

Ethnomathematics & Ethnolinguistics: Cultural and Islamic Values in the Architecture of *Taqwa* Mosque-Metro, Indonesia

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Abstract—This study explores the intersection of ethnomathematics and ethnolinguistics in the architectural design of Taqwa Mosque in Metro, Indonesia. Employing a qualitative descriptive design with an ethnographic approach, data were collected through field observation, interviews with community leaders, and visual documentation. The mosque's domes, arches, minarets, and decorative motifs embody mathematical principles such as symmetry, geometry, proportion, and transformation. These elements are simultaneously functional, aesthetic, and symbolic, embedding Islamic values and local cultural traditions. Ethnolinguistic expressions, including Arabic calligraphy and Lampung script inscriptions, further reinforce cultural identity and religious narratives. The findings reveal that the mosque functions as a “living text,” integrating mathematical and linguistic knowledge with spiritual and cultural meaning. The novelty of this study lies in its dual-disciplinary lens, which simultaneously connects ethnomathematics and ethnolinguistics in the analysis of Islamic architectural space—an approach rarely applied in previous research. This perspective not only highlights the cultural epistemologies embedded in mosque design but also demonstrates the potential of mosque architecture as a contextual learning resource for both mathematics and language education. The study underscores the importance of culturally responsive pedagogy that aligns educational practice with students' sociocultural environments. To the best of our knowledge, this is the first documented study in Indonesia to integrate these

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two fields within the context of mosque architecture, offering new insights into character-based education in multicultural and religious settings.

***Index Terms*—contextual education, culturally responsive pedagogy, ethnomathematics, ethnolinguistics, Islamic architecture**

I. INTRODUCTION

Culture functions as a collective identity embedded in human life, encompassing values, beliefs, languages, and social practices that shape education and character development (Causadias, 2020; Hariyanto et al., 2023; Zajda, 2023). As a dynamic system passed down through generations, culture encompasses diverse domains language, arts, architecture, and belief systems that influence how knowledge is produced and transmitted. In education, culture offers a vital context for meaningful learning, enabling students to relate abstract concepts to their lived realities. However, in the era of globalization, education faces the challenge of sustaining local and spiritual values.

Ethnomathematics emerges as a promising approach to address this challenge. It examines how mathematical concepts are embedded in daily cultural practices and how communities construct knowledge outside formal systems (Batiibwe, 2025; d'Ambrósio, 2006; Jacob & Dike, 2023; Nicol et al., 2024; Rosa & Gavarrete, 2017; Rosa & Orey, 2023; Zalmansyah et al., 2023). Rather than treating mathematics as a culturally neutral discipline, ethnomathematics highlights its cultural relativity and potential to support contextual learning. This approach connects abstract mathematical theories with community practices, such as architecture, textiles, or ritual patterns, thereby enhancing engagement and relevance in the classroom.

Indonesia's diverse cultural and religious landscape offers fertile ground for ethnomathematics. Each region holds unique cultural values, languages, and artistic expressions that can inform educational practices. Mosques, as centers of worship and social life, hold significant potential to serve as living texts where mathematics, culture, and spirituality converge. Architectural features such as domes, minarets, arches, geometric motifs, and floor patterns can demonstrate mathematical ideas including symmetry, geometry, proportion, and transformation. When approached pedagogically, these features can support mathematics instruction grounded in cultural values (Ramadani, 2025; Yance et al., 2024; Zalmansyah et al., 2026; Tamrin et al., 2025).

Previous studies have demonstrated how mosque architecture in Indonesia encodes mathematical elements. For example, the Great Kauman Mosque in Semarang contains ethnomathematical symbolism in its pyramid roof and door design (Lail et al., 2021), while the Jami' Al-Baitul Amien Mosque in Jember features geometric figures in its domes and pillars (Purniati et al., 2020). The Nurul Kalam Grand Mosque in Pemalang similarly integrates planar geometry and reflective symmetry into its structure (Nalim et al., 2024). These findings illustrate the mosque's potential as a resource for contextual mathematics education.

This study focuses on the Taqwa Mosque in Metro, Lampung, built in 1967 and known for its distinctive blend of Lampung, Javanese, and Middle Eastern architectural elements. Its design includes mathematical structures embedded in visual motifs, geometric forms, and spatial arrangements, reflecting religious significance and potential for educational exploration.

To enrich this analysis, the study also adopts an ethnolinguistic lens. Ethnolinguistics explores how language reflects cultural worldview. Within mosque architecture, terms such as dome, mimbar, and minaret, as well as decorative patterns like the pucuk rebung motif and Lampung script inscriptions, embody symbolic meanings rooted in local identity. These linguistic representations connect language, mathematics, and cultural values, making them powerful pedagogical tools.

