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## Teachers' Perception toward the Use of Ethnomathematics Approach in Teaching Math

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## Teachers' Perception toward the Use of Ethnomathematics Approach in Teaching Math

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### Abstract

Albeit the research on the ethnomathematics have extensively undertaken, little empirical evidence reports teachers' perception on the ethnomathematics approach. To fill the gap, this present case study showcases that the teachers positively perceived ethnomathematics approach. The case study design was applied in this study with a focus on an exploratory overview of Indonesian's teachers understanding ethnomathematics and practices. Teachers apply myriad media from Buginese and Makassar traditional meals and games in teaching math through the ethnomathematics approach, and most participants agree to include ethnomathematics in the math curriculum. This study found from the findings that by ethnomathematics students can grab the lesson easily and acknowledge their own culture based on the Indonesian National curriculum. Drawing on these findings, policy recommendations for teachers and school stakeholders, along with conceptual and empirical implications are discussed.

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### Introduction

The scores of National Examination of junior high school students in mathematics decreased in the last five consecutive years. In 2015, Data from the Ministry of Education and Culture of the Republic of Indonesia showed the average mathematics score for junior high school students (56.26). In 2018 and 2019, the average score significantly declined to 43.34 and 45.52 and became the lowest national average among four subjects tested in the National examination.

Similarly, the study results of the Program for International Students Assessment (PISA) released in 2019 showed that Indonesian students had a math drop from 386 in 2015 to 379 in 2018, and the Indonesian rank in math was 73 from the 79 countries assessed. Students' and teachers' ability of higher-order thinking skill (Retnawati et al., 2018), teachers' work performance (Atmotiyoso & Huda, 2018), and teachers' and students' beliefs and perceptions (Kusaeri & Aditomo, 2019; Siswono et al., 2019), lacking cultural contextualized (ethnomathematics) in the teaching process (Mauluah & Marsigit, 2019; Utami et al., 2019) are considered to be some of the factors influencing students' interest and performance on math in Indonesia (Budiharso & Tarman, 2020).

A few studies have focused on cultural contextualization or ethnomathematics. Existing studies on ethnomathematics can be divided into three categories; the first category lists studies about ethnomathematics related to practical mathematics concepts in cultural life. Several studies have found that ethnomathematics concepts have been used in estimating, measuring, and making patterns in creating cultural sites, crafting, and fashion in Indonesia (Maryati & Prahmana, 2019; Muhtadi et al., 2017) and in the Philippines (Rubio, 2016). The second category includes studies that examine the use of ethnomathematics in the mathematics' curriculum and pedagogy in several countries such as in Hawaii (Furuto, 2014), Israel (Fouze & Amit, 2018a) and Indonesia (Hartinah et al., 2019), specifically in teaching geometry (Sunzuma & Maharaj, 2018; Supriadi, 2019; Verner et al., 2013). The third category of studies highlights the teacher's competence on teaching math through ethnomathematics like in Papua New Guinea (Owens, 2014) and Indonesia (Sintawati et al., 2019). Such studies have failed to present the teachers' perception towards ethnomathematics approach.

This study aims to fill the gap by exploring teachers' perception of teaching math through the ethnomathematics approach in several schools in South–Sulawesi, Indonesia, by answering three questions. First, how do teachers perceive teaching mathematics through the ethnomathematics approach in math classes? This question is expected to contribute to schools' stakeholders in Indonesia, particularly to consider a new approach namely, ethnomathematics in teaching mathematic in order to increase students' scores in math. Second, why and how do the teachers apply the ethnomathematics approach to teaching math? This question will contribute to the mathematics teachers on what and how to teach mathematics in recreational ways by including cultural media that are commonplace in the students' lives. Third, how should ethnomathematics be included in the math curriculum? This question seeks to contribute to the mathematics curriculum in Indonesia by combining the ethnomathematics curriculum with Indonesian National curriculum.

This article draws upon three arguments. First, using the ethnomathematics approach in teaching math in schools is more acceptable and enjoyable in the teaching and learning process; furthermore, mathematics concepts will be easier to be understood. Second, recently media used in teaching math and learning process focus on the concept and fail to contextualize based on the students' cultures and backgrounds. Third, the math curriculum should have been contextualized to the Indonesian culture; moreover, Indonesian culture is immensely diverse and can be explored. In other words, the math curriculum and pedagogy must maintain and explore more on the ethnomathematics approach.

