ETHNOMATHEMATICS IN *PANJAT PINANG* AS LEARNING CONTENT FOR THE PYTHAGOREAN THEOREM AND CIRCLES

Rino Sinus Pandanu

Department of Mathematics Education, Faculty of Teacher Training and Education, Tanjungpura University

Email: rinowarnawarni@gmail.com

Abstract

This study examines ethnomathematical elements in the traditional Indonesian game Panjat Pinang as contextual learning content for teaching the Pythagorean Theorem and circle geometry. Using a descriptive qualitative approach within the ethnomathematics framework, data were obtained through visual documentation of Panjat Pinang activities during Indonesia's Independence Day celebration in Pontianak City. The analysis reveals two main mathematical concepts. First, the upright pole, rope, and ground base form a right triangle, representing the Pythagorean Theorem ($C^2 = A^2 + B^2$) used to determine ideal rope length for stability. Second, the circular arrangement of prizes illustrates circle geometry, including center, radius, diameter, circumference, and sector division with equal central angles. The study concludes that integrating Panjat Pinang into mathematics lessons promotes conceptual understanding, cultural appreciation, and contextual learning, demonstrating that mathematics is deeply embedded in local cultural practices.

INTRODUCTION

Mathematics learning often poses challenges for students because it is presented in an abstract manner and disconnected from real-life contexts. Ethnomathematics then emerges as a bridge that connects mathematical knowledge with cultural practices, recognizing that every community possesses its own ways of counting, measuring, classifying, and solving problems based on local traditions and values. (D'Ambrosio, 1985). Furthermore, D'Ambrosio (2016) positions ethnomathematics not merely as a pedagogical approach but also as an epistemological paradigm that acknowledges the diversity of mathematical thinking across different cultural communities. This perspective has been continually reinforced by various contemporary studies

demonstrating the effectiveness of ethnomathematics in enhancing the quality of mathematics learning.

For instance, Dhema, Cholily, and Rahardjanto (2025) found that integrating local cultural contexts into mathematics learning can enhance students' mathematical literacy, critical thinking skills, and learning motivation. Similarly, Sanjaya and Safitri (2024) emphasized that applying a multi-contextual approach that combines ethnomathematics, Realistic Mathematics Education (RME), and technology integration can deepen conceptual understanding and problem-solving abilities through authentic contexts. These findings are further supported by Sunzuma and Umbara (2025), who demonstrated that technological support in ethnomathematics-based learning enables more interactive visualization and contextualization of cultural values, making learning more relevant, inclusive, and aligned with 21st-century competencies. Thus, ethnomathematics serves not only as a means of bridging mathematics and culture but also as a foundation for developing contextual, transformative learning that is deeply rooted in the identity and local wisdom of the Indonesian people.

Indonesia, as an archipelagic nation stretching from Sabang to Merauke, possesses a remarkably rich cultural diversity (Yunita et al., 2025). The implementation of ethnomathematics can be realized through the exploration of various cultural practices that contain educational values and are relevant to mathematical concepts (Mahyuni et al., 2025). One form of local wisdom that holds great potential as a learning context is the *Panjat Pinang* competition, a traditional game commonly held to celebrate Indonesia's Independence Day. The origin of this activity can be traced back to the Dutch colonial era, when *Panjat Pinang* was often organized by Dutch communities during major events such as weddings or festivals, with indigenous people as participants (Adisaputra et al., 2021). The prizes typically included food items such as cheese and sugar, as well as clothing like shirts, which were considered luxury goods at the time. In terms of form and mechanism, the *Panjat Pinang* tradition has undergone little change to this day. The competition involves erecting a tall, slippery areca palm tree coated with lubricant, at the top of which various prizes are hung for participants to reach.

