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ETHNOMATHEMATICS EXPLORATION IN THE *PED'OA* TRADITIONAL DANCE OF THE SABU COMMUNITY IN THE RAIJUA DISTRICT

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Abstract

Ped'oa is a traditional dance performed in mass by the Sabu community in a circle and led by the dance leader or *mone pedjoe*. This research aims to explore ethnomathematics in the *Ped'oa* traditional dance of the Sabu Community in the Raijua District. In addition, through ethnomathematics exploration, we can identify various mathematical concepts that exist in the *Ped'oa* traditional dance of the Sabu community in the Sabu Raijua Regency. This research is qualitative-explorative research with an ethnographic design. The subject of this study consisted of five people who were dancers and leaders of the cultural society. The data in this research is obtained through interviews, observations, and documentation. The data validity test is carried out by triangulation of sources. The data obtained were analyzed using Spradley's model data analysis techniques carried out through domain, taxonomy, componential, and cultural themes analysis. The results of this study showed that there is ethnomathematics in the *Ped'oa* traditional dance which is indicated by the characteristic of counting, locating, designing, and explaining activities. Based on those activities, mathematical concepts can be identified in the *Ped'oa* traditional dance, including multiplication, geometry, number patterns, geometric transformations, and mathematical logic. Those various mathematical concepts can be developed by designing mathematics learning tools that can be applied in mathematics learning, both for primary and secondary education levels.

Keywords: ethnomathematics, mathematics learning, mathematics concept, ethnography, local culture

1. Introduction

Mathematics is one of the subjects taught in schools at various levels, from elementary school to college (Hariastuti, 2017; Wijayanto, 2017). Mathematics is an abstract science related to complex formulas (Wulandari, 2020), thus making mathematics a subject that is difficult for students to understand (Pathuddin et al., 2021).

In learning mathematics, many teachers still use conventional learning methods that only present material monotonously of abstract concepts to concrete concepts to make students unhappy, feel bored, and can reduce student interest in learning mathematics (Irawan & Kencanawaty, 2017). It confirms that mathematics learning tends to be separated from the context, so students only interpret mathematical knowledge as abstract computational knowledge and procedures. It makes learning becomes less meaningful, which results in students' meaning of mathematics being something that has no connection to local life and culture (Fauzi et al., 2022). One of the reasons for this is the lack of teacher knowledge about the relationship between mathematics and local culture (Santoso et al., 2022), which has the potential to cause a poor understanding of students' mathematical concepts. In addition, in mathematics learning, teachers rarely or never use sociocultural contexts close to students' lives (Rudyanto et al., 2019; Supriadi et al., 2016).

Therefore, there is a need for innovations in the mathematics learning process that allow students to learn and understand mathematics better. One alternative solution is to teach mathematics through contextual learning resources that are real, relevant, and familiar to students, namely local culture (Pathuddin et al., 2021). It is because mathematics is born and formed from the experience or culture of community in all aspects of life (Zaenuri et al., 2017). Mathematics learning that utilizes sociocultural contexts that are closely related to students' daily lives will make students learn mathematics through situations that are real, relevant, and familiar to students. The use of sociocultural contexts in learning is also in line with Law Number 5 of 2017 concerning the promotion of cultures that aims to educate the nation's life and can preserve the nation's cultural heritage (Kementrian Pendidikan dan Kebudayaan, 2017). Furthermore, this allows students to be more interested in learning and understanding mathematical concepts while facilitating students to be more creative and critical in thinking to solve various mathematical problems (Fauzi et al., 2022; Radiusman et al., 2021). Learning that connects culture with mathematics is called ethnomathematics (Pathuddin et al., 2021).

Ethnomathematics can be defined as mathematics that is practiced and even developed in certain cultural groups (D'Ambrosio, 1985). Gerdes suggests that ethnomathematics is a field of research that studies and examines mathematics or mathematical knowledge related to the overall culture and social life of certain cultural groups (Gerdes, 2001). It is in line with the opinion of Fredy et al., (2020) stated that ethnomathematics is a technique that can explain and understand mathematics originating from culture by exploring the mathematical concepts contained in the culture. In addition, ethnomathematics is also a science that studies community cultural and historical heritage related to mathematics and mathematics learning (Fatkhurohman et al., 2021). Furthermore, (N. D. Zaenuri et al., 2017) emphasized that ethnomathematics is an idea that combines mathematics learning with a culture to create more meaningful student learning and understanding. Thus, it is necessary to study culture first before applying it to mathematics learning (Pramudita & Rosnawati, 2019). Furthermore, the results of the study can be used as material for a mathematics learning plan which is then applied in the process of learning mathematics in school. The first step that needs to be done in exploring and assessing community culture is to explore elements of community culture that contain mathematical concepts.

