Tec Empresarial
P-ISSN: 1659-2395; E-ISSN: 1659-3359

EXPLORATION OF ETHNOMATHEMATICS IN THE ICONIC TOWER OF SABILILUNGAN 99 IN BANDUNG REGENCY AS A REFLECTION OF SUNDANESE CULTURE AND ITS RELATION TO MATHEMATICAL CONCEPTS

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Abstract

Learning strategies that integrate cultural elements with mathematics are referred to as ethnomathematics. The application of ethnomathematics in education is crucial for fostering love towards local culture, which is currently being overshadowed by modernization. This research aims to elucidate the mathematical elements inherent in the iconic Tower of Sabilulungan 99 in Bandung Regency as a reflection of Sundanese Culture and its relation to mathematical concepts. The research method employed is ethnographic research. Data collection techniques include observation, interviews, field notes, and documentation. The data analysis method utilized is triangulation analysis, consisting of data reduction, presentation, and conclusion drawing. The research findings indicate the presence of several mathematical concepts in the Tower of Sabilulungan 99, such as plane geometry: triangles, quadrilaterals, polynomials, transformation geometry, spatial plane geometry including cubes, rectangular prisms, prisms, pyramids, and the concept of comparison. Exploring ethnomathematics can be utilized as a mathematics learning strategy, serving as an innovation in mathematics education within schools. The application of ethnomathematics strategies can enhance the elements of character education in the form of patriotism towards the homeland.

Keywords: Ethnomathematics, Mathematics, Sundanese Culture, Tower of Sabilulungan

Introduction

Education and culture are two inseparable aspects of daily life (Putri 2017). Education is considered a basic necessity for every individual in society, while culture is a comprehensive unit that applies within society, where the values and ideas contained therein are absorbed by a group of people in a specific societal context at a particular time(Aldina 2016). The relationship between culture and society is mutually dependent, where culture influences society and vice versa, as well as the relationship between culture, civilization, and history (Zulaekhoh and Rahman Hakim 2021). Society can shape culture, while culture also shapes its own identity. Therefore, the relationship between humans and culture is close and can shape an individual's character..

Integrating culture into education is considered a crucial solution for the younger generation to enrich themselves with valuable value (A.J.Bishop 2002) . Implementing intellectual and local cultural values in the educational context means making them the basis or guide in the development of teaching programs (Pratama and LEstari 2017). One way to encourage students to think critically is through mathematics education, as mathematics involves modeling, problem-solving, and logic, aimed at enhancing critical thinking skills in understanding the world (Febriyanti, Prasetya, and Irawan 2018). Mathematics is seen as an essential discipline and has significant contributions to humans in carrying out daily activities(Supriadi 2019)(Rosa and Orey 2013).

Innovative and interactive mathematics learning can be achieved through a cultural approach that is highly familiar with the term ethnomathematics. Ethnomathematics is the interface between cultural anthropology and mathematics and mathematical modeling to solve everyday problems and translate them into modern mathematical language systems(Orey and Rosa 2006). D'Ambrosio proposed the idea of restoring mathematics to be rooted in culture and students' daily lives and internalizing socio-cultural values that can shape good character in students. Many researchers and educators have realized that ethnomathematics is part of a powerful pedagogical strategy for understanding mathematical concepts based on students' experiences and cultures (Muwahhidah, Asikin, and Mariani 2018). Teaching mathematics is essentially related not only to everyday mathematics subjects but also to the meaning of thinking and epistemological perspectives of genetic theory, sociology, and culture (D. I. Abdullah, Mastur, and Sutoarto 2015)

Many studies have highlighted mathematical values related to Sundanese culture, which can be used as a basis for mathematics learning, (Rahman et al. 2022) related to the exploration of transformation geometry concepts in the iconic buildings of the city of Soreang, (A. Abdullah 2016) noted the use of mathematical models, clock symbols, and units of measurement in rural communities in Pantai Santolo, Pameungpek District, Garut Regency.. (Muhtadi et al. 2017) found that mathematical operations in Sundanese belief symbols connect standard numbers, especially naktu, with the Sundanese hanacaraka script..

