Ethnomathematics: Exploration of Mathematics and Cultural Values in the Performing Arts of the Sasak Tribe Perisean

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Abstract

Perisean art developed since the 13th century according to existing history, which started with a ritual to ask for rain when there was a long dry season which resulted in a famine. Perisean art performances are currently used as mere agility art performances. Pepadu is a term for players or fighters. The show is led by three referees, one pekembar tengaq (middle referee) who is in charge of leading the fight and two pekembar sedi (side referee) who is in charge of determining each pepadu. Perisean art is not only studied in the form of art but can also be studied as a form of contextual learning in mathematics. Thus, this study aims to explore the forms of mathematics and cultural values contained in the performing arts of perisean which can later be used as a source of contextual mathematics learning. This research is a qualitative research using ethnographic method. The informants used are traditional figures, pepadu, and cultural experts who understand the art of perisean , documentation and field notes. The findings show that in the performing arts of perisean in the tradition of the Sasak people there are mathematical ideas, namely geometric shapes found in perisean art instruments and musical instruments. which has the potential as a starting point in contextual mathematics learning.

Keywords: mathematical exploration, cultural values, art of perisean

INTRODUCTION

Lombok is one of two islands in the province of West Nusa Tenggara with an area of 4,700 square kilometers located east of the island of Bali. The original inhabitants of the island of Lombok are the Sasak tribe. Like other regions in Indonesia, Lombok Island also has cultural diversity with its own uniqueness that becomes the identity of its

community. Various important elements that can be found in a cultural system, one of which is art, because art is a means to express sensory experiences and ideas that educate their inner life. In other words, art is one type of human need related to expressing a sense of beauty. Art can also function as an orientation in preserving the local wisdom of an area.

Orientation and direction in the life of a society are guided by cultural values and local wisdom, this gives signs and limits in acting as an implementation of behavior which is a dimension of life , both when dealing with other people and with the universe (Soetomo, 2012; Theresia, 2014). There are five main problems in studying local values and wisdom, namely: (1) the nature of humans as humans , (2) the nature of work in activities , (3) the nature of human position in space and time, (4) the nature of humans related to nature. surroundings, and (5) the nature of human relationships with each other (Theresia, 2014). These values and local wisdom are also found in the culture of the Sasak people, which can be seen from the preservation of traditional p*erisean arts* .

Peresean is one of the traditional arts of the Lombok people, namely the Sasak people. *Peresean* is played in pairs starting after Asr and ending after sunset. The clothes used in this art are a *sapuk* (headband), a long cloth to tie the waist called a *bebet* and a long sarong, and players are not allowed to wear clothes and footwear. The value of sportsmanship is highly upheld in this game. *Peresean* and led by a referee called the *pekembar* . This *peresean* game depicts the courage and agility of ancient youths when fighting against the enemy (Soewena et al., 2020). This art uses equipment such as bats and shields by wearing distinctive clothes and accompanied by gamelan beats with distinctive tones as encouragement.

Pepadu is a term for players or fighters. *Perisean* is a performing art that is held in an open field in the form of a square with a size of approximately 10 x 10 meters. Each *pepadu* who will fight is equipped with an *ende* (shield) and *penjalin* (a bat made of rattan). This *peresean* art is led by three referees , known as *pekembar* , which consists of *pekembar sedi* (edge referees) and one *pekembar tengaq* (middle referee). *Pekembar sedi is* in charge of choosing the pepadu who will fight, while the *pekembar tengaq* (middle referee) is in charge of leading the course of the game, generally this game lasts for five rounds if the fight goes normally. In general, in this game there is no winner and no loser, but the fight will be stopped when one of the *pepadu* (fighters) is injured in the head (

bocor) even if it has not reached the end of the round. In this game the *pepadu* must understand the rules (*awiq-awiq*) that become the grip. *Pepadu* may only hit the opponent from the waist up to the top of the head, may not stab with a *penjalin* and hit the bottom or legs.