Raijua District is one of the districts in Sabu Raijua Regency, East Nusa Tenggara Province. The cultural diversity of Sabu is naturally a source of pride that must be maintained and further explored and integrated into various sectors of community life, one of which is education. It can foster a sense of love for culture. The culture of the Sabu community can be a source of learning in mathematics learning. *Ped'oa* traditional dance is one of the cultures of the Sabu community in the Raijua District (Ceunfin & Dewi, 2020). It is a dance performed by the Sabu community in mass and accompanied by verses of songs chanted by the *mone pedjoe* as the leader of the dance and also accompanied by (Ceunfin & Dewi, 2020; Sooai & Qisty, 2021). *Ped'oa* traditional dance can be a source of learning in mathematics learning because it contains mathematical activities. In the *Ped'oa* traditional dance, there are activities to count the number of dancers and count the number of *ke'due* used by dancers and others. Therefore, this study aims to explore ethnomathematics in the *Ped'oa* traditional dance of the Sabu community in Raijua District. In addition, it aimed

to find out the mathematics concept in the dance that can be used for the learning process in school.

2. Method

This research uses a type of qualitative-exploratory research with an ethnographic approach (Creswell, 2014; Prahmana & D'Ambrosio, 2020). This research aims to explore, identify, and describe the ethnomathematical activities and mathematical concepts in *Ped'oa* traditional dance.

This research was conducted from June to August 2022 in Raijua District, Sabu Raijua Regency, East Nusa Tenggara. The subjects of this research consist of 5 research subjects who were dancers and leaders of the cultural society. The data collection technique in this study is field data collection through interviews, observation, and documentation methods. The main instrument was the researcher himself, whose role was to collect data through interviews, observation, and documentation methods.

After the data is obtained, the validity of the data was tested using the source triangulation technique (Moleong, 2007). Then, the data were analyzed using the qualitative data analysis model proposed by Spradley (1980), namely the Spradley analysis model, which includes Domain, Taxonomy, Componential, and Cultural Theme analysis.

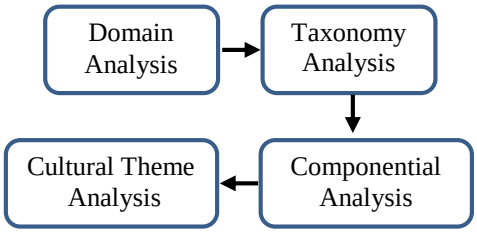

Figure 1. Spradley Model Data Analysis

3. Results and Discussion

Raijua sub-district is one of the sub-districts in Sabu Raijua Regency, East Nusa Tenggara Province. It has various and diverse cultures. One of them is the *Ped'oa* traditional dance which is the traditional dance of the Sabu community in Raijua District.

This section describes the research results on the history of the Ped'oa traditional dance of the Sabu community and the stages of the Ped'oa traditional dance. It also describes the various ethnomathematical activities and mathematical concepts in the dance.

3.1 History of *Ped'oa* Traditional Dance

Ped'oa traditional dance is a dance performed in mass by the Sabu community. It was held because *Ro Ju Deo* came to search for her son in Raijua because her son was kidnapped by Queen *Nadega*. *Ro Ju Deo* searched for her son in several places in Raijua such as *Ledeke, and Ronabalu* and finally her son was found in *Nadega*. After meeting with Queen *Nadega*, *Ro Ju Deo* and Queen *Nadega* made an agreement that Queen *Nadega* had the right to kill her son. However, if Queen *Nadega* kills him, then Queen *Nadega* must hold an event to commemorate and appreciate *Ro Ju Deo*'s son. Based on this agreement, Queen *Nadega* killed *Ro Ju Deo*'s son and held an event known as *Pegede Ped'oa* which is still performed by the Sabu community in Raijua District until now. There are four stages in performing the *Ped'oa* traditional dance accompanied by verses of songs chanted by *mone pedjoe* and *ked'ue* which are tied to the backs of the legs of the dancers. The followings are the stages and accompaniment of the *Ped'oa* traditional dance.

