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ETHNOMATHEMATICAL EXPLORATION OF THE GREAT MOSQUE OF KABANJAHE, KARO REGENCY

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ABSTRACT

This research aims to explore the ethnomathematical elements found in the building of the Kabanjahe Grand Mosque. The method used is qualitative descriptive with an ethnographic approach. The subject in this study is the Chairman of the Mosque Prosperity Agency (BKM) of the Kabanjahe Grand Mosque. Data collection techniques are carried out through direct observation, interviews, and visual documentation of the mosque architecture. Data analysis is carried out through the process of data reduction, data presentation, and conclusion drawn, as well as the application of source triangulation techniques to ensure data validity. The results of the study show that various parts of mosques, such as floors, fences, ornaments, pulpits, and domes contain geometric shapes of flat and spatial buildings, such as squares, rectangles, triangles, circles, beams, tubes, cones, and others. These findings show that the Great Mosque of Kabanjahe can be used as a contextual learning resource in mathematics learning, especially in introducing the concept of geometry through a cultural approach (ethnomathematics). This research reinforces the importance of integration between mathematics and local culture to support meaningful and relevant learning for students.

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1. INTRODUCTION

Mathematics as a basic science has an important role in human life, not only as an abstract discipline, but also applied in various aspects of life such as economics, technology, art, and culture (Rahmah 2018; Agustini, Leton, and Fernandez 2019). The concepts of geometry, pattern, and proportions are widely found in traditional building structures and cultural ornaments that are passed down from generation to generation (Albani et al. 2024). In the context of education, mathematics is not only taught as a calculation tool, but also as a means of developing critical, logical, and analytical thinking skills (Ramdani et al. 2023). Unfortunately, learning math is often considered difficult and irrelevant to everyday life. One effective approach to bridging this gap is ethnomathematics, which is the introduction of mathematical concepts through the context of local culture (D'Ambrosio in Alwahab et al. 2024; Febriyanti and Afri 2023).

D'Ambrosio (1977) defines ethnomathematics as the study of mathematical thinking and practice in a particular cultural community, which shows that mathematics is a social and cultural construct. This approach provides a great opportunity to relate mathematical concepts to cultural objects around students (Wulandari, Lubis, and Siregar 2024). The mosque is one of the cultural objects that is rich in mathematical elements, both in terms of architecture and ornaments. Various studies have examined the relationship between

ethnomathematics and mosque building, such as those conducted by Arifin et al. (2025) at the Al-Mashun Grand Mosque in Medan and Hadi and Siregar (2025) at the Great Mosque of Rantau Prapat, which shows that elements of symmetry, proportion, and geometric shapes can be used as contextual learning media.

Research Endriani et al (2023) also found that traditional Minangkabau ornaments in the Great Mosque of West Sumatra have great potential as a source of geometry learning. On the other hand, research tia ananda solin et al (2024) reveals that the architectural elements of the mosque such as symmetrical patterns, fractals, and proportions are representations of mathematical and cultural values. Sipahutar and Reflina (2023) emphasized that the introduction of building spaces through local cultural contexts, such as museums or traditional buildings, can make it easier for students to understand geometric concepts in a concrete way. Moreover Camellia (2023) It shows that learning based on local culture can significantly improve students' spatial and mathematical reasoning skills.

The Kabanjahe Grand Mosque in Karo Regency is one of the real examples of buildings that combine Islamic values and local wisdom of the Karo tribe. Built in 1965 and inaugurated in 1975 (Tanjung et al. 2024), this mosque has various architectural elements with geometric shapes such as squares, triangles, circles, parallelograms, rhombuses, beams, cubes, tubes, and cones. These elements are not only aesthetically valuable, but also have great potential to be used as a source of ethnomathematics-based mathematics learning in schools. This research aims to explore the ethnomathematical elements contained in the architecture of the Great Mosque of Kabanjahe, by examining the geometric forms of flat buildings and spaces, as well as reviewing the local values contained in the design. It is hoped that the results of this research can contribute to the development of mathematics teaching materials based on local culture and enrich ethnomathematical literature in Indonesia.

