The exploration of ethnomathematics based on Rapa'i Geleng dance as mathematics learning media

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Abstract. Several abstract topics in mathematics are considered unrelated to contextual problems. This condition occurs because students cannot use some abstract mathematics topics which obtained at school in their daily activities. Hence, students are less interested in mathematics learning. Therefore, a bridge connecting formal school mathematics and the local culture is needed; one of them is ethnomathematics research method design. Ethnomathematics is a qualitative method design which examines the practice and elements of mathematics in a cultural group. One of the cultures which grows, develops, and is popular in Banda Aceh City is the Rapa'i Geleng dance. Rapa'i Geleng is a traditional Acehnese dance performed by shaking the head to the left and right regularly in a specific pattern following the rhythmic strains of the Acehnese traditional musical instrument called Rapa'i. The data were collected through document review, including videos, photos, notes, and interviews with experts. The results of the exploration show that there is a mathematical concept in the Rapa'i Geleng dance, namely number pattern. The sequence topic was observed from dancers' regular movement based on their position. Consequently, this dance is supposed to be used as a learning medium to explain abstract mathematical concepts to the students.

1. Introduction
Mathematics is one of the essential learning subjects taught at every level of education, from elementary school to higher education. The importance of learning mathematics cannot be separated from its role in various aspects of daily life. The prominence of mathematics in everyday life must be supported by a learning process that provides students opportunities to investigate and experience the usefulness of mathematics in life and link mathematics with problems in daily life [1].

Mathematics learning in schools has been limited to connecting the concepts with its application in students' daily lives [2]. This situation is in line with the opinion of Sirate, which states that mathematics learning obtained by students in schools is different from students' experience as a part of the local society [3]. So, students will assume learning mathematics is not related to their activities. This assumption drags students to think that mathematics is a subject with no connection to their real world. Learning mathematics is not enough to know the concept but use the idea to solve problems found in daily life [4].

There are two main objectives in the classroom learning process between teachers and students: teachers must transfer knowledge and the value of the knowledge learned (transfer of value)[5]. This
statement means that the teachers do not only transfer the knowledge but also transfer the values of local wisdom that are found in the student society. However, not all classroom learning uses local wisdom as a starting point in learning activities. This condition dragged the students to neglect the culture and affected the comprehension of their own culture. Consequently, this condition is assumed as factors that make students have difficulties in learning mathematics, including cultural conflicts and mismatch of cultural traditions that they find at home and in society with what they see at school [3].

Students' cultural background influences the mathematical abilities because they are based on what they see and experience[6], [7]. This condition is also in line with what was conveyed by the father of Indonesian education, Ki Hajar Dewantara, "culture cannot be separated from education, even culture is for education" [8]. Turmudi also states that culture can be used as an alternative in learning mathematics [9]. Therefore, it is necessary to create a bridge that connects the local community's culture with formal mathematics taught in the schools, namely the ethnomathematics approach.

Ethnomathematics is mathematics practised in specific cultural environments such as ethnic groups, groups of workers, children from particular age groups, and professional classes [10]. Then, Wahyudin defines ethnomathematics as the study of mathematics related to the culture [11]. This definition is derived from the words 'ethno' and 'mathematics.' The prefix 'ethno' refers to the phrase ethnography, which means a study of people habits or the culture of people in an area studied directly from their natural environment. In contrast, 'mathematics' means the mathematics knowledge itself. So ethnomathematics can be interpreted as learning mathematics whose material is arranged based on the community's culture in an area.

One of the traditions that can be used as an alternative in learning mathematics is the Rapa'i Geleng dance. Rapa'i geleng is one of the Acehnese traditional dances performed by shaking the head left and right using the rapa'i instrument. Furthermore, Rapa'i Geleng grew and developed in Seunelop Village, Manggeng District, Southwest Aceh Regency, Aceh Province [12]. This Rapa'i Geleng dance is performed by nine or more male dancers while sitting. This dance is often performed at events such as celebrating Islamic days, welcoming and honouring the guests, or wedding parties. Rapa'i Geleng dance consists of several parts: shalawat, saleum, likok, kisah, and lagu. The verses in this dance contain prayers and stories of prophets, kings, or religious advice. Almost all the Elementary School and Senior High School in Banda Aceh have made Rapai Geleng as one of students' extracurricular activities.