Accordingly, this study investigates how mathematical principles and linguistic symbols embedded in the architecture of Taqwa Mosque reflect Islamic teachings and local traditions. The goal is to offer insights into how contextual mathematics education can be developed by integrating Islamic values and indigenous culture. Through this interdisciplinary lens, the study seeks to strengthen culturally relevant pedagogy and curriculum design in Indonesia's pluralistic educational landscape.

This study addresses two primary research questions. First, it investigates how the concept of Islamic-based ethnomathematics is manifested in the architectural design of the Taqwa Mosque in Metro. This includes an examination of geometric patterns (Verner et al., 2019), spatial arrangements, and visual structures that embody mathematical values grounded in Islamic principles. Second, the study explores how these architectural elements also reflect local cultural values and Islamic teachings from an ethnolinguistic perspective. It seeks to understand how the language and terminology associated with the mosque's design function as cultural and symbolic expressions, reinforcing the relationship between mathematics, language, and religious identity.

The objectives of this study are fourfold. First, it aims to explore the integration of ethnomathematical concepts within the architectural design of Taqwa Mosque in Metro, focusing on elements such as geometry, symmetry, and transformation. Second, it seeks to analyze how language and terminology used in the mosque's architectural features reflect both local and Islamic cultural values. Third, the study intends to examine the role of ethnolinguistics in shaping the community's understanding of mathematical and symbolic structures embedded in religious architecture. Finally, it aims to contribute to the development of contextual mathematics teaching materials that are grounded in Islamic and local

values, thereby supporting character education and strengthening cultural identity within the framework of Indonesia's educational context.

II. LITERATURE REVIEW

The study of ethnomathematics and ethnolinguistics in mosque architecture represents a multidisciplinary approach that positions culture as a source of knowledge and learning. Ethnomathematics, introduced by d'Ambrosio, explores how cultural groups develop and apply mathematical ideas in daily life (d'Ambrosio, 1985). Each culture possesses its own mathematical system shaped by specific needs, environments, and values (Ding et al., 2023; Dong & Kang, 2022; Larvor, 2016; Mellone et al., 2021; Nunes & Bryant, 2021). In Islamic architecture, ethnomathematical elements manifest through geometric patterns that symbolize unity, balance, and sacredness, philosophical representations of tawhid (the oneness of God) and cosmic harmony (Ajouluni, 2020; Prahmana & D'Ambrosio, 2020). These patterns, including symmetry, tessellation, and proportionality, serve not only aesthetic purposes but also convey deep spiritual and cultural meanings.

In educational contexts, ethnomathematics promotes contextual learning by linking formal mathematical concepts to students' cultural backgrounds (Cimen, 2014; Fouze & Amit, 2023; Kabuye Batiibwe, 2024). It enables learners to perceive mathematics as integral to daily life, rather than as abstract or disconnected knowledge. This approach enhances conceptual understanding and fosters appreciation for local heritage. In Islamic settings, integrating ethnomathematics with religious values can encourage the development of positive character traits such as honesty and cooperation (Imamuddin & Isnaniah, 2023; Ratriana et al., 2021).

Studies related to mosque architecture reinforce the pedagogical potential of ethnomathematics. The *Taqwa* Mosque in Metro, for example, contains architectural features such as domes, proportions, and calligraphic inscriptions that hold mathematical significance (Loviana & Merliza, 2023; Safitri, 2023). Other mosques, such as the Great Kauman Mosque in Semarang and the Jami' Al-Baitul Amien Mosque in Jember, exhibit elements like pyramidal roofs, reflective doors, and geometric shapes including cylinders, pyramids, and circles used to teach transformation and congruence (Lail et al., 2021; Nalim et al., 2024; Purniati et al., 2020).

Ethnolinguistics complements ethnomathematics by examining how language and culture shape meaning. As a subfield of anthropological linguistics, ethnolinguistics focuses on how language reflects worldview, identity, and social norms (Pradhan & Kathmandu, 2020; Wildfeuer, 2022). Language is not merely a tool of communication but also a cultural marker embedded in visual and symbolic representations, particularly in sacred architecture (Mühlenbeck & Jacobsen, 2020; Saefuloh & Halimah, 2021). Mosque design often incorporates Arabic calligraphy, Qur'anic verses, and phrases such as the names of Allah, which serve as linguistic expressions with theological significance (Er-Ragragi, 2022; Nasser, 2022). Words like *minbar*, *mihrab*, and *minaret* carry not only architectural definitions but also cultural and symbolic weight. These linguistic elements align with mathematical concepts such as symmetry, reflection, and proportion.