2. RESEARCH METHODS

This research was conducted at the Great Mosque of Kabanjahe, Karo Regency, North Sumatra, which was chosen because its architecture is rich in ethnomathematical elements in the form of geometric patterns, symmetry, and proportions of cultural and mathematical value. The research will take place in May 2025 with a descriptive qualitative approach to analyze the shape of flat buildings and spaces in mosque architecture. Primary data were obtained through observations, semi-structured interviews with the Chairman of BKM and community leaders, as well as visual documentation, while secondary data came from literature, journals, and documents related to ethnomathematics, mosque architecture, and Karo culture (Adolph, 2016). Data collection was carried out through observation, interviews, and documentation, then analyzed using the Miles and Huberman model, which includes data reduction, data presentation, and conclusion drawn. The validity of the data was tested through source triangulation, extension of observation, and peer discussion to ensure the validity of the study.

3. RESULT AND ANALYSIS

Research Results

Table 1. Observation results

No.	Aspects	Objects Observed	Observation Notes
1.	Historical aspects	Inauguration nameplate	The mosque was built in 1965 on the provision of waqf land with construction carried out by working together between the community and the government
2.	Philosophical Aspects	Carving motifs on the dome of the mosque and some of the walls of the mosque	A Collection of Paintings That Symbolize Contemporary Art
3.	Mathematical aspects	Has a size	The main size of the mosque building is square meters. The mosque tower towers 27 meters high, becoming a striking architectural element as well as having meaning in Islamic architecture. At the very top of the building there is a large dome, namely the main dome which has a diameter of 16 meters and a height of 20 meters. For the 4 domes that surround the large dome have a diameter of 1.5 meters high and 2 meters high24×24
		There is a flat build shape	There are square shapes on the floor, rectangular shapes on the wall decorations, triangles on wall ornaments, parallelographs on fences, rhombus shapes on fences and circle shapes on the pulpit.

		There is a form of space building	There are beam shapes on the pillars and charity boxes, tubes on pillars, cones on the end ornaments on the mosque domes, and ball shapes on the pulpit.
4.	Socio-cultural aspects	Multipurpose room and mosque courtyard	The mosque is used for social activities such as recitation, education and deliberation. The mosque courtyard is a place for community interaction and parking.

Based on the table above as a result of observations, the Kabanjahe Grand Mosque is a building that is not only used as a place of worship, but is also used as a place of social culture reflecting the combination of local karo culture and Islamic teachings. Where in history this mosque was built as a result of mutual cooperation between the community and the government. Which will make it a symbol of the development of Islam in the karo area.

Description of Interview Data

The Great Mosque of Kabanjahe, formerly called the Kabanjahe Grand Mosque, was built on the land of the waqf of Haji Umaruddin Baros. The construction began on May 3, 1965 and was inaugurated on October 11, 1975 by the Minister of Religion of the Republic of Indonesia, Prof. Dr. H.A. Mukti Ali, with the support of donations from the community, the government, and agencies. This mosque had functioned as a school (MTs and Aliyah) before being transferred during a total renovation. A major renovation was carried out on December 16, 2010, followed by an overhaul of the dome and ornaments in 2012. Initially, the mosque dome was in the form of an ornament of a Karo traditional house, but it was changed to a public mosque dome, still retaining traditional Karo motifs such as Pengerets, bamboo shoots, and other combined patterns. The mosque measures 24 × 24 m² with a 27-meter-high minaret, as well as a 16-metre diameter and 20-metre-high main dome, surrounded by four small domes. The results of observations show that the architecture of this mosque contains mathematical concepts in the form of flat and spatial buildings, reflecting the integration of Karo culture with Islamic values.