3.1.1 *Doa Pedattu*

D'oa pedattu is the first stage in the *Ped'oa* traditional dance. *D'oa pedattu* is the first stage in the *Ped'oa* traditional dance. At the beginning of the *Ped'oa* traditional dance, the *mone pedjoe* will sing the verses of the song so that all the dancers will form a circular formation and hold hands on the elbows to start the dance. In *d'oa pedattu*, *mone pedjoe* will step the right foot forward once and followed by the left foot swung forward and immediately pulled back and the right foot pulled back.

Figure 2. *D'oa pedattu*

3.1.2 *D'oa Halla*

D'oa halla is the second stage in the *Ped'oa* traditional dance. In performing *d'oa halla*, dancers only move in place without shifting left or right. The movements in this *halla* prayer consist of *halla* and *jodo* movements. *Mone pedjoe* as the leader of the *Ped'oa* traditional dance will chant the verses of the songs of *d'oa halla* and

start *d'oa halla* with *halla* movements, namely swinging the left foot and right foot forward once each and followed by jerking the left foot and right foot once each in turn. The movement will be carried out until there is a code from the *mone pedjoe* in the form of verses to perform the *jodo* movements.

The *jodo* movements are done by jerking the right foot and left foot once each in turn followed by swiping the right foot and left foot forward twice each. This *jodo* movement is carried out until the verses of *d'oa halla* are finished being chanted by the *mone pedjoe*. After the *d'oa halla* verses are finished, the *mone pedjoe* will sing the verses of the songs of *d'oa leo dai*.

Figure 3. *D'oa halla*

3.1.3 *D'oa Leo Dai*

D'oa leo dai is the third stage in the Ped'oa dance. In *d'oa leo dai*, the *mone pedjoe* and the dancers will sing the verses of the song *d'oa leo dai* in return led by the *mone pedjoe*. In this, *d'oa leo dai* consists of *halla* movements and *jodo* movements. Like *d'oa halla*, *d'oa leo dai* will also begin with *halla* movements until there is a code from the *mone pedjoe* in the form of verses to do *jodo* movements. After the verse of the song *d'oa leo dai* has been sung by the *mone pedjoe*, it will be followed by *pegede*.

Figure 4. *D'oa leo dai*

3.1.4 *Pegede*

Pegede is the last stage of the *Ped'oa* traditional dance. After the *d'oa leo dai* is finished, the *mone pedjoe* will chant verses of the songs to start *pegede*. The movement in the *pegede* is swinging the right and left legs forward once each.

Figure 5. *Pegede*

3.2 *Ped'oa* Accompaniment Instruments

Mone pedjoe is the leader of the *Ped'oa* traditional dance who sings verses of songs to accompany the dancers of the *Ped'oa* traditional dance dancers. In addition, dancers in performing dance use *ked'ue* which is tied to the instep as an additional accompaniment in *Ped'oa* traditional dance. All dancers of the *Ped'oa* traditional dance will use one pair of *ked'ue* each one for the right foot and left foot.

Figure 6. *Ked'ue*

3.3 Ethnomathematics in *Ped'oa* Traditional Dance

Ethnomathematics in the *Ped'oa* traditional dance of the Sabu community in Raijua Regency is described based on six characteristics according to Bishop (Dominikus, 2021) which include counting, locating, measuring, designing, playing, and explaining. The ethnomathematics contained in the *Ped'oa* traditional dance can be described as follows.

3.3.1 Counting Activities

Counting activities in *Ped'oa* traditional dance is found when counting the number of dancers. At the beginning of the *Ped'oa* traditional dance, the dancers of *Ped'oa* traditional dance consisted of three groups of people, namely *Ro Ledeke*, *Ro Naballu*, and *Ro Nadega* with ten dancers each from each group so the total number of dancers thirty dancers. After these 30 dancers perform the *Ped'oa* traditional dance, the number of dancers in the next *Ped'oa* traditional dance is not determined, it can be more or less than thirty dancers. In counting activities the number of dancers, there are math concepts (see Table 1).