## **Literature Review**

### **Ethnomathematics Approach**

Ethnomathematics was first introduced in 1978 by D'Ambrosio at the American Association for the Advance of Science (AAAS) annual meeting (Aslan Tutak et al., 2011). D'Ambrosio (2001) used the term of ethnomathematics to express the connection between culture and mathematics. Ethno is described as all the elements that form a cultural identity, such as language, codes, jargon, values and beliefs, food and dress, and habits. Mathematics, which is close to the cultural perspective, includes arithmetic, classifying, ordering, and modeling. For instance, Sasak ancestor, in Lombok, measured home living and worship building by using

anthropometric ability (Supiyati et al., 2019). Ethnomathematics is simply defined as the style, art, and method of understanding, managing, explaining, and connecting between mathematics and the environment—social and nature. Although criticism emanated from some teachers that believe mathematic teaching should be culture-free (D. Clements, 2016; Hobson & Vu, 2015; Muntersbjorn, 2016), several teachers perceive ethnomathematics approach positively. Previous studies found that teachers were excited and fascinated by the learning approach through ethnomathematics (Verner et al., 2013). Teachers also claim that ethnomathematics approach supports students in improving self-conception and higher-order thinking skills, making the subject more accessible (Fouze & Amit, 2018b; Utami et al., 2019).

### **Teaching Math through Ethnomathematics**

Teaching math through ethnomathematics is not only interesting but also capable of presenting context and engagement. When context and engagement appear in the learning process, students find it easier to understand the lesson and are more likely to bring experience into their daily lives (Meaney & Lange, 2012; Snounu, 2019). As a result, students are prepared to live in societies concerning cultural dignity, show critical reflexivity toward social justice, and be aware of their duties or responsibilities in the practice of citizenship (D'Ambrosio, 2018; Lafer & Tarman, 2018; Rosa & Orey, 2015; Solikhah & Budiharso, 2019).

Using ethnomathematics as a teaching approach and method can vary depending on which culture the students belong to. In the past decade, there have been studies conducted toward the application of ethnomathematics in the classroom, such as teaching geometry in the lower grade through ethnomathematics of the Borobudur temple (Muhammad et al., 2020) and Prambanan temple (Fitrianawati et al., 2020). From the Borobudur temple, elementary students identify square, rectangle, triangle, and circle (Muhammad et al., 2020). Kraton Jogja has many cultures that can be explored to be used as materials in teaching math, such as measuring the height of Gunungan, counting the area of Batik motif, counting the calendar of Sultan Agung (the king of Jogya), drawing the shape of the part of Kraton, and etc. (Mauluah & Marsigit, 2019). In Banten, flat rectangular shapes by using Sundanese culture board media were used to teach math through the didactical design research (Supriadi, 2019). The ethnomathematics approach brings context and engagement along with excitement into the classroom.

### **Ethnomathematics Curriculum**

In order to respect the cultural dignity, context, and engagement in learning mathematics, it has become necessary to reconceptualize the curriculum based on ethnomathematics called the Trivium Mathematics Curriculum, which consists of literacy, matheracy, and technocracy (D'Ambrosio 1999 as cited in Rosa & Orey, 2015). Literacy is the integration of schools and cultural context through the process of cultural dynamism (Ajaps & Obiagu, 2020; Bigagli, 2019; Newton et al., 2020). The literacy approach requires students to mix and exchange their academic knowledge that they gather from schools with their own cultural background (Erbilgin, 2017; Rosa & Orey, 2015; Tarman, 2016). For example, in teaching geometry concepts, teachers present traditional games, such as Pacu Jalur in Riau. By knowing the weight, height, and shapes of the boat used in Pacu Jalur, students can learn geometry, shapes, and measurements at the same time (Fendrik et al., 2020).

Matheracy is defined as the ability to use and interpret signs and codes. In the context of Ethnomathematics, matheracy supports students in reading and identifying mentifact and artifacts in a particular culture (Rosa & Orey, 2015); understanding the function and the meaning of the kingdom's logos is an example. Technocracy deals with the technology used. With the massive increase in technology, it is necessary to integrate mathematics teaching and technology such as computers and digital tools. In the practice of technocracy, students insist on being able to use technology tools to solve mathematics problems and to find solutions in their everyday lives (D'Ambrosio & D'Ambrosio, 2013; Mainali, 2021). Using YouTube-based ethnomathematics learning to improve the problem solving-students' ability in Middle school and high schools is an example (Nugroho, 2019).