The linguistic expressions found in the architectural elements of *Taqwa* Mosque reveal strong connections to mathematical ordering and the cultural worldview of the Lampung Muslim community. Terms such as *mihrab*, *minaret*, and *qiblah* carry spatial semantics that correlate with geometric principles, including orientation, symmetry, and proportional hierarchy. The Lampung cultural terminology embedded in decorative patterns, such as *kekhat*, *tapis*, and *siger* motifs reflects culturally embedded principles of balance, harmony, and geometric ordering. The architectural elements of the mosque contain symbolic values that reflect a worldview that values balance (*neraca*), structured harmony, and proportional beauty. These linguistic expressions do not merely label architectural elements but encode culturally informed spatial logic, demonstrating how ethnic language becomes a cognitive tool for organizing space mathematically and spiritually.

The interplay between architecture, language, and mathematics is evident in mosque construction that considers the social and spiritual needs of the community. For instance, the design of the Saidina Abu Bakar As-Siddiq Mosque in Malaysia used measurements based on human dimensions to enhance comfort and inclusivity (Ng et al., 2022). This reinforces how architectural forms can act as linguistic and mathematical texts, transmitting meaning through structure and symbolism. It is asserted that language shapes perception and cognition, implying that linguistic elements in mosque architecture may influence spiritual awareness (Alsaawi, 2022; Whorf, 2012).

The integration of ethnomathematics and ethnolinguistics in mosque studies particularly at the *Taqwa* Mosque in Metro offers a comprehensive framework for understanding how Islamic cultural knowledge is constructed and conveyed. These visual and linguistic symbols are not only reflections of artistic and spiritual richness but also resources for contextualized education (Lang Hearlson, 2021). This approach supports the development of culturally grounded learning models that emphasize identity and local wisdom (Mahaswa & Syaja, 2025; Mania & Alam, 2021; Sakti et al., 2024).

By drawing from both disciplines, this study investigates how mathematical ideas and linguistic expressions are embedded in mosque architecture, providing an educational resource that integrates spiritual, cultural, and intellectual values. The *Taqwa* Mosque thus represents a space where mathematics, language, and religion converge offering a model for learning rooted in heritage and belief.

III. METHODOLOGY

This study aims to explore the interrelationship between language, culture, and mathematics within mosque

architectural design, as well as how these elements influence religious and social practices in the Metro community. A qualitative method with an ethnographic and ethnolinguistic approach was employed to understand the cultural meanings embedded in the architecture and linguistic features of the *Taqwa* Mosque in Metro. This approach emphasizes in-depth exploration through narrative and visual data (Creswell & Plano Clark, 2023). Data were collected through participant observation, semi-structured interviews with the imam, mosque caretakers (*marbot*), and local residents, as well as visual documentation (Mahsun, 2005).

Ethnolinguistic theory was used to examine mathematical terminology in mosque design that reflects local culture and Islamic teachings. A mixed-method approach was also applied to integrate qualitative and quantitative data, thereby producing a comprehensive understanding of the interconnection between language, culture, and mathematical concepts in mosque architecture. The data obtained from observations, interviews, and documentation were analyzed using an ethnolinguistic framework to examine the relationship between language and culture (Hymes, 2013). This framework was utilized to interpret mathematical terms present in the architectural design of the *Taqwa* Mosque and how these terms reflect mathematical concepts and cultural values rooted in Javanese, Lampungnese, and Middle Eastern traditions. The integration of qualitative and quantitative findings (Creswell & Poth, 2016; Sugiyono, 2014) helped uncover the convergence of language, culture, and mathematics within the architectural context. To ensure the credibility of the findings, data triangulation (Maggetti, 2020; Meydan & Akkaş, 2024; Silva et al., 2024) was applied by cross-verifying information from interviews, observations, and visual documentation.

IV. RESULTS AND DISCUSSION

The *Taqwa* Mosque in Metro, constructed in 1967 through the collective initiative and funding of the local community, stands as one of the most iconic religious landmarks in Lampung Province. Beyond its role as a place of worship, the mosque embodies cultural heritage and architectural acculturation between local Lampung traditions and Middle Eastern Islamic design. From an ethnomathematical perspective, the mosque features a variety of structural elements that contain embedded mathematical values demonstrating how mathematical reasoning intersects with spirituality and local identity.

The research findings show that the mosque's design incorporates clear geometric forms and symmetric patterns. Architectural features such as the dome and minaret represent cylindrical and circular shapes, while the layout of the building exemplifies axial symmetry. The calligraphic inscriptions within the mosque reflect balanced composition and proportional spacing, resonating with mathematical precision. These visual forms illustrate core concepts in mathematics, including transformation, reflection, and measurement, all of which can be linked to school-level mathematics curricula.