The cohesiveness of dancers’ motion, the regularity of the movements, and the sound of the Rapa'i make this dance interesting for all levels of the societies, including children, adolescents, adults, and older adults. The researcher obtained this experience during a teaching in a school in Banda Aceh. Some of the students were enthusiastic about learning the dance, and the rest were impressed to watch it. This dance is also performed in art performances in the school.

Meanwhile, formal mathematics in schools tends to bring out students' stress. So, learning mathematics requires a serious touch with the real mathematics material which often encountered and fun. Considering this condition, this dance was assumed to be a suitable solution for learning media to explain abstract or formal mathematics concepts in the school.

Several previous kinds of research had been conducted in exploring ethnomathematics, especially dances. Herawati et al. had conducted research that implemented andun dance as ethnomathematics for middle school students. The study results showed that the mathematics values in andun dance were able to simplify the concept of function [13]. Then Ma'rifah et. al. stated that junior high school students represented a concept of geometry using kejei dance [14]. But no research explores Rapa'i Geleng dance as mathematics learning media. So, this study aims to explore mathematics values in Rapa'i Geleng Dance as Learning Media.

2. Method
The data were collected using document reviews such as videos, photos, notes, and interviews with experts. Then, these documents were used to identify the mathematical elements contained inside them. The document considered as a primary source was the personal documentation of the studio. Besides, other data were also obtained from documentation from other sources, including notes from Rapa'i
Geleng choreograph. To reinforce the information obtained from videos and photos, the researcher also conducted an in-depth interview with experts concerning on Rapa'i Geleng dance.

3. Result and Discussion
3.1. Rapa'i Geleng Dance as Mathematics Learning Media
There are mathematical elements seen from the dancers' cohesiveness and their regularity in the Rapa'i Geleng dance. One of the mathematical concepts contained in this dance is the number of patterns. This dance can be used as an alternative media in learning mathematics to introduce number patterns to students.

Learning media is a tool in the teaching and learning process which makes the learning purpose more evident, and learning objectives can be achieved effectively and efficiently [15]. The use of learning media can encourage students' interest in learning new things or topics. So, the learning material presented by the teacher can be easily understood. Moreover, one of the factors that support the success of the learning process in schools is learning media because it can be helpful to convey information from teachers to students or vice versa [16].

Based on previous opinions, it can be concluded that local culture as a media in schools' learning process can improve students' motivation in learning mathematics. This statement is also reinforced by Irawan & Kencanawaty, which explain that students become more interested and excited in learning mathematics with the local culture [2].

The Rapa'i Geleng dance can be used as a learning medium for number pattern material. Here are some examples of the Rapa'i Geleng dance's implementation as a learning medium for number pattern material: Consider the Rapa'i Geleng dancer in Figure 1. If every dancer is given a number and the end is given three dots, it means that the dancer will continue using the previously formed pattern. If there are 35 dancers, what colour are the clothes worn by the 31st and 34th dancers?

![Figure 1. Rapa’i Geleng Dancers.](image1)

In Figure 2, it can be seen that there are two positions of the dancer, namely bent and upright. If there are 100 dancers, what is the place of the 78th and 99th dancers?

![Figure 2. Bent and upright position.](image2)
In this picture, we can see the pattern of the dancer clothes that have been numbered. The same colour of the clothes will be found after every two dancers. The students will continue the order and then will be asked the question, "If there are 30 dancers, what colour of clothes are worn by the 21st, 25th, and 30th dancers? After the students get the answer, the question will be continued with a greater number. "If there are 250 dancers in a row, what colour are the clothes worn by the 231st and 248th dancers?"

![Figure 3. Clothes colours pattern.](image)

In the pattern of regular 'musik kosong' strokes, the children are directed to count the number of 'musik kosong' strokes in each part, then the result is:

![Pattern](image)

If this pattern is repeated several times, what number is in the order of 100?

**Square number**

1st pattern

2nd pattern

3rd pattern

By considering the Rapa'i pattern arrangement in example 5, determine the number of Rapa'i in the 4th pattern, the 5th pattern, the 10th pattern, and the nth pattern, where n is a positive integer?