Most people view mathematics as an independent science, free from culture and outside of social values (Bishop et al., 1993; D'ambrosio, 1995). If we look further, culture can be understood as a pattern of meaning, historically constructed and socially transmitted, which is embodied in symbols and language, through which humans communicate, perpetuate and develop their knowledge and understanding of life. As stated by Bishop (1988), mathematics must be understood as a cultural product that is built on habits that produce language, beliefs, religion, rituals, food-producing techniques, artifacts and others. So we can say that all cultures produce mathematics (Bishop, 1988). Thus, there is a need for cultural accommodation in learning mathematics.

Most schools in Lombok have not linked subject matter with student culture contextually. Learning takes place as it is, as an abstract mathematics learning routine. So that learning becomes less meaningful, which results in students' interpretation of mathematics being something that has no relationship with other subjects and does not even have a relationship with local life and culture. Mathematics is a complete component of all cultural contexts and the meaning of all cultural contexts is influenced by the interpretation of individuals in that culture. To take advantage of all the cultural activities that exist in society, students must be exposed to various experiences and cultural resources that they experience. Schools can facilitate students learning about their own culture as well as the culture of others through learning activities that demonstrate the relationship between culture and mathematics (d'Entremont, 2015). Teachers should pay attention to students' prior knowledge obtained from the environment in cultural activities (Zeichner, 1996). In addition, teachers must also pay attention to the ethnic and cultural identity of students to be able to understand and develop students' mathematical potential which is socially and culturally built (Banks, 1991; Lee, 2003) .

The era resulted in cultural acculturation which was influenced by outside cultures, which resulted in students being difficult to show their cultural identity. By connecting culture with subject matter, especially in mathematics, students indirectly rediscover their cultural identity. This is considered necessary because students find many mathematical contexts directly in the form of association, games, and interactions with their

environment and culture. Researchers have high hopes for the development of mathematics learning in the cultural context in Lombok, can improve literacy as expected from the independent curriculum, considering that Lombok or the Sasak people have unique cultural diversity that can be used as a source of learning mathematics.

To accommodate a change in mathematics learning, one thing that needs to be done is to develop a theory of culture-based pedagogy in a critical paradigm through an explicit relationship between student culture and school subject matter (D'ambrosio, 1995; Firdaus et al., 2020; Gay, 2000; Ladson-Billings, 1995; Wahyudi et al., 2021). In this perspective, learning mathematics needs to connect students' experiences and culture with mathematical content. Connecting student culture with mathematics content is a very important component in culture-based education because it will provide freedom for teachers to contextualize mathematics learning by linking mathematics content to student culture and real-life experiences (Irfan et al., 2019; Torres-Velasquez & Lobo, 2014). Artifacts, and cultural representation systems are important components in learning mathematics.

Cultural traditions basically cannot be separated from formal learning activities. In *perisean,* when viewed from the tools and supporting components, it can be used as a source of learning in schools. For example in learning mathematics, tools can be viewed from a geometric shape. However , most people view mathematics as an independent science, without any connection with community activities (Fauzi et al., 2021, 2022; Fauzi & Gazali, 2022).

Based on the explanation above, this study aims to explore the forms of mathematics and cultural values contained in the performing arts of *research* which can later be used as a contextual source of learning mathematics.

METHOD

The type of research used in this study is a qualitative research with an ethnographic approach. Ethnography as a research approach aims to explore, analyze and interpret the behavior or natural phenomena of a cultural group in society (Spradley, 2016). The main purpose of the ethnographic research method is to understand a cultural phenomenon and its relation to people's lives. This method is used to examine the condition of the object of research, namely the existence of the *perisean tradition* in the Sasak tribal community and the cultural values contained in it which can be implemented in learning mathematics . This method is in line with ethnomathematical studies that focus on mathematics applied by a group of cultures (D'Ambrosio & D'Ambrusio, 2013). While the data collection

technique used in this study refers to the steps proposed by (Spradley, 2016) namely participant observation, interviews, documentation and field notes.

