(JIML) JOURNAL OF INNOVATIVE MATHEMATICS LEARNING
Volume 8, No. 2, June 2025
P-ISSN 2621-4733
E-ISSN 2621-4741
https://dx.doi.org/10.22460/jiml.v8i2.p26861

ETHNOMATHEMATICS ON AYUNAN JANTRA IN BALI: INTEGRATION OF MATHEMATICAL CONCEPTS IN CULTURE

Sheilla Zalzabilla Al-Jabar[1], Fikri Fauzi[2], Wahyu Hidayat[3], Nelly Fitriani[4], Tatang Supriatna[5]

[1]IKIP Siliwangi, Jl. Terusan Jend. Sudirman, Cimahi, Indonesia.
aljabarfortask@gmail.com
[2]Universitas Pendidikan Indonesia, Jl. Dr. Setiabudi No.229, Bandung, Indonesia
fikri.fa@upi.edu
[3]IKIP Siliwangi, Jl. Terusan Jend. Sudirman, Cimahi, Indonesia.
wahyu@ikipsiliwangi.ac.id
[4]IKIP Siliwangi, Jl. Terusan Jend. Sudirman, Cimahi, Indonesia.
nellyfitriani@ikipsiliwangi.ac.id
[5]IKIP Siliwangi, Jl. Terusan Jend. Sudirman, Cimahi, Indonesia.
statang776@gmail.com

ARTICLE INFO

Article history:

Received Jan 21, 2025
Revised Mar 15, 2025
Accepted Mar 19, 2025

Keywords:

Ethnomathematics
Ayunan Jantra
Mathematical Integration
Culture

ABSTRACT

This research explores the concept of ethnomathematics in the ayunan jantra culture in Majalangu Village, Denpasar, Bali. Using an ethnographic approach, this research identifies the mathematical elements contained in the making, structure and use of the jantJra swing. The research was conducted through observation, interviews and documentation when the ayunan jantra was used at a Balinese traditional ceremony. The interview was conducted with Mr. I Made Semara Putra, the manager of the Subak TeBA Majalangu Educational Tourism foundation, Denpasar, Bali. Swing jantra has a philosophy about the values of life, namely the rotation of destiny that we do not know, but must be ready to live it. The main findings of this research are the application of the concepts of geometry, proportion and oscillation in the making and operation of the ayunan jantra. From the geometry aspect, the swing structure includes the position of the support, rotating shaft, and arms that refer to the principles of symmetry and balance. In addition, the measurement of the dimensions of the arms and stand shows the application of the concepts of proportion and comparison. The use of the ayunan jantra also involves the concept of oscillation where the rotating movement resembles harmonic oscillation. This research reveals that Balinese people have intuitively integrated mathematical concepts into their cultural traditions. The findings from this study offer new insights into the relationship between cultural traditions and mathematics learning that could contribute to developing ethnomathematics-based learning in schools. This research is expected to enrich culture-based mathematics learning methods and preserve the local wisdom of the Balinese people.

Corresponding Author:

Sheilla Zalzabilla Al-Jabar,
Department of Mathematics Education,
Institut Keguruan dan Ilmu Pendidikan Siliwangi,
Jl. Terusan Jend. Sudirman, Cimahi, Indonesia
Email: aljabarfortask@gmail.com

How to Cite:

Al-Jabar, S.Z., Fauzi, F., Hidayat, W., Fitriani, N., & Supriatna, T. (2025). Ethnomathematics on Ayunan Jantra in Bali: Integration of Mathematical Concepts in Culture. *JIML*, 8(2), 210-219.

INTRODUCTION

Ethnomathematics is a study that connects mathematics and culture. The term was first introduced by Ubiratan D'Ambrosio in 1985 as a study of how people in certain cultures understand, interpret and use mathematical concepts in everyday life (D'Ambrosio, 1985). Until now, ethnomathematics has been increasingly studied, one of which is as an inspiration for how mathematics is then taught. As explained by Gerdes (1994), the results of ethnomathematics studies can change students' paradigm towards mathematics so that it is more contextual and relevant. In addition, Rosa & Orey (2011), explain the role of ethnomathematics in bridging formal mathematics with local practices in solving everyday problems.