The ethnomathematics curriculum has not been used massively in the math curriculum nowadays, which is proven by the research that addresses it. Previous studies mostly conclude that the ethnomathematics curriculum has changed the way of mathematic is taught. For instance, Brazil's ethnomathematics curriculum renders learners more critical and reflective (Rosa & Orey, 2018). Meanwhile, The ethnomathematics curriculum for grades 7 and 8 in Jose Panganiban Camarines Norte, the Philippines, is considered to contribute to mathematics education (Rubio, 2016), which is also applied in Turkey, and with this curriculum, students' academic achievement in math has improved (Fouze & Amit, 2018b). In Indonesia, although some studies have examined ethnomathematics approach in teaching/ pedagogy (Fitrianawati et al., 2020; Maryati & Prahmana, 2019; Mauluah & Marsigit, 2019; Muhtadi et al., 2017; Sunzuma & Maharaj, 2018; Supriadi, 2019), limited studies have specifically focused on the ethnomathematics curriculum. In fact, in line with the trivium mathematic curriculum concepts, Ministerial Education Regulation number 21, the year 2016 about Standard Content, directly and indirectly have the concept of the ethnomathematics.

The objectives of the unit of mathematics based on Indonesian Ministry education are: (1). students are able to understand the mathematical theory and explain the interrelationship between concepts, such as logarithms concepts. (2). Students are able to use reasoning on patterns and traits, formulating evidence, or articulating mathematical ideas and statements. (3). Students can solve problems, design mathematic models, and interpret solutions. (4). Students can communicate their ideas with symbols, tables, diagrams, and (5). Students appreciate the usefulness of mathematics in life (Mauluah & Marsigit, 2019).

By analysing the trivium math curriculum concept and Indonesian standard content for mathematics learning above, it is necessary to formulate and reconstruct a new mathematic curriculum in Indonesia. The previous concepts of the curriculum have not focused on the Indonesian context, which is characterized by various ethnicities, culture, and philosophy. For instance, in Buginese, there is a tradition called 'menre bola' or celebrating new house. This celebration serves traditional meals (e.g., barongko and tumpi-tumpi) which have philosophical values. Most of the students in South Sulawesi are familiar and consume these meals. It has recently turned out that those meals have shapes that can be used as teaching media in teaching mathematics. At this point, the trivium mathematic concept can be adopted and applied in the context of mathematics learning in Indonesia.

## Methods

The case study design was applied in this study with a focus on an exploratory overview of Indonesian's teachers understanding ethnomathematics and practices. It examined how teachers perceive and use ethnomathematics approach in classroom. The guiding questions are as follows: how do teachers perceive teaching mathematics through the ethnomathematics approach in the math classroom? Why and how do teachers apply the ethnomathematics approach to teaching math? And how should ethnomathematics be included in math curriculum?

### Context and Participants

This study took place in two regencies in South Sulawesi, namely Makassar and Gowa. These sites were purposely chosen based on several factors, such as types of schools (e.g., public and private schools, middle school and Islamic middle school), and teachers (e.g., gender, and ethnomathematics service–training participation). Makassar and Gowa and are located at the centre of South Sulawesi. Makassar itself is a capital city of South Sulawesi that has the largest population with the most schools compared to other cities in the south Sulawesi province. Because Makassar and Gowa are education, business, and government centres, the students are from many different cultures and backgrounds, which allow the teachers to explore many cultures (e.g., Makassar and Buginese foods and games) in teaching mathematics. Teachers-participants were purposely recruited from the data of ethnomathematics training that was conducted in 2016. The training was held by the mathematics department in one of the Islamic Universities in Makassar and included six public and private middle schools with two math teachers as representatives from each school. However, only six teachers were interviewed voluntarily in this study. Five of them teach in public schools, and another teaches in a private school. Four teachers teach in Makassar, and two of them teach in Gowa. In addition, from all participants, only one male teacher volunteered in this study, as the majority of math teachers in Makassar and Gowa were female, and limited male teachers participated in ethnomathematics training. Table 1 displays the list of the participating of teachers based on gender, name of schools, type of schools, and location