Data were collected through the stages as stated above, namely (1) observation, observations were made on *perisean* art performances ; (2) interviews with traditional leaders, *pepadu*, and cultural observers ; (3) documentation is done by taking pictures of *perisean* performances at the location of the show (4) making field notes. Observations were made on *perisean* performing arts activities held in various regions, followed by interviews with traditional leaders and *pepadu*. The informants used in this study consisted of 2 traditional leaders, 4 *pepadu* people and 2 cultural experts. Informants were selected based on information obtained from traditional leaders who know the context of the art of *perisean*.

Furthermore, the data were analyzed in stages, namely domain analysis with the aim of obtaining a general description of the object of research; taxonomic analysis which describes the domains in a more detailed form to find out the mathematical ideas, meanings and forms contained in *perisean* art and the cultural values contained therein ; component analysis to determine the specific characteristics of the research object; and analysis of cultural themes, namely looking for relationships between domains which are then stated in the theme.

RESULTS AND DISCUSSION

Based on history, as stated by the informant that in addition to this research is to test the level of agility of a soldier , but this *perisean* is also a ritual to ask for rain when in one season there is a long dry season which results in crop failure and famine. With the development of the era, this tradition has turned into agility performance art which is held at certain times or at certain celebrations such as the celebration of the independence day of the Republic of Indonesia every August in several areas in Lombok. Before the *perisean* art performance is held , there are rituals carried out so that the activity runs smoothly. Besides being carried out by the organizers individually, a *pepadu* also performs rituals before competing to fortify themselves so that something unwanted

happens. These rituals are basically conditions with cultural values that can be used as a lesson in life.
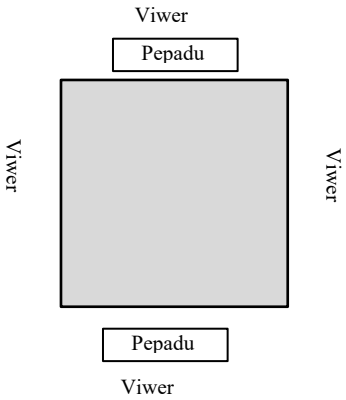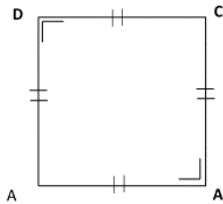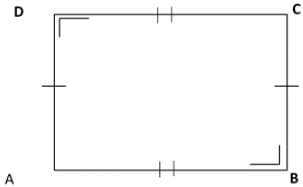

Figure 1. Perisean art performance

Math Ideas

The show is performed in a spacious square with a size of approximately 10 x 10 m. This arena is limited by ropes to limit the seating of the audience. The audience sat cross-legged around the arena in an orderly manner. The performance of this *perisean* art agility competition begins after the Asr prayer and ends at sunset. Apart from being a ritual for asking for rain in ancient times, *perisean* also aims to find and choose a formidable knight in the face of war. The *pepadu* are on the side of the field together with *pekembar sedi* (side referees) who are tasked with countering the *pepadu* . While the *pepadu group* together with *pekembar sedi* (side referees) are on the other side of the field facing each other.

Before the fight begins *, pekembar sedi* (edge referees) prepare the *pepadu* (fighters) to wear clothes consisting of a long cloth as a sarong, wear a belt (*bebet*) and wear a headband (*sapuk*) accompanied by gamelan with a distinctive sound accompaniment. The types of musical instruments used as accompaniment consist of: *gendang, rincik, suling, oncer* and *gong.* Based on the form and structure of the

performing arts of the Sasak people, it can be found mathematical forms and elements that can be used as learning materials as shown in table 1. As follows:

Table 1. Forms and mathematical *perisean* performing arts

Representation	Object	Mathematical concepts
Perisean performing arts arena structure	*Perisean* performing arts arena layout	Perimeter = 4s Area = s ^{2}
A rectangular shield made of cowhide wood, measuring 50 x 60 cm.	*Ende* (shield)	Rectangular Perimeter = *2(p + l)* Area = *pxl*

The bat is made of rattan with a diameter of 3 cm and a length of approximately 1 m.