Ethnomathematics research is growing and is of great interest including in Indonesia. Some of them are on cultures on the island of Java such as the research of Risdiyanti & Prahmana, (2018), who observed traditional Javanese games, such as Dhukter and Macanan. In these games, mathematical concepts such as number operations, comparison, and geometry were found to be used to calculate the number of seeds and determine game strategies. Prahmana & D'Ambrosio (2020), found geometry transformation concepts such as reflection (mirroring), translation, rotation, and dilation (resizing) applied in the making of various traditional batik motifs in Yogyakarta, such as Babon Angrem, Parang Barong, Sidomukti, and others. Filiestianto & Al-jabar (2022), studied the Betawi Si Pitung Stage House which contains various mathematical fundamental activities, such as calculating the number of supporting poles and collections of goods, as well as measuring the area and height of the building. Supriyadi et al. (2024) revealed that the production of Sundanese gamelan instruments at the Gong Factory in Bogor involves mathematical principles such as ratio and proportion, particularly the 1:3 ratio between tin and copper, which is crucial to achieve the desired sound quality. In addition, geometry plays a key role in instrument design, with each instrument having unique geometric attributes that contribute to its visual and acoustic appeal.

Figure 1. Learning Geometry and Value from Patterns: Ethnomathematics in Yogyakarta Batik Patterns

In other cultures in Indonesia, Darmayasa et al. (2019), examined the Asta Kosala-Kosali system, a traditional Balinese doctrine used to determine the dimensions (including size) of traditional Saka Roras houses based on the body measurements of the head of the family, such as the length of the index finger (rai) and head circumference. The application of mathematical concepts such as linear regression, geometry, and modulo are implicitly contained to create harmony between the physical size and spiritual aspects of the building. Malalina et al. (2020), explored the ethnomathematical aspects of treasure hunting activities (including valuable objects from the Sriwijaya Kingdom period to the colonial era) in the

Musi River, Palembang. The mathematical concept used is counting such as calculating the number of searchers, wages, and determining the price of "treasure".

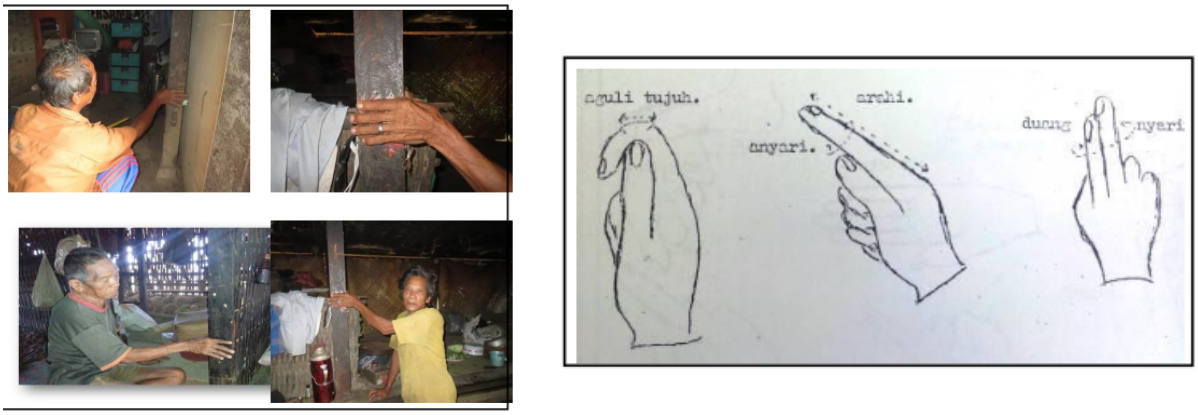

Figure 2. Ethnomathematics: Predicting the Average Height of Bali Mula Ancestors Using Linear Regression

Diputra et al. (2022), revealed that Balinese woven fabrics contain various geometric elements such as straight lines, parallel lines, and folding symmetry seen in the motifs. Diputra et al. (2022) Diputra, studied klakat, which is woven bamboo used in Balinese Hindu religious ceremonies and found mathematical concepts such as arithmetic rows and series, as well as representations of square flat shapes and cube and prism spaces.