When examined more closely, the *Panjat Pinang* competition contains various mathematical concepts that can be explored, particularly those related to the Pythagorean Theorem and circles. In the process of erecting the pole, the use of ropes as supports to maintain its balance forms a right triangle consisting of the height of the pole, the length of the rope, and the distance between the base and the stake. The relationship among these three components can be analyzed using the Pythagorean Theorem. Meanwhile, at the top of the pole, the prizes are usually arranged in a circular pattern surrounding the peak. This pattern serves as a concrete representation of the circle concept, where each prize is positioned at a point on the circumference, equidistant from the center (the top of the pole). Through this context, students can learn and understand the relationships among the radius, diameter, circumference, and the constant π (pi).

However, although cultural contexts such as *Panjat Pinang* contain rich mathematical potential, the integration of ethnomathematical elements into geometry learning in schools is still rarely implemented in a systematic manner. Most classroom mathematics instruction remains focused on procedural knowledge and formal symbols, without linking concepts to students' cultural realities. As a result, learners often

struggle to grasp the meaning and real-world applications of concepts such as the Pythagorean Theorem and circle geometry. In fact, through the context of *Panjat Pinang*, students can observe how the sides of a right triangle are naturally formed by the pole, the supporting rope, and the ground surface, as well as how circle concepts are represented by the circular arrangement of prizes at the top of the pole. Such a learning approach not only enhances conceptual understanding but also fosters an appreciation of cultural heritage and the ability to connect mathematics with everyday life. Therefore, this study is essential to explore and develop ethnomathematical elements in the *Panjat Pinang* tradition as learning content for the Pythagorean Theorem and circle geometry, aiming to realize contextual, meaningful, and culturally grounded mathematics learning in Indonesia.

METHOD

This study employed a descriptive qualitative approach within the ethnomathematics framework to identify and analyze mathematical concepts embedded in the traditional *Panjat Pinang* competition. This approach was selected because it aligns with the research objective, which is to explore and describe cultural practices that contain mathematical values as contextual learning resources. The primary data source in this study consisted of visual documentation, specifically photographs of *Panjat Pinang* activities taken during Indonesia's Independence Day celebration on Tanjung Harapan Street, Bansir Laut Subdistrict, Southeast Pontianak District, Pontianak City. The data collection techniques included visual documentation and literature review related to ethnomathematics, as well as references discussing the Pythagorean Theorem and circle geometry within the context of contextual learning.

RESULTS AND DISCUSSION

General Description of the Panjat Pinang

Panjat Pinang is a traditional competition in which participants climb a tall areca palm tree that has been stripped of its bark and coated with a slippery substance to reach prizes hung at the top. This event is commonly held to commemorate Indonesia's Independence Day and remains one of the most popular traditional games across the country.

Figure 1. *Panjat Pinang* Pole
(*Source:* Personal Documentation)

The *Panjat Pinang* game is a long-standing tradition passed down through generations and continues to be a beloved activity among Indonesian communities. The

event is generally organized in several categories, such as a children's category with poles approximately 10 meters high and an adult category with poles reaching up to 20 meters.

Historically, similar forms of this game have existed in other cultures. Records show that a game resembling *Panjat Pinang* was known during the Ming Dynasty (1368–1644) and the Qing Dynasty (1644–1911) in China. It is believed to have originated as an adaptation of the Ghost Festival ceremony and is known in China as qiang-qu. Comparable games have also been documented in Malta since the Middle Ages, following the fall of the Western Roman Empire in the 15th century. Known as Gostra, this version is typically held during the Saint Julian Festival. In Indonesia, the tradition flourished during the Dutch colonial period, when it was referred to as "de Klimmast", meaning "climbing the pole" (Adisaputra et al., 2021).

Identification of Ethnomathematical Elements

The *Panjat Pinang* tradition not only reflects cultural values such as cooperation, sportsmanship, and the spirit of perseverance, but it also contains various mathematical elements that can be identified and integrated into mathematics learning. Based on observations of visual documentation, several key elements were found to represent fundamental geometric concepts, particularly the Pythagorean Theorem and circle geometry.

