



Decoding the Architectural Geometry of Plaosan Temple: An Ethnographic Exploration for Contextual Mathematics Education

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ABSTRACT

Student Many ethnomathematical studies in Indonesia have explored mathematical concepts embedded in cultural products such as batik, traditional houses, and other temple architectures. However, there has been little to no research specifically investigating the geometric aspects of Plaosan Temple as a cultural heritage site. Therefore, the current study aims to explore the geometrical concepts embedded in Candi Plaosan using an ethnographic approach. The study used ethnography as an approach by answering four principal questions, namely, "Where do I start looking?", "how do I find it?", "how do I recognize that it has found something significant?", and "how to understand what it is?". By answering these questions, the researchers successfully examined the geometrical concepts contained in Plaosan Temple. This study reveals that the concepts embedded in Plaosan Temple are focused on the geometrical aspect, namely, (1) plane geometry such as squares, rectangles, rhombuses, right triangles, trapezoids, and circles; (2) solid geometry such as cubes, rectangular prisms, and triangular prisms; (3) geometric transformations such as dilation and reflection; and (4) symmetry, similarity, and congruence. The findings are expected to introduce Plaosan Temple to students through contextual mathematics learning while supporting its preservation as cultural heritage. Future studies may further examine the effectiveness of Plaosan Temple-based learning with GeoGebra in enhancing students' understanding of geometry concepts.

Keywords: plaosan temple, ethnography, ethnomathematics.

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INTRODUCTION

This section discusses the purposes of the study or research problems, the contribution to knowledge, and the research gap. Please state them clearly in the beginning paragraph, supported by related theories in the next paragraphs. Indonesia is a nation endowed with immense diversity, particularly in the realm of arts and culture. This cultural diversity encompasses no fewer than 470 ethnic groups, 19 customary law regions, and more than 300 local languages spoken across the archipelago (Ardiwidjaja, 2018). Indonesia's cultural heritage is exceptionally rich, including temples (*candi*) that are relics of the past, not only holding historical value but also reflecting advanced mathematical and architectural skills. The *Kamus Besar Bahasa Indonesia* defines a *candi* as a stone structure built as a place of worship or an ancient tomb from the Hindu-Buddhist period in the archipelago. These temples

can still be found in various regions of Indonesia, particularly in Sumatra, Java, and Bali. According to (Rachmad, [2017](#)), temples in Java were designed based on the principle of symmetry to represent the balance between the physical and spiritual worlds. Although many now exist as ruins, some still stand majestically and serve as major attractions for cultural and historical tourism. Their architectural elegance illustrates the mastery of ancient societies in the art of construction, while preserving the spiritual teachings embedded within them. Architecturally, *candi* embody the religious, artistic, engineering, and technological values of past civilizations.

Plaosan Temple

Plaosan Temple is a temple complex from the Ancient Mataram Kingdom, located in Bugisan Village, Prambanan, Klaten, Central Java, approximately 1.5 kilometers from Prambanan Temple. It was built in the 9th century CE by King Rakai Pikatan of the Sanjaya Dynasty, a Hindu, together with his wife Pramodhawardhani of the Sailendra Dynasty, a Buddhist. The temple stands as a symbol of tolerance and harmony between Hinduism and Buddhism, two major religions that coexisted peacefully at the time. The Plaosan Temple complex consists of two main groups: Plaosan Lor (North Plaosan) and Plaosan Kidul (South Plaosan). They are separated by a road running east to west and are surrounded by rice fields, which enhance the scenic beauty of the area. In the Plaosan Lor complex, there are two two-story main temple buildings, both facing west and each enclosed by a stone wall. On the western side of the stone wall surrounding the main temples is an entrance gate in the form of a *Gapura Paduraksa*. The roof of this gate is adorned with a row of small crowned reliefs, and its square-shaped peak is also decorated with small crowns, adding to the overall elegance and grandeur of the temple's architecture. By contrast, the Plaosan Kidul complex now exists mostly as ruins, with only a few remaining *Candi Perwara* (ancillary temples) that still radiate beauty. Excavation and restoration began in May 2003. Since the restoration process is still ongoing, detailed information about Plaosan Kidul has yet to be fully revealed.