Build Flat

A flat build is a building that can be drawn on a flat plane or can be called a two-dimensional image that has length and width but does not have height or thickness (Mardatih and Sintawati 2019). Flat buildings can be grouped into several parts, including:

Square

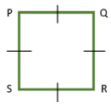

Figure 1. Square

A square is a flat shape where the four sides are the same size and the four corners are right-angled (Irmaet al 2021). Square properties:

a. The sides facing each other are parallel and equal in length
b. All sides are of the same length
c. The two diagonals are the same length, divided in half by the same length, and intersect perpendicular to each other
d. The opposite angle is the same size, i.e. the angle of the elbow

Formula of area and circumference of square

Square Area = s_2

Figure 2. Floor Ceramics 1

Square circumference = $4 \times s$

Figure 3. Floor Ceramics 2 and 3

The Great Mosque of Kabanjahe has a square ceramic coated floor with varying sizes, namely 24×24 cm on the first floor and 40×40 cm on the second floor. This square shape reflects the concept of a two-dimensional flat building relevant to geometric materials, in which the area and circumference of ceramics can be calculated, such as the first floor which has an area of 576 cm² and a circumference of 96 cm, and the second floor with an area of 1,600 cm² and a circumference of 160 cm.Philosophically, the symmetrical and balanced square shape symbolizes balance, order, and stability, and reflects the justice and equality of human beings before Allah SWT, because each side has the same length. From a socio-cultural aspect, the selection of motifs and colors of floor

tiles not only pays attention to aesthetics, but also describes the local values of the Karo people who uphold the sanctity, comfort of the worship space, and the spirit of mutual cooperation in caring for the mosque.

Rectangle

A rectangle is a flat shape whose sides face each other in equal length and the four corners are right (Irma, Putra 2021)

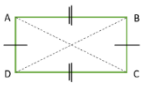

Figure 4. Rectangle

Properties of Rectangle

a. The sides facing parallel and equal length (length and width)
b. It has 2 diagonals of equal length and divides each other in half of equal length
c. Every corner is right

Rectangular Area = $p \times l$

Circumference of Rectangle = $2(p + l)$

Figure 5. Wall ornaments

Rectangular Width and Circumference Formula

The rectangular wall ornaments of the Great Mosque of Kabanjahe not only function as an aesthetic element, but also have mathematical and cultural value. Mathematically, it has two pairs of parallel sides of different lengths, measuring 210 cm × 130 cm, so that it has an area of 27,300 cm² and a circumference of 680 cm. This simple calculation shows that geometric elements are present in the architecture of the mosque and can be used as a contextual learning resource for students. From a philosophical point of view, the rectangular shape symbolizes the balance between the vertical (human with God) and horizontal (human with others) relationship, while this ornament is often decorated with calligraphy or typical Karo motifs that reflect the combination of Islamic values and local culture. Wulandari et al (2024) mentioning that geometric symbols in worship architecture strengthen cultural identity and spiritual meaning. In addition, according to Hadi and Siregar (2025), geometric ornaments like this are often used as a visual da'wah medium through calligraphy, which combines aesthetic, cultural, and religious values.

Triangle

A triangle is a flat build that has three sides and three corner points, with a large number of angles in the triangle i.e. 180° (Irma, Putra 2021)

Formula of Area and Circumference of Triangle

Triangle Area = $\frac{1}{2} \times a \times t$ Circumference of a Triangle = a + b + c

Rumus pythagoras:

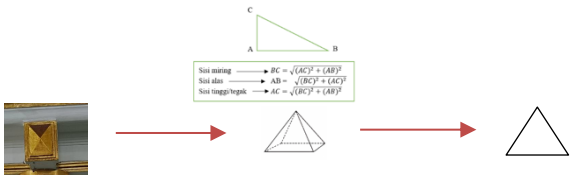

Figure 6. Triangle ornaments

One of the wall ornaments in the Kabanjahe Great Mosque is triangular in shape, as part of the limas ornament, with a base size of 20 cm and a height of 10 cm. Based on the geometric formula, the area of the triangle is 100 cm² and its circumference is 48.28 cm. The presence of this shape shows that the concept of geometry can be learned directly from the decorative elements of the mosque, making learning more contextual and real for students. Philosophically, the triangle symbolizes balance and stability, which in the context of Islam and Karo culture represents faith, knowledge, and charity as the foundation of spiritual life. The placement of triangular ornaments on the walls or pulpits of the mosque is not only aesthetically valuable, but also full of spiritual messages. From a socio-cultural aspect, this triangular shape is often found in traditional Karo carvings, reflecting the acculturation of Islamic culture and local wisdom. Sipahutar and Reflina (2023) mentioned that the use of geometric shapes in local culture is a bridge for context-based mathematics learning, so that it is more meaningful and close to students' lives.

