well-established Bugis historical legacy.

Each event presented in Bugis Makassar City will feature traditional Bugis Makassar food. It increases the popularity of Bugis food in Makassar, particularly among students. Traditional Bugis Makassar food has a complex morphological composition that has remained virtually unchanged since prehistoric times (Pathuddin & Raehana, 2019).

Tumpi-Tumpi is a traditional Bugis Makassar dish employing the concept of geometry (Pathuddin & Raehana, 2019). This dish's shape embodies the concept of geometry upon closer examination. Based on the trend of Tumpi-Tumpi, the author believes it is necessary to investigate and study the geometric principles within, which might be used to solve mathematical problems through mathematical Realistic Mathematics Education.

Realistic Mathematics Education (RME) is a paradigm that emphasizes student participation in discovering and resolving mathematical problems that occur in everyday activities (Rahman, 2018). Students use a conventional strategy that gives a broad range and vertical mathematization to answer problems. Horizontal and vertical mathematical processes are integral to modeling a particular real-world circumstance mathematically.

This modeling method is known as "mode of" and "model for" in RME (Stacey, 2015). The iceberg model (Putrawangsa, 2017) illustrates the concept of models and processes that result in advanced pattern understanding. Discovering traditional Tumpi-Tumpi cuisine with Icebergs may assist students in learning mathematics while preserving the culture of the Bugis Makassar tribal territory.

METHODS

This study is descriptive exploratory qualitative research focused on investigating the mathematical notion of plane figure geometry in the traditional Bugis Makassar cuisine, namely Tumpi-Tumpi. Direct observation of the process of creating traditional cuisine in the town of Pallantikang, Pattallassang district, Gowa Regency, South Sulawesi, was used to gather data. In addition, Mrs. Hasnah Dg. Kanang, as an informant, was interviewed regarding creating Tumpi-Tumpi. In exploring ethnomathematics in traditional Bugis Makassar food, researchers carried out several stages of research. The stages were determining data sources, conducting interviews, conducting documentation, reducing data, presenting data, drawing conclusions, and making research reports in articles.

An interview was conducted with an informant, and documentation was conducted to obtain valid data regarding traditional Tumpi-Tumpi food. The type of data obtained in this study was qualitative data. Data was declared valid if the informant answered based on the guidelines of several archives and was proven by showing related to Tumpi-Tumpi traditional food. Furthermore, data analysis was carried out after obtaining the data to see the mathematical elements contained in the traditional Tumpi-Tumpi food.

Data analysis techniques refer to (Miles & Huberman, 1984) by reducing data, presenting data, and concluding/verifying. Data reduction was classifying, removing unnecessary, and organizing data so that various conclusions could be drawn and verified. Presentation of data was an activity of combining information arranged in a coherent form. After that, a conclusion can be drawn.

RESULTS AND DISCUSSIONS

Tumpi-Tumpi as a plane figure Equilateral Triangle based on Iceberg RME

Traditional cuisine is often found by the Bugis-Makassar community during Ramadan. In addition, Tumpi-Tumpi is also used to celebrate important days such as the prophet's mauled, circumcision, and marriage events. From the results of studies on the shape of food, it is known

that Tumpi-Tumpi has a geometric shape in the form of a plane figure (Busrah & Pathuddin, 2021). To see how the plane figure is created, here is a recipe for making Tumpi-Tumpi as a traditional Bugis Makassar food:

1. Clean the fish, after which cook the fish with turmeric.

FIGURE 1. Fish is Fished and Cooked

2. The bones separate the cooked fish, and the meat is mixed with coconut.

FIGURE 2. Fish and Coconut Meat

3. Ranrang (Makassarese) or fish and coconut puree using a knife and mortar.

FIGURE 3. Ranrang or Fish and Coconut Puree

4. Once smooth, mix it with the sweet potatoes.

FIGURE 4. Fine Dough Mixed with Sweet Potatoes

5. After that, the shape of the Tumpi-Tumpi becomes a Triangle shape using banana leaves.

FIGURE 5. Forming A Triangle with Banana Leaves

6. Finally, fry the Tumpi-Tumpi

FIGURE 6. Frying Tumpi-Tumpi

Based on an analysis of the Tumpi-Tumpi recipe, a geometric idea in the shape of a simple equilateral triangle constructed from banana leaves has been discovered. The properties of an equilateral triangle, namely that the three sides are equal in length, the three angles are equal in size, 60°have three folding symmetries, and rotate, develop this form. Consequently, without really realizing it, the practical activity of producing Tumpi-Tumpi is a product of geometry (plane figure). Students are expected to benefit from the presence of traditional Tumpi-Tumpi cuisine as a plane figure while understanding and solving geometry problems (Mania & Alam, 2021).