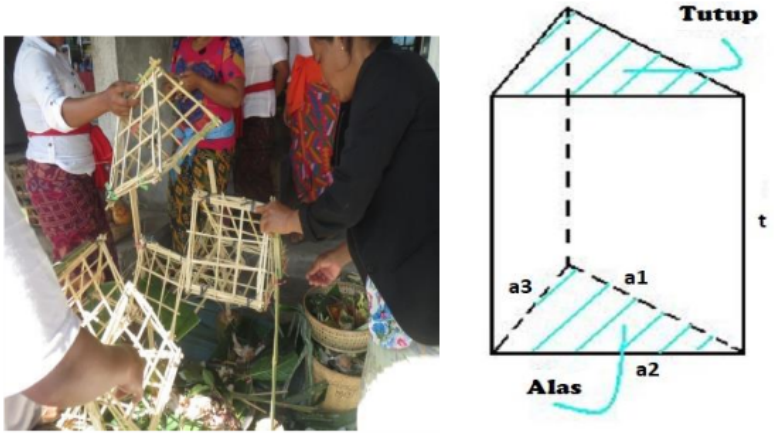

Figure 3. Ethnomathematics in Balinese Traditional Ceremony Klakat

These examples show that ethnomathematics is of great interest. There are many other studies on ethnomathematics and they cannot all be written in this article. Although there have been many articles on ethnomathematics, there are still many cultures, especially in Indonesia, that have not been studied. Indonesia with so many cultures is a fertile ground for ethnomathematics research. This inspired the researcher to conduct ethnomathematics research on one of the cultures in Bali Province, Indonesia. The culture to be studied is the ayunan jantra.

The ayunan jantra is a traditional game tool that is usually present in religious ceremonies and festivals in Bali ((Astawan, 2020; Bareng, 2023).This swing has a Ferris wheel-like structure that rotates with the power of several teenage boys and is ridden by several adult girls. The ayunan jantra is a symbol of togetherness and a symbol of the round of life that is sometimes above, sometimes below (Desa, 2023). The structure of this swing is very interesting to study more deeply the mathematical elements that exist in it. It is hoped that this research can be a

new insight into cultural diversity, especially Balinese culture, Indonesia and also insight into how people indirectly use mathematics in their culture. Hopefully this research will be a prelude to teaching math concepts so that students can not only understand math concepts, but can understand how these concepts are applied to culture in society. The good impact is that math learning becomes more meaningful.

METHOD

This ethnomathematics research method uses a qualitative approach with an ethnographic study design. Geertz (1973), emphasized the importance of understanding culture through symbolic interpretation and deep meaning in a social context, to reveal the values and knowledge contained in a society. This research method was chosen because it fits the purpose of ethnomathematics to explore the relationship between mathematical concepts and cultural practices (D'Ambrosio, 1985; Gerdes, 1994; Rosa & Orey, 2011). In this study, data were collected through participatory observation, interviews, and documentation so that the cultural object to be studied, namely the ayunan jantra, could be understood thoroughly (Spradley & McCurdy, 1989). Participatory observation was conducted on the use and construction of the ayunan jantra. Researchers observed the use of swing jantra during the NFS (National Field Study) visit from IKIP Siliwangi. Furthermore, in-depth interviews with cultural figures, namely Mr. I Made Semara Putra, manager of the Subak TeBA Majalangu Educational Tourism foundation, Denpasar, Bali. Then documentation regarding the physical condition, and the use of the ayunan jantra.