Based on various studies related to ethnomathematics in Sundanese society, there is great potential to make it an area of study in the field of mathematical ethnography (Febriyanti, Prasetya, and Irawan 2018). Bandung Regency community is an example of a Sundanese community that still maintains its cultural traditions, both in social interactions and in artifacts or buildings that symbolize their culture. One striking example is the iconic Tower of Sabilulungan 99 which reflects Sundanese cultural values related to mathematical elements.

Method

This research employs ethnographic research method, a qualitative research developed from anthropological methodology(Komara, Syaodih, and Adriani 2022). This method investigates communities and cultures by examining human, interpersonal, social, and cultural relationships in

all their complexities(Komara, Syaodih, and Adriani 2022). In line with this, the research describes the mathematical elements contained within iconic buildings in Bandung Regency, thus focusing on the Tower of Sabilulungan 99. Data collection techniques used include observation, interviews, field notes, and documentation. The research object is the Tower of Sabilulungan 99. The research subjects are Sundanese cultural experts. Interview informants are used to obtain information about the elements contained within the Tower of Sabilulungan 99. Data analysis in this research employs triangulation. Triangulation is a technique for analyzing the results of the same research using different data collection methods. Data reduction is a form of analysis that sharpens, classifies, directs, and eliminates unnecessary data. In this research, the collected data from interviews, observations, and documentation about the Tower of Sabilulungan 99 are reduced by selecting the necessary information for this research. The results of data reduction indicate that the elements contained within the Tower of Sabilulungan 99 are geometric concepts. Then, after reduction, the next stage is data presentation where in this research, the results of data reduction are presented by depicting sketches and then explaining the mathematical elements contained within it. After reducing and presenting the data, conclusions are drawn to determine the mathematical elements within the Tower of Sabilulungan 99.

Results and Discussion

Image 1: Tower of Sabilulungan 99 in Bandung Regency

The Tower of Sabilulungan 99 is not just a physical structure, but it also plays a role as a public service location and holds significant symbolic value in the culture and history of Bandung Regency. The name of the tower, as written on the front part, is "Munara Sabilulungan 99." The large writing is white against a white background. "Munara" itself means tower in Sundanese, while "Sabilulungan" means mutual cooperation, and the number 99 represents the philosophy of the Asmaul Husna (the 99 names of Allah). At the top of the tower, there is a kujang, a typical Sundanese weapon, symbolizing that Sundanese people preserve the environment, as the blade of the kujang is not sharpened to prevent it from cutting trees, thus preserving nature. In its profile, the Tower of Sabilulungan 99 is often identified as a meeting point between modern technological sophistication and traditional cultural sustainability. Standing 99 meters tall, the Tower of Sabilulungan 99 embodies the

philosophy of the Asmaul Husna and reflects values such as strength, resilience, unity, and progress in the context of local beliefs or culture.

At night, the lights surrounding the tower and skywalk illuminate, as seen in the image. It's no wonder that many people want to visit it at night just to see, stroll around, enjoy the food vendors, and take photos.

Image 2: Upper Part of the Tower of Sabilulungan 99 in Bandung Regency

Front view from the roof aspect, this tower has a roof shaped like an isosceles triangle and 3 stacked isosceles trapezoids. An isosceles triangle is a flat shape with two sides of equal length, positioned at the top of this roof section, and a trapezoid is a flat shape with 4 sides, with one pair of sides of equal length. It can be seen here that the concept of similarity is applied, where the first and second trapezoids are similar, as well as the second and third trapezoids..

On the side view, it appears in three dimensions, thus creating a new structure, namely a square pyramid and a trapezoidal prism. However, when we combine the three parts, it will create a triangular prism, with its peak located exactly on the kujang. It can even be seen when viewed from above.

Image 3: Sketch of the Upper Part of the Tower of Sabilulungan 99

Not only at the top of the Tower, the application of geometric concepts also exists on every side of the Tower. Moving on to the middle part of the Tower. In the middle part of the Tower, there is a rectangle. A rectangle is a flat shape with 4 sides, with 2 pairs of sides of equal length. However, when viewed from the side, it can form a rectangular prism. A rectangular prism is a three-dimensional shape bounded by three pairs of parallel sides that are rectangular or square, with at least one pair of parallel sides having different measurements

Image 4: Sketch of the Middle Part of the Tower of Sabilulungan 99

And for the cylindrical pillars, upon closer inspection, it turns out that within these standing pillars used as supports for the building, there are flat circular shapes, hexagons, and kites.