Table 1. Teacher – participant lists based on Gender, Name of Schools, Type of School, and Location

ID	Unit	Gender	Name of schools	Type of schools	Location
P1	Participant 1	Female	Islamic Middle School 1 Makassar	Public	Makassar
P2	Participant 2	Female	Middle School 27 Makassar	Public	Makassar
P3	Participant 3	Female	Middle School 26 Makassar	Public	Makassar
P4	Participant 4	Female	Middle School 2 Makassar	Public	Makassar
P5	Participant 5	Male	Islamic Middle School Madani	Private	Gowa
P6	Participant 6	Female	Islamic Middle School Gowa	Public	Gowa

### Data Sources and Analysis

Before conducting in-depth interviews with the teacher-participants, the researchers interviewed all

ethnomathematics training trainees to identify their backgrounds. The researchers gave a form to 12 participants, but only six of them were ready to volunteer in the in-depth interviews. Due to the COVID-19 pandemic, in-depth interviews were conducted through phone calls. The objective of the interview was to have more in-depth and exploratory information to explore and gather richer data. In order to have examples of ethnomathematics approach, the participants were asked to send their ethnomathematics teaching materials and picture of media that they used in their classroom through email voluntarily.

The interview session was audio-recorded using a recording device and took approximately 45 minutes for each participant. The interview guidelines used included interview questions related to the teachers' views of the ethnomathematics approach, how and why ethnomathematics should be implemented, and the mathematics curriculum for middle schools' students in Indonesia. In order to maintain the participants' anonymity, the participants were coded as participant 1, participant 2, participant 3, and so forth. During the interview, the researchers used Bahasa Indonesia in order to get more in-depth information.

The recorded data was immediately transcribed and translated into English. The analysis entailed reading the researchers' notes and transcribing them verbatim. The researchers then broke down the raw data and synthesized it to find patterns using cross-case analysis (Strauss & Corbin, 1990). During this process, the researchers identified themes and patterns.

## **Results**

### **Teachers' Perception toward Ethnomathematics Approach**

Most of the teachers who participated in this study used ethnomathematics approach in their classroom and participated in the ethnomathematics service training. The findings of this study indicate that all teachers have a positive perception of ethnomathematics approach. The teachers reported that they were interested and supported ethnomathematics approach to be used in classrooms. In general, teachers claim that ethnomathematics approach can stimulate and motivate students to learn mathematics, it overcomes boredom and gives new nuances as a result as learning becomes more interesting, teaching and learning become meaningful and students understand easily grab the lesson. Participant 1 pointed out that:

*My view is that mathematics learning based on the ethnomathematics approach motivates, stimulate students, overcome boredom and provide new nuances in learning mathematics.*

Ethnomathematics is part of the daily lives of students and it is the initial concept they already have in their local socio-cultural environment. Participant 2 pinpointed that:

*Connecting school mathematics with cultural activities and the context of students' everyday life is not only interesting but also minimize the difficulties that students experienced in learning math.*

It is appealing to find a relationship between school mathematics and out-side school mathematics because mathematics is a communication tool and a cultural product that was created to solve problems. Mathematics is a form of human thinking activity as an effort to interpret the environment systematically. Understanding the

students' cultures and background is important, given that it will lead to understanding their mathematical thinking. Understanding students' mathematical thinking will make it easier to determine the most appropriate mathematics learning approach for them.

All teachers in this study support teaching math through ethnomathematics approach and agree that teaching math in Indonesia should be contextualized according to students' culture. Participant 4 demonstrated that:

*I really support ethnomathematics-based mathematics learning. Basically, students have one of the learning assets of mathematics, namely cultural capital. Students already have mathematical knowledge and experience of mathematics from their cultures and environments. This thing is sometimes ignored by the teachers in schools, in fact mathematics learning will be more meaningful if it is related to the students' daily life.*

The statement above demonstrates that teachers recognize if ethnomathematics will be meaningful in mathematic teaching and learning. However, the teachers usually do not use it in their classrooms.

On the whole, teachers consentaneously agree that culture-based mathematics learning (ethnomathematics) is appropriate to be used in Indonesia because of the cultural diversity and the many artefacts or cultural buildings that can be used as models or examples. In addition, learning with a cultural approach can facilitate students to get to know, understand, and appreciate cultural values in their lives, foster students' awareness on their culture and help students easily adapt to mathematics teaching and learning process.