Parallelogram

Parallelogram is a rectangular flat structure with its sides facing parallel and equal length (Irma, Putra, and Netriwati 2021).

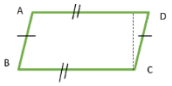

Figure 7. Parallelogram

Properties of a Parallelogram

a. Opposite sides of the same length
b. The two diagonals are divided in half by the same length
c. The opposite angle is equally large

Parallelogram Width and Circumference Formula

Parallelogram Area = $a \times t$

Circumference of parallelogram = 2 (a +b)

Figure 8. Parallelogram on the mosque fence

The fence of the Great Mosque of Kabanjahe not only functions as a protector, but also contains aesthetic elements that are rich in cultural and mathematical value. One of the elements is a parallelogram-shaped ornament with a base size of 100 cm, a height of 13 cm, and a slanted side of 15 cm, so that the area is 1,300 cm² and the circumference is 230 cm. This form is a clear example of the application of the concept of wide and circumference of a square flat building, which can be used as a contextual learning resource for students. From a cultural point of view, parallelogram ornaments reflect the harmony between functions, art, and symbols. Its oblique shape symbolizes steadfastness and stability, as a message to maintain the values of faith and tolerance in social life. Agustini, Leton, and Fernandez (2019) It states that the elements of flat buildings in traditional architecture often reflect local and religious values. In this case, the parallelogram fence of the Kabanjahe Grand Mosque is a concrete example of ethnomathematics, which combines mathematical concepts with the cultural and spiritual values of the Karo people.

Split Ketupat

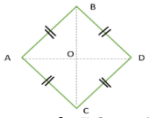

Figure 9. Rhombus

Rhombus is a parallelogram whose two sides are close together in equal length (Irma, Putra, and Netriwati 2021).
Properties of Kethombus

a. The sides facing are parallel and equal in length
b. The two diagonals intersect perpendicular to each other and divide in half the same length
c. The angle is divided in half by its diagonal

Formula of Area and Circumference of Rhombus

Rhombus Area = $\frac{1}{2} \times d1 \times d2$

Circumference of Ketupat = 4s

Figure 10. Rhombus on the mosque fence

One of the uniqueness of the fence of the Kabanjahe Grand Mosque lies in its rhombus shaped ornaments, with diagonal sizes of 55 cm and 56 cm, resulting in an area of 1,540 cm² and a circumference of 156.96 cm. Mathematically, this form introduces the concept of flat building geometry which can be used as a contextual learning medium for students. In terms of culture and philosophy, rhombus symbolizes simplicity, honesty, openness, and is closely related to the symbol of the rhombus which is synonymous with purity and forgiveness in the Eid al-Fitr tradition. This ornament is not only an aesthetic element, but also full of spiritual and moral value for society. Albani et al. (2024) explained that traditional North Sumatran geometric motifs, including rhombus, often contain symbolic messages that reflect traditional and religious values. Through the integration

of ethnomathematics, this form helps students understand that mathematics is deeply rooted in their socio-cultural lives.

Circle

A circle is a flat structure where the distance of all points is the same length (Irma, Putra, and Netriwati 2021)

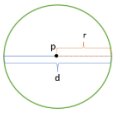

Figure 11. Circle

Properties of Circles

a. All points on the circle are equally spaced
b. Diameter is the longest line in a circle
c. Has no corners
d. It has infinite rotational symmetry and folding symmetry

Formula of Area and Circumference of Circle

Circle Area = πr^2

Circumference of Circle = $2\pi r$

Figure 12. Circles on dome ornaments

At the top of the pulpit of the Great Mosque of Kabanjahe there is a circular ornament with a diameter of 16 cm that contains the calligraphy of the word "Allah". Mathematically, this circle has an area of 200.96 cm² and a circumference of 50.24 cm. The shape of the circle symbolizes perfection, eternity, and in Islam it reflects monotheism, which is the belief in the oneness of Allah that has no beginning and end. The placement of the calligraphy "Allah" in the center of the circle symbolizes that God is the center of life, as expressed by Hadi and Siregar (2025) in his study of the philosophical meaning of mosque ornaments. Albani et al. (2024) added that building ornaments in North Sumatra, including geometric motifs such as circles, reflect a balance between function, aesthetics, and religious values. This shows that geometry in mosque architecture is not just decoration, but a means to understand spiritual and cultural values through an ethnomathematical approach.