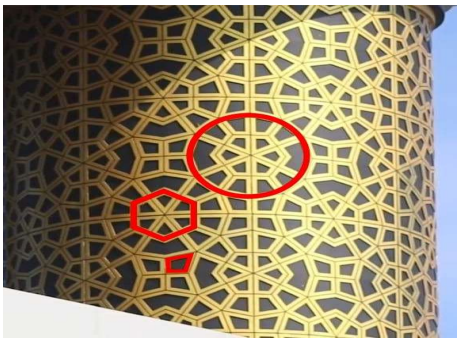

Image 5: Sketch of the Pillar Part of the Tower of Sabilulungan 99

The application of geometric transformation concepts, specifically rotation, on the kite creates the aforementioned hexagonal flat shape. Not only that, but it can even create new shapes that can enhance these pillars. At the bottom of the Tower, there are 3 floors that will be used as public service offices, which also apply geometric concepts.

Image 6: Sketch of the Bottom Part of the Tower of Sabilulungan 99

From the exploration results of iconic buildings, particularly the Tower of Sabilulungan 99 in Bandung Regency, related to mathematical concepts, several important points were obtained that can be analyzed through the application of atlas.ti, as shown in the figure below.

The research results indicate that in Sundanese society, the Sundanese culture is known for its art and architecture. Iconic buildings today often depict the uniqueness of Sundanese culture, which needs to be studied and utilized as a learning resource in schools. Currently, each district in West Java has developed iconic buildings with motifs and characteristics based on their respective regions (Rahman et al. 2022). However, although many ornaments and architectural styles have moral values and aspirations visualized that they want to convey to the general public who see them. Furthermore, it turns out that in construction, there are mathematical elements including concepts of flat geometry, spatial geometry, and transformation geometry such as reflection, translation, rotation, and resizing, which they learn autonomously, based on experience, creativity, and also their cultural traditions (Rahman, Kosasih, and Saputra 2022).

The relevance of culture in iconic buildings in Bandung Regency with mathematical concepts, especially geometry, can be seen through various aspects such as design, symbolism, and cultural values reflected in the structure of the building. Here are some examples of this relevance:

1. Architectural design; Iconic buildings in Bandung Regency often reflect the use of distinctive geometric shapes in their architectural designs(Lusiana et al. 2019). For example, buildings use geometric elements such as circles, triangles, or rectangles in the layout and structure of the buildings. This reflects the application of geometric concepts in the planning and construction of buildings (Funan and Mamoh 2019).
2. Proportion and symmetry; The concepts of proportion and symmetry, which are integral parts of geometry, are often applied in the design of iconic buildings. Buildings may have harmonious proportions and visually pleasing symmetry (Indriyani 2017). For example, symmetrical domes or regular lines can be found in many iconic buildings, reflecting the use of geometric principles in design (Z and Muchlian 2021).
3. Cultural symbolism; Iconic buildings in Bandung Regency often contain deep cultural symbolism. These symbols may reflect cultural values, history, or local identity (Amelinda, Wardhani, and Putri 2022). For example, traditional patterns or typical Sundanese ornaments are often applied in building designs, creating a strong connection between the building and local culture..
4. Historical and cultural context; Iconic buildings in Bandung Regency also reflect the historical and cultural context of the region. The design and structure of buildings may draw inspiration from local cultural heritage or well-known traditional stories within the community. The use of specific geometric shapes may also be related to symbolism or special meanings in the local cultural context (Nurhayati and Emilzoli 2022).

Therefore, iconic buildings in Bandung Regency are not only prominent architectural achievements but also reflect deep cultural relevance with mathematical concepts, especially in

geometry. The use of geometric principles in architectural design not only creates visually beautiful buildings but also reaffirms the cultural identity and values of the local community.

Conclusion

The results of the exploration of the iconic Tower of Sabililungan 99 in Bandung Regency as a reflection of a part of Sundanese culture are closely related to mathematical concepts such as flat geometry: triangles, quadrilaterals, polynomials, transformation geometry, spatial geometry including cubes, rectangular prisms, prisms, pyramids, and the concept of comparison.

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