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Ethnomathematics: Exploring Lamban Pesagi to Instill the Concept of Plane Figures

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Abstract
One of the interesting applications of ethnomathematics is utilizing traditional houses as learning media, particularly for understanding the concept of plane shapes, which forms a crucial foundation in geometry and various real-world applications. Lamban Pesagi, the traditional house of Lampung people can be used as a source or material in conveying geometry concepts. The research aims to discuss how Lamban Pesagi can be utilized as a medium for learning the concept of flat figures. This research examines the elements of mathematics (ethnomathematics) in the architecture of Lampung traditional houses, especially Lamban Pesagi, which is in the State Museum of Lampung Province. This research analyzes the geometry figures found in Lamban Pesagi and develops creative and innovative mathematics learning activities based on the analysis with the principles of constructivism. In addition, it can also evaluate the impact on students' understanding and attitudes through geometry ability tests, observations of student participation in learning activities, and questionnaires to measure students' attitudes towards mathematics. Based on the results of exploration and discussion, it can be concluded that in Lampung traditional houses, especially Lamban Pesagi, geometric shapes are found. The geometry shapes are in the form of flat figures including square, rectangle, parallelogram, rhombus and triangle. Lamban Pesagi with its various geometric shapes can be an interesting learning resource to teach the concept of plane figures. Students are invited to identify and categorize the figures, thus fostering pride in local culture and increasing motivation and understanding of geometry. The impact of this learning can be evaluated through comprehension test and questionnare to measure students' attitudes.
Keywords: Ethnomathematics, Traditional House, Lamban Pesagi, Geometry, Flat Figure

Introduction

Mathematics is often considered an abstract and difficult subject to understand, especially for primary level students. Learning that is centered on formulas and procedures tends to ignore the connection between mathematics and everyday life, thus reducing students' interest and motivation to learn. Mathematics learning should not only focus on memorizing formulas, but also train students to apply mathematical knowledge in solving everyday problems (Sermatan et al., 2019). Because mathematical concepts tend to be abstract, the use of objects around students can help make these concepts more real and easy to understand (Bustan et al., 2021). This challenge encourages educators to look for alternative approaches that can make math more relevant and meaningful to students. Ethnomathematics as an approach that explores local wisdom in the context of mathematics,

offers a potential solution to this challenge. Ethnomathematics is the study of mathematical concepts and practices within diverse cultural contexts, including indigenous cultures. Ethnomathematics is a form of mathematics that is fused with culture (Supriyadi et al., 2024).

Cultural elements can be used in mathematics learning (Putra et al., 2020). As a result of the development of human culture and thinking, ethnomathematics is relevant to be incorporated into mathematics learning (Hendriyanto et al., 2023; Nurcahyo et al., 2024). Ethnomathematics can improve mathematics learning by connecting mathematical concepts with students' daily experiences, including local arts and culture, so that students more easily understand the mathematical concepts being studied (Side et al., 2021). The main principle in integrating culture into mathematics learning is to connect mathematical concept with cultural contexts relevant to students, such as cultural artifacts. Mathematical elements contained in cultural artifacts can be used as learning media, so that students not only learn mathematics, but also gain knowledge about related cultures (Soebagyo & Haya, 2023).

One example of an interesting application of ethnomathematics is by utilizing traditional houses as learning media. Indonesia is rich in culture including traditional houses from various regions. One of the famous traditional houses in Lampung Province is Lamban Pesagi. Lamban Pesagi is a house with a square shape with four sides of the same wall (Nisa, 2023). Lamban Pesagi with its unique architecture full of meaning and philosophy, is rich in elements of geometry that can be explored to introduce figures such as square, rectangle, triangle, parallelogram, and trapezoid. Similar to the research conducted by Kurino & Rahman (2022) showed that the Panjalin traditional house is rich in geometry elements such as trapezoids, blocks, squares and rectangles. By linking math concepts with local culture, it is expected that learning becomes more meaningful and relevant to students.