Figure 1. North Plaosan



Figure 2. South Plaosan

Plaosan Temple Conservation Efforts

In the Central Java region, several temples exhibit distinct local characteristics, with larger structures and more intricate relief details, one of which is Plaosan Temple. Based on the author's interview with an officer from the Cultural Heritage Preservation Center Region X at Plaosan Temple

in November 2024, it was conveyed that many visitors are not even aware of the existence of Plaosan Temple. This is not due to a lack of beauty, but rather factors such as branding, promotion, and tourist perception, which result in fewer visits compared to other surrounding temples. This condition is concerning, as Plaosan Temple, being one of Indonesia's cultural entities, particularly for the people of Central Java, faces increasingly challenging efforts in terms of cultural preservation.

The uniqueness of Plaosan Temple is reflected in its architecture, which demonstrates the acculturation of Hindu and Buddhist cultures for example, the presence of Buddha statues combined with architectural styles characteristic of Hindu traditions. Unlike other temples that generally consist of a single main complex, Plaosan is divided into two parts: Plaosan Lor (North) and Plaosan Kidul (South). The symmetrical arrangement of its ornamental details reflects the sophistication of ancient geometry. The geometric patterns in the reliefs and overall layout are highly relevant to ethnomathematical studies. One strategy that can be implemented is integrating Plaosan Temple into mathematics learning as an innovative approach to enhance students' understanding. Through this, students can see how mathematical concepts are applied within the local cultural context, such as building structures, carving patterns, and even traditional calculation systems. In this regard, the role of mathematics education researchers becomes crucial in exploring the mathematical concepts embedded in Plaosan Temple. By connecting mathematics with culture, students are able to recognize the relevance of mathematics, particularly in geometric aspects of daily life, while also appreciating the contributions of local culture. Through ethnomathematics-based learning, students can better understand the implementation of mathematical concepts in everyday life (Rodríguez-Nieto & Alsina, [2022](#)).

Ethnomathematics

The term ethnomathematics was first introduced by Ubiratan D'Ambrosio, a Brazilian mathematician, in 1977. Etymologically, the term ethnomathematics is derived from three Greek words: "Ethno," which refers to cultural groups, communities, or particular societies; "Mathema," which is interpreted as something to be learned or understood (mathematical knowledge); and "Tics," which means specific methods or techniques (D'Ambrosio, [1985](#)). Terminologically, ethnomathematics is defined as "the *mathematics which is practiced among identifiable cultural groups such as national-tribe societies, labor groups, children of certain age brackets, and professional classes*" (D'Ambrosio, [1985](#)).

In the current study, the context of ethnomathematics is used as an effort to explore and unveil the mathematical concepts of Plaosan Temple, particularly in the aspect of geometry. These concepts can later be used as materials to introduce Plaosan Temple as a national culture, and in the context of mathematics, learning can make it more contextual to study by students.

From previous research, there have been many studies that examine the mathematical concepts of temple. Some of which are research conducted by (1) Hardiarti ([2017](#)), who studied the quadrilateral

of Candi Muaro Jambi, (2) Maula & Sumitro (2023) who studied the artefact of Candi Songgoriti Batu, (3) Mahuda (2020) which examines the philosophical aspects of Batik Lebak, and (4) Nursyeli & Puspitasari (2021) who studied the mathematical concept of Candi Cangkuang Leles Garut Jawa Barat, and (5) Irsyad et al. (2020) who studied the mathematical concept of Candi Asu. However, from many previous types of research related to the excavation of mathematical concepts in temple culture, no research has been found related to the exploration of Candi Plaosan: an ethnomathematical analysis of geometrical aspect. Therefore, it is considered necessary to conduct studies related to mathematical concepts in Plaosan Temple as an effort to conserve batik as a culture in Indonesia. Conservation efforts of Plaosan Temple require intervention from various sectors, one of which is sector education, so that from an early age, student have known their cultural roots, namely Plaosan Temple.