During the stage of erecting the *Panjat Pinang* pole, the use of supporting ropes becomes an essential aspect to ensure the pole stands upright. The structure formed by the height of the pole (vertical side), the distance between the base and the anchor point (base side), and the length of the supporting rope (hypotenuse) naturally creates a right triangle. The relationship among these three components can be analyzed using the Pythagorean Theorem ($A^2 + B^2 = C^2$) to determine the ideal rope length that allows the pole to remain stable. This concept illustrates how local communities intuitively apply mathematical principles in traditional activities without explicitly referring to them in formal terms. Thus, the practice of erecting a *Panjat Pinang* pole represents a real-life application of the Pythagorean Theorem within a cultural context, demonstrating the intersection between traditional knowledge and mathematical reasoning.
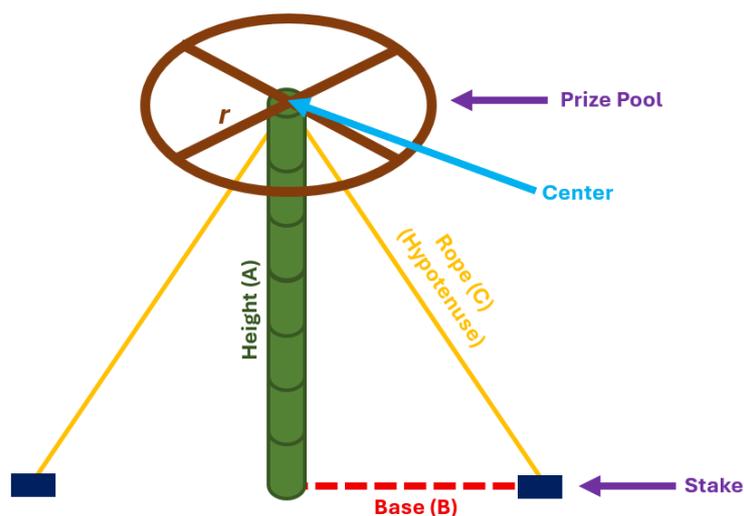

Figure 2. Illustration of *Panjat Pinang* Model as a Right Triangle
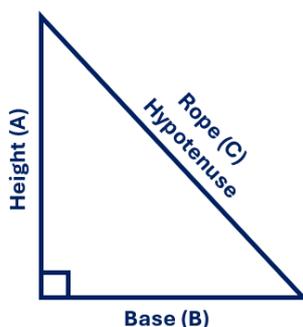(Source: Personal Documentation)

At the top structure of the *Panjat Pinang* pole, the prizes are typically arranged around the pole in a circular pattern, forming a concrete representation of the circle concept in geometry. The upright pole serves as the center of the circle, while the distance between the pole's center and each prize represents the radius (r). When measured from one side to the opposite side through the center of the pole, this distance forms the diameter (d) of the circle, which mathematically follows the relationship $d = 2r$.

This circular arrangement of prizes allows students to understand that the circumference (K) of a circle can be calculated using the formulas $K = 2 \times \pi \times r$ or $K = \pi \times d$, where π (pi) is approximately 3.14. Through this context, students do not merely learn the formula in an abstract way but are also able to relate the concept to real phenomena observed within their local cultural environment. For instance, if the distance between the center of the pole and the position of each prize is 0.5 meters (r = 0.5 m), the circumference of the prize circle can be calculated as $K = 2 \times 3.14 \times 0.5 = 3.14$ meters. Thus, students can perform direct measurements and calculations based on an authentic and meaningful context.

This cultural context enables teachers to design ethnomathematics-based mathematics learning that fosters conceptual understanding through hands-on activities. By connecting the concepts of circumference, radius, diameter, and π, students not only comprehend the mathematical relationships symbolically but also internalize their meaning within a familiar cultural setting. Consequently, learning becomes more meaningful, contextual, and applicable to real-life experiences.