In this study, data analysis was conducted inductively, referring to the qualitative data analysis model proposed by Miles & Huberman (1994), which involves three main stages: data reduction, data presentation, and conclusion drawing and verification, all of which are interrelated to identify patterns, themes, and concepts that emerge from the data collected through observation, interviews, and documentation. Data were analyzed to identify mathematical concepts contained in the practice of making and using ayunan jantras, such as the principle of balance, angle measurement, the use of ratios, or geometric patterns.

Data triangulation was applied to ensure the validity of the research results, by comparing findings from various sources, including field notes, interviews, and documentation, and involving cultural practitioners to verify interpretations. Triangulation allows researchers to obtain a more comprehensive picture and reduce the possibility of bias that can occur by relying on a single data source or method (Flick, 2018). The results of the study are expected to provide insight into the integration of mathematical concepts in the swing jantra tradition and its relevance to mathematics education, while preserving Balinese cultural values through culture-based teaching and learning.

RESULTS AND DISCUSSION

Results

The observation shows that the Ayunan jantra in Majalangu, Denpasar Bali has a unique structure and has philosophical value. This swing is not shaped like a typical swing that only moves back and forth. Instead, the Ayunan jantra moves like a Ferris wheel that is commonly known in festivals or night markets. Ayunan jantras are often found in traditional ceremonies intended for young girls as a sign that they have reached adulthood. The characteristics of her adulthood are not only that she is 17 years old, but that she has menstruated even though she is not yet 17 years old.

An interview with the Manager of Subak TeBa Majalangu Educational Tourism Foundation revealed that the Ayunan jantra is not only a game tool, but also a symbolization of the human life cycle. In the Balinese view, life is always spinning, sometimes we are at the top (success)

and sometimes at the bottom (difficulty). The constantly rotating motion of the swing symbolizes a life that never stops spinning. In addition, this philosophy also teaches that humans must be ready to face all positions in life. When at the top, humans are taught to be grateful and humble, while when at the bottom, humans must be patient and keep trying. Through this tradition, the values of life are symbolically instilled in the teenagers who participate in the swing. Another philosophy is the meaning of unity and cooperation. The process of making and using the Ayunan jantra involves many parties, including male teenagers (teruna) and female teenagers (daha), as well as traditional leaders and the general public. The cooperation in making, swinging and maintaining the swing symbolizes that a harmonious community life can only be achieved through collaboration and togetherness.

Figure 4. Ayunan Jantra in Bali

The Ayunan jantra has two crossbar-shaped (+) supports mounted upright facing each other as pillars. These poles are made from old cempaka wood that has gone through a rigorous selection process. At the top of the frame, there is a wooden beam that connects the two horizontally as a large rotating axis (shaft). This shaft is made from a log that has been processed in such a way that it can withstand the weight of the seat and constant movement. This shaft acts as the rotating center of the entire swing structure. On the shaft, four swing arms are mounted on the left and right so that they can move around like a propeller. The four swing arms extend from the center of the shaft and are made of thick wooden planks connected directly to the shaft. At the end of each arm, there are two rectangular seats large enough for two teenage girls. Each arm has an outward-facing seat, allowing the girls to sit with their backs to the shaft.

Based on documentation and observation at Subak TeBa Foundation, the process of using the Ayunan jantra begins with a purification ritual (Ngayunan Lokan). This procession aims to ask permission from the ancestors and ask for safety for the participants who ride the swing. Before the swing is used, a ceremony is conducted led by traditional leaders. The procession includes offerings such as flowers, incense and food. The traditional leader recites prayers while sprinkling holy water over all parts of the swing, including the poles, shafts and seats. The young women (daha) who will ride the swing must wear traditional Balinese clothing. They line up, then sit on the seats available at the ends of the swing arms. Each arm can be filled with up to two participants. The teenage boys (teruna) are the movers. Two people take positions on the sides (on the support poles), pushing the swing arms with their physical strength. Two more climb the support pole and stand on the bar. With a certain rhythm, they push the swing until it rotates at a steady speed. The swing rotates clockwise with a slow rotating motion at the beginning, then gradually gets faster. When the swing reaches a certain

speed, the young women in the seats will feel the sensation of floating and spinning, which seems to emphasize the meaning of the rotation of human destiny.

