



EXPLORING THE CONCEPT OF ETHNOMATHEMATICS IN THE TRADITIONAL GAME OF PATHILAN

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Abstract

Mathematics is often perceived as an abstract subject that is disconnected from students' daily lives. However, mathematical concepts can actually be found in various cultural activities within society. One approach that can bridge mathematics and local wisdom is ethnomathematics. This study aims to explore the mathematical aspects found in the traditional game of pathilan and its potential as a culture-based mathematics learning medium. The study employed a qualitative method with a descriptive case study approach in grade V at SD Negeri Batok Bali. Data were collected through observation, interviews, and documentation, then analyzed using the Miles and Huberman model, including data reduction, data presentation, and conclusion drawing. Data validity was tested through source triangulation. The findings indicate that the pathilan game contains mathematical aspects such as addition and subtraction operations of whole numbers as well as geometric solid concepts. Addition appears when students count the number of sticks obtained, while subtraction is shown in determining the remaining sticks. In addition, the shape of the sticks represents cuboid and cylinder forms. Therefore, the pathilan game has the potential to become an ethnomathematics-based learning medium that is relevant to real life and meaningful for students.

Keywords: Contextual Learning; Ethnomathematics; Mathematical Concepts; Mathematics Learning

Abstrak

Matematika kerap kali dikategorikan sebagai studi yang abstrak dan terpisah dengan rutinitas sehari-hari peserta didik, namun sebenarnya konsep matematika dapat dijumpai di berbagai aktivitas budaya masyarakat. Upaya yang dapat diterapkan untuk menjembatani antara matematika dan kearifan lokal ialah etnomatematika. Penelitian ini bertujuan untuk mengeksplorasi aspek matematika yang dijumpai pada permainan tradisional pathilan serta potensinya sebagai sarana belajar matematika berbasis budaya. Metode yang diterapkan pada penelitian ini ialah metode kualitatif dengan pendekatan deskriptif studi kasus di kelas V SD Negeri Batok Bali. Data dikumpulkan dengan teknik observasi, wawancara, dan dokumentasi, lalu dikaji menggunakan model Miles dan Huberman yang mencakup reduksi data, penyajian data, dan penarikan kesimpulan. Tingkat keakuratan data diuji melalui triangulasi sumber. Temuan penelitian mengindikasikan bahwa permainan pathilan mengandung aspek operasi hitung penjumlahan dan pengurangan bilangan cacah serta konsep bangun ruang. Penjumlahan muncul saat siswa menghitung jumlah stik yang diperoleh, sedangkan pengurangan terlihat pada aktivitas menentukan sisa stik. Selain itu, bentuk stik merepresentasikan bangun ruang balok dan tabung. Dengan demikian, permainan pathilan berpotensi menjadi media pembelajaran matematika berbasis etnomatematika yang relevan dengan kehidupan nyata dan berarti bagi siswa.

Kata kunci: Etnomatematika; Konsep Matematika; Pembelajaran Kontekstual; Pembelajaran Matematika;

INTRODUCTION

Mathematics is a scientific discipline that plays a significant role in everyday life and serves as a fundamental basis for the advancement of science and technology. However, in educational practice, mathematics is often perceived as an abstract subject that is disconnected from students' real-life

experiences. In reality, mathematical concepts are embedded in various cultural practices and continue to evolve within community activities. This close relationship between mathematics and culture has given rise to the concept of ethnomathematics.

Ethnomathematics is an inclusive perspective of mathematics that emphasizes that mathematical knowledge is not limited to the formal and modern concepts taught in schools. Instead, it recognizes that mathematical ideas are closely linked to the cultural contexts in which they develop. From this perspective, mathematics is viewed not as an abstract discipline detached from daily life but as a product of human thought emerging from everyday activities and lived experiences. Therefore, the development of mathematical knowledge should also involve exploring mathematical concepts embedded within cultural practices and social life (Kurniawan & Hidayati, 2019)

According to Mumu et al (2026) ethnomathematics plays a crucial role in mathematics education at the elementary school level across diverse cultural contexts. It is regarded as a pedagogical approach that enhances students' mathematical competencies, including problem-solving, mathematical communication, reasoning, and numeracy. Beyond cognitive development, ethnomathematics also contributes to strengthening students' mathematical identity, increasing learning engagement, and reducing mathematics anxiety, particularly among learners from diverse cultural and linguistic backgrounds. Their study further demonstrated that ethnomathematics-based instruction creates more practical, interactive, and culturally responsive learning experiences, enabling students to relate mathematical concepts more easily to their daily activities. Furthermore, ethnomathematics promotes appreciation of local culture and supports culturally responsive pedagogy. Nevertheless, its implementation continues to face several challenges, including limited teacher competence, insufficient culture-based instructional materials, and the lack of culturally appropriate assessment instruments.