Analysis of the Pythagorean Theorem Concept

In this traditional game, there is a main pole that stands vertically, representing the vertical side (A), the base side (B) representing the distance between the rope's anchor point and the foot of the pole, and the hypotenuse (C) representing the length of the supporting rope. These three elements form a right triangle, with the right angle located at the intersection between the pole and the ground. According to the Pythagorean Theorem, the length of the hypotenuse or rope can be determined through the quadratic relationship among the sides, expressed as $C^2 = A^2 + B^2$.


Gambar 3. Right Triangle Formed from the *Panjat Pinang* Model
(*Source*: Personal Documentation)

This relationship shows that the length of the rope (C) depends on the height of the pole (A) and the distance of the anchor point on the ground (B). In real-life contexts, this principle can be applied to determine the ideal rope length needed for the pole to stand upright and remain stable. Thus, the Pythagorean Theorem is not merely an abstract concept

but also has practical applications in everyday life, particularly in cultural activities such as the *Panjat Pinang* competition, which naturally presents a right triangle as a representation of the mathematical relationship among its three sides.

Analysis of the Circle Concept

In addition to illustrating the Pythagorean Theorem, the figure also represents the application of circle geometry at the top section of the *Panjat Pinang* pole. The circular structure serves as a prize pool, where prizes are arranged symmetrically around the pole. In this structure, the center of the circle acts as the main reference point, while the distance from the center to the edge of the circle is known as the radius (r). Through the concept of the radius, students can understand the fundamental relationships within a circle, such as the diameter ($2 \times r$) and the circumference ($K = 2 \times \pi \times r$).
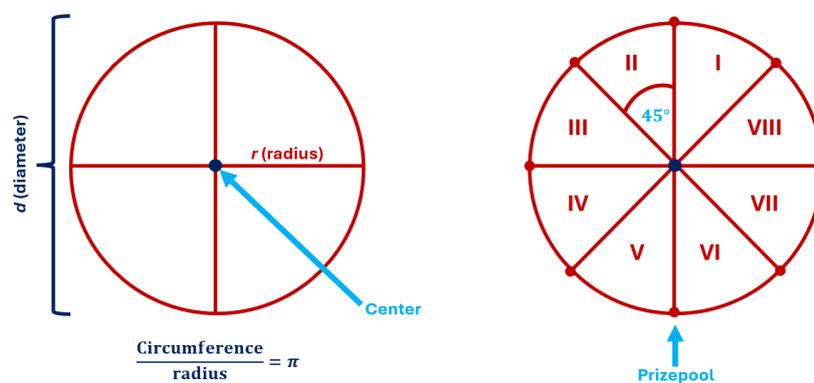
Gambar 4. Circle Formed from the Prize Placement Area of *Panjat Pinang*
(*Source*: Personal Documentation)

In addition, the equal distribution of prizes around the circle can be used to explain the concepts of central angles, rotational symmetry, and sector division. Thus, the top part of the *Panjat Pinang* pole not only serves as a decorative element or a support for the prizes but also acts as a concrete representation of circle geometry. This integration demonstrates that traditional games such as *Panjat Pinang* contain mathematical values that can serve as contextual learning resources, enabling students to connect circle concepts with real-world phenomena that are familiar within their own cultural environment.

Interpretation of Ethnomathematics-Based Learning

The traditional game *Panjat Pinang* not only embodies cultural values and sportsmanship but also represents various mathematical concepts that can serve as contextual learning resources. Within the framework of ethnomathematics, teachers can utilize the structures and elements of this game to meaningfully teach both circle geometry and the Pythagorean Theorem.

At the top of the pole, the circular arrangement of prizes serves as a real-life representation of circle geometry. Elements such as the center, radius (r), diameter (d), and circumference ($K = 2 \times \pi \times r$) can be understood through direct observation. When prizes are placed evenly around the circle, students can explore how a circle may be divided into equal sectors with identical central angles. For example, dividing the circle into eight sectors each with a 45° central angle illustrates the concept of sector division, symmetry, and geometric regularity, all of which emerge naturally from a

well-known cultural activity. In this way, students do not only grasp abstract mathematical concepts but also recognize that mathematics lives within their own culture.