Integrating ethnomathematics into mathematics learning provides many benefits, students can understand geometry not only as an abstract concept, but also as part of everyday life. If not introduced to students, the potential of ethnomathematics will be forgotten and lost to the times (Kadir et al., 2021). Ethnomathematics can contain aspects of understanding mathematical concepts with objects that are seen in real life (Faturrahman & Soro, 2021). In addition, ethnomathematics also plays a role in strengthening cultural identity, appreciating diversity, and fostering a sense of pride in local heritage. By learning geometry through Lampung traditional houses, students can understand how their ancestors have applied and developed mathematics for centuries. As stated by Z & Muchlian (2019)

that without learning the theory of mathematical concepts, Minangkabau people have applied mathematical concepts in everyday life using ethnomathematics.

The research aims to discuss how Lamban Pesagi can be utilized as a medium for learning the concept of flat figures. Thus, it is hoped that this research can contribute to efforts to improve the quality of mathematics learning through the ethnomathematics approach, as well as inspire educators to explore the potential of local wisdom in learning.

Method

This research is descriptive qualitative, focusing on exploring ethnomathematical elements in the architecture of Lampung traditional houses, especially Lamban Pesagi. This research uses an explorative method to examine the mathematical aspects contained in the traditional house of Lamban Pesagi, a collection of the State Museum of Lampung Province. The integration of Lamban Pesagi into mathematics learning is guided by the principles of ethnomathematics and constructivism. This approach emphasizes linking mathematical concepts with local cultural contexts, encouraging active learning, and fostering appreciation for cultural heritage. It involves identifying geometric elements in Lamban Pesagi architecture and developing creative and innovative learning activities based on those elements, such as identifying and classifying geometric shapes, modeling Lamban Pesagi, solving problems related to Lamban Pesagi geometry. The exploration will end with an evaluation of the impact of these activities on students' understanding and attitude towards mathematics. This evaluation will be based on criteria such as improved understanding of geometry concepts, improved problem solving skills, development of an attitude of respect for local culture, and increased motivation to learn mathematics. Data will be collected through geometry concept understanding tests, observations, and questionnaires to determine students' attitudes towards learning mathematics.

Results and Discussion

A traditional house is a building whose form, structure, decorative functions, and manufacturing methods are passed down from generation to generation and can be used to carry out life activities as well as possible. Lamban Pesagi has established and tested architectural principles. This is proven by the solidity of Lamban Pesagi from the shocks of the earthquake that occurred in West Lampung (Wahyuningsih & Gunadi, 2019). The

exploration of flat plane concepts found in Lamban Pesagi can be seen in the following images.

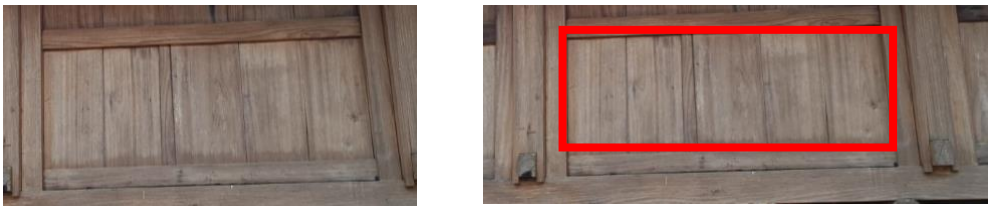

Figure 1. Rectangular wall

The wall of Lamban Pesagi has a rectangular surface. The rectangular wall surface can be used in conveying rectangular concepts starting with explaining the properties of rectangles, the formula for the perimeter and area of rectangles, to its application in everyday life. The wall surface of Lamban Pesagi can be used as a stimulus material in making numerical problems to measure students' mathematical concept understanding ability. An example of a problem that can be made by the teacher is that students are asked to calculate the perimeter of the lamban pesagi wall frame and also the surface area of the wall to calculate the number of boards needed in making the Lamban Pesagi wall.

Figure 2. Square-shaped window

The Lamban Pesegi window section has a square-shaped surface. This part can be used by the teacher to explain the concepts of a square starting from the properties of a pesergy, perimeter and area of a square to its application in students' daily lives. In addition, the teacher can also explain the concept that a square is a rectangle with the same size of its four sides. For the application in making questions, teachers can provide numeracy questions that are contextual in nature. Numeracy problems to measure the understanding of concepts related to the perimeter and area of a square, students are asked to calculate the perimeter of the window frame and also the area of Lamban Pesagi window shutters.