### **Teaching Mathematics through Buginese Traditional Meals and Games**

Most interviewed teachers agree that through the ethnomathematics approach, teaching and learning are not only effective, easily understood, and fun, but teachers can also introduce the existing culture and elaborate on the values of that culture in the student environment. Participant 5 stressed that:

*The reason I used ethnomathematics is that learning mathematics with an ethnomathematics approach is more effective. My students find it easier to understand the subject, because the media that I use is directly related to my students' cultures.*

The statement gives a perspective that ethnomathematics approach was beneficial for the teacher because it is considered more effective and is also beneficial for students as it allows students to understand easily the material given. Moreover, the presence of ethnomathematics in mathematics learning brings a new atmosphere because learning is not only focusing on listening to the teacher's explanations, but it is also attractive because of the use of various media and learning resources familiar to the students. Besides, the learning process can be applied both in the classroom and outside by visiting or interacting with local cultures, artifacts, and buildings.

The teachers in this study used various ways and resources in teaching math through ethnomathematics approach. Most commonly, teachers apply ethnomathematics approach in teaching geometry with several different media, such as traditional cakes, batik, and picture of traditional games. Participant 2 used traditional

meals from Buginese culture called barongko, and tumpi-tumpi. She brought these meals to the class, and students were asked to observe. The example lesson can be seen as follows:

1. Teacher asks students to observe the media (e.g. tumpi-tumpi or barongko).
2. Teacher explains the materials to students then try to help and stimulate them to ask some questions related to the materials.
3. Students do the exercise provided.
4. Students analyze the materials by discussing with their group.
5. Students are asked to work on other problems that are relevant to the material, and then they present their works to the class.
6. Other students are asked to observe, to ask questions, and then conclude (can be in writing or verbally).

In teaching and learning activities by using traditional meals, students can learn the concept of geometry contextually, so that students feel engage to the learning process because they find it in their real lives.

### *Traditional Buginese Meals*

*Barongko.* Barongko has a geometric concept, namely a triangular prism. A prism is a space that has a parallel and congruent base and upper plane. By using barongko, the teacher introduces the features of a triangular prism (Figure 1).

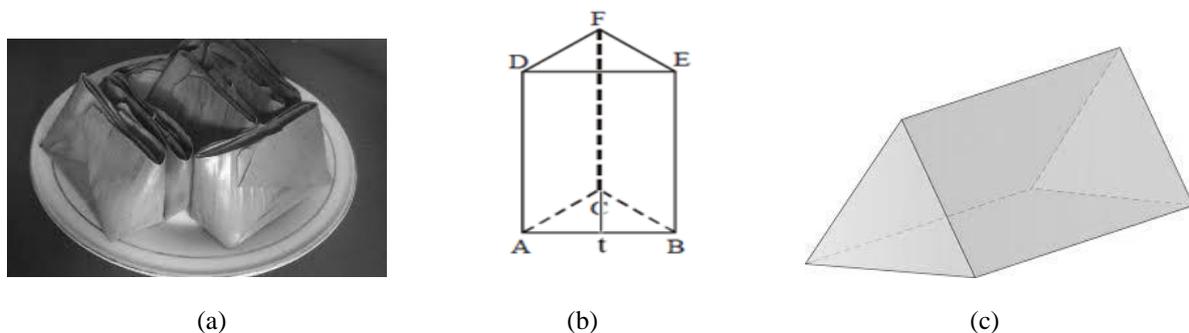


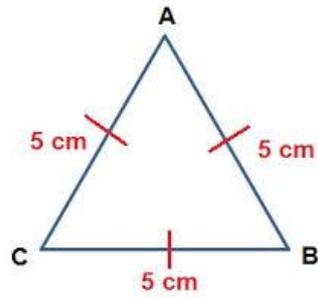
Figure 1. Features of a Triangular Prism

Figure (a) Barongko and Figure (b) Barongko has 5 sides consisting of 2 congruent triangles and 3 rectangles. The congruent sides of the triangle are ABE and CDF (b). The sides of the rectangle are ABCD, BCEF, ADEF; Figure (c) Barongko has a base and a triangular top. Having 9 ribs, the vertical ribs are the same length. The nine ribs are AB, CD, AE, CF, BE, DF, BC, EF, and AD. The abstract and slightly confusing is what the teacher wants to simplify by using barongko.