One of the most distinctive cultural elements is the integration of the Lampung traditional motif "*pucuk rebung*" (bamboo shoot), which appears in decorative patterns around the mosque. This motif, shaped like a tapering triangle, aligns with geometric principles and symbolizes growth, humility, and cultural identity. Its repetition in various parts of the mosque's architecture reflects tessellation and recursive symmetry, both key topics in mathematics. The spatial organization of the mosque also reveals underlying mathematical logic. The prayer hall is designed for gender-based congregation while maintaining visual balance and equitable access. The measurements used to determine prayer rows, wall height, and ventilation align with principles of scale and proportion. The multipurpose layout accommodates religious services, educational functions, and social gatherings showcasing the mosque's structural functionality.

The symbolic meanings of colors, motifs, and architectural shapes were strengthened by incorporating insights from interviews with mosque stakeholders and community elders. The dominance of green and gold, for example, is interpreted by informants as representing purity, wisdom, and leadership—values that align with both Islamic symbolism and Lampung indigenous philosophy. Motifs such as the *siger* crown and *tapis* pattern are consistently described by respondents as embodying balance (*kesetimbangan*) and communal unity. These interpretations were cross-checked with existing cultural literature to ensure that symbolic readings are grounded in ethnographic evidence rather than speculative assumptions.

Overall, the architecture of the *Taqwa* Mosque illustrates the convergence of cultural symbolism, religious function, and mathematical structure. It demonstrates how geometry, symmetry, and spatial reasoning are not only aesthetic choices but also expressions of spiritual and cultural meaning. These findings reinforce the potential of mosque architecture as a pedagogical tool in contextual mathematics education linking formal knowledge with local wisdom and religious values.

A. Mathematical Features

The architectural design of the *Taqwa* Mosque demonstrates a strong integration of mathematical concepts that reflect proportional reasoning, spatial organization, and geometric harmony. The mosque's capacity of approximately 2,000 worshippers is supported by a floor plan based on a 45×45 m² square layout, which provides a clear foundation for spatial optimization and equitable distribution of prayer rows. The six main entrances and additional side doors are arranged symmetrically along the mosque's perimeter, illustrating bilateral symmetry and proportional spacing—fundamental concepts in geometry and school-level mathematics.

The rectangular doors combined with semicircular arches (Figure 1) form composite geometric shapes, demonstrating geometric transformation and the integration of straight and curved lines. Above these entrances, the *pucuk rebung* motif appears as an isosceles triangle, providing an example of reflection symmetry and recursive geometric patterns used in Lampung decorative arts. This cultural motif simultaneously exhibits mathematical principles such as repetition, scaling,

and tessellation.



Figure 1. Entrance Doors of Taqwa Mosque Featuring the “Pucuk Rebung” (Bamboo Shoot) Motif

This motif, shaped like an isosceles triangle, reflects geometric transformation and symmetrical reflection, symbolizing spiritual growth and continuity in Lampung culture.

The mosque complex is enclosed by an irregular pentagonal boundary (Figure 2), a unique geometric form that frames the spatial environment. The central placement of the word “Allah” within this boundary generates a focal point that reinforces radial balance within the complex. Additionally, the arched ornaments surrounding the mosque emphasize the role of curves, angular repetition, and geometric proportion in Islamic architectural aesthetics. The verandah or porch, positioned lower than the main prayer hall, extends the proportional gradient of the structure and directs visual flow toward the interior space. This symbolizes humility (tawadhu’) that every person should possess when entering the house of Allah.



Figure 2. Exterior View of Taqwa Mosque With Decorative Arches and Symbolic Spatial Arrangement

The structure is surrounded by five-sided symmetry with an “Allah” inscription at the center, representing humility and submission in Islamic spiritual practice.

Geometric principles are further emphasized through the mosque’s floor patterns, which feature concentric circles, radial motifs, and repeated geometric tessellations (Figure 3). These patterns manifest mathematical ideas such as rotational symmetry, radial geometry, and uniform scaling. Ethnomathematically, these visual arrangements express the principles of unity and cosmic order, resonating with Islamic architectural heritage (d’Ambrosio, 1985; Said & Parman, 1976).

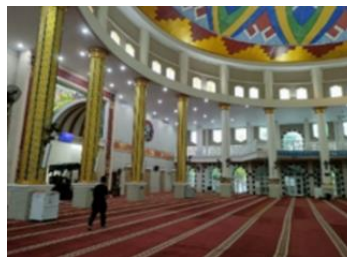


Figure 3. Main Dome of Taqwa Mosque Illustrating Hemispherical Geometry and Radial Symmetry

This element reflects both mathematical perfection and the symbolic focus on divine unity in Islamic architecture.