Build Space

A space build is a three-dimensional shape or object with three main dimensions: length, width, and height, as well as surface volume and area. The building parts of the space are delimited by flat or curved planes (Friska 2022).

Cube

The cube is a space structure that is bounded by six sides that are square and congruent (Friska 2022)

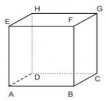

Figure 13. Cube

Cube Elements

a. It has 6 square sides (ABCD, EFGH, ABFE, CDHG, ADHE, and BCGF)
b. Has 12 ribs of equal length (AB, BC, CD, DA, EF, FG, GH, HE, AE, BF, CG, and DH)
c. Have 8 equal angle points (right angles)
d. Has 4 diagonal spaces (AG, BH, CE, and DF)

Formula of Surface Area and Cube Volume

Cube Surface Area = $6s^2$

Volume of a Cube =

Figure 14. Cube on the clock

Mathematically, this cube has a surface area of 1,350 cm² and a volume of 3,375 cm³. The clock not only serves as a timekeeper, but also is full of philosophical and mathematical meanings that can be analyzed through ethnomathematics. In Islam, the clock is a symbol of spiritual discipline because it is a tool in maintaining the punctuality of worship. The shape of the cube that has sides of equal length symbolizes equality and balance, in

accordance with the value of justice in Islamic teachings. Harahap, L Y (2023) mentioned that building a cube-like space in mosque ornaments reflects order that is closely related to Islamic principles. In the context of ethnomathematics, this cube-shaped clock shows that everyday objects in mosques not only have a practical function, but also store cultural, spiritual, and mathematical values that are relevant as a source of learning.

Beam

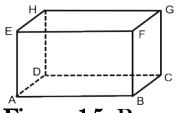

Figure 15. Beam

A beam is a three-dimensional spatial structure shaped like three pairs of squares, with at least one pair having a material size (Friska 2022).

Beam Elements

a. It has 6 sides consisting of three pairs of equal sides (ABCD = EFGH, ABFE = CDHG, and BCGF = ADHE)
b. It has 12 ribs which are divided into 3 parts namely length, width and height with the same and parallel ribs
c. Has 8 corner points
d. It has 12 diagonals and 4 diagonal spaces

Formula of Surface Area and Volume of Beams

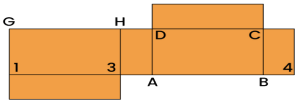

Figure 16. Beam Net

Beam Surface Area = $2 \times (pl + pt + lt)$

Beam Volume = $p \times l \times t$

Figure 17. Beams on the pillars of the

The pole in the main room of the Kabanjahe Grand Mosque has a white block with a size of 70 cm × 70 cm × 220 cm. Mathematically, this pole has a volume of 1,078,000 cm^3 and a surface area of 71,600 cm^2. The shape of this block is a contextual example to study the concept of volume and surface area in building a space, in line with the recommendations Astuti et al (2021) about ethnomathematics-based learning. Philosophically, these pillars symbolize the steadfastness of faith, just as the sturdy pillars support the mosque building. Its white color reflects purity and sincerity of heart. From the socio-cultural aspect, the shape of the block reflects the combination of traditional and modern architecture, showing the role of the mosque as a symbol of the sustainability of Karo culture. Halim (2020) emphasizing that structural elements in traditional buildings are often full of local aesthetic and symbolic meanings. Therefore, this beam pole is not only a geometric object, but also a medium for reflection on spiritual and cultural values in ethnomathematical learning.