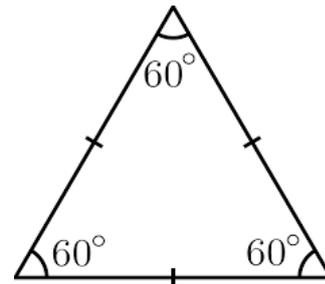
*Tumpi – tumpi.* Tumpi-tumpi has geometry concept that is, an equilateral triangle (Figure 1). To introduce this feature, the teacher cuts the bladders following each line. After knowing the features of shapes and spaces using various ethno-based media, the teacher then asks students to identify objects around them that have the same features. (The pictures and the explanations are provided and sent by participant 2).



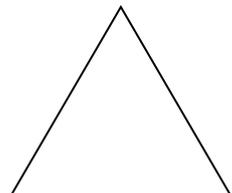
(a)



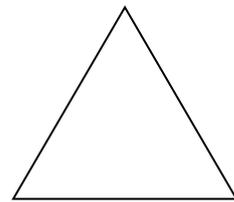
(b)



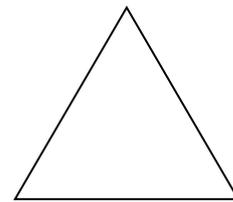
(c)



Starting position



After rotating 60 degrees



After rotating 120 degrees

(d)

Figure 2. a) Tumpi-tumpi. By using the tumpi-tumpi, the teacher introduces the equilateral triangle; b) All three sides are the same length; c) The three angles are the same, 60 degrees each; d) Has 3 equal rotating symmetries.

### Traditional Games

Besides the traditional meals that teachers used to teach geometry, participant 5 used a traditional game, namely Engklek. Engklek has mathematical elements: flat shapes, counting, nets, congruence, reflection, probability, and mathematical logic. The teacher introduces the shape of the Engklek, which consists of a rectangular and semicircular as can be seen in Figure 3.

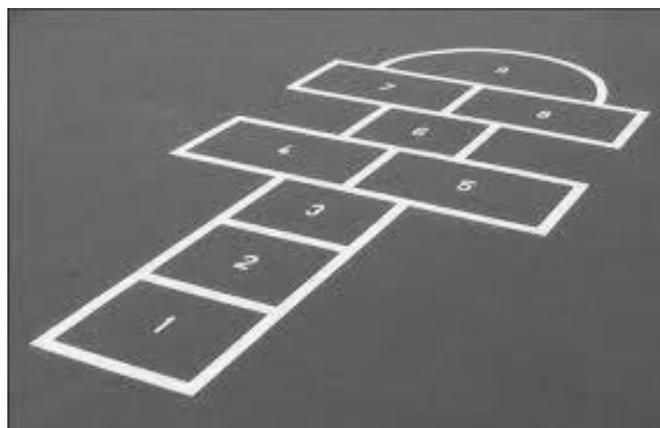


Figure 3. The Shape of the Engklek

In addition to having the elements of a flat shape, the teacher asks students to identify elements of reflection. This can be seen from the shape of the plot. If the axis of symmetry is drawn, it will cut the Engklek plot into two parts right and left and will show the right side of the symmetry with the left. Reflection illustration can be seen in Figure 4.

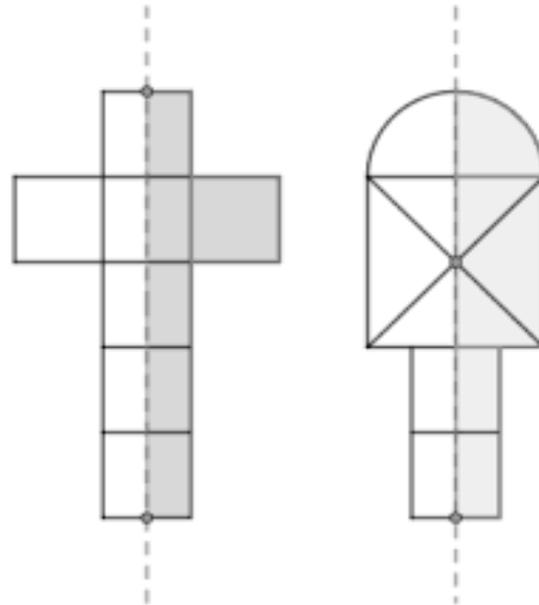


Figure 4. Reflection Illustration of Engklek

The third element that the teacher introduced through the Engklek is the element of emptiness. This element was introduced to the students by inviting them to observe each plot that had the same shape. Another element in the Engklek plot is counting; it can be seen in the sequence of squares traversed in the game. (The pictures and explanations are sent by participant 5).