Additional mathematical representations can be observed in the courtyard lamps inscribed with Asmaul Husna (Figure 4). Each lamp is encased within a square box, a geometric form associated with balance, stability, and proportional order. The regular spacing of these lamps around the mosque allows learners to engage with tasks such as measuring distances, identifying patterns, and analyzing symmetry, thereby positioning the mosque as a contextual environment for mathematics education.



Figure 4. Lamp Poles With Asmaul Husna Inscriptions Surrounding the Mosque and Public Square
Each square-shaped panel bears one of the 99 names of Allah, integrating geometric order, spiritual symbolism, and opportunities for contextual mathematics leaning.

Other structural components, such as the pulpit (mimbar) (Figure 5), present clear mathematical features through the arrangement of rectangular panels, proportional step dimensions, and repeated geometric ornaments rooted in Javanese art traditions. The mimbar demonstrates the use of geometric segmentation and proportional scaling, where each step and panel reflects deliberate measurement and spatial hierarchy. These mathematical characteristics reinforce the mimbar's symbolic role as an elevated platform for religious instruction while simultaneously showcasing culturally embedded geometric craftsmanship.

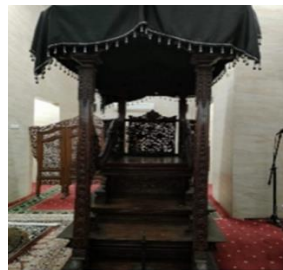


Figure 5. Pulpit (Mimbar) Made From Jepara-Carved Teak Wood With Islamic Geometric Motifs
The rectangular structure reflects cultural integration between Javanese and Islamic aesthetics, while also supporting proportional spatial arrangement.

The imam's prayer area (Figure 6) similarly incorporates ethnomathematical elements through balanced spatial composition, repetitive geometric patterns, and symmetrical decorative arrangements. The integration of Lampung and Middle Eastern motifs produces a visual equilibrium that reflects proportional harmony and axial symmetry. Through its structured layout and geometric ornamentation, this area exemplifies how mathematical reasoning is embedded in sacred architectural design, reinforcing both spiritual focus and cultural identity.



Figure 6. Imam's Prayer Area (Mihrab) Adorned With Ornaments Representing Cultural Fusion
This area reflects the qibla direction and features symmetrical decorative patterns from both Lampung and Middle Eastern traditions.

The ornament in Figure 7 represents a refined example of geometric art that integrates repetition, symmetry, and proportional scaling, three core principles of ethnomathematics. The interlocking star patterns, polygonal arrangements, and balanced calligraphic strokes demonstrate controlled geometric transformation, including reflection, rotation, and dilation. Calligraphy within the ornament adheres to proportional spacing rules characteristic of classical Islamic design (Burckhardt, 2009; Faruqi & Faruqi, 1986), where each curve, line, and counter-space follows a precise visual rhythm. Interviews with mosque caretakers and local cultural elders further indicate that such ornaments symbolize *tawazun* (balance) and disciplined order, values embedded both in Islamic spiritual philosophy and Lampung cultural aesthetics. Thus, the ornament serves not only as decoration but also as a culturally informed mathematical structure that conveys ethical and spiritual meaning.



Figure 7. Interior Calligraphic Ornamentation Using Principles of Repetition, Symmetry, and Scale
The placement of Qur'anic verses enhances visual balance and conveys theological meaning, while simultaneously reinforcing ethnomathematical aesthetics.

Overall, the architectural features of the Taqwa Mosque demonstrate a unified narrative of Islamic ethnomathematics, where geometric reasoning, linguistic symbolism, and cultural philosophy converge into a coherent spatial expression. Through its domes, patterns, calligraphy, and spatial arrangements, the mosque embodies mathematical ideas such as symmetry, proportion, tessellation, and spatial hierarchy. At the same time, these mathematical forms are inseparable from the mosque's religious function and the cultural worldview of the Lampung Muslim community. This interconnectedness reinforces the potential of mosque architecture as a contextual medium for mathematics education, cultural transmission, and character formation rooted in local wisdom and Islamic values.

B. Cultural Symbols and Mathematical Concepts

Motifs such as the *pucuk rebung* are represented through triangles and transformations such as reflection and rotation. The presence of Islamic calligraphy and ornaments demonstrates symmetry and aesthetic harmony, which are essential in Islamic art and architecture. The local culture in this mosque, which is the largest in Metro City, is reflected in the structure of the mosque's dome. The dome, dominated by a golden color, represents a hue commonly used by the Lampung people and symbolizes glory.