Figure 18. Beam on the infak box

Inside the Great Mosque of Kabanjahe there is a charity box in the form of a block measuring 30 cm × 20 cm × 17 cm. Mathematically, this box has a volume of 10,200 cm^3 and a surface area of 2,900 cm^2, making it relevant as a learning medium for geometry to build spaces. Astuti, Zulfah, and Rian (2021) and Santoso, Yulia, and Rusliah (2020) emphasizing that the use of culturally based real objects supports contextual mathematics learning. Philosophically, the charity box symbolizes sincerity, generosity, and solidarity of the ummah, where the simple shape of the block reflects the stability of the heart in charity (Q.S. Al-Baqarah: 271). From a socio-

cultural aspect, the charity box reflects the culture of mutual cooperation of the Karo Muslim community in maintaining mosques and managing people's funds. Nalim et al. (2016) and Sabirin et al. (2023) states that the architectural elements of the mosque often represent local socio-religious practices. Thus, this charity box can be used as an ethnomathematical learning medium that brings together the concept of geometry with character values and religious culture.

Tube

A tube is a spatial structure that is bounded by two parallel circular planes of the same size, as well as by a curved plane that is at a fixed distance from the axis (axis) and symmetrical to it. The curved plane cuts the two circles right on their sides (Suharjana 2008)

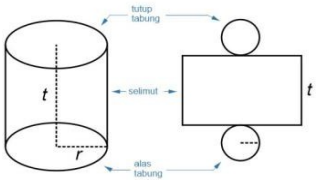

Figure 19. Fund

Elements of the Tube

a. It has 3 side planes namely, the side plane of the base = base, the curved plane = the tube blanket and the top plane = the lid
b. The sides of the base and the top of the tube have a congruent and parallel circular shape
c. The curved sides of the tube are rectangular when laid out with the size, length = circumference of the tube base and width = tube height
d. A tube is a prism whose base is a circle

Formula of Surface Area and Volume of Tubes

Tube Surface Area = $2\pi r^2 + 2\pi r \times t$	Volume Tabung = $\pi r^2 \times t$

Figure 20. Tubes on poles

The Great Mosque of Kabanjahe has a tubular support pole with a diameter of 16 cm and a height of 200 cm. Mathematically, this pole has a surface area of 10,449.92 cm^2 and a volume of 40,192 cm^3, so it is a relevant medium for learning to build curved side rooms. Astuti et al (2021) and Wulandariet al (2024) emphasizing that the use of local cultural objects like this supports contextual ethnomathematics-based mathematics learning. Philosophically, the tube pole reflects the firmness of faith and devotion in upholding the pillars of Islam, while the shape of the circle on the base and lid symbolizes unity and immortality related to the concept of monotheism. In terms of socio-culture, the typical Karo carving ornaments and calligraphy on this pole reflect the combination of Islamic values and local traditions. This is in line with the findings Alwahab et al. (2024; Sabirin et al. (2023) that the architectural elements of mosques often contain mathematical and cultural symbols that can be used as a source of contextual learning in ethnomathematics learning.

Cone

A cone is a description of a space that has two surfaces: a circular plane of the base and a curved vertical side plane.

Cone Elements

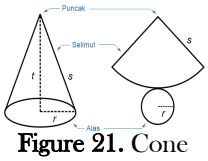

Figure 21. Cone

a. Having two sides (base and curved side) is called a blanket
b. Has a circular side of the base
c. It has conical curved sides if it is laid out in the shape of a circular jaw

d. Has a painter's line that connects the apex point with the base ribs
e. The radius of the base (r), the height of the cone (t) and the painter's line (s) have a relationship:

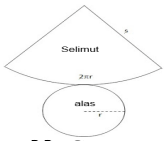

Figure 22. Cone mesh

Surface Area and Cone Volume

Cone Surface Area = $\pi r(r + s)$

Cone Volume = $\frac{1}{3} \times \pi r^2 t$

Figure 23. Cones on dome ornaments

Figure 24. Changing the dome of a traditional house into a semi-ball dome

The Great Mosque of Kabanjahe has a dome with a cone-shaped tip measuring 7 meters high and 4 meters in diameter. Mathematically, this shape has a surface area of 582,790.28 cm² and a volume of 29,306,666.67 cm³, which is relevant for learning to build curved side spaces. The change in the design of this dome occurred in the renovation in 2012, where it was previously in the form of the roof of the Karo traditional house, then changed to a semi-spherical dome with a conical top to better reflect the identity of Islamic architecture. These findings are in line with research Nalim et al. (2016) and Harahap, L Y (2023) which affirms that geometric shapes in mosque architecture reflect spiritual and Islamic values. This dome change also shows cultural acculturation and modernization, which integrates local wisdom with the universal symbols of Islam, as explained by D'Ambrosio (in Albani et al., 2024) and Wulandari et al. (2024) through the ethnomathematical concept that mathematics lives in culture.