Although the use of ethnomathematics in teaching math is varying and considered exciting for students, a few informants argue that many teachers have tried to apply the ethnomathematics approach in their class, but sometimes teachers find it challenging to implement it in the classroom. Participant 4 said:

*I myself have not applied teaching using the ethnomathematics approach because I have not understood the steps of learning ..... Besides that, as a teacher, I have not been fully able to integrate the mathematics material ..... Another reason is that I rarely find ethnomathematics-based teaching materials.*

Teachers generally understand ethnomathematics; however, others do not use it because they are unfamiliar with the teaching method and do not know to use the media or resources.

### **Ethnomathematics Based-Curriculum**

The Indonesian curriculum did not fully adopt the trivium curriculum initiated by D'Ambrosio, but the ethnomathematics curriculum is possibly included in the 2013 Indonesian curriculum because the principle of both curriculums has similarities as most teachers in this study suggested. The participants who agreed to use the ethnomathematics approach in the Indonesian curriculum had similar reasons that Ethnomathematics approach integrate students' knowledge from schools and outside the schools. Moreover, ethnomathematics approach possibly causes the students to have the awareness to preserve their culture. Preserving culture fits into

the 2013 Indonesian national curriculum.

The ethnomathematical approach perceives that mathematics will be more meaningful and contextual if the material is related to the students' culture. Besides, teachers believe that by integrating school knowledge and culture, students will preserve their own cultures. Participant two revealed that:

*the school curriculum should be integrated with culture in the hope that students will always preserve their culture.*

This is in line with D'Ambrosio's statement that the purpose of Ethnomathematics is that in teaching mathematics. Teachers should integrate students' mathematical knowledge with students' cultures and background by considering other forms of society's activities, such as ways of grouping, counting, measuring, designing buildings, and playing in order to learn and preserve the culture (D'Ambrosio, 2001).

The basic principle of learning in the 2013 Indonesian curriculum emphasized that students should be independent and active learners. The role of the teacher is a facilitator, not the only source of learning. Also, students are expected to learn using various learning resources with a scientific approach and using information and communication technology to increase the efficiency and effectiveness of learning and recognition of individual differences and students' cultural backgrounds. The participants of this study view the Indonesian curriculum fits the ethnomathematics approach. Participant 6 revealed that:

*Ethnomathematics should be included into the school curriculum. Indonesia curriculum instills scientific thinking and character education so that it becomes very rational to integrate ethnomathematics approach and mathematics learning.*

By looking at the basic principle of the Indonesian curriculum above, it is necessary to include ethnomathematics approach in the math curriculum.

## **Discussion**

All teachers articulated their opinions positively toward ethnomathematics approach. They reported that the ethnomathematics approach is interesting and can overcome students' boredom in studying math. This is because teachers can concretize the abstract formula of mathematics to reality that is close to students' lives. For example, in the game of Buginese and Makassar, students easily understand the shapes (e.g., rectangle and square) because they play the game daily. These findings are consistent with the findings of a number of researchers (Ebersole & Kanahale-Mossman, 2020; Fouze & Amit, 2018a; Honegger, 2020; Utami et al., 2019; Verner et al., 2013;). They commonly reported that mathematics concept is understood easily. Turan and Matteson (2021) pointed out that by understanding mathematics concept, students can increase their achievement. Additionally, most participants in this study suggest using the ethnomathematics approach in the classroom because teaching math that is culturally contextualized can stimulate and motivate students to learn math. This finding implies that students can be motivated to learn mathematics through ethnomathematics approach; therefore, the school stakeholders need to pay attention and facilitate for teachers e.g., conducting ethnomathematics training, encouraging math teacher to use ethnomathematics approach in their classrooms,

and providing medias.