Table 1. Counting the Number of Dancers

Udu	Counting the Number of Dancers
Ledeke	1 (*Udu*) × 10 (dancers for each *Udu*) = 10 dancers
Nabalu	1 (*Udu*) × 10 (dancers for each *Udu*) = 10 dancers
Nadega	1 (*Udu*) × 10 (dancers for each *Udu*) = 10 dancers
Total	3 (*Udu*) × 10 (dancers for each *Udu*) = 10 + 10 + 10 = 30 dancers

Counting activities are also found when counting the number of *ked'ue* used by dancers in performing *Ped'oa* traditional dance. *Ked'ue* (dumplings) made of palm leaves as an accompaniment tied to the instep. The *ked'ue* used by dancers of *Ped'oa* traditional dance is two *ked'ue* or one pair of *ked'ue* (one for the left foot and one for the right foot) for one dancer so that the number of Ked'ue that will be used in *Ped'oa* traditional dance depends on the number of dancers of *Ped'oa* traditional dance. If the number of dancers in a *Ped'oa* traditional dance is thirty people, then the number of *ked'ue* the dancers use is thirty pairs or sixty *ked'ue* (Table 2).

Table 2. Counting the Number of *Ked'ue*

Number of Dancers	Counting the Number of *Ked'ue*
1	2 *ked'ue* = 1 (dancer) × 2 (*ked'ue* for each dancer)
2	4 *ked'ue* = 2 (dancer) × 2 (*ked'ue* for each dancer) = 2 (*ked'ue*) + 2 (*ked'ue*)
3	6 *ked'ue* = 3 (dancer) × 2 (*ked'ue* for each dancer) = 2 + 2 + 2
4	8 *ked'ue* = 4 (dancer) × 2 (*ked'ue* for each dancer) = 2 + 2 + 2 + 2
…	…
30	60 *ked'ue* = 30 (dancer) × 2 (*ked'ue* for each dancer) = 2 + 2 + 2 +. . . + 2 (2 add up to 30)

In addition, counting activities are also found when dancers perform several movements. Dancers carrying out the *Ped'oa* traditional dance have counts such as carrying out *pedattu*, *halla*, and *jodo* movements. The *pedattu* movement is carried out by the right foot forward once and followed by the left foot swinging forward and immediately pulling back and the right foot pulled back (count 1 × 4). Then, the right foot comes forward once and is followed by the left-right foot jerked twice each, then the left foot and right foot are jerked once, then swinging the left foot forward (count 1 × 8) and ending with pulling the left foot back followed by the right foot back (count 1 × 2). Then, the *halla* movement is done by swinging the left foot and right foot forward once each and followed by jerking the left foot and right foot once each alternately (count 1 × 4 and 1 × 2). While the *jodo* movement is done by jerking the right foot and left foot once each in turn followed by swiping the right foot and left foot forward twice each (count 2 × 2).

Dancers of *Ped'oa* traditional dance in performing *pedattu*, *halla*, and *jodo* movements do not count directly. However, the dancers perform these movements repeatedly so that the Sabu community in general has applied the thought process in counting activities to carry out these movements. Thus, in *Ped'oa* traditional dance, there are counting activities in carrying out several movements, namely with a count of 1 × 2, 1 × 4, 1 × 8, and 2 × 2.

The results show that there is ethnomathematics in *Ped'oa* dance regarding counting activities. In addition, mathematical concepts can be found in counting activities in *Ped'oa* traditional dance such as the concept of multiplication as a repeated addition.

3.3.2 Locating Activities

In the *Ped'oa* dance, locating activities is found when determining the position of the Ped'oa dancers. In performing the *Ped'oa* traditional dance, the mone pedjoe will chant verses of songs as a sign that the *Ped'oa* traditional dance has started so that the dancers wear ked'ue and come to perform the dance in a way that dancers with other dancers hold hands on the elbows (*pedattu* movement) and hold on to the shoulders (*halla* and *jodo* movements). In this way, the dancers will form a circle to perform the *Ped'oa* traditional dance. Based on the description above, it can be said that in localizing activities in the *Ped'oa* traditional dance, the *mone pedjoe* coordinates the dancers with chanted verses of songs to take their respective positions so that they form a circle to perform the *Ped'oa* traditional dance.