Ball

A ball has only one curved side and has no angular point, a ball is a space built from the full rotation of a circle with its diameter axis (Sari 2009).

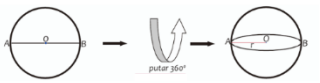

Figure 25. Ball

Ball elements

Figure 26. Ball Elements

a. Has one arch-shaped side plane
b. It has no ribs, diagonal plane and angular point
c. Have a single central point
d. Has diameter and radius (Sipahutar and Reflina 2023)

Formula of Surface Area and Volume of Ball

Ball Surface Area = πd2

Ball Volume = $\frac{4}{3} \times \pi r3$

Figure 2.7 Of a ball on a pulpit ornament

On the pulpit of the Great Mosque of Kabanjahe there is a spherical ornament with a diameter of 10 cm and a radius of 5 cm. Mathematically, this ornament has a surface area of 314 cm^2 and a volume of 523.33 cm^3, which can be used in learning to build curved side spaces. From an ethnomathematical perspective, the shape of the sphere symbolizes perfection and equality, where all points on its surface are equally distant from the center, reflecting the Islamic teaching that all human beings are equal before Allah SWT. Harahap (2023) emphasized that geometric shapes in mosque architecture not only have mathematical value, but also philosophical and religious value. The placement of the ball on the pulpit is a symbol that the teachings of Islam cover all aspects of the life of the ummah as a whole. Albani et al. (2024) and Agustini et al (2019) also emphasizing the importance of using cultural-based architectural elements as a contextual learning medium in introducing geometry concepts to students.a.

Discussion

This study explores the mathematical elements in the architecture of the Great Mosque of Kabanjahe and analyzes the application of geometric concepts to its design and structure. The results of observations show that there are various forms of flat and spatial buildings, such as squares, rectangles, triangles, circles, parallelograms, rhombus, blocks, cubes, tubes, cones, and spheres scattered on floors, fences, walls, pulpits, columns, domes, and clocks. These elements not only show the application of mathematical concepts architecturally, but also reflect the symbolic, historical, and cultural value of the Karo. This finding is in line with Endriani et al. (2023) and Hadi and Siregar (2025) who stated that the geometric elements in the mosque represent the balance, harmony, and religious values of the local culture. Nalim et al. (2016) emphasized that the design of the dome and arch contains Islamic spiritual symbols. The ethnomathematical concept of D'Ambrosio and Rosa (2017) views mathematics as a socio-cultural construction, making the geometric elements of the mosque as a contextual learning medium. Research by Sabirin et al. (2023), Salsabila and Soebagyo (2023), and Hasanah et al. (2024) supports the integration of ethnomathematics in education to improve the understanding of geometry in a concrete way. The Great Mosque of Kabanjahe is a representation of the integration of mathematical values, Karo culture, and Islamic teachings, which has the potential to be used as a learning medium based on local culture to strengthen students' understanding of mathematical concepts in a real context.

4. CONCLUSION

Based on the results of observation and analysis, the architecture of the Great Mosque of Kabanjahe contains various geometric elements of flat and spatial buildings, such as squares, rectangles, triangles, rhombus, parallelograms, circles, blocks, cubes, tubes, cones, and balls scattered on the floor, pillars, fences, domes, pulpits, and decorative ornaments. These forms not only function structurally, but also have aesthetic, philosophical, and spiritual significance in the context of Karo culture and Islamic teachings. These findings confirm that religious buildings such as mosques can be an effective contextual learning medium, especially in the introduction of geometric concepts through ethnomathematical approaches that relate mathematics to local cultural wisdom.

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