Penjalin (batter)
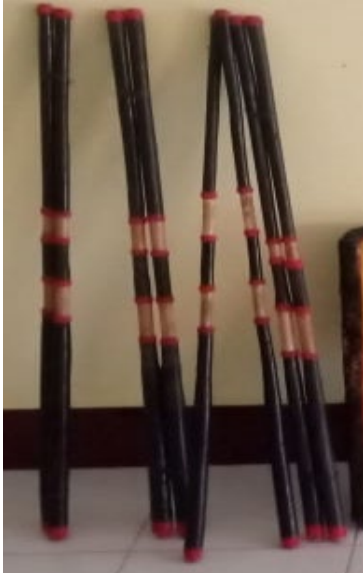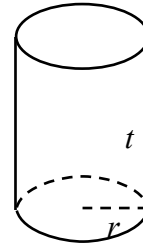
Tube

Tube Properties:
1. Has 3 sides: base, cover and blanket (upright side)
2. Surface area of the cylinder = 2 x area of the base + area of the blanket

$$= 2 r^2 + 2\pi rt$$
$$= 2\pi r(r + t)$$

3. Volume = area of base x height = r^2

This performance is accompanied by distinctive music consisting of *gendang, rincik ,suling oncer and gongs* .

Gendang and *suling*

Tube

Tube Properties:
4. Has 3 sides: base, cover and blanket (upright side)
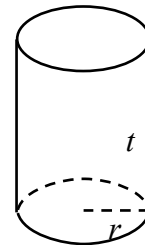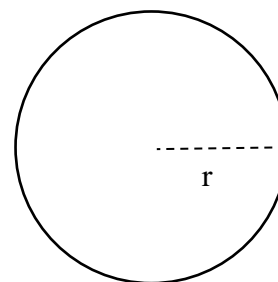5. Surface area of the cylinder = 2 x area of the base + area of the blanket

$$= 2 r^2 + 2\pi rt$$
$$= 2\pi r(r + t)$$

Volume = area of base x height = r^2

This performance is accompanied by distinctive music consisting of *gendang, rincik, suling oncer and gongs* .	*Gong* and *rincik*	Circle

Area of circle $= r^2$
of circle $= 2\pi r = d$

The results showed that in the performing arts, the form of sugar palm and game tools and musical instruments used as accompaniment were formed from mathematical models. The show arena is a square with a size of approximately 10 x 10 m. Whereas performance instruments in the form of geometric shapes in the flat plane as well as space stars , such as a rectangular *ende* (shield) *and penjalin* (batter). In addition, the shape of the musical instruments used as accompaniment also reflects geometric shapes, both flat geometry and spatial geometry, as seen on the *gendang, suling oncer,rincik and gong* .

The results of mathematical exploration in the performing arts of the Sasak community can be used as a learning resource in learning mathematics, where the cultural context can be used as a first step to grow students' initial knowledge obtained from their environment. Designing student knowledge by referring to prior knowledge obtained from the environment that is the focus of the teacher in designing learning. An important component in integrating culture with mathematics learning is contextualizing learning materials with mathematical content found by students in their culture (Torres-Velasquez & Lobo, 2014). Where, the form of analysis of students' mathematical knowledge found in the environment makes most researchers conclude that mathematical knowledge is not

only found in formal activities such as school but mathematical knowledge is found in their own culture and habits (Orey & Rosa, 2011). Based on the experience of learning mathematics in the classroom through various cases, it is a frightening learning for students (Boaler, 2014), therefore, the learning carried out should focus on students' sociocultural experiences. This sociocultural-based experience is obtained from various student activities naturally which is used as initial knowledge obtained from interactions with their own environment (Devkota, 2013). Students can build their socio-cultural experience in various ways (Battista, 2011). Ethnomathematical principles do not offer static learning, but students consistently develop new knowledge gained from interaction with their environment. Humans are constantly telling stories or constructing narratives to understand the various experiences they encounter in the environment as part of their prior knowledge (François & Stathopoulou, 2012).