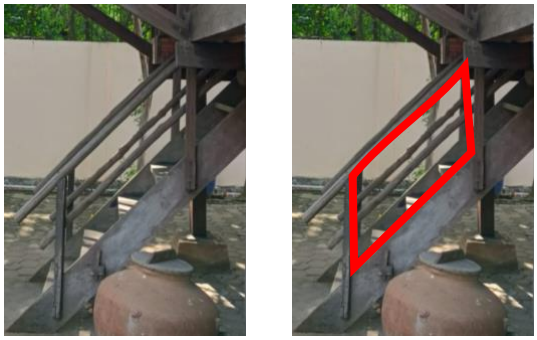

Figure 3. Stair handrail in the shape of a parallelogram

The handrail on the stairs to enter Lamban Pesagi has the shape of a parallelogram. In the process of conveying concepts related to the properties to the formula for the perimeter and area of a parallelogram, the teacher can invite students to observe the banister of Lamban Pesagi. Students can see the real form of the application of the parallelogram concept on the Lamban Pesagi banister. The teacher can also easily explain the concept related to the difference between a rectangle and a parallelogram because students can directly see the real form without having to imagine the abstract form. Students see that a parallelogram and a rectangle both have two pairs of parallel sides, the angles are equal, the diagonals are bisected, the sum of two adjacent angles is 180°. But physically there are differences in the two shapes. Based on the observation, students can conclude that a rectangle is a parallelogram with four right angles. The properties found in a parallelogram are also found in a rectangle.

Figure 4. Paguk carving in the shape of a rhombus

Paguk is a decoration on the corner post of the front of the house, installed with a peg system. The body of the paguk is horn-shaped, the ends curl up like fern leaf shoots, shoot bamboo shoots and twisting motifs, originating from Kenali West Lampung (Wahyuningsih & Gunadi, 2019). The concept of rhombus can be introduced by the teacher through the shape of the carving on the paguk. The teacher can explain that a rhombus has several properties in common with a square, including that all sides are equal in length, the angles are equal in magnitude, the diagonals bisect each other in length and are perpendicular, and the diagonals divide the angles in half equally. However, the difference between a rhombus

and a square lies in the corners, a square has four right angles while a rhombus does not. After students are invited to observe the shape of a rhombus, students can conclude that a square is a rhombus whose four corners are right-angled. A rhombus has properties that are also found in a square. To measure students' understanding of mathematical concepts on rhombus, teachers can create contextual questions by including carved shapes found in Lamban Pesagi.

Figure 5. Trapezoidal wall

Part of the Lamban Pesagi wall is not only rectangular, but there are also parts whose surface is trapezoidal. The trapezoidal wall surface can be utilized by the teacher as a medium in instilling the concept of trapezoid. Students can be invited to observe that the edge of the Lamban Pesagi wall is not rectangular. This is because the edge of the Lamban Pesagi wall adjusts to the slope of the Lamban Pesagi roof. Students not only learn the concept of trapezoid in the form of its properties, as well as the formula for the perimeter and area of a trapezoid, but students can also learn why the edge of the Lamban Pesagi wall is trapezoidal. To test students' mathematical concept understanding ability related to trapezoid, teachers can create contextual questions by utilizing the shape of the Lamban Pesagi wall surface.

Figure 6. Right-angled triangle shaped pole winder

Figure 7. Terrace supports in the shape of an isosceles triangle

The wood of the Lamban Pesagi pole has a shape resembling a right triangle. As the name implies, the wood is referred to as elbow wood. In addition to its position to keep the pole from changing position, the angle formed is 90°. Not only in the form of a right triangle, on the terrace there is also a supporting pole that forms an isosceles triangle. Its function is also the same as the pole, to maintain the position of the terrace so that it does not change. Armed with the triangular shape found at Lamban Pesagi, the teacher can introduce the concepts of right triangle and isosceles triangle. Not only limited to the introduction of the shape and concept of triangles, but the teacher can also explain its function at Lamban Pesagi.