From the description above, the research questions that arise are exploring mathematical concepts in Plaosan Temple and the mathematical concepts contained in Plaosan Temple. Therefore, this research aims to describe the process of exploration of mathematical concepts in Plaosan Temple and describe the mathematical concepts contained in Plaosan Temple, particularly in the aspect of geometry.

METHOD

This study employed a qualitative research method with an exploratory approach. According to Moleong (2017), qualitative research is a type of research intended to understand phenomena experienced by research subjects such as behavior, perceptions, motivations, and actions holistically, and described in words and language within a natural context by utilizing various scientific methods. The current study is ethnomathematics by using an ethnography approach where four principal questions must be answered namely "where do I start looking?", "how do I find it?", "how do I recognize that it has found something significant?", and "how to understand what it is?" (Prahmana & D'Ambrosio, 2020). Therefore, the design of this study is based on these four questions (see Table 1).

Table 1. Research Design

Principal Questions	Initial Answer	Specific Point	Specific Activity
Where do I start looking?	Observation begins by analyzing the place where There is Plaosan Temple	Culture	Conducting interviews with people who know Plaosan Temple
How do I find it?	Investigating the architectural structures of Plaosan Temple directly	Alternative Thinking	Analyzing how the architectural structures of Plaosan Temple are designed.

Principal Questions	Initial Answer	Specific Point	Specific Activity
How do I recognize that it has found something significant?	Evidence (results) think alternatives are processed beforehand	Philosophy Mathematics	Determining what geometrical concepts are contained in the architectural structures of Plaosan Temple. Identify what geometrical concepts are contained in the architectural structures of Plaosan Temple. In the architectural structures of Plaosan Temple, there are geometric concepts in them.
How to understand what it is?	It is essential for culture, and it is crucial for maths	Anthropological Methodology	Describes the connectedness that occurs between two systems of knowledge (culture and mathematics) Describing the mathematical concepts in the architectural structures of Plaosan Temple, particularly in the aspect of geometry.

This research was conducted in November 2024. Prior to carrying out the study, the researcher first determined the research site and obtained the necessary research permits. The study was conducted at Plaosan Temple, located on Manisrenggo Street, Plaosan Hamlet, Bugisan Village, Prambanan, Klaten, Central Java, Indonesia.

The type of data in this study is qualitative data consisting of observation data, interview data, and documentation data. To obtain the data, the data collection technique is observation techniques to observe mathematical forms/concepts in Plaosan Temple, semi-structured interview techniques used to strengthen observation data, and documentation techniques to document both the interview process and the architectural structures of the temple under study. Specifically, the interview was conducted with an officer from the Balai Pelestarian Cagar Kebudayaan Wilayah X at Plaosan Temple.

In addition to researchers as the primary research instrument, another instrument was also used to obtain desired data, namely a semi-structured interview draft that consisting of two points which are (1) the existence of mathematical concepts, particularly in the aspect of geometry within Plaosan Temple and (2) the possibility of using Plaosan Temple as a context for teaching mathematics in the aspect of geometry. In this qualitative study, findings are considered valid if there is no discrepancy between what the researcher discovers and the reality of the object being studied. However, it should be noted that the truth of the data in qualitative research is not singular; rather, it depends on human constructions and the backgrounds that shape them (Sugiyono, [2019](#)).

The data obtained will be processed through three stages: data reduction, data presentation, and conclusion drawing (Sutama, [2019](#)). Then the data were analyzed based on mathematical and Plaosan

Temple knowledge by authors to see the existence of mathematical concepts in the batik. Next, the experts confirmed the analysis results as a form of data validity test (triangulation of data sources).

RESULTS & DISCUSSION

Result

Where do I start looking?

This research began by identifying the location of Plaosan Temple, which is situated on Jalan Manisrenggo, Plaosan, Bugisan Village, Prambanan, Klaten Regency, Central Java, Indonesia. Furthermore, the authors conducted an interview with an officer from Balai Pelestarian Cagar Kebudayaan Wilayah X at Plaosan Temple, named Gunawan (51 years), who possesses knowledge related to the values and philosophy of Plaosan Temple. The results of this interview are presented in the introduction section of this article. In addition, the interview was also conducted to directly observe the structures of Plaosan Temple, which were later used as research material in this study.