Developing mathematical reasoning can be done by creating and using appropriate learning designs and carefully designed tasks (Mueller et al., 2015). Relevant mathematical ideas consisting of facts, concepts, principles and skills are the result of mathematical knowledge obtained from socio-cultural interactions (Russell, 2019). Therefore, lesson plans and assignments must be adapted to the phase and level of the student's age and mathematical experience (Stacey, 2012). However, teachers often find it difficult to design and present appropriate assignments, by not giving students an academic burden, but rather maintaining the involvement and exploration of mathematics that they find from their own environment (Cheeseman et al., 2016).

Educational Values

Perisean art is a form of cultural product. This cultural product has complex values and philosophies, both in terms of game procedures, game tools and other things that support the performance. For example , *pepadu* (fighter) must have the characteristics of *wirase, wirame* and *wirage* . *Wirase* is the nature of a cohesive *way* of *controlling* his feelings, his heart when going to fight. *Wirame* is the characteristic of being cohesive in performing movements such as dancing to relieve tension and become a way to influence opponents. *Wirage* is a cohesive body condition that must be strong in order to be able to face the opponent.

This form of game not only displays dexterity or dexterity in games or battles but also shows the cultural values contained in it. These values are reflected from all sides

both before, during and after the *pepadu* battle. The educational values contained in the artistic performance of the *Sasak* tribal community philosophically can be seen in table 2. as follows

Table 2. The educational value of the art of research

Representation	Object	Educational value
At the end of the fight , *Pepadu* must shake hands and hug each other	*Pepadu*	A form of sportsmanship that after hitting each other there should be no grudges even if they hurt each other
Pepadu must follow all the rules in the game called *obediently*	*Pepadu*	The value of being obedient to the Sasak people is a form of respect for the agreed rules
Pepadu must be able to avoid the opponent's blow so as not to get *hurt*	*Pepadu*	Thorough and tenacious in doing something so that what will be the goal can be accomplished.
Pepadu must be able to control feelings	*Pepadu*	Self-control is a trait that must be possessed by a person to maintain emotions so that harmonious relationships are established between others
Pepadu must be tough in fighting	*Pepadu*	Never give up is a must for everyone if you want to succeed in achieving goals. The effort is more important than the end result.

Based on the table above, it can be seen that there are moral messages contained in the performing arts of the Sasak tribal community. The messages or educational values contained are advice that can be used as a basis for living life for their children and grandchildren (Imran & Hananingsih, 2021; Yasa, 2020). The form of the game in the performing arts of the *Sasak* tribal community gives a picture of the character of the community as an identity. The rules that must be obeyed show that togetherness has the same goal as obeying the leader, in this case, the *pekembar tengaq* (middle referee). In general, we understand that society highly values morality and ethics .

CONCLUSION

This study provides an illustration that mathematics can be found in every activity of life in the form of ideas, activities and cultural artifacts. One of the cultural artifacts that can be found in the Sasak people is traditional art . Art show *press* The tradition of the Sasak people is not only used as a show of dexterity or the selection of tough soldiers, but this ritual is also used to ask for rain when the community is hit by drought which causes famine. As seen in the equipment and musical instruments used in the form of geometric shapes, both flat geometry and spatial geometry.

The geometric shapes found in the *Perisean* art performances of the Sasak people can be found in learning mathematics. This study shows that cultural artifacts which are ancestral heritages can be used as the first step in real mathematics learning, especially on the topic of geometry. So the usefulness of cultural artifacts of the Sasak people can be used as a tool to motivate students to learn mathematics and build meaningful cultural values in learning mathematics, and aspects of mathematical substance, the culture of the Sasak people can be used as objects of concrete mathematics, the context of mathematical problems and examples of applications of mathematics in everyday life. One of the ways to develop student creativity is through the integration of mathematics and culture in education to foster students' ability to develop cultural values in the current context based on mathematical creative thinking skills.

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