Tumpi-Tumpi as a plane figure Equilateral Triangle based on Iceberg RME

The hands-on activity of finding solutions to the plane figure problem by studying traditional Tumpi-Tumpi foods is a mathematical process. Through mathematical modeling, discover geometric concepts through holistic activities, and improve students' mathematical thinking ability to the level of formal mathematics or abstract mathematics (Kaiser, 2020; Simamora et al., 2018). This modeling idea is divided into two process stages, horizontal and vertical mathematization.

The idea of the horizontal mathematization of traditional food begins with students analyzing the process of making and the shape of Tumpi-Tumpi, then doing a strategic by trying to model the shape of Tumpi-Tumpi by recognizing plane figure that can be formed from Tumpi-Tumpi such as triangles, parallelogram, and kites—then continued with the idea of vertical mathematization, where students try to recognize the characteristics of the triangles formed from Tumpi-Tumpi, namely equilateral triangles and know the formula for the perimeter and area of the equilateral triangle.

The horizontal mathematization and vertical mathematization processes are closely related to the mathematical modeling process of the traditional food from the problem given. This modeling process in RME is known as the "model of" and "model for" (Stacey, 2015). The idea of the process model of and model for achieving understanding at the formal level of students in solving geometry problems is illustrated through the Iceberg Model in figure 7.

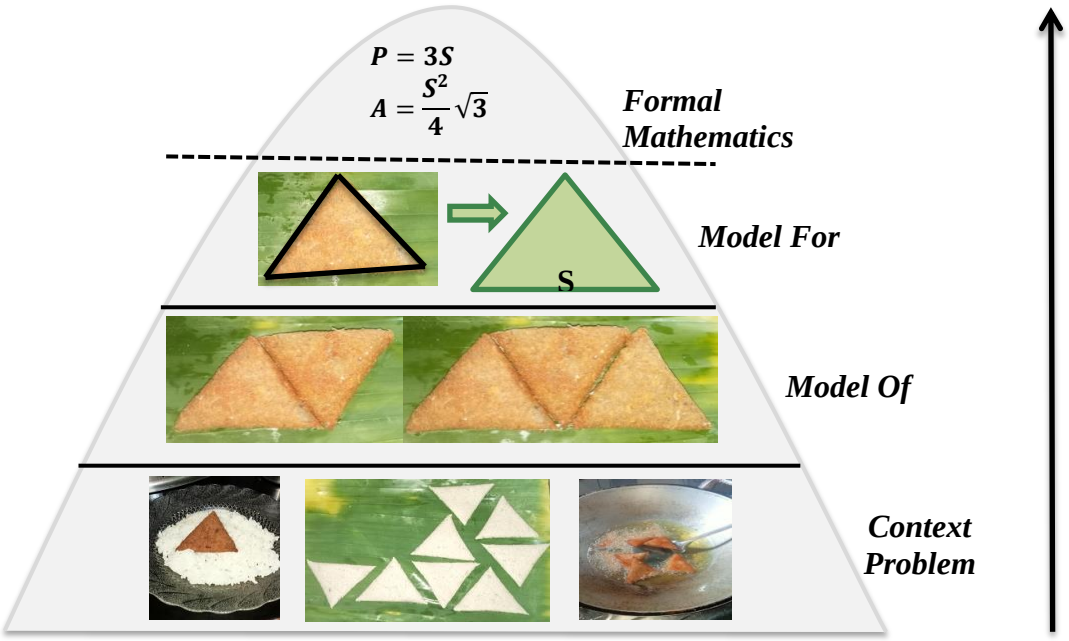

FIGURE 7. Iceberg of the model from the problem, models of, models for, and mathematics

The Iceberg Model, "the model of" which Tumpi-Tumpi shape is analyzed, is a horizontal mathematization. Meanwhile, "the model for" in which students' thinking analyzes the characteristics and standard forms of geometry mathematics is also a vertical mathematization process. Iceberg aims to assist students in solving problems through systematic stages toward forming formal mathematical ideas (Putrawangsa, 2017).

CONCLUSION

Based on the results of research on traditional Bugis Makassar Tumpi-Tumpi food, there are two important subjects that can be concluded. First, there is an ethnomathematics element, namely the concept of plane figure geometry consisting of equilateral triangles explored by making Tumpi-Tumpi with banana leaves. The existence of ethnomathematics aims to help students explore the culture and put it into mathematical concepts. Second, there is a solution to mathematical problems through ethnomathematics with the Iceberg mathematical process, namely the model of and the model for, to increase the level of critical thinking of students into the formal mathematics level of students in the form of discovering characteristics and formulas of area and perimeter of equilateral triangles.

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