Meanwhile, the structure consisting of the pole, rope, and ground base forms a right triangle, representing the practical application of the Pythagorean Theorem in ensuring the stability of the pole. Students can connect the formula $C^2 = A^2 + B^2$ with a real-world need, determining the proper rope length to keep the pole upright, demonstrating that mathematics serves to solve authentic problems in daily life.

Pedagogically, such ethnomathematics-based learning helps students construct knowledge from cultural experiences, fosters appreciation for local wisdom, and promotes deep conceptual understanding. By bringing the *Panjat Pinang* context into the classroom, teachers present mathematics not merely as a set of formulas but as a way of thinking and engaging with the real world, enriched with meaning and local values.

CONCLUSION

Based on the analysis and interpretation conducted, it can be concluded that the traditional game of *Panjat Pinang* is a form of local wisdom rich in ethnomathematical values. Through the structure and activities of this game, students can learn various mathematical concepts contextually, particularly the Pythagorean Theorem and circle geometry. The pole, rope, and base form a right-angled triangle representing the squared relationships between the sides, while the circle at the top of the pole, with prizes arranged in a circular manner, provides a concrete representation of circle elements such as the center, radius, diameter, circumference, as well as the division of sectors and central angles. Thus, ethnomathematics-based learning in the context of *Panjat Pinang* not only strengthens the understanding of mathematical concepts but also fosters appreciation for local culture, motivates students to learn through real-life experiences, and demonstrates that mathematics is alive and develops within societal traditions.

BIBLIOGRAPHY

Adisaputra, A. K., Rosita, L., Barnas, Jubaedah, E., Aryani, I., Saragih, J. F. S., Nalova, L. M., Toha, M., Elsye, R., Wahyudi, S., Suparmiati, Susanto, A., Hidayat, S., Pangestuti, Y., Shabira, B. N., Firizki, C. S. F., Farida, D., Haq, F., Parida, I., … Muhklis, D. D. (2021). *Antologi Literasi Merdeka: Opini dan Puisi* (S. Munawar (ed.)). Yayasan Ruang Baca Komunitas.

D'Ambrosio, U. (1985). Ethnomathematics and Its Place in the History and Pedagogy of Mathematics. *For the Learning of Mathematics*, *5*(1), 44–48. https://www.jstor.org/stable/40247876

D'Ambrosio, U. (2016). An Overview of the History of Ethnomathematics. In *Current and Future Perspectives of Ethnomathematics as a Program* (pp. 5–10). Springer. https://doi.org/10.1007/978-3-319-30120-4_2

Dhema, M., Cholily, Y. M., & Rahardjanto, A. (2025). Tracing Local Wisdom in the Integration of Ethnomathematics in Vocational High School Mathematics Education: A Scopus Systematic Review. *Indonesia Journal of Science and Mathematics Education*, *8*(2), 472–485.

Mahyuni, N., Fitarani, K. R., Nengsi, & Wahyuni, B. D. (2025). Eksplorasi Etnomatematika pada Makanan Tradisional Bengkulu Sebagai Sumber Belajar

Kontekstual. *Edukreatif: Jurnal Kreativitas Dalam Pendidikan*, *6*(3), 398–408.

Sanjaya, Y. A., & Safitri, D. (2024). Integrasi Nilai-Nilai Kearifan Lokal Dalam Pengembangan Pendidikan Karakter Di Era 4.0. *JICN: Jurnal Intelek Dan Cendikiawan Nusantara*, *1*(2), 3007–3013.

Sunzuma, G., & Umbara, U. (2025). Ethnomathematics-Based Technology in Indonesia: A Systematic Review. *Asian Journal for Mathematics Education*, *4*(1), 129–153. https://doi.org/10.1177/27527263241305812

Yunita, S., Andini, D. R., Khansa, L., & Nadira, N. (2025). Pendidikan Kewarganegaraan sebagai Sistem Pendidikan Multikultural di Indonesia. *Indonesian Journal of Learning Studies*, *5*(2), 64–68.