Ethnomathematics offers numerous benefits for mathematics education because it demonstrates that mathematics does not exist independently of society but rather develops through social and cultural activities. Through this approach, students recognize that mathematical concepts emerge from human needs, customs, and everyday practices. In addition to fostering contextual mathematical understanding, ethnomathematics cultivates appreciation for cultural diversity, strengthens students' pride in their local heritage, and integrates mathematics with other disciplines, making learning more meaningful and applicable (Fauzi, 2022).

One cultural activity that reflects ethnomathematics is traditional games. As part of cultural heritage, traditional games involve rules, patterns, interactions, and activities that naturally incorporate various mathematical concepts. These characteristics indicate that traditional games possess not only recreational and social value but also rich mathematical content worthy of investigation from an ethnomathematical perspective. Consequently, traditional games have considerable potential as instructional media that help students connect mathematical concepts with the cultural experiences they encounter in everyday life.

The educational potential of traditional games as ethnomathematical resources has been demonstrated in numerous previous studies. Recent ethnomathematics research has consistently sought to transform cultural activities into meaningful mathematics learning resources. Kirana et al (2021) through an exploratory ethnographic study of traditional games within the TGR community, identified various mathematical concepts embedded in these games, including units of length and the geometry of cylinders in *patok lele*, as well as basic arithmetic operations in *congklak* and *bekel*. A more focused study by Sarah et al (2022) identified three-dimensional geometric concepts, such as spheres and trigonometry, in the traditional marble game while also highlighting the role of marble-shooting mechanics in developing students' motor skills and discipline. Meanwhile, Miftahurohmah and Wahyuni (2023) examined the traditional game *dam-daman*, emphasizing advanced transformational

geometry concepts, including translation represented through piece movements and reflection illustrated by symmetry during gameplay.

Although research on ethnomathematics in traditional games continues to expand, most studies have focused on well-known games such as congklak, marbles, dam-daman, and patok lele. This concentration has resulted in repetitive findings that primarily identify isolated mathematical concepts. Consequently, there remains limited understanding of how multiple mathematical concepts simultaneously emerge and interact within a single cultural activity. In contrast, the traditional game Pathilan has received little attention in ethnomathematics research, leaving its mathematical potential largely unexplored. Yet, the mechanics of Pathilan, which involve collecting, counting, removing, and arranging sticks, provide a rich context for representing various mathematical concepts, particularly addition, subtraction, and geometry.

Furthermore, most previous studies have been limited to identifying mathematical elements embedded in local cultural practices. Research that explicitly connects ethnomathematical findings with elementary school learning outcomes and mathematics curriculum content remains scarce. This gap indicates the need for studies that comprehensively examine how addition, subtraction, and geometric concepts are represented simultaneously within the traditional game *Pathilan* and how these concepts relate to formal mathematics learning at the elementary school level.

Based on this research gap, the present study aims to explore the ethnomathematical content embedded in the traditional game *Pathilan* by analyzing the representations of addition, subtraction, and geometry that emerge during gameplay. The novelty of this study lies in revealing the interrelationships among multiple mathematical concepts integrated within a single traditional game while mapping their relevance to fifth-grade elementary mathematics content. Therefore, this study not only enriches the body of ethnomathematics literature through the investigation of a relatively underexplored cultural practice but also provides practical contributions by offering an alternative culture-based mathematics learning resource that is contextual, meaningful, and aligned with the needs of elementary mathematics education.

Traditional games inherently contain numerous mathematical concepts that can be utilized as culturally relevant learning media. Unfortunately, this potential has not been widely recognized by teachers and is therefore rarely incorporated into classroom instruction. Preliminary interviews with teachers at the research site confirmed that local wisdom-based learning media have not yet been integrated into classroom practice. One homeroom teacher stated that *"I have never been introduced to ethnomathematics-based learning and have never implemented it, particularly through traditional games such as Pathilan."* This finding raises an important question regarding how the rules and activities of traditional games can be transformed into formal mathematical concepts suitable for classroom instruction. Accordingly, this study seeks to identify the mathematical concepts embedded in the traditional game *Pathilan* and to propose the game as an alternative context-based mathematics learning medium rooted in local cultural heritage.

METHOD

This study employs a qualitative research method. Qualitative research is based on the philosophy of postpositivism and focuses on natural phenomena (rather than experiments), with the researcher serving as the key instrument. This method uses purposive (or snowball) sampling, triangulation as a data collection technique, and inductive analysis, which focuses more on the discovery of meaning. (Sugiyono, 2010). This study employs a descriptive case study approach. A case study is a scientific research approach that involves a systematic, in-depth, and intensive examination of a subject (an individual, group, or institution) to understand real-world events or phenomena as they occur (Sinaga,

2025). This methodological approach was chosen to explore the mathematical concepts embedded in the traditional game of Pathilan.

The study employed both primary and secondary data sources. Primary data were collected directly from field observations and participants at the research site. The fieldwork was conducted on December 12, 2025, in a fifth-grade classroom at SD Negeri Batok Bali, Serang District, Serang City, Indonesia. The participants comprised ten fifth-grade students and one fifth-grade homeroom teacher, who were selected through purposive sampling. Secondary data consisted of supporting documents compiled by other sources and were obtained through documentation, including photographs, video recordings, and relevant literature (Manan & System, 2021).

Primary data were collected through direct observations of the *Pathilan* gameplay and semi-structured interviews with the research participants. Secondary data were obtained from documentary sources, including photographs, video recordings of the gameplay, the physical *Pathilan* game equipment used for geometric analysis, and supporting literature, such as scholarly journal articles and books on ethnomathematics.

To obtain comprehensive and credible data on the ethnomathematical concepts embedded in the traditional game of Pathilan, the researcher employed three data collection techniques: observation, interviews, and documentation. During the observation phase, the researcher directly observed the scoring process and gameplay using an observation checklist to record game activities and identify the mathematical concepts that emerged during play. Semi-structured interviews were conducted with ten fifth-grade students who participated in the Pathilan game and their fifth-grade homeroom teacher. The interviews aimed to explore the limited integration of local culture into formal mathematics instruction, examine the rules of the game, and understand the participants' interpretations of the activities performed throughout the gameplay. The findings were further supported through documentation, which included visual evidence (photographs and video recordings of the gameplay), physical artifacts (the Pathilan game equipment used for geometric analysis), and relevant literature, including books and scholarly journal articles on ethnomathematics (Abubakar, 2021).

The data were analyzed using the interactive data analysis model proposed by Miles & Huberman (1994). The interactive data analysis model proposed by Miles and Huberman (1994) was adopted as the analytical framework for processing all data collected in this study. The analysis consisted of three stages: data reduction, data display, and conclusion drawing and verification. During the data reduction stage, the researcher summarized, organized, and focused on the raw data obtained from field observation notes, photographic documentation, and interview transcripts. In the data display stage, the reduced data were systematically organized and presented to facilitate interpretation and reveal meaningful patterns. Finally, conclusions were drawn and continuously verified by examining the relationships and patterns identified in the data displayed to address the research questions.

To enhance the credibility and trustworthiness of the research findings, this study employed triangulation and member checking. Triangulation was used by integrating multiple data sources, data collection methods, and theoretical perspectives throughout the data collection and analysis processes to strengthen the validity of the findings (Arianto, 2024). Triangulation was employed to strengthen the data collection and analysis processes while providing a more comprehensive understanding of the phenomenon under investigation through the integration of multiple data collection methods and theoretical perspectives. This approach was particularly appropriate given the limited theoretical foundation available to explain the phenomenon being studied. Furthermore, triangulation enhanced the breadth and depth of the analysis by providing a richer understanding of the research focus and guiding the interpretation of the research questions (Winaryati, 2017). In this study, the triangulation methods used included source triangulation, methodological triangulation, and data triangulation. Source

triangulation was conducted by comparing information obtained from students and fifth-grade teachers. Methodological triangulation was conducted by comparing data obtained through observation, interviews, and documentation to identify the concepts of addition, subtraction, and geometry present in the pathilan game. Meanwhile, data triangulation was conducted by comparing the consistency of data obtained from interviews, photographic evidence, and observations.

In addition, this study also employed member checking, which is a data verification process conducted by reconfirming the research findings with the data providers (informants). The purpose of this activity is to ensure the accuracy and validity of the data obtained by the researcher based on the information provided by the informants (Husnullail et al., 2024). Accordingly, these procedures helped ensure the credibility and trustworthiness of the research findings

RESULTS AND DISCUSSION

The traditional game of Pathilan originates from the cultural heritage of Central Java, Indonesia. It combines precision, concentration, and fine motor skills as players take turns collecting as many sticks as possible. Although the game is traditionally played using small wooden sticks, other materials may also be used as substitutes; in this study, ice cream sticks were used as the game equipment. A fundamental rule of the game requires players to remove one stick at a time without touching or disturbing the remaining sticks. This rule encourages patience, carefulness, and motor control throughout the gameplay. Accordingly, the ethnomathematical analysis in this study focuses on reconstructing and interpreting the activities performed by the students while playing Pathilan. The analysis aims to examine the extent to which the game's mechanics and rules embody formal mathematical concepts.

Ethnomathematics is an approach that examines the relationship between mathematics and culture within the context of everyday community life (Prahmana, 2022). From this perspective, mathematics is not viewed merely as abstract discipline but as a body of knowledge that emerges from cultural practices and social activities (Hoffmann & Even, 2024). By incorporating elements of local wisdom into mathematics instruction, abstract mathematical concepts can be connected to students' real-life experiences and cultural environments, thereby making learning more meaningful and relevant (Leton et al., 2025). In this context, culture encompasses ways of thinking, customs, language, behavioural patterns, and various community practices that embody mathematical ideas (Risdiyanti & Prahmana, 2020).

In the game of pathilan, there are various activities that indirectly reflect the application of mathematical concepts. Activities such as counting the number of ice cream sticks, estimating how many sticks are left, devising strategies for picking up sticks, and recognizing shapes on the game pieces demonstrate the presence of mathematical elements that emerge naturally in this traditional game. This shows that traditional games are not merely a form of entertainment but can be utilized as tools to support more contextual mathematics learning (Pan et al., 2022). Through a descriptive case study approach in Grade 5 at Batok Bali Public Elementary School, the researcher directly observed how students interacted with the game pieces and their fellow players. The results of the observation showed that during the game, students unconsciously practiced basic mathematical reasoning. These repetitive activities can serve as a bridge between concrete cultural experiences and an understanding of the mathematical theories taught in school.

The Concept of Counting in Mathematics

At the elementary school level, natural numbers form the most fundamental foundation of all mathematical concepts. Formal education requires students not only to memorize numbers but also to understand their functional meaning through basic arithmetic operations, particularly addition and

subtraction. Natural numbers are the set of non-negative integers, starting with zero and continuing onward (0, 1, 2, 3, ...). Simply put, natural numbers are the combination of zero and all positive integers (Sutriyani & Widiyono, 2021).

Addition can be explained as follows: If A and B are two disjoint sets with n and b elements, respectively, then the sum $a + b$ is the total number of elements in the union of the two sets. Mathematically, this is expressed as: $a + b = n (A \cup B)$. In everyday life, addition is often described with words such as combined, united, included, or made into one. Subtraction is a basic mathematical operation for taking away or separating some members from a group of numbers. The basic notation for subtraction is: $a - b = c$ (where a is the number being subtracted from, b is the subtrahend, and c is the difference) (Danuri & Fathiyah, 2020).

The Concept of Three-Dimensional Shapes in Mathematics

At the elementary school level, learning about three-dimensional shapes involves students' ability to identify, classify, and analyze the visual characteristics and constituent elements of these shapes. A three-dimensional shape is a three-dimensional object that has volume or capacity and is enclosed by boundary surfaces. These geometric objects are generally grouped into two categories: solids with flat faces (such as cubes and rectangular prisms) and solids with curved surfaces (such as cylinders and spheres). The characteristic elements of each solid can be identified based on several features, namely: faces, edges, vertices, and diagonals.(Danuri & Fathiyah, 2020).

Addition Concepts Embedded in the Pathilan Game

The research findings show that the concept of addition in the traditional game of pathilan is represented through the activity of picking up and collecting sticks carried out by players during the game. Each stick successfully obtained is added to the number of sticks already possessed, so that players indirectly perform repeated addition operations in a real-world, contextual setting. These activities demonstrate that addition is not merely an abstract mathematical procedure but also a concrete experience that students can observe and engage in directly. Through this process, students have the opportunity to build an understanding of the concept of addition based on real-world experiences before connecting it to more formal mathematical representations.

These findings are consistent with the research Kirana et al (2021) which revealed that traditional games, such as congklak and bekel, incorporate basic arithmetic operations such as addition and subtraction. However, that study focused more on identifying the presence of arithmetic concepts in the games without providing an in-depth explanation of the mechanisms by which these concepts emerge during play. In contrast to previous research, this study shows that the concept of addition in the game of pathilan emerges systematically at every stage of the game through the process of accumulating the number of sticks obtained by players. These findings indicate that the game of pathilan not only represents the concept of addition but also provides a learning context that enables students to understand the meaning of addition as a process of gradually increasing quantity.

During the observation conducted at SD Negeri Batok Bali, ten fifth-grade students participated in the Pathilan game in pairs, with each pair playing one round of the game. Each ice cream stick successfully removed without disturbing the remaining sticks was counted as an individual score. Because each participant played only one round, the concept of addition naturally emerged when the students calculated the total number of sticks they had collected at the end of the game. These findings have important implications for mathematics instruction at the elementary school level, particularly in promoting contextual and culturally responsive learning. The integration of the Pathilan game into mathematics instruction enables students to connect their gameplay experiences with the concept of

addition learned in the classroom. As a result, students develop not only procedural fluency in performing addition but also a deeper conceptual understanding of addition as it is applied in authentic, real-world contexts (Nilimaa, 2023).



Figure 1. Students Playing the Pathilan Game

Subtraction Concepts Embedded in the Pathilan Game

The concept of whole-number subtraction is reflected in the strategic nature of the Pathilan game, where players estimate the number of sticks collected by their opponents. Before the game begins, the players count the total number of ice cream sticks used during the session. In this study, a total of 42 ice cream sticks were used in a single round of Pathilan. The number of sticks collected by an opponent can be determined by subtracting the number of sticks held by the player from the total number of sticks. If the game is still in progress, the remaining sticks on the floor are also subtracted from the total. Once the game has ended, however, players simply subtract the number of sticks they collected from the total number of sticks used in the game to determine the number collected by their opponent.

These activities indirectly foster students' number sense and arithmetic reasoning. Through direct gameplay experiences, students recognize addition as the cumulative process of combining tangible objects that they have collected during the game. Likewise, subtraction is understood as the process of removing, separating, or determining the remaining quantity of tangible objects within the context of the Pathilan game. These findings demonstrate how both addition and subtraction emerge naturally through gameplay, providing meaningful and culturally relevant contexts for learning fundamental arithmetic concepts (Supriyadi, 2024).

The findings of this study are consistent with those reported in previous research Kirana et al (2021) The findings of this study are consistent with previous research demonstrating that traditional games embody basic arithmetic concepts, including subtraction, through various gameplay activities. However, earlier studies were primarily limited to identifying the presence of subtraction concepts without examining in depth the mathematical reasoning that develops throughout the gameplay process. In contrast, the present study reveals that subtraction in the Pathilan game serves not only to determine the final game outcome but also functions as a strategic tool for monitoring the number of sticks collected by opponents and estimating the likelihood of winning. Thus, subtraction in Pathilan extends beyond a simple arithmetic operation and becomes an integral part of decision-making processes that involve mathematical reasoning.

These gameplay situations indirectly promote students' sense of number by helping them understand the relationships among the initial quantity, the quantity they have collected, and the

remaining quantity. Through direct gameplay experiences, students construct the understanding that subtraction is a process of determining the remainder or difference between quantities of tangible objects that can be directly observed and manipulated. This experiential learning enables students to connect abstract mathematical concepts with the concrete experiences encountered during the game.

These findings indicate that the Pathilan game has considerable potential as a contextual learning resource for teaching whole-number subtraction in fifth-grade elementary mathematics. The activities of counting, comparing, and determining the remaining number of sticks during gameplay not only help students develop procedural proficiency in subtraction but also foster a conceptual understanding of subtraction as a meaningful operation in authentic real-world situations. Consequently, mathematics learning becomes more meaningful, contextual, and closely connected to students' everyday experiences.

Analysis of Students' Cognitive Processes During the Pathilan Game

The traditional game of Pathilan provides more than a recreational activity; it also creates opportunities for social interaction among students throughout the gameplay. During the game, students engage in various forms of interaction, including observing their peers' moves, comparing the number of sticks collected, and participating in simple discussions to determine the game results. These interactions demonstrate social processes that contribute to the development of students' cognitive abilities. This finding is consistent with Vygotsky's sociocultural theory, which emphasizes that social interaction plays a fundamental role in cognitive development. Through interactions with peers and their surrounding environment, students have opportunities to ask questions, respond to others' ideas, express their own opinions, and collaboratively construct understanding (Warmansyah et al., 2023).

According to Piaget's theory of cognitive development, learning progresses through a series of sequential stages that correspond to an individual's age and cognitive maturity. Because these stages are hierarchical, learners are expected to progress through them in order, and concepts that exceed their cognitive capacity cannot be fully understood. Piaget identified four stages of cognitive development: the sensorimotor stage (birth to 2 years), the preoperational stage (2 to 7 or 8 years), the concrete operational stage, and the formal operational stage. The activities involved in the Pathilan game reflect the characteristics of the concrete operational stage. At this stage, children begin to understand logical relationships through concrete, tangible, and directly observable objects. During gameplay, students manipulate physical objects, count and compare the number of sticks, estimate the remaining quantity, and apply logical reasoning to make strategic decisions. These activities demonstrate that Pathilan provides a concrete learning context that supports the development of mathematical thinking in accordance with students' cognitive developmental stage (Dikdas, 2021). When students count the number of sticks, estimate the remaining sticks, or observe changes in quantity throughout the game, they are implicitly engaging in logical thinking based on concrete objects. These experiences demonstrate that students develop an understanding of arithmetic concepts through activities that are closely connected to their everyday experiences.

Bruner argued that conceptual understanding is more effectively developed when learners first engage in concrete learning experiences before progressing to more abstract forms of representation. Mathematical knowledge is constructed through interactions with objects, the surrounding environment, and direct experiences. In the context of the Pathilan game, the use of sticks as manipulatives provides students with opportunities to interact with tangible objects. Consequently, the mathematical concepts that emerge during gameplay can be understood through concrete experiences before being connected to symbolic representations in formal mathematics instruction (Abrahamson, et al., 2020).

In the Pathilan game, ice cream sticks serve as concrete manipulatives that help students develop an understanding of whole numbers and basic arithmetic operations through direct, hands-on experiences. Through this engagement, students learn to perceive numbers not merely as abstract symbols but as meaningful representations of quantities that emerge from their own gameplay experiences.

Beyond serving as a recreational activity that encourages social interaction, the Pathilan game also contributes to students' cognitive development. The activities involved in the game provide concrete learning experiences that support conceptual understanding and the development of logical reasoning. During gameplay, students observe their peers' actions, compare the number of sticks collected, perform arithmetic calculations, and estimate the number of sticks remaining. These activities demonstrate that students naturally apply arithmetic concepts using tangible objects, which is consistent with the characteristics of Piaget's concrete operational stage.

Furthermore, the interactions that occur throughout the game encourage students to exchange ideas, ask questions, and explain their reasoning to their peers. This finding supports Vygotsky's sociocultural theory, which emphasizes that cognitive development is strongly influenced by communication and social collaboration. From Bruner's perspective, the use of ice cream sticks as learning manipulatives also highlights the importance of direct experience in the construction of mathematical knowledge. By manipulating concrete objects, students are able to develop an understanding of whole numbers and arithmetic operations before connecting these experiences to more abstract symbolic representations in formal mathematics learning.

Overall, the Pathilan game serves as a learning medium that integrates both social and cognitive dimensions of learning. Gameplay involving concrete objects not only helps students construct meaningful mathematical understanding but also fosters logical reasoning, problem-solving skills, and effective social interaction. These findings suggest that Pathilan has considerable potential as a culturally responsive and contextual learning resource for elementary mathematics instruction.

Three-Dimensional Geometric Concepts Embedded in the Pathilan Game

The analysis of the game equipment used in *Pathilan* revealed a clear connection to three-dimensional geometric concepts, particularly those represented by the ice cream sticks, the primary game materials. From a geometric perspective, everyday objects can serve as effective instructional media that bridge students' real-life experiences with the abstract and formal concepts of mathematics. Spatial representation extends beyond the ability to recognise geometric objects; it also involves visualising object positions in space and constructing and representing geometric models (Lavicza et al., 2023). These findings are consistent with previous research demonstrating that traditional games and everyday objects can provide meaningful contexts for developing students' spatial reasoning and geometric understanding Sarah et al (2022) which suggests that marble games incorporate concepts of spatial geometry—particularly the shape of a sphere as well as concepts of motion in space. However, this study is still limited to identifying three-dimensional shapes without emphasizing the connection to students' hands-on experiences within the context of the game.

In contrast to those findings, this study shows that the concept of three-dimensional shapes in the pathilan game is understood not only through visual observation but also through students' direct engagement in manipulating the game objects. This process provides a more concrete and meaningful learning experience in geometry. Thus, the Pathilan game has the potential to serve as a learning medium for solid geometry that can support a more contextual understanding of solid geometric concepts among elementary school students (Pramuditya et al., 2025). This is in line with the opinion Agriyanto et al (2021) regarding the scope of spatial representation skills. Therefore, the popsicle sticks

used in the “Pathilan” game are not interpreted as three-dimensional shapes in and of themselves, but rather as real objects that help students construct geometric representations through concrete experiences (Pramuditya et al., 2025).

From a geometric perspective, the physical shape of an ice cream stick exhibits elements that can be linked to various concepts of three-dimensional shapes. The elongated, flat body of the stick resembles the characteristics of a rectangular prism, while its curved end can be associated with elements of three-dimensional shapes with curved sides, such as a cylinder (Grigorieva, 2025). The ability to connect the characteristics of real-world objects with these geometric concepts reflects the process of spatial representation that plays a role in building mathematical understanding through the interpretation and modeling of visual objects into formal geometric forms (Agriyanto et al., 2021).

These findings are consistent with those reported in previous research Kusumawardani et al (2023) which reveals that various cultural objects can be used as tools to represent geometric concepts through the identification of shape characteristics and the process of mathematically visualizing objects encountered in real life. In the “pathilan” game, popsicle sticks serve as concrete media that help students connect the physical characteristics of an object with the geometric concepts they are learning. By observing the shape of the popsicle stick, students can identify flat elements along the body of the stick and curved elements at its ends. This process serves as a foundation for building an understanding of geometry before students construct more abstract and formal concepts of three-dimensional shapes (Molle & Sabandar, 2025). A block is defined as a three-dimensional shape with flat sides, the main characteristic of which is that it has three sides that are congruent in shape and dimensions. In our everyday surroundings, this geometric object is very easy to find in various concrete forms, such as erasers and cardboard boxes (Wildaniati, 2018).

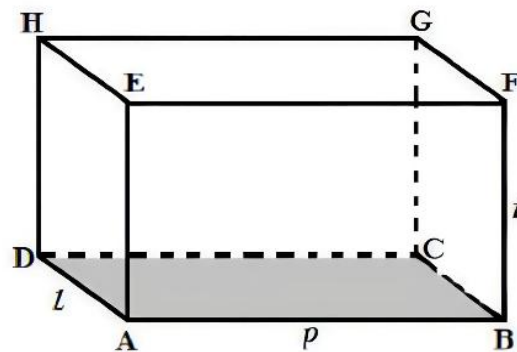


Figure 2. Ice Cream Stick Representing a Rectangular Prism

According to Wildaniati (2018) a rectangular prism consists of the following basic structural components:

1. Faces: A rectangular prism has six rectangular faces, consisting of the bottom face (ABCD), the top face (EFGH), the left face (ADEH), the right face (BCFG), the front face (ABEF), and the back face (CDGH).
2. Vertices: The rectangular prism ABCD.EFGH has eight vertices, namely A, B, C, D, E, F, G, and H.
3. Edges: A rectangular prism has twelve edges, which can be grouped into three categories according to their dimensions: length edges (AB, CD, EF, and GH), width edges (BC, AD, EH, and FG), and height edges (AE, BF, CG, and DH).

4. Face Diagonals: A rectangular prism has twelve face diagonals (AC, BD, EG, FH, BG, CF, AH, DE, DG, CH, AF, and BE). The length of each face diagonal can be determined using the Pythagorean Theorem. For example, the length of diagonal AC is calculated as follows: $AC^2 = AB^2 + BC^2$.
5. Diagonal Planes: A rectangular prism contains six diagonal planes that extend through its interior, namely BDFH, ADFG, BCHE, CDEF, ABGH, and AECG.
6. Space Diagonals: A rectangular prism has four space diagonals (BH, AG, CE, and DF), each connecting a pair of opposite vertices through the interior of the prism

The geometric characteristics identified in the ice cream sticks extend beyond those of polyhedra, as the rounded ends of the sticks also exhibit features associated with curved-surface solids. This observation suggests that the materials used in the Pathilan game have considerable potential as concrete learning media for introducing a variety of geometric concepts to elementary school students. By directly observing the shapes of the objects used during gameplay, students can develop a more contextual understanding of the properties and elements of three-dimensional figures through experiences that are closely connected to their everyday learning environment (Jones & Tzekaki, 2016). A cylinder is a three-dimensional geometric solid composed of two parallel and congruent circular bases connected by a curved lateral surface. When the curved surface is unfolded, it forms a rectangle. (Danuri & Fathiyah, 2020).

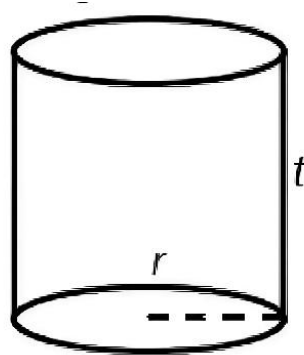


Figure 3. Cylinder Solids

A cylindrical solid has the following elements (Danuri & Fathiyah, 2020):

1. Faces: A cylinder has two congruent circular faces, namely the base and the top, connected by a curved lateral surface. When the curved lateral surface is unfolded, it forms a rectangle.
2. Vertices: A cylinder has no vertices because it does not have edges that intersect to form corners.
3. Edges: A cylinder has two curved edges located at the intersections of the curved lateral surface with the circular base and the circular top.
4. Diagonal Planes and Face Diagonals: A cylinder has neither diagonal planes nor face diagonals because it is bounded by a curved surface rather than flat polygonal faces.

In the Pathilan game observed in this study, ice cream sticks were used as the primary game materials. Geometrically, the shape of each ice cream stick exhibits the characteristics of both a rectangular prism and a cylinder. This finding indicates that a single game object can represent multiple three-dimensional geometric concepts, highlighting its potential as a concrete instructional medium for introducing elementary students to spatial geometry through culturally meaningful learning experiences (Pramuditya et al., 2025).

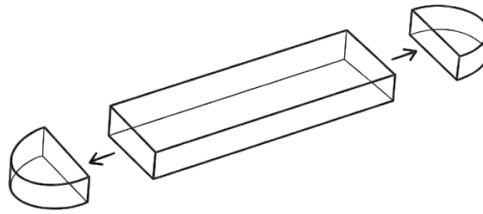


Figure 4. Ice Cream Sticks with the Ends Cut Off



Figure 5. Ice Cream Sticks as Toys for the “Pathilan” Game

The main body of the ice cream stick predominantly resembles a rectangular prism because it has flat, elongated surfaces with identifiable length, width, and thickness. These characteristics enable students to recognize the structural elements of a rectangular prism through direct observation of the objects used during gameplay. As a result, abstract geometric concepts become more accessible through concrete learning experiences. In contrast, the rounded ends of the ice cream stick exhibit characteristics associated with a cylinder (Kazimova et al., 2025). The curved shape of the stick's ends reflects the presence of circular features and a curved surface that distinguishes them from the flat surfaces of the main body. This combination provides students with visual and tangible experience demonstrating that a single everyday object can embody more than one geometric form (Boonstra et al., 2023). Consequently, the Pathilan game offers a meaningful context for introducing multiple three-dimensional geometric concepts through authentic objects encountered in students' daily lives.

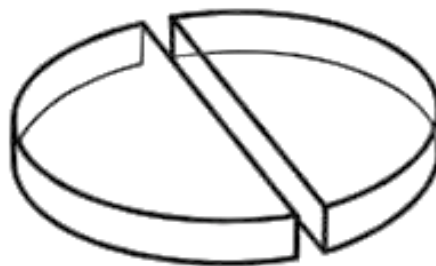


Figure 6. The Ends of the Ice Cream Sticks That Have Been Cut and Then Joined Together

When related to the concept of a cylinder, the rounded ends of the ice cream stick help students recognize the curved surface and circular features that characterize this three-dimensional figure. Although an ice cream stick is not a perfect cylinder, its rounded ends can still serve as an introductory representation for teaching the concept of curved-surface solids. Through direct observation of the game

materials, students can distinguish the curved surfaces of a cylinder from the flat faces of polyhedra such as a rectangular prism.

Based on the observational findings, the use of ice cream sticks in the Pathilan game provides an authentic, experience-based learning environment that helps students connect geometric concepts with everyday situations (Chonchaiya & Srithammee, 2025). Rather than learning three-dimensional figures solely through theoretical definitions, students develop conceptual understanding by interacting directly with tangible objects used during gameplay (Pramuditya et al., 2025). These findings demonstrate that traditional games can function as ethnomathematics-based learning resources, bridging cultural experiences with the learning of mathematical concepts in elementary school (Wardani & Himmah, 2026). From a broader perspective, ethnomathematics demonstrates that the ways in which mathematical concepts are applied and understood may vary across cultural groups according to their unique cultural backgrounds and experiences (Batiibwe, 2025). This perspective suggests that mathematical knowledge is continuously adapted and developed in response to the needs, practices, and experiences of different communities. Therefore, mathematics should be understood not only as a universal body of knowledge but also as a cultural construct that evolves through human activities and cultural practices (Fauzi, 2022).

CONCLUSION

The findings of this study indicate that the traditional Pathilan game has considerable potential as an ethnomathematics-based learning resource for fifth-grade elementary school students by integrating cultural values, cognitive development, and hands-on learning experiences. The game naturally embodies fundamental mathematical concepts, including addition, subtraction, and three-dimensional geometry, while also supporting students' cognitive development through concrete learning experiences consistent with the theories of Piaget, Vygotsky, and Bruner. The use of ice cream sticks as manipulatives enables students to construct meaningful understandings of whole numbers, arithmetic operations, and geometric concepts by connecting abstract mathematical ideas with tangible objects encountered during gameplay. Consequently, Pathilan provides a contextual, culturally responsive, and meaningful approach to mathematics learning that promotes conceptual understanding rather than procedural proficiency alone. These findings suggest that Pathilan can be effectively incorporated into elementary mathematics instruction as a culturally grounded learning medium, while future research should investigate its effectiveness in improving students' mathematical achievement and identify optimal instructional strategies for its classroom implementation.

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