The process of making the Ayunan jantra contains various mathematical elements, especially those related to the concept of geometry. The height of the support pole and the position of the rotating shaft are set proportionally so that boys can move it. On the rotating shaft are installed 4 arms that are equal in length and perpendicular to each other so that the rotation is balanced and not one-sided. The length of the arms and the position of the rotating shaft on the seat are adjusted to the height and weight of the adolescent girls. The seat is rectangular in shape with enough width for one person and the height is made more so that when riding the swing her head does not hit the roof. This involved a good knowledge of geometry and measurement. It is sized appropriately to be moved by boys and ridden by girls.

Figure 5. Sketch of Ayunan Jantra

Another ethnomathematical aspect of the ayunan jantra is that only teenagers of a certain height and weight are considered eligible to ride it. Balinese people have unwritten physical criteria to determine who can ride the swing. These criteria are used to indicate that the user of the swing has reached the physical maturity required to participate in the ceremony. Balinese people have a traditional way of estimating body proportions that indicate that a person has entered adolescence, i.e. has met the criteria so that they can ride the ayunan jantra. The ayunan jantra can be used as a sufficient indicator that a person has entered adolescence.

In addition to the mathematical aspect, the ayunan jantra can also be analyzed through the physics of oscillatory motion, which is part of applied mathematics in physics. Although Balinese people do not recognize the terms oscillatory motion or angular velocity formally, they have a very good understanding of how swings work. The speed and motion of the swing is affected by the user's body weight and the force they exert on the swing. In practice, the rotation of the ayunan jantra is driven by the power of the adolescent boys. As the swing rotates, the seat oscillates back and forth and the angle of oscillation can be affected by the height of the arms, the force exerted by the adolescent boys, and the weight of the adolescent girls riding on it. This complicated process works well without any serious risk due to its use.

Discussions

From the results of the above research, the culture of swing jantra has a mathematical concept in it from the start of making, to the process of using it. Balinese people practically use the concept of mathematics in their lives. Although they do not use modern measurements,

Balinese people in Majalangu village have qualified mathematical knowledge so that they can make the ayunan jantra operate properly. This local wisdom provides insight for researchers in particular that mathematics has an important role in culture. Below we will explain one by one the ethnomathematical aspects found in the ayunan jantra in Majalangu village, Denpasar, Bali.

The height of the support poles and the position of the rotating shaft are set proportionally for adolescent boys to move. The height of the support pole is estimated to be 4-4.5 meters and the position of the rotating shaft is twice the height of the adolescent, which is about 3-3.4 meters. This height is sufficient to attach proportional swing arms that are not too long and not too short. Four arms of equal length and perpendicular to each other are attached to the rotating shaft. The length of the arms is about 2 meters, and near the end of the arms, another rotating shaft is installed for the seat. The arms that are installed perpendicular to each other can make the rotation balanced so that the energy expended by male adolescents in each rotation remains consistent. The length of the arm and the position of the rotating shaft on the seat were adjusted according to the height and weight of the adolescent girls.

The seat is rectangular in shape with enough width for one person and the height is made more so that when riding the swing his head does not hit the roof. This width was estimated at 30-35 cm. This is in accordance with the hip width of adolescent girls (Mulyasari & Purbowati, 2018). The distance of the seat from the ground level from the foot to the middle of the thigh of the adolescent is about 60-70 cm while the height of the rotating shaft of the seat from the ground level is equivalent to the height of the adolescent so it is about 160-170 cm. This size means that a teenage girl can immediately sit on the swing without jumping and without difficulty. In addition, after sitting, her feet are not far from the ground