The position of the dancers during the dance can be considered an ethnomathematical aspect of locating activities in *Ped'oa* traditional dance. It can be shown and explained by localized activities based on the position of the dancers for each stage during the dance. In addition, it can identify math

concepts related to locating activities.

Figure 7. The position of dancers during *d'oa pedattu* form circular

Figure 7 shows that the position of the dancers at the *d'oa pedattu* stage is circular. This circular shape is seen in all stages of the *Ped'oa* traditional dance from *d'oa pedattu* to *pegede*.

3.3.3 Designing Activities

The designing activity of the Sabu community in *Ped'oa* dance is related to the pattern formed by the position of the dancers in performing *Ped'oa* dance. Based on the results of the analysis of mathematical concepts related to the position of the Ped'oa dancers in the locating activity, it can be seen that the pattern formed from the position of the dancers in performing the Ped'oa dance is circular (see Figure 6). The circle shape in the *Ped'oa* dance symbolizes the brotherhood and unity that continues to be intertwined to always work together in the community.

Designing activities are related to making local objects, artifacts, traditional clothing, equipment, and accompaniment tools (Bishop, 1998) for the *Ped'oa* traditional dance, one of which is *ked'ue* as an additional accompaniment in the *Ped'oa* dance. *Ked'ue* has a basic shape of a square quadrilateral. There are concepts of flat geometry in *ked'ue* weaving like square, rectangle, rhombus, isosceles triangle, point, line, parallel line, intersecting line, angle, diagonal, and beam space with a square base (Figure 8 and Figure 9).

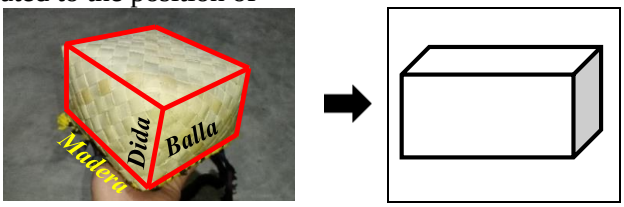

Figure 8. Beam shape in *ked'ue*

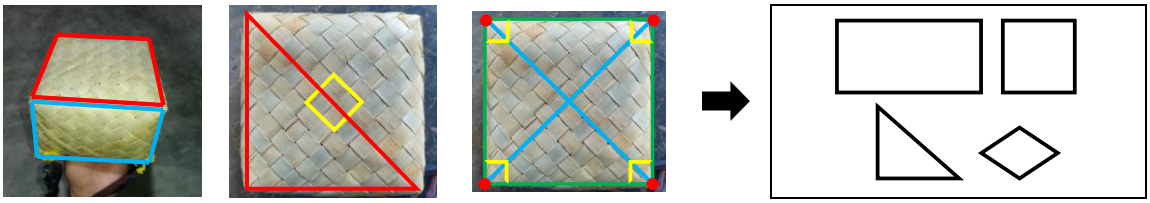

Figure 9. Flat shapes on the *ked'ue*

3.3.4 Explaining Activities

The Explaining activities refer to the relationship between the dance and its explanation regarding the philosophy or cultural argumentation. In *Ped'oa* traditional dance, the explaining activity can be determined by explaining the minimum number of dancers. The number of dancers in the *Ped'oa* dance is at least nine dancers. It is because when the dancers perform the *Ped'oa* dance, they can form a large circle so that the *mone pedjoe* has a large enough area to lead or guide the *Ped'oa* dance. If the number of dancers is less than nine, then when the dancers dance, they will form a rather narrow circle, making the *mone pedjoe* uncomfortable and less free in leading the *Ped'oa* dance. In explaining the activities of the Sabu community in Sabu Raijua Regency, a mathematical concept was found, namely the concept of implication mathematical logic (if-then). If the number of dancers is less than nine, then the dancers will form a narrow circle, making the *mone pedjoe* less comfortable and less free in leading the *Ped'oa* traditional dance.