In this study, most teachers in Makassar and Gowa, Indonesia, teach mathematics through Buginese traditional meals and games. Traditional meals such as barongko and tumpi – tumpi are usually consumed by students in South-Sulawesi. Those traditional cakes can be found easily so that teachers can bring them to the class. Barongko is made from mashed banana and other ingredients like eggs, coconut milk, and salt. After all the materials are mixed, it is then covered by banana leaves as can be seen from the picture above. Barongko is made from bananas and covered by banana leaves, which philosophically means ‘it must be the same as on the outside and what is inside or say what you feel, do what you say, and feel what you do’, people say in the Buginese language ‘taro ada taro gau’ (Pathuddin & Raehana, 2019). In addition, many cultural figures and historians in Bugis and Makassar claim that tumpi-tumpi, which is made from fish and grated coconut, is a symbol of happiness (Ami & Yuliana, 2020).

Besides traditional food, teachers sometimes introduce traditional games such as engklek. Engklek was a popular game in the past. Some Indonesian historians believe Netherlander introduced it in the colonial era. Engklek can be interpreted as a symbol of human efforts to build a place to live and a symbol of human efforts to achieve power. In achieving the goals, humans need to keep trying based on the rules that have been made (Febriyanti et al., 2018). Unlike the finding of this study where teachers mostly used traditional meals and games in Makassar and Gowa, previous studies found that most of the teachers in other parts of Indonesia (e.g., Java and Sumatera) utilize cultural building, such as temples and traditional houses (Fitrianawati et al., 2020; Muhammad et al., 2020), fashion such as batik, artistic board and calendar (Mauluah & Marsigit, 2019; Supriadi, 2019) as media for teaching mathematics. These findings imply that teachers may apply many kinds of media in teaching mathematics based on the students’ culture and background because Indonesia has various ethnicities, cultural sites, fashions, buildings, traditional cuisines, and traditional games.

Most of the participants agree to integrate the ethnomathematics curriculum and Indonesian national curriculum. They have a similar reason that by including ethnomathematics, mathematics will be more meaningful. This finding is in line with previous studies that identify ethnomathematics contributions to students’ math (Fouze & Amit, 2018b; Rubio, 2016) in rendering students critical and reflective (Rosa & Orey, 2015), making mathematics more meaningful. Besides, by contextualizing mathematic with the students’ culture, students will preserve their culture. Additionally, concerning preserving culture in the Indonesian context, the trivium mathematic curriculum needs to be extended by adding one aspect that contains philosophy or contextual contribution, namely quadrivium mathematics curriculum. As a result, teaching math through cultural media, such as traditional food, teachers teach not only mathematics content but also philosophical values.

## **Conclusion**

Ethnomathematics are precisely not only fun and meaningful, but also more concrete in the students’ minds. Concretely, students can see and find traditional meals and games daily that teachers can use as media to teach mathematics. This study has mainly found teachers’ positive perception of the ethnomathematics approach. All

participants suggest to adopt ethnomathematics in the Indonesian math curriculum, given the similarities it has with the concept of ethnomathematics or trivium mathematic curriculum, which is introduced by D' Ambrosio, and which focuses on the students' cultural context. By contextualizing Indonesian culture to mathematics learning, it is expected that students can grab the lesson easily and acknowledge their own culture.

Based on the data presented earlier, this study recommends that school stakeholders, who are interested in applying the ethnomathematics approach, improve the teaching quality of math in their schools. School principals need to pay more attention to the school curriculum by including ethnomathematics and enabling teachers to have ethnomathematics service training. Not to mention, this study bears both conceptual and empirical implications toward the teachers' perception of ethnomathematics. D' Ambrosio, with his trivium mathematic curriculum, propound literacy, materacy, and technocracy, this study adds one content, namely contextual contribution of philosophy. In other words, this study proposes a quadrivium mathematic curriculum. Empirically, this study finds a correlation between students' motivations and ethnomathematics approach, which was not considered in the previous studies.

The limitation of this study is not only found in the limited data of teachers, but also the limited ethnicities; so this study cannot provide a comprehensive understanding of ethno-mathematics learning in the Indonesian context, which has many ethnicities, cultures, and life philosophies. Therefore, future research can further explore how ethnomathematics learning is related to other ethnicities, cultures, and the diverse life's philosophy in Indonesia. Furthermore, the correlation between students' motivation in learning mathematics and the ethnomathematics approach by involving more teachers and students as participants can be further examined. Likewise, the quadrivium mathematics concept, which consists of literacy, materacy, technocracy, and philosophy is needed to have in-depth and broad analysis by exploring diverse ethnicities, cultures, and philosophical values.

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