Figure 3. The Interview Process with Gunawan

Based on the interview results regarding the Plaosan Temple sample to be examined in this study, the temple was built between the 8th and 10th centuries AD by King Rakai Pikatan of the Sanjaya Dynasty, who was Hindu, together with his wife Pramodhawardhani of the Sailendra Dynasty, who was Buddhist. The temple stands as a symbol of tolerance and harmony between the two great religions, Hinduism and Buddhism, which coexisted during that period. Plaosan Temple is known as a "twin temple" consisting of Plaosan Lor (North Plaosan) and Plaosan Kidul (South Plaosan). Both are separated by a road stretching from east to west and surrounded by a moat or rice fields that enhance the beauty of the surrounding environment. During the Dutch colonial era, the temple experienced damage caused by Mount Merapi's eruption and earthquakes, which led to the collapse of several temple structures. The collapsed structures have been reconstructed or restored by *Balai Pelestarian Cagar Kebudayaan Wilayah X*. Furthermore, the interview also revealed that Plaosan Lor consists of 2 main

temples, 58 main *perwara* temples, 117 *perwara* stupas, 6 *pathok* temples, 1 *mandhapa* temple, and 78 *perwara* stupas of the *mandhapa* (currently still in ruins). Meanwhile, in Plaosan Kidul, the remaining identified structures include a *mandhapa*, 14 *perwara mandhapa* temples, and 60 *perwara mandhapa* stupas.

How do I find it?

From the information obtained during the interview at Plaosan Temple, the authors began to conduct observations regarding the mathematical concepts found in the architectural structures of the temple. Furthermore, the authors analyzed the connections to geometric aspects that can be observed in the temple buildings. Various geometric shapes in Plaosan Temple are not only found in the stone materials but also appear in the relief carvings on the temple walls. A summary of the authors' observations can be seen in [Table 2](#).

Table 2. Analysis of mathematical concepts in geometrical aspect by author

Concept	Concept Existence	Sub-Concepts	Topic
Geometry	Yes	Plane Geometry	Square
			Rectangle
			Right triangle
			Rhombus
			Right trapezoid
		Solid Geometry	Cube
			Rectangular prism
			Triangular prism
		Transformation	Dilation
			Reflection
Symmetry			
	Similarity and Congruence		

How do I recognize that it has found something significant?

Based on the authors' preliminary analysis of mathematical concepts as shown in Table 2, it was found that geometry is embedded in the architectural structures of the temple. Within this geometry, several sub-concepts were identified, including plane geometry consisting of squares, rectangles, right triangles, rhombuses, right trapezoids, and circles; solid geometry consisting of cubes, rectangular prisms, and triangular prisms; geometric transformations consisting of dilation and reflection; as well as symmetry, similarity and congruence.

According to the authors' analysis, the sub-concept of plane geometry on the topics of square, rectangle, rhombus, right triangle, right trapezoid, and circle was identified in the structure of Plaosan Temple. By definition, a square is a quadrilateral with four equal sides and four equal angles of 90° . A

rectangle is a two-dimensional quadrilateral with two pairs of parallel and equal opposite sides, and all angles are right angles. A rhombus is a two-dimensional quadrilateral with four equal sides and equal opposite angles; in addition, its two diagonals intersect perpendicularly. A right trapezoid is a quadrilateral with one pair of parallel sides and at least one right angle (Gunawan, 2023). A triangle is a polygon with three sides and three angles whose interior angles sum up to 180° . A right triangle is a triangle in which one of its angles is a right angle (90°). A circle is defined as the set of all points in a plane that are equidistant from a fixed point called the center. The distance from the center to any point on the circle is called the radius (Soedjadi, 2000). Based on the authors' observations of the architectural structure of Plaosan Temple examined in this study, several plane geometric figures were identified. Squares and rectangles were found on the walls of both the Northern and Southern Main Temples (Figure 4), while rhombus-shaped carvings were identified on the temple walls (Figure 5). Right-triangle-shaped reliefs were observed on the entrance gate of the ancillary temple (Figure 6), and right trapezoids were identified on the stairs of the temple entrance (Figure 7). The Buddhist influence in Plaosan Temple is indicated by the presence of stupas on the roof of the main temple. At the top of the stupa lies the chattra, supported by a structure shaped like a square base with a circular top (Figure 8).