The exploration of ethnomathematics activities (Bishop, 1998) in the *Ped'oa* traditional dance shows that the dance contains ethnomathematical activities, namely counting, locating, designing, and explaining. It can be determined from the movements, clothing, equipment, and dance formations in the *Ped'oa* traditional dance. It emphasizes the connection between mathematics with local culture, especially in the traditional dances. As previous studies have also found ethnomathematics activities in the cultural context of traditional dance and music (Fauzi et al., 2022; Radiusman et al., 2021), traditional games (Astuti et al., 2023; Cesaria et al., 2022; Salsabilah et al., 2022), traditional food (Pathuddin et al., 2021), and others.

The results also show that the traditional *Ped'oa* dance contains mathematical ideas that represent the way of thinking of the Sabu

community. The following are the mathematical ideas (ethnomathematics and mathematical concepts) contained in Ped'oa traditional dance (see Table 3).

Table 3. Ethnomathematics of *Ped'oa* Traditional Dance in School Mathematics Problems

Ethnomathematics of Ped'oa Traditional Dance	Concept of School Mathematics	Basic Competencies	Level of Education
Counting Activities	Multiplication	3.4 Describe multiplication and division involving integers with products up to 100 in daily life and relate multiplication and division 4.4 Solve multiplication and division problems involving integers with products up to 10 in daily life and relate multiplication and division to daily life	Elementary School (Class II)
Locating Activities	Geometric	3.12 Analyze various flat shapes based on their properties 4.12 Classify various flat shapes based on their properties	Elementary School (Class III)
	Geometric Transformation	3.5 Explain geometric transformations (reflection, translation, rotation, and dilation) connected with contextual problems 4.5 Solve contextual problems related to geometric transformations (reflection, translation, rotation, and dilation)	Junior High School (Class IX)
Designing Activities	Number Patterns	3.1 Make generalizations from patterns in the number sequence and object configuration sequence 4.1 Solve problems related to patterns in the number sequence and object configuration sequence	Junior High School (Class VIII)
	Geometric	3.12 Analyze various flat shapes based on their properties 4.12 Classify various flat shapes based on their properties	Elementary School (Class III)
	Geometric Transformation	3.5 Explain geometric transformations (reflection, translation, rotation, and dilation) connected with contextual problems 4.5 Solve contextual problems related to geometric transformations (reflection, translation, rotation, and dilation)	Junior High School (Class IX)
Explaining Activities	Mathematical Logic	3.22 Analyze contextual problems related to mathematical logic (simple statements, negation of simple statements, compound statements, negation of compound statements, and inference) 4.22 Solve contextual problems related to mathematical logic (simple statements, negation of simple statements, compound statements, negation of compound statements, and inference)	Vocational High School (Class XI)

Based on Table 3, *Ped'oa* traditional dance can be a learning resource and context for mathematics teachers (both elementary and secondary school teachers) to design and develop lesson plans, learning materials, and learning tools to provide students with a more relevant, attractive, and contextualized mathematics learning process. It is because ethnomathematics contained in community culture is related to mathematical concepts that can be integrated and used in learning mathematics at school, both at the primary and secondary education levels (Abi, 2016; Muhammad et al., 2023; Zaenuri & Dwidayanti, 2018).

4. Conclusion

The results of this study indicate that the *Ped'oa* traditional dance of the Sabu community in Raijua District is still preserved by the community on Sabu Island.

The *Ped'oa* traditional dance contains ethnomathematical activities on the stage of dance and clothing, equipment, and tools accompaniment. The ethnomathematical activities that can be identified such as counting, locating, designing, and explaining activities in the *Ped'oa* traditional dance. Furthermore, mathematical concepts were also found in the *Ped'oa* dance. The mathematical concepts that exist in *Ped'oa* traditional dance include the concept of multiplication, geometry (such as points, lines, parallel lines, intersecting lines, angles, circles, triangles, squares, rhombus, rectangles, and beams), and mathematical logic concepts (implication). It shows that mathematics has a relationship with daily activities and culture and can be integrated into mathematics learning so that it can be learned in a fun way by students. Therefore, *Ped'oa* traditional dance can be used as a learning resource and learning context by teachers to teach mathematics. In addition, all the ethnomathematical characteristics and mathematical concepts contained in *Ped'oa* traditional dance can be basic knowledge for teachers to design contextual learning tools that can be used in primary and secondary education as an effort to improve students' understanding of mathematics.

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