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Ethnomathematical Exploration of the Kelana Mask Dance in Cirebon, Indonesia: Geometric Concepts and Cultural Integration

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ABSTRACT

Geometry learning is often perceived as abstract and disconnected from students' lived experiences; therefore, this study aims to explore the potential of the Gegesik-style Kelana Mask Dance (Cirebon) as a contextual medium for mathematics learning through an ethnomathematics approach. The study employed a descriptive qualitative approach with an ethnographic design, collecting data through a literature review, participant observation, and analysis of performance documentation (videos), systematic notes on movement structures and floor patterns, and interviews with dancers/artists to strengthen the interpretation of movement meanings. The findings indicate that the choreography of the Kelana Mask Dance embodies fundamental mathematical—particularly geometric—concepts such as angles, lines, rotation, symmetry, and plane figures; its floor patterns display geometric forms (e.g., circles, triangles, and straight lines), while directional changes and turns produce angles and symmetry that can be leveraged as learning contexts. In addition, the symbolism embedded in movements and dance properties enriches learning by linking mathematical ideas with cultural values. In conclusion, the Kelana Mask Dance has strong potential as an engaging, contextual resource for teaching geometry while also supporting the preservation of local culture and strengthening students' cultural identity.

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1. INTRODUCTION

Mathematics is one of the basic sciences that plays an important role in the development of science and technology. However, in practice, learning math is often seen as rigid, abstract, and disconnected from real-life contexts. This makes it difficult for many students to fully understand mathematical concepts. This gap between mathematical ideas and students' daily realities highlights the need for learning approaches that are more

meaningful and contextual. One approach believed to address this challenge is ethnomathematics. D'Ambrosio defines ethnomathematics as the study of how certain cultural groups develop, identify, and use mathematical concepts in their cultural contexts [1]. Through this perspective, culture is not positioned as a “decorative” addition to learning, but as a genuine source of mathematical ideas and reasoning.

One form of local culture that can serve as the context for learning mathematics is traditional dance. The Cirebon Mask Dance, especially the Gegesik style, is a cultural heritage rich in philosophical, ethical, and aesthetic values, and contains mathematical elements such as the formation of corners and floor patterns. This dance has a long history dating back to the 15th century during the reign of Sunan Gunung Jati, who used the performance of Mask as a medium of Islamic da'wah. One of the iconic figures is Nyi Mas Gandasari, whose appearance captivates Prince Welang without resorting to violence, eventually leading him to give up his claim to the Curug Sewu inheritance and convert to Islam [2]. This historical narrative shows that the dance is not only an artistic performance but also a medium of communication and social transformation, thereby strengthening its relevance as a learning context.

The development of the Mask dance continued, especially after the artist left the royal palace due to Dutch colonial intervention. They spread to areas such as Gegesik, Palimanan, and Losari, each developing its own distinctive style. The Gegesik style is known for its complex structure and emphasis on character expression, including Klan characters. The Klana mask symbolises courage, assertiveness, emotional strength, and ambition, expressed through its dark red colour, powerful, energetic movements, and intense facial expressions with protruding eyes and moustaches. The idea of "courage" in the Klana language not only indicates physical strength but also symbolises assertiveness and courage [3]. These distinctive characteristics make the Gegesik style particularly rich for analysis, as its movements are structured, repetitive, and visually explicit in their spatial formation.

In the context of mathematics education, elements of dance, such as changes of direction forming angles and dancer movements forming geometric floor patterns, can be used to explain mathematical concepts contextually. Integrating local cultures into math learning helps students understand abstract concepts through real-life experiences while reinforcing their cultural identity. In other words, cultural integration serves a dual purpose: improving conceptual understanding while positioning students as learners connected to their own cultural environment.

Although many previous studies have explored ethnomathematics in the context of batik, architecture, and traditional clothing, research on traditional dances such as the Kelana Mask remains very limited, especially inegrating geometric concepts into classroom learning [4], [5], [6]. This limited focus creates a research gap, particularly in identifying how dance-specific elements (movement sequences and spatial formations) can be systematically translated into geometry learning materials.

In addition, the urgency of contextual and culturally rooted mathematics education is growing globally, as it responds to the 21st century's demand for meaningful, relevant, and inclusive learning [7], [8]. Such learning is expected to accommodate diverse student

backgrounds and reduce the sense that mathematics is “detached” from social and cultural realities.

The use of the Kelana Mask dance as a medium for mathematics learning reflects an ethnomathematical approach that links mathematical concepts to local cultural practices. The Cirebon Kelana Mask Dance features many geometric elements to explore, such as straight, circular, and symmetrical floor patterns, as well as dancers' body movements that form certain angles. Analysis of floor patterns and angles of movement allows students to learn concepts such as angles, rotation, translation, and symmetry in meaningful, contextual contexts. This approach also supports the culture-based learning principles mandated by the Independent Curriculum, which emphasise learning that is relevant to students' lives and environments. Recent studies show that integrating local cultures into mathematics learning not only improves understanding of concepts but also strengthens students' cultural identities and their involvement in the learning process. In addition, the use of traditional art in learning has been shown to foster a more inclusive and collaborative learning atmosphere and to make it easier for students to conceptualise math ideas [9], [10]. Therefore, the Kelana Mask dance can function not merely as an example, but as a structured learning resource that bridges mathematical abstraction with tangible cultural practice.

The integration of elements of the Kelana Mask dance into mathematics learning also opens the door to the STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach, which views art as an important component of 21st-century skill development. In this context, dance is not only a cultural expression but also an interdisciplinary learning medium that fosters critical thinking, collaboration, and creativity. Mathematical analysis of dance floor patterns, for example, in terms of rotational symmetry, translation, and the angle of shift between dancers' positions, can be used as a problem-based learning (PBL) project that encourages students to observe, measure, and model in a real and fun context. By framing dance analysis as a project, students can engage in inquiry processes similar to those used in scientific investigation—observing patterns, formulating conjectures, and validating results.

This research aligns with the idea that math lessons should be linked to students' authentic experiences to increase engagement and meaning. In this regard, the Kelana Mask dance, which is rich in repetitive movement structures and orderly spatial compositions, provides an auspicious teaching material for concretely introducing the concepts of transformation geometry and angular measurement. The findings of Mailani et al. and Wibawa et al. reinforce this, showinghat the linkage between cultural activities and mathematical concepts can deepen conceptual understanding while improving students' cultural literacy [11], [12]. Thus, examining dance elements is not an “extra activity,” but a pedagogical strategy grounded in research on meaningful learning.

Observations of the Cirebon Kelana Mask dance show that the movement structure and players' positions follow an order that can be represented mathematically. Within the framework of ethnomathematics, this offers significant opportunities to integrate cultural heritage into formal learning. A study by F. R. Lestari and M. Wahyudin confirms that exploring traditional dance structures can significantly increase student participation in

mathematics learning. Dance is not only a cultural object but also a representation of logic and structure central to learning mathematics. Furthermore, integrating culture into education encourages meaningful learning, which occurs when students connect new information with knowledge they already have, especially knowledge sourced from their environment and culture. This aligns with the principles of education based on local wisdom, which emphasise integrating local values into the national education system. Therefore, the use of the Kelana Mask dance as a mathematics learning medium is an innovative strategy that not only enhances academic understanding but also strengthens the preservation of cultural identity in the era of educational globalisation [13]. Consequently, this study positions the Kelana Mask dance as both a cultural heritage to be preserved and an instructional resource that can be operationalised into concrete geometry learning experiences.

2. METHOD

This study uses a qualitative, ethnographic approach to explore the mathematical elements embedded in the Cirebone Kelana Mask dance, particularly the Gegesik style. This design is suitable because the object of study is not only the dance as a performance, but also the cultural meanings and patterned practices that shape how movements and spatial formations are produced. The ethnographic approach was chosen because this research aims to understand the cultural significance of traditional dance and to interpret the mathematical forms that emerge from movement and floor patterns within local cultures. As Creswell explains, ethnographic research seeks to describe and interpret the patterns of behaviour, beliefs, and language of a cultural group through in-depth observation and interaction [14].

The data sources in this study include cultural artefacts such as documentation of dance movements, masks, and dancer costumes. These artefacts were treated as visual and material evidence that reflect both aesthetic conventions and recurring spatial structures that can be analysed mathematically. In addition, data were collected through in-depth interviews with dance artists who understood the philosophy and techniques of the Coconut Mask dance, as well as through firsthand observation of dance performances at cultural events. Interviews were used to clarify the intent and meaning behind specific movements, while observations captured how those movements are executed in real performance settings.

Data collection techniques involved document analysis of the dance's visual and written records, in-depth interviews with key traditional artists, and participatory observation, allowing researchers to witness firsthand the dancers' movement processes and patterns during performances. Combining these techniques allowed the study to connect “what is seen” in the choreography with “what is meant” by the cultural practitioners, thereby strengthening the interpretive analysis of mathematical elements. This approach supports the collection of rich, authentic data on the mathematical ideas embedded in the dance.

Data reliability was strengthened through triangulation across interviews, observations, and literature reviews, as well as peer debriefing with mathematics education

experts. Triangulation was used to check the consistency of interpretations, particularly when identifying geometric concepts that could be explained in multiple ways. Data validity was maintained through methodological triangulation, expert consultation, and collaborative verification of interpretations. This collaborative checking helped reduce individual researcher bias and ensured that the identified concepts remained faithful to both the cultural context and geometry theory.

The data collected were analysed descriptively by interpreting dance movement patterns and ornaments using geometric analysis frameworks, including:

a. Angle: analysed through a change in the direction of the dancer, visually interpreted as a representation of a measured angle.
b. Floor patterns: explored as representations of two-dimensional shapes and geometric transformations
c. Symmetry: examined through the balance and position of the dancer's movements in the space.
d. Rotation and translation: interpreted as the movements of the body shifting and rotating throughout the performance [6], [7].

To support analytical clarity, movement segments and floor-pattern sequences were grouped into recurrent forms before being mapped to the corresponding geometric concepts. The results of the analysis are presented in a narrative, supported by illustrative images and interpretations grounded in geometric theory, to highlight the relationship between local culture and mathematical concepts relevant to classroom learning. This presentation format is intended to make the findings accessible for instructional design, enabling educators to translate cultural elements into contextual geometry learning activities.

3. RESULTS AND DISCUSSION

The Kelana Mask Dance is a traditional performing art rich in symbolic meaning and cultural values. Each movement is not only arranged for visual aesthetics but also conveys philosophical messages closely tied to the character being portrayed. Because the choreography is structured and repeatedly performed across generations, it provides a fertile setting for identifying patterns that can be interpreted mathematically. From an ethnomathematical perspective, these movements embody fundamental mathematical ideas, such as angles, lines, rotation, and symmetry, that naturally emerge through choreographic structure and spatial organisation. Thus, the discussion below presents typical movements of the Kelana Mask Dance by connecting its mathematical features with their symbolic and cultural meanings, so that the results can be understood both culturally and pedagogically.

In an ethnomathematical perspective, the choreographic structure of the Kelana Mask Dance shows a strong connection with basic mathematical concepts. The floor pattern formed by the dancer's movement trajectory presents geometric shapes such as circles, straight lines, and spirals. The circular movements (rotations) performed by dancers also reflect the principles of transformation and symmetry in mathematics. The changing direction of movement forms angles that can be classified geometrically, such as

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pointed, right-angled, and blunt corners. In addition, the symmetrical formation of the dancer group reflects folding symmetry and rotational symmetry, while the repetition of the movement pattern displays a rhythmic regularity that can be attributed to the concept of repetitive patterns and periodic functions [15], [16]. Importantly, these mathematical elements do not appear as "inserted content," but arise organically from the demands of choreography, rhythm, balance, and spatial composition in performance. This reinforces the central claim of ethnomathematics: mathematical reasoning can be discovered within cultural practices and articulated for formal learning contexts.

3.1. Identification Results

This section identifies geometric angle concepts embedded in selected movements of the Kelana Mask Dance, progressing from joint-based angles to broader spatial patterns.

Figure 1. *Buang rawis* movement

In *Buang rawis movement* (Figure 1), an acute angle is clearly visible at the elbow in this posture. The angle is less than 90 degrees and corresponds to a basic geometric concept. In performance terms, this acute angle contributes to the gesture's visual sharpness and helps emphasise character expression through arm tension and directionality. From a learning perspective, this movement can be used to introduce how angles are identified on the human body as a real-life representation of geometric measures. This initial example provides a starting point for recognising angle types before progressing to other common categories in subsequent movements.

Figure 2. *Ngola Kedok* Movement

After observing an acute angle in Figure 1, Figure 2 presents a posture dominated by a right angle, offering a clear comparison in angle magnitude and function. In Figure 2, a typical position in the Kelana Mask Dance is shown, with the dancer standing firmly, one leg supporting the body while the other is lifted, forming a right angle between the thigh and the calf. This 90-degree angle, known in geometry as a right angle, can symbolise balance and firmness. Biomechanically, the right-angle formation also reflects stability, as the supporting leg and body alignment help maintain equilibrium during performance. This makes the movement particularly useful for classroom illustration of right angles, perpendicularity, and the stability of geometric structures. Together, Figures 1 and 2 show how different angle categories can be linked to distinct expressive qualities such as sharpness versus stability.

Figure 3. *Nindak* movement

In contrast to the acute and right angles previously noted, Figure 3 highlights an obtuse angle, extending the identification results to a broader range of angle measures. In the Nindak movement, as seen in Figure 3, an obtuse angle is visible at the elbow of the

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right arm, formed by an angle greater than 90 degrees but less than 180 degrees. This obtuse angle represents flexibility and variation in hand positioning within dance movement patterns. The visual openness of the obtuse angle also helps create a broader spatial impression, showing how dancers "expand" movement space through arm extension. For instructional purposes, this provides a clear contrast between acute and right angles, enabling students to compare angle categories using a single cultural example. This progression from acute to right to obtuse angles helps organise the findings as a structured set of comparative examples.

Figure 4. *Buang ules* movement

To complete the set of commonly introduced angle types, Figure 4 illustrates the straight angle as an extreme case of alignment. In this posture, the dancer's legs form a straight line representing a 180-degree angle in geometry. Unbent knees and a stable pelvis create a linear form, providing a direct example of straight lines as a basic element of geometry in dance. This posture can be linked to the idea of collinearity and straight angles, which often feel abstract in textbooks but become observable in bodily alignment. Additionally, it demonstrates how "line" in geometry can be interpreted not only as a drawn object but also as a physical arrangement in space. By including straight angles, the analysis connects joint positioning to the broader geometric idea of linearity that underpins many shapes and constructions.

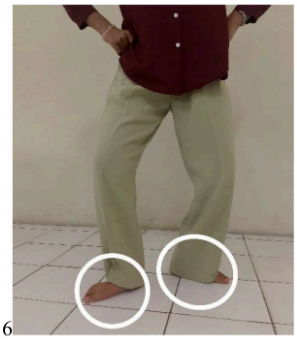

Figure 5. *Adeg – Adeg* Movement

While the previous figures emphasise one dominant angle at a time, Figure 5 shows how multiple angle concepts can appear simultaneously in a single pose. In this position, the left leg is directed diagonally outward at approximately 45 degrees (an acute angle), while the right foot supports the body at a right angle (90 degrees), reflecting stability within the overall geometric structure. The combination of an acute angle and a right angle in one pose highlights how multiple geometric concepts can appear simultaneously in a single movement sequence. This can be extended in learning activities by asking students to estimate angles, verify them with simple measuring tools, and relate angle size to the dancer's direction and balance. This example also encourages learners to see movement as a composite geometric arrangement rather than isolated measurements.

Figure 6. Floor Pattern

Beyond angles formed by the body, the dance also conveys geometry through spatial pathways on the performance area, as shown in Figure 6. The circular floor pattern in the Kelana Mask Dance reflects a basic geometric concept that supports the rhythm of repetitive movements and helps maintain consistency in dancers' formations. In

ethnomathematical studies, this pattern creates an ordered visual space that enables the audience to follow the dance's flow. Mathematically, the circular pattern can also be connected to rotation, radius, centre point, and repeated cycles, which opens the possibility of linking geometry with concepts of repetition and periodicity. In classroom practice, this floor pattern can be modelled using diagrams or simple movement simulations to help students grasp geometric transformations in a culturally meaningful context. Thus, the identification results cover both micro-level geometry (joint angles) and macro-level geometry (floor patterns), strengthening the coherence of the overall analysis.

3.2. Discussion

In the Throw Away Rawis movement of the Kelana Mask Dance, the dancer assumes a posture of readiness to attack, with both hands open wide and a strong horse stance. Geometrically, this formation features an acute angle at the elbow, namely an angle of less than 90 degrees. Such acute angles are among the basic concepts of plane geometry and can be used to describe direction and rigidity in line formation. To make the interpretation more systematic, the acute angle is identified from the joint configuration formed by the upper arm and forearm, which becomes visually prominent when the dancer extends the arms outward. However, within the context of traditional dance, this angle should not be understood merely as a mathematical form; it also symbolises strength, courage, and steadfastness—core attributes of the Kelana character. Through an ethnographic lens, the sharpness of the elbow angle can be interpreted as a bodily representation of Kelana's aggressive, ambitious, and masculine persona. In other words, the same bodily configuration simultaneously communicates a geometric property and a cultural message, which is the main focus of ethnomathematical analysis. This interpretation aligns with D'Ambrosio's view that geometry within culture functions as a medium through which people express and structure their thinking; similarly, Mellawaty's findings on the Kelana Mask Dance indicate that movements, costumes, and musical elements are not purely aesthetic but also carry geometric structures reflecting cultural values through angles, symmetry, and spatial composition [17].

Research results by Anggraini et al. [18] on the Malangan Mask Dance reinforce this argument. They found that mask dance movements consistently included angular elements, such as tapered, dull, right-angled, and straight, formed by the posture of the dancer's hands and feet. This comparison strengthens the claim that angularity is a recurring structural feature across mask-dance traditions, rather than an incidental visual effect. The ethnographic approach used in this study confirms that these angular configurations are embedded in the community's shared movement vocabulary and carry symbolic values associated with each formed angle. Therefore, identifying an angle in dance is not the endpoint of analysis; it becomes the entry point for interpreting why the angle matters in the cultural logic of performance.

In the Processing Masks movement, the Kelana dancer stands firmly with one leg supporting the body's weight while the other leg is raised so that the thigh and calf form a 90° right angle. In geometry, this right angle is often associated with stability and balance, and visually, it creates a clear sense of structure and firmness. Movements like this require

body control and concentration, and they also symbolise readiness and vigilance as the Kelana character faces challenges. The ethnographic interpretation suggests that the right-angle structure in this position represents an authoritative and composed character, signifying self-control and physical–spiritual preparedness. This indicates that “stability” in a geometric sense parallels “steadfastness” in a symbolic sense, allowing the same concept to be read across two domains. Right-angle formations also appear in other traditional dances; for example, research on the Umbrella Dance and Shawl Dance shows that right angles are often used as references for creating stable body compositions [19]. Habibah [20] shows that in Baksa Kembang Dance, geometric transformations, including rotation and reflection, as well as taper and blunt angles, serve as a Medium of cultural expression. This discovery reinforces the idea that the right angle in Ngolah Kedok not only has a technical function but also serves as an ethnomathematical symbolic element, showinghe balance between physical strength and ritual awareness of the character Kelana. Taken together, these studies support the interpretation that the right angle in Ngolah Kedok serves both a technical function (stability and control) and an ethnomathematical-symbolic function (discipline and readiness).

Meanwhile, Motion Picture shows the dancer's step pattern, performed alternately between the right and left legs for eight counts, while rotating until it returns to face forward. These movements combine elements of rotational and repetitive patterns in mathematics, creating dynamic shapes that unite the body, hands, and head in a single, harmonious motion. The position of the hands holding the soder and the head following the direction of the steps adds a symmetrical and orderly impression to the movement pattern. In the context of ethnomathematics, this pattern of repetitive steps and rotations reflects how the concept of movement in space is internalised and embodied in cultural practices rich inymbolic meaning, while affirming the dynamic and decisive character of the Kelana character [21]. From a mathematical perspective, this movement can be framed as a rotational transformation over time, where each count corresponds to a discrete step in a repeating cycle.

In the Buang Ules movement, the dancer's body stands perpendicular, with both legs facing forward, forming a 180-degree angle, which in geometry is known as a straight line. The presence of this straight line reflects the structure of people's thinking, which uses linear forms as symbols of control, unity, and self-integrity, conveying the values that dance supporters want to convey. Studies on mask dances, such as the Malangan Mask Dance, show that linear and straight-angle movements are used consciously as aesthetic expressions and educational media in basic mathematics learning [22]. In the framework of ethnomathematics, this straight-line form is a tangible manifestation of how simple mathematical concepts are present in traditional art as a means of conveying society's philosophy [12]. The absence of knee or pelvic bending strengthens the visual clarity of the straight line, making the geometric concept observable without additional tools. The posture also embodies symmetry and balance while symbolising readiness, alertness, and control. Thus, the straight angle operates as both a formal geometric feature and a culturally meaningful sign of composure and firmness.

The absence of bending at the knees or pelvis allows for perfect visualisation of linear shapes. The movement showcases the integration of the principles of symmetry and balance in the local culture, while symbolising high body readiness, alertness, and control. In the framework of ethnomathematics, this straight-line form is a tangible manifestation of how simple mathematical concepts are present in traditional arts as a means of conveying society's philosophy.

Movement Timings In the Kelana Mask Dance, it shows a strong angular formation from a geometric perspective, with the left foot directed obliquely outwards to form a taper angle of around 45 degrees, and the right foot becomes the main focus at a 90-degree angle. The combination of these angles reflects the basic concepts of geometry that appear naturally in dance structures. In addition to being a technical element, these angular formations also signify agility, strength, and character, which are strengthened through an ethnographic approach that includes direct observation and participation in cultural practices. As explained, this approach uncovers the symbolic and mathematical meaning hidden behind each movement pattern as part of the thinking structure of the society that supports the dance art. Studies on the Mask Dance also demonstrate that the concepts of Symmetry, rotation, and reflection are naturally present in the structure of dance movements, forming visual harmonies that strengthen the character's expression in the show. This provides a broader context for geometric patterns in mask dances, such as angular formations, lines, rotations, and circular floor patterns [23]. Accordingly, geometric patterns in mask dance—angles, lines, rotations, and circular formations—function as part of a community's cultural code, communicating values through structured bodily movement rather than verbal explanation. This reinforces the ethnographic view that ethnomathematics is not merely an analysis of form but also a way to understand dance movements as collective thinking structures originating from the community that created them.

The floor pattern in traditional dance performances plays an important role in guiding dancers' movements to be in harmony with the dance's structure and theme. In the context of the Gegesik style Kelana Mask Dance, the circular floor pattern, although it looks simple, actually plays a very vital role. The circular pattern allows the dancers to move around the stage, reinforcing the dynamic narrative of Kelana's character, which blends anger, ambition, and moments of self-introspection. This ethnomathematical study of floor patterns shows that the circular pattern supports rhythmic movement, maintains the consistency of dancers' formations during performances, and creates an orderly visual space that makes it easier for the audience to follow and enjoy [23]. In an ethnomathematical review of mask dance, Faradhita et al. [24] highlight that in Beautiful Mask Dance, floor patterns, including circles, straight lines, and zig-zags, are used to compose symmetrical compositions and to tell character narratives through geometric aspects such as the rotation and alignment of flat builds. Similar patterns are also observed in the Malangan Mask Dance, where lines, corners, and circular floor shapes symboliseogetherness, unity, and continuous rhythm in the overall structure of the dance. These cross-dance comparisons suggest that the circle functions not only as a spatial guide but also as a shared cultural symbol expressed through geometry.

In addition, a symbolic study of Dance Mask Klana Prawirosekti emphasises the deep meaning of its floor patterns: the circle symbolises sacredness, unity, and magical power, even though it appears compact and straightforward. This shows that the circular pattern on the stage of the Kelana Mask Dance not only enhances the aesthetics of the space but also serves as a symbolic substrate and a cultural impression conveyed through a simple mathematical structure. Therefore, the circular floor pattern in the Kelana Mask Dance, which conceptually merges with rotational and repetitive movements, is a manifestation of the combination of mathematical concepts (rotation, looping, symmetry) and cultural values (unity, dynamic character of Kelana). Consequently, the dance becomes a concrete example of how geometry can operate as a language of cultural expression, enabling mathematics education to connect formal concepts with lived cultural meaning. This reinforces ethnomathematics's position as a bridge between mathematics and cultural expression in mask dance [25].

4. CONCLUSION

Summary of Findings

This research found that the Kelana Mask Dance, as a cultural heritage of Cirebon, combines aesthetic, symbolic, spiritual, and mathematical elements that are inherent to cultural practices. Typical movements such as *Buang Rawis*, *Ngolah Kedok*, *Nindak*, *Buang Ules*, and *Adeg-scène* show geometric principles such as taper corners, blunt angles, right angles, straight lines (180°), as well as a combination of 45° and 90° angles that symbolise assertiveness, balance, direction of goal, and self-control. These findings indicate that geometric concepts are not artificially imposed on the dance but can be identified through careful observation of posture, joint configuration, and spatial orientation. In addition, the circular floor pattern supports the rhythm of repetitive movements, maintains the formation's consistency, and creates an orderly visual space. As a spatial structure, the circular pattern functions both as a choreographic organiser and as a mathematical representation of rotation, cyclic repetition, and symmetry. Each movement element and pattern not only produces visual beauty but also serves as a symbolic medium for communicating Kelana's character, cultural philosophy, and the dynamics of human emotions such as ambition, passion, and self-control. The dance, therefore, cultivates balance, focus, and spatial awareness, and it can serve as a cross-disciplinary educational medium that brings together art, culture, and mathematical ideas. In this way, the Kelana Mask Dance offers a concrete entry point for students to experience geometry through embodied movement and culturally meaningful contexts. Properties such as the red mask and ules cloth also play important roles as narrative devices, symbols of identity, and tools of emotional expression. Taken as a whole, these components position the dance not merely as entertainment, but as a structured cultural system that embodies community values and ways of thinking. All of these elements make the Kelana Mask Dance not only an artistic performance but also a reflection of the community's worldview and a reminder of the importance of preserving the meaning and value of this cultural heritage.

Research Contributions

This research contributes to the ethnomathematics literature by demonstrating how geometric elements are embedded in traditional dance movements and floor patterns as forms of mathematical knowledge internalised within culture. These results reinforce the idea that traditional arts can provide meaningful contexts for learning mathematics by connecting abstract concepts to observable cultural practices. More specifically, this study extends prior ethnomathematics work, often centred on material culture such as batik or architecture, by highlighting dance as a dynamic, embodied source of geometric understanding. The findings also open up opportunities to develop contextual approaches in mathematics education, especially in geometry teaching in schools. In practical terms, the identified movements and floor patterns can be translated into learning tasks such as angle identification, transformation mapping, and symmetry exploration using culturally familiar examples.

Suggestions for Further Research

Further research is recommended to examine mathematical elements in other regional dances or to extend the analysis to rhythmic patterns, bodily symmetry, and proportional relationships in traditional performing arts. Future studies may also employ more detailed movement-analysis tools (e.g., motion mapping or systematic coding of sequences) to improve precision in describing geometric transformations. In addition, implementation studies are needed to integrate these findings into primary and secondary mathematics curricula, strengthening culture-based learning to enhance students' understanding and interest in mathematics. Such implementation research should evaluate learning outcomes, student engagement, and the development of cultural identity to demonstrate the educational impact of ethnomathematical integration empirically.

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