Figure 4. Squares and rectangles on the walls of Plaosan Temple



Figure 5. Rhombus in the carvings/reliefs on the walls of plaosan temple



Figure 6. Right triangles in the carvings/reliefs of the entrance gate of the perwara temple



Figure 7. Right trapezium on the stairs of the entrance gate of Plaosan Temple



Figure 8. Circle on the base of the stupas at Plaosan Temple

Another geometric concept found is solid geometry, where several shapes resemble a cube, cuboid, and triangular prism. By definition, a cube is a solid figure bounded by six congruent square faces, with twelve equal edges and eight vertices (Soedjadi, 2000). A cuboid is a solid figure characterized by six faces, eight vertices, and twelve edges. Its faces are either squares or rectangles, with opposite faces having equal areas, and parallel edges having equal lengths (Qomaria & Wulandari, 2022). A prism is a solid figure with two congruent and parallel faces, while its lateral edges are parallel to each other. If both the base and the top are triangular, the solid is called a triangular prism, which has five faces (two triangles and three rectangles), six vertices, and nine edges (Sukino, 2006). In the ruins of Plaosan Temple, stones shaped like cubes were identified as materials used for the temple walls (Figure 9), while stones with relief carvings resembled triangular prisms (Figure 10). In addition, the temple ruins also reflect a mixture of Buddhist and Hindu architectural styles. The Hindu influence is evident in the perwara (companion) temples, whose ratna-shaped roofs resemble cuboids (Figure 11).



Figure 9. Cubes on the stone materials used for the walls of Plaosan Temple



Figure 10. Triangular prisms on the relief carvings of the building materials of Plaosan Temple

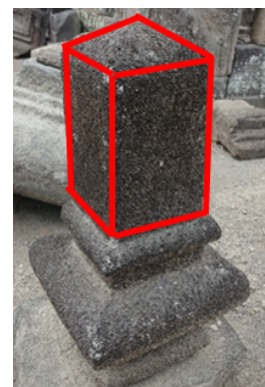


Figure 11. Rectangular prisms on the ratna roof of the perwara temple

Another geometric concept found in Plaosan Temple is transformation, such as dilation and reflection. Dilation is a transformation that changes the size of a figure by enlarging or reducing it while still maintaining its shape and the ratio of its sides (Sukino, 2006). An example of dilation can be

observed in the *Batu Ratna*, which is part of the temple roof or pinnacle. The *Batu Ratna* has a tiered or layered structure, where each layer is a scaled-down version of the one below it, illustrating the principle of dilation ([Figure 12](#)). Meanwhile, reflection is a transformation that maps points or figures by applying the property of mirror images, where the distance of a point to the axis of symmetry is equal to the distance of its corresponding point on the image (Qomaria & Wulandari, [2022](#)). Reflection can be seen in the *makara* carvings on the temple doorframe, located on the right and left sides of the entrance. If a line of symmetry is drawn through the center, the *makara* figures appear as mirror images of one another. The *makara* relief is an ornament found at the lower part of the temple entrance, symbolizing a mythological creature in Hindu belief that combines elements of three animals: an elephant, a snake, and a fish ([Figure 13](#)).