- Example 6

**Rectangular number**

1st pattern

2nd pattern

3rd pattern

If the Rapa'i arrangement are continued with the same pattern, how many Rapa'i are in the 4th, the 5th, and the nth patterns?

**Triangular number**

1st pattern

2nd pattern

3rd pattern
With the same pattern, how many Rapa'i arrangements are in the 10th pattern, and how many Rapa'i arrangements are in the n-th pattern?

3.2. The Implementation of Rapa'i Geleng in Learning
Implementing the Rapa'i Geleng learning media in the mathematics learning process can be conducted using a visualization approach. A visualization approach can explain an abstract mathematical concept in the classroom's learning process [17]. There are several stages in the visualization approaches, such as visualization - representation - abstraction - schema.

i. Visualization
At this stage, the students will be presented with a dance video or picture shown in figure 1. Students are asked to observe the patterns contained in the figure 3. First, students are directed to give numbers to each dancer. Then by looking at the pattern of the colours of the Rapa'i dancers' clothes, namely red, blue and yellow, the students can guess that the 11th dancer is in blue, and the 12th is in yellow

ii. Representation
Someone is representing when he models something without external media [17]. After observation, the students are invited to collect some information about what was obtained from the visualization stage observations. So, by paying attention to the colour of the clothes of the Rapa'i dancers, we get that:
The pattern of red clothes: 1, 4, 7, 10, 13, 16, 19, 22, 25, …
The pattern of blue clothes: 2, 5, 8, 11, 14, 17, 20, 23, 26, …
The pattern of yellow clothes: 3, 6, 9, 12, 15, 18, 21, 24, …

iii. Abstraction
Abstraction is a statement reconstruction that applies to all models generated from the representation. After the observation process and information collection, the students are directed to conclude the pattern of the sequence of numbers at this stage. By paying attention to the results of the representation steps before, it can be revealed that:
● If a sequence of dancers (a number) is divided by 3, then the dancer (number) is in the yellow clothes pattern
● If a sequence of dancers (a number) is divided by 3 and the remainder is 1, then the dancer (number) is in the red clothes pattern.
● If a sequence of dancers (a number) is divided by 3 and the remaining 2 is, then the dancer (number) is in the blue clothes pattern

iv. Schematization
To recheck students' conclusions correctness, the teacher can check them by mentioning a great number, and then the students were asked to find the colour of the clothes worn by the dancers. For example: "If there are 250 dancers in a row, what colour of the clothes are the dancers 231 and 248 wearing?"

By understanding the stages of abstraction, students can solve this problem very quickly.
● The colour of the clothes worn by the 231st dancer.

\[
3 \div 231 = 77 \\
\underline{21} \\
21 \\
\underline{21} \\
0
\]

\[
\therefore \text{Since } 231 \text{ is divisible by } 3, \text{ then the colour of the clothes worn by the } 231^{\text{st}} \text{ dancer is yellow}
\]
● The colour of the clothes worn by the 248th dancer.

\[
\frac{3 \sqrt{248}}{82} = 24
\]

\[
\begin{array}{c|c}
8 & 24 \\
6 & 6 \\
2 & 2
\end{array}
\]

\[\therefore \text{Since 248 is divisible by 3 remaining 2, so the clothes worn by the 248th is blue.}\]

4. Conclusion

According to the result and discussion, it can be concluded that the Rapa’i Geleng dance contained mathematical concepts, namely the number pattern. This topic briefly can be observed from the regular movement of the dancers during their performance. Thus, Rapa’i Geleng dance is assumed to be utilized as a learning medium to explain abstract mathematical concepts for students. This result also reinforced that ethnomathematics exploration in the Rapa’i Geleng dance has a close relationship with culture and contextual mathematics problems. Therefore, these findings can eliminate the general perspective about unrelated abstract mathematics topics to the contextual situation. However, this study does not seem to be supported with sufficient references due to the limitation of previous ethnomathematics research. It is very suggested to conduct more research about ethnomathematics in Rapa’i Geleng dance which is utilized as learning media.

5. References

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