The inner dome (Figure 8) of Masjid *Taqwa* is painted to resemble a beautiful floral motif, overall forming a circular shape with a variety of color combinations. The floral motif is combined with traditional Lampung patterns, reflecting local culture. The inner dome incorporates one of the Lampung *tapis* motifs *pucuk rebung* or *tumpal* placed around the circumference of both the smaller inner circle and the larger outer circle. The concept of “*pucuk rebung*” is the concept of *Tawhid* (monotheism) (Hassan et al., 2017). The *pucuk rebung* (bamboo shoot) motif symbolizes the strength that grows from within, signifying usefulness from youth to old age. This conveys the idea that the mosque is meant for both the elderly and the young. The motif is derived from the flat shape of a triangle. The triangle in this motif also symbolizes the relationship between three entities: God, humanity, and nature. The circle represents the geometric concept of dilation, as it enlarges from a smaller to a larger form. This motif also reflects the mathematical concepts of geometric transformation, specifically reflection, translation, and rotation. The concept of reflection is exemplified by the repeating patterns around the dome when observed along a straight line.



Figure 8. Decorative Archway With Symmetrical Motifs Reflecting Local Lampung Culture
The arch above the entrance demonstrates bilateral symmetry and cultural symbolism, integrating local aesthetics with Islamic architectural principles.

On the western wall of the mosque, there is calligraphy featuring the names of Allah and the Prophet Muhammad (Figure 9). From a cultural perspective, the calligraphy reflects Islamic art that has evolved through various writing forms and decorative styles, including those found in mosques across the Indonesian archipelago. This calligraphy is written with a symmetrical and balanced pattern, reflecting the principles of harmony and beauty in form, which are also part of geometric concepts in mathematics (Sari et al., 2022). Through an ethnomathematics approach, students can learn to observe the shapes of letters, line symmetry, and spatial balance in the calligraphy while understanding the Islamic values embedded within it. This illustrates that mathematics education can be meaningfully integrated with local art and culture, which are imbued with religious significance.



Figure 9. Calligraphic Ornament Displaying the Name of Allah in the Center of a Geometric Pattern
This composition features an irregular pentagon framing the word “Allah,” symbolizing divine centrality and the balance between spirituality and geometry.

The *bedug* (Figure 10) is a cultural artifact from local society (Wiryo Martono, 2023), traditionally used to signal prayer times and the time to break the fast. This *bedug* takes the form of a cylinder and uses cowhide as the surface to be struck, producing a distinctive and resonant sound.



Figure 10. Main Dome of Taqwa Mosque Featuring Concentric and Radial Symmetry
The hemispherical dome illustrates perfection and unity, serving as a spiritual and mathematical focal point within the mosque’s architectural narrative.

In the mosque courtyard, there is an inscription written in Lampung script (Figure 11), which reads *Masjid Taqwa*. This inscription reflects the use of Lampung culture, arranged with aesthetic value. The shapes of the characters can be studied through mathematical concepts such as symmetry, patterns, and geometry. Culturally, the inscription shows that local identity remains present in religious settings, allowing students to see that mathematics is inseparable from the culture in which they live. This inscription serves as a concrete example that culture and mathematics can complement each other and can be used as meaningful and contextual learning material.



Figure 11. Series of Asmaul Husna Lamps Encircling the Mosque and Public Plaza
Each lamp post bears one of the 99 names of Allah, positioned equidistantly in a circular arrangement to represent balance, repetition, and spiritual presence in public space.

The mosque courtyard serves as a vast and multifunctional public space. It features a replica of the *Kaaba* (Figure 12) and an open garden called *Taman Merdeka*. Ornamental lamps inscribed with the *Asmaul Husna* encircle the courtyard in a circular formation, reflecting principles of order and centrality. These patterns not only enhance visual aesthetics but also represent the cosmological geometric structure in Islam, as explained in the concept of sacred architecture (Nasr, 1987). Additionally, the *manasik hajj* (hajj simulation) activities frequently held in the mosque courtyard, using the *Kaaba* replica, provide a contextual learning medium for congregants, especially children to understand concepts such as distance, *qibla* direction, rotation (*tawaf*), and directional orientation through the basic principles of spatial geometry.



Figure 12. The Pulpit (Mimbar) With Carved Geometric and Floral Motifs Rooted in Javanese and Islamic Traditions
Constructed from teak wood, the structure uses rectangular planes and elevated steps to support both religious function and culture identity.

C. Linguistics Expressions and Mathematics

The linguistic expressions associated with the architectural elements of the Taqwa Mosque reveal interconnected cultural, spiritual, and mathematical meanings. The term *minaret*, derived from the Turkish and Arabic *manāra*, meaning “a place of light” reflects the linguistic metaphor of illumination and guidance (Riany et al., 2018). This semantic meaning corresponds with the minaret’s vertical geometry, which mathematically emphasizes axial orientation, proportional height, and cylindrical symmetry (Faruqi & Faruqi, 1986; Nasr, 1987). Linguistically, *manāra* embodies the concept of spiritual elevation—an idea that aligns with ethnomathematical interpretations of vertical forms as representations of transcendence and divine orientation (d'Ambrosio, 1985).



Figure 13. The Imam’s Prayer Area Featuring Ornate Framing and Cultural Symbolism

This sacred niche incorporates Middle Eastern and Lampungese design elements, emphasizing symmetry, directionality toward qibla, and integration of mathematical and spiritual meaning.

Similarly, local linguistic expressions used to describe the dome strengthen the link between cultural terminology and mathematical structure. The mosque’s outer dome is locally likened to a *belimbing* (starfruit), emphasizing its five-lobed geometric configuration, which symbolizes the Five Pillars of Islam. This linguistic association helps the community conceptualize the dome as both a hemispherical solid with radial symmetry and a cultural symbol of Islamic principles (Burckhardt, 2009; Said & Parman, 1976). The use of culturally embedded analogies, such as *belimbing* demonstrates how language functions as a cognitive bridge enabling local communities to interpret geometric structures through familiar cultural categories (Foley, 2012).



Figure 14. Series of Structural Columns Forming a Modular Pattern Along the Mosque Veranda

Twenty-four cylindrical pillars decorated with golden motifs exhibit principles of repetition, verticality, and spatial rhythm, reinforcing the architectural coherence of the mosque.

Beyond the dome and minaret, decorative elements throughout the mosque also contain linguistic expressions tied to Lampung cultural terminology, such as *siger*, *tapis*, and *pucuk rebung*. These terms encode culturally informed mathematical ideas, including balance, proportionality, recursive symmetry, and geometric transformation (Loviana & Merliza, 2023; Zalmansyah et al., 2023). Linguistically, these expressions shape how local communities interpret spatial relations, decorative repetition, and geometric ordering in the mosque’s architecture. This demonstrates that language not only names architectural elements but also guides the ethnomathematical understanding of form, symmetry, and spatial reasoning within the cultural and religious context of Lampung.

D. Ethnomathematical Analysis

The ethnomathematical analysis of the *Taqwa* Mosque, Metro reveals that this building not only serves a religious function but also acts as a medium for conveying contextual mathematical concepts imbued with cultural meaning. The geometric patterns found in the mosque's structure such as circles, triangles, rectangles, and cylinders are part of the Islamic mathematical heritage, integrated with values of aesthetics and spirituality. The circular symbolism of the main dome, for instance, not only reflects the concepts of radial symmetry and the hemisphere as a geometric solid, but also symbolizes the oneness of God and the perfection of creation. This concept of symmetry is further reinforced by the aligned and repetitive arrangement of columns in the mosque's veranda, creating rhythmic patterns that support the structure and contribute to visual harmony.

The presence of the "*pucuk rebung*" (bamboo shoot tip) motif on the doors and ornaments represents a local cultural element that can be analyzed through the geometric concepts of reflection and translation. This motif, characterized by repeated isosceles triangle shapes, reflects diversity within order, consistent with the principles of Islamic aesthetics. These forms emphasize not only beauty but also embed philosophical values such as spiritual growth and social advancement.

In terms of spatial usage, the measurement of the main prayer hall measuring 45 x 45 square meters demonstrates a deep understanding of area and capacity concepts. The proportional division of space between male and female worshippers, along with the symmetrical and efficient design of the ablution areas, shows that mathematical elements are employed not only for structural purposes but also to reflect ethical values and social order in Islam.

Furthermore, the religious activities conducted within the mosque also incorporate elements of ethnomathematics. For example, the distribution of *zakat fitrah* based on weight (2.5 kg per person) requires knowledge of units, volume, and basic arithmetic operations. During the hajj simulation activities using a replica of the *Kaaba*, participants are taught concepts such as rotation (*tawaf*), directional orientation (toward the *qibla*), and distance calculation between ritual stations. These elements position Masjid *Taqwa* Metro as a living laboratory for understanding mathematics within cultural and spiritual contexts.

The presence of ethnomathematics in this mosque demonstrates that mathematics is not merely a rigid, abstract science, but rather is integrated into community life and religious practices. This aligns with the perspective of Rosa and Shirley, who state that ethnomathematics enables learners to understand mathematics through their own cultural experiences, thereby fostering more relevant, contextual, and meaningful learning (Rosa & Orey, 2011; Shirley, 2015).

E. Ethnolinguistic Analysis

Meanwhile, the ethnolinguistic study of the *Taqwa* Mosque, Metro reveals how local language and symbols play an essential role in the mosque's structure and function. Architectural terms such as "*minaret*," "*mimbar*," and "*mihrab*" used in the Islamic context have etymological roots in Arabic, but in practice, these terms have undergone localization in meaning and function. The word *minaret*, derived from *manāra* meaning "place of light," indicates that the tower is not merely a vertical structure but a spiritual symbol guiding the faithful toward divine illumination. Likewise, the *mimbar* is not just a platform for delivering sermons, but a symbol of scholarly authority and moral leadership in Islam.

Interestingly, the *Taqwa* Mosque, Metro also integrates local symbols with significant linguistic and cultural value. The "*pucuk rebung*" (bamboo shoot tip) motif from Lampung tradition, for instance, carries meanings of growth, hope, and regeneration from an ethnolinguistic perspective. Visually, this motif is adapted into the mosque's architectural design and transformed into geometric patterns that can be analyzed mathematically. This reflects a close interaction between local linguistic expression and visual architectural forms.

Moreover, the use of Lampung script in several areas of the mosque's courtyard reinforces local identity and serves as a symbol of cultural pride. The presence of regional script in a religious public space indicates that language is not merely a means of communication but also a tool for expressing identity and transmitting local values. This supports views that language and culture are inseparable, each shaping and enriching the other (Caronia & Nasi, 2021; Foley, 2012; Kasper & Omori, 2010).

Ethnolinguistics also helps explain how the mosque's linguistic symbols (Alsaif & Starks, 2021; Ekawati et al., 2023; Yusuf & Putrie, 2022) are not merely decorative but carry religious and educational significance. Quranic calligraphy adorning the interior walls conveys moral and spiritual messages while simultaneously introducing congregants to the linguistic structure of the Arabic language. In other words, the mosque functions as a semiotic arena where verbal language, visual language, and mathematical language converge into a unified religious and educational experience.

Thus, an ethnolinguistic approach not only adds layers of meaning in understanding the architecture of Masjid *Taqwa* Metro, but also supports the development of contextual education grounded in local symbolic and linguistic richness. The integration of ethnomathematics and ethnolinguistics paves the way for a new interdisciplinary approach to learning, particularly in efforts to strengthen cultural identity and foster spiritual character within modern educational contexts.

V. CONCLUSION

A. Conclusion

This study reveals that the *Taqwa* Mosque, Metro is more than a place of worship; it embodies the integration of Islamic values, local culture, mathematics, and language. Ethnomathematically, its architecture features geometric elements:

circles, triangles, symmetry, and repeated patterns reflecting contextual mathematical thought rooted in Islamic aesthetics and spirituality. Socio-religious practices such as zakat distribution, *manasik haji* ‘pilgrimage simulations’, and spatial organization also demonstrate real-life mathematical applications. From an ethnolinguistic lens, the mosque’s terminology and ornaments carry deep cultural and linguistic meaning. Words like *minaret* and *mimbar* serve not just architectural but also symbolic functions, while local motifs like *pucuk rebung* and the use of Lampung script reinforce cultural identity. As a semiotic space, the mosque conveys moral, historical, and educational messages. Therefore, *Taqwa Mosque* serves as a holistic learning resource, contributing to ethnopedagogical studies and supporting curriculum development based on local wisdom and Islamic values. This research represents the first documented integration of ethnomathematics and ethnolinguistics analysis within mosque architecture in Indonesia, providing a dual-disciplinary perspective that has not been explored in previous studies.

B. Educational Implication

This research contributes to contextual education rooted in local culture and Islamic values. The mosque serves as a concrete learning resource for teaching mathematical and linguistic concepts through the Realistic Mathematics Education (RME) approach, which connects academic content to students’ real-life experiences (Aragón et al., 2024; Çilingir Altiner, 2024; Fajri & Marini, 2025; Tong et al., 2021). Ethnomathematical and ethnolinguistic elements in mosque architecture help strengthen cultural identity, develop spiritual character, and enhance appreciation for local heritage. Schools, *madrasahs*, and *pesantrens* can involve community leaders, *ulama*, and local architects as authentic learning sources. This study also encourages further research on cultural symbols in education across Indonesia. Unlike previous studies that focus solely on either ethnomathematics or ethnolinguistics, this research demonstrates the pedagogical potential of integrating both perspectives within a single architectural context, offering a unique framework for culturally responsive STEM and language education in Indonesia. In addition, these findings provide policy recommendations relevant to curriculum design, particularly for incorporating local wisdom and Islamic values into mathematics and language education.

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