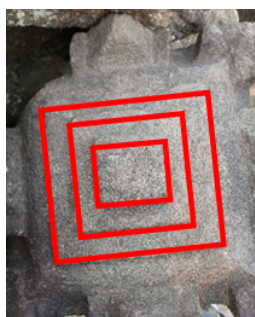


Figure 12. Dilation on the ratna stone of Plaosan Temple



Figure 13. Reflection on the makara relief at the doorway threshold of Plaosan Temple

For the sub-concepts of symmetry, similarity, and congruence, symmetry is defined as the balance or proportionality of parts of a figure in relation to a transformation, in which one part becomes the reflection of another (Soedjadi, [2000](#)). At the entrance of the perwara temple, there is a symbol of the Kala head or Batarakala, complete with its lower jaw; when a line of symmetry is drawn, it forms a balance or proportionality between the parts of the figure ([Figure 14](#)). Similarity refers to the condition when two objects have the same proportions, meaning the figures have the same shape, with corresponding sides in equal ratios and corresponding angles of equal measure (Soedjadi, [2000](#)). Two figures are said to be congruent if they can completely overlap each other when superimposed, with no difference in size or shape (Purwanto, [2007](#)). On the walls of both the North Main Temple and the South Main Temple of Plaosan, the authors found several relief carvings that were congruent with one another ([Figure 15](#)).

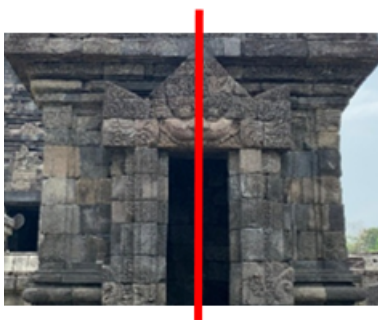


Figure 14. Symmetry on the doorway of the perwara temple



Figure 15. Similarity and congruence in the relief carvings of Plaosan Temple

Discussion

How to understand what it is?

As an effort to test the validity of data, a triangulation process was conducted by comparing the authors' assumptions about the mathematical concepts, especially the geometry aspects in Plaosan Temple as shown in [Table 2](#), with the viewpoints of experts in geometry. The triangulation process was carried out using the walkthrough interview method, where the authors directly communicated with the experts to compare their findings with the experts' opinions (Fitri & Prahmana, [2020](#)). Two fundamental questions were posed to the experts: (1) their perspective on the mathematical concepts in the temple (to confirm whether they found the same concepts as the authors), and (2) whether the context of Plaosan Temple can be used in mathematics learning.

The first concept confirmed was the concept of geometry, which was asked directly to a geometry expert. In response to the first question, the expert identified the same sub-concepts as those found by the authors, namely plane geometry (square, rectangle, right-angled triangle, rhombus, right-angled trapezoid, and circle), solid geometry (cube, cuboid, and triangular prism), geometric transformations (dilation and reflection), as well as symmetry, similarity, and congruence. All of these sub-concepts were found in the structural elements of Plaosan Temple (Putri et.al., [2025](#)). According to the expert's analysis, this occurs because, in general, all temples in Indonesia, including Plaosan Temple, are constructed with structures closely related to geometric concepts. This can be seen from the use of basic plane and solid geometric shapes in every part of the construction, not only in the stones themselves but also in the carved reliefs on the temple walls.

The materials used to construct the temple, such as andesite stones, were cut and arranged with precise dimensions and shapes, forming a sturdy and symmetrical structure (Tegar, et.al., [2026](#)). The regularity of the stone arrangement patterns demonstrates the application of similarity, congruence, and symmetry principles in geometry. Thus, the construction of the temple not only represents aesthetic and religious values but also embodies strong mathematical concepts.

For the second question, the geometry expert believed that Plaosan Temple can serve as a meaningful context for mathematics learning. According to the expert, teachers can utilize GeoGebra (a dynamic geometry software for visualizing mathematical objects (Judith & Markus, 2008); (Setyawan et al., 2018) during geometry lessons, particularly on topics such as solid geometry, similarity, and symmetry. For instance, teachers can sketch the structure of Plaosan Temple in GeoGebra, and students can analyze the basic shapes resembling prisms, pyramids, cubes, or cylinders, as well as examine the reflectional and rotational symmetries of carvings or reliefs on the temple walls (see Figure 16). This approach enables students to learn geometric concepts not only in the abstract but also in connection with the nation's cultural heritage. The use of temple contexts in mathematics instruction aligns with previous studies showing that ethnomathematics in temple structures can enhance understanding of geometric concepts while fostering cultural appreciation.

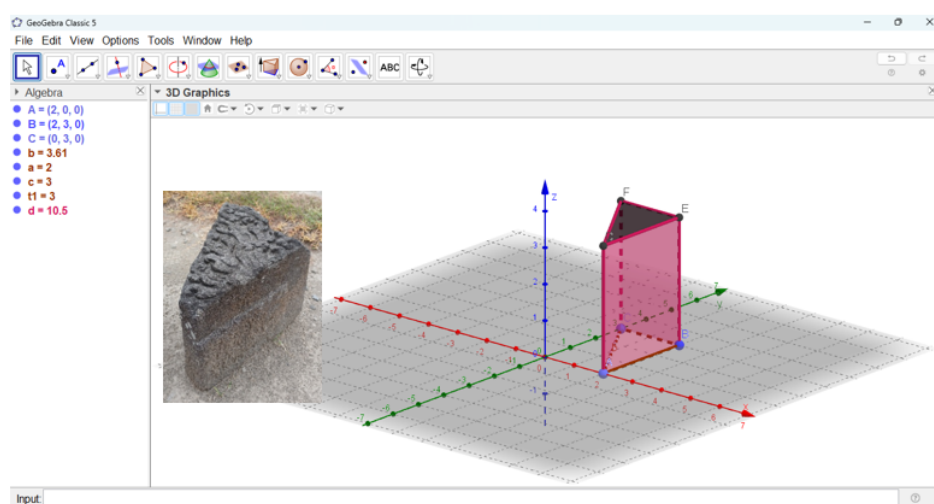


Figure 16. The use of GeoGebra in modeling the stones of Plaosan Temple

In the GeoGebra sketch, the teacher illustrates one of the stones with relief carvings in the form of a right triangular prism as a building material of Plaosan Temple, which can be used to calculate its surface area and volume. If the lengths of the base sides are 20 cm, 30 cm, and 36.05 cm, and the height is 35 cm, calculate the surface area and the volume of the prism.

Discussion:

Surface area of the prism

$$L = (2 \times \text{area of the base}) + (\text{perimeter of the base} \times \text{height})$$

$$L = (2 \times \frac{1}{2} \times 20 \times 30) + ((20 + 30 + 36,05) \times 35)$$

$$L = 600 + 3011,75$$

$$L = 3611,75 \text{ cm}^2$$

Volume of the prism

$V = \text{area of the base} \times \text{height}$

$$V = \left(\frac{1}{2} \times 20 \times 30\right) \times 35$$

$$V = 21000 \text{ cm}^3$$

Based on the research findings, it was discovered that Plaosan Temple contains various mathematical concepts, particularly in the field of geometry. These concepts include plane geometry (square, rectangle, rhombus, right triangle, right trapezoid, and circle), which appear in the temple walls, entrance gates, and relief carvings; solid geometry (cube, cuboid, and triangular prism), found in the building stones and the Ratna roof; geometric transformations in the form of dilation on the Batu Ratna and reflection on the makara at the doorway, as well as symmetry, similarity, and congruence in the Batarakala head ornament and the reliefs on the main temple walls. These findings indicate that the architecture of Plaosan Temple is not only of cultural and religious value but also represents a strong application of mathematical concepts. Therefore, Plaosan Temple has the potential to be used as a context for ethnomathematics-based mathematics learning, for instance, through the use of GeoGebra to visualize its geometric forms.

The findings of this study are in line with the results of Putra et al. (2020), who identified plane geometry shapes and reflection in the architecture of the Soko Tunggal Mosque. Similarly, Zuliana et al. (2023) found cuboid, cylinder, symmetry, and rotation patterns in Javanese traditional mosque ornaments as sources for geometry learning. Meanwhile, Sulistyawati & Rofiki (2022) demonstrated how GeoGebra can be utilized to model fractal batik motifs through repeated geometric transformations. Compared to these studies, the research on Plaosan Temple offers a more comprehensive perspective, as it not only reveals plane geometry but also solid geometry (cube, cuboid, triangular prism), transformations (dilation and reflection), as well as the concepts of symmetry, similarity, and congruence. Furthermore, the use of GeoGebra in the context of this temple opens new opportunities to connect cultural heritage with mathematics learning in a more interactive way.

This study has important implications for mathematics education. The geometric concepts found in Plaosan Temple can be utilized by teachers as contextual learning resources so that students understand mathematics not only in an abstract way but also in relation to local culture. The use of GeoGebra helps to visualize solid figures, symmetry, similarity, and congruence more concretely. In addition, these findings support the implementation of Project-Based Learning, for example through activities such as sketching the temple in GeoGebra and analyzing basic geometric shapes. Thus, this research enriches ethnomathematics studies while also offering innovative learning strategies that integrate mathematics, technology, and culture.

This study also has several limitations. First, the analysis focused more on geometric concepts, so other mathematical aspects such as algebra, arithmetic, or statistics were not explored in depth. Second, this research is descriptive in nature and has not yet been tested directly in classroom practice, so the effectiveness of using the Plaosan Temple context through GeoGebra to improve students' understanding still needs to be further investigated. Third, the use of GeoGebra in this study was limited to simple visualizations of three-dimensional shapes and has not yet reached the stage of developing interactive learning media.

Based on these limitations, several recommendations can be proposed for future research. First, subsequent studies are expected not only to focus on geometric concepts but also to involve other branches of mathematics such as algebra, arithmetic, and statistics. Second, future research needs to implement the context of Plaosan Temple in real classroom learning so that its effectiveness in enhancing students' understanding can be tested. Third, the use of GeoGebra can be further developed by creating interactive learning media that provide more complex and engaging visualizations of the temple's structures.

Of course, there are still many aspects that need to be further investigated from the results of this study, such as how the integration of Plaosan Temple into mathematics learning, particularly in the context of geometry, can be implemented and how effective it is in enhancing students' understanding. Therefore, the significance of this study is expected to provide a broader and more comprehensive impact, not only in improving students' mastery of geometry but also in contributing to the preservation and promotion of Plaosan Temple as a cultural heritage.

CONCLUSION

The As an effort to preserve Plaosan Temple through mathematics learning, the researchers examined mathematical concepts that can be explored from the temple's architectural structures through an ethnomathematics study. In this study, the process of studying mathematical concepts contained in Plaosan Temple was conducted with an ethnographic approach by answering four principal questions, namely "where do I start looking?", "how do I find it?", "how do I recognize that it has found something significant?", and "how to understand what it is?". The authors began this study by conducting direct observation at Plaosan Temple to identify architectural elements that contain geometric concepts. After recognizing the relevant geometric forms, the authors analyzed them using GeoGebra, and the results of the analysis were then confirmed with experts as a form of triangulation and an effort to deepen the understanding of mathematical concepts embedded in the architecture of Plaosan Temple. By answering these four questions, the authors successfully examined the geometric concepts contained in Plaosan Temple. The identified sub-concepts include: (1) plane geometry such as squares, rectangles, rhombuses, right triangles, right trapezoids, and circles, (2) solid geometry such

as cubes, rectangular prisms, and triangular prisms, (3) geometric transformations including dilation and reflection, and (4) concepts of symmetry, similarity, and congruence.

This study has successfully revealed the geometric concepts contained in Plaosan Temple. These concepts are expected to be utilized as contextual mathematics learning materials in schools, enabling students to understand mathematics not only in an abstract manner but also in relation to local cultural heritage. Therefore, this study also contributes to the preservation of Plaosan Temple through the integration of education and culture. Furthermore, the preservation efforts of Plaosan Temple as a cultural heritage can be carried out more optimally through its integration into mathematics learning. This study can also be further developed through effectiveness tests related to the implementation of Plaosan Temple-based learning using GeoGebra to improve students' understanding of geometry concepts.

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