Triangular shapes are often found in various buildings or architecture. Generally, triangular shapes are found at the corners of the pole. The function of the triangle is as a ruler or lock so that the position of the pole remains upright. The righting pole in a building is a very important element because without a righting pole a building will not have strength and easily collapse. In mathematics, the length of the elbow can be calculated using the Phytagoras theorem. In fact, there are many builders who do not know Phytagoras' theorem but they can determine an angle that is right or 90°. The builders learn by experience or are hereditary taught by more senior builders. This is a form of ethnomathematics in architecture. People in ancient times could make poles stand upright without being armed with mathematics. Without realizing it, mathematics has been applied in everyday life.

Lamban Pesagi as a traditional Lampung house is not only rich in cultural values, but also holds tremendous potential as a source of learning geometry, especially flat shapes. Its unique architecture features a variety of two-dimensional geometric shapes that can stimulate students' interest and understanding of math concepts. One of the most prominent parts is the floor plan and layout of Lamban Pesagi. Its generally square or rectangular shape is a tangible representation of the concepts of flat shapes, symmetry, and perimeter and area measurement. Geometry concepts are interrelated with many topics in mathematics. The

construction of conceptual knowledge and understanding in geometry is essential for its application in everyday life (Sunzuma & Maharaj, 2019, 2022).

The ethnomathematics approach is in line with constructivism theory which emphasizes the importance of direct experience and active involvement of students in building understanding. Through the exploration of Lamban Pesagi, students not only memorize the definition of flat shapes, but also construct their own knowledge about the properties and relationships between shapes. This is expected to improve students' conceptual understanding and problem solving skills. In line with the research of Wahyuni et al. (2023) which states that Tongkonan, the traditional house of Tana Toraja has the potential as a rich learning resource, not only in math but also history. By linking math learning with local culture such as Tongkonan, it is expected to foster students' love and appreciation for their cultural heritage. Using geometry concepts contained in Malay traditional houses as a learning approach can increase students' interest and understanding of geometry, while fostering their love and pride for local cultural wealth (Hia et al., 2024). The same thing was also revealed by Sukmawati et al. (2022) in his research which concluded that teachers can utilize the mathematical concepts contained in the Jami' Al-Falah Jember Mosque to introduce geometry material to students in a way that is easier to understand and relevant to local culture.

Ethnomathematics can make geometry learning more meaningful and contextualized for students, especially by linking it to traditional crafts (Fauzi & Setiawan, 2020). Students' culture has a big influence on their understanding of mathematical materials. Material that is not relevant to their culture will be difficult to understand. A learning approach that connects mathematics with students' culture is needed, because cultural elements can be utilized in mathematics learning (Hasibuan & Hasanah, 2022; Laukum et al., 2024). In line with research by Suherman & Vidákovich, 2022) who stated that Lampung Tapis can be used to disseminate and inform the world about Indonesia's local wisdom and has the potential as a contextual math resource in rural and urban schools. Furthermore, Natasya et al. (2023) in his research concluded that mathematics teaching material supplements using an ethnomathematics approach proved to be able to increase student learning interest. This shows that the supplement is effective in learning square and rectangle materials.

Based on the results of the exploration of Lamban Pesagi, several parts were found that contain elements or forms of geometry. The geometry shapes found in Lamban Pesagi include square, rectangle, parallelogram, rhombus, and triangle. Although not all flat figures

are found in Lamban Pesagi, at least the figures can represent the basic concepts of flat figures. Teachers can utilize the parts of Lamban Pesagi that have flat figures as a medium in instilling the concept of flat shapes. In addition to being a medium in instilling concepts, teachers can also use the context of traditional houses as a stimulus in making numerical problems to measure students' mathematical concept understanding skills. Another benefit of utilizing Lamban Pesagi as a learning material is that students get to know the cultural heritage around them. This will have a tremendous impact on students because they will feel proud of their ancestral culture.

Conclusion and Suggestion

Based on the results of exploration and discussion, it can be concluded that in Lampung traditional houses, especially Lamban Pesagi, geometric shapes were found. The geometric shapes are in the form of flat figures including square, rectangle, parallelogram, rhombus and triangle. These figures can be used as materials in instilling the concept of flat figures. Teachers can make the shapes on Lamban Pesagi as a stimulus in making numeracy questions to measure students' mathematical concept understanding ability. Utilizing Lamban Pesagi as a learning material can foster students' pride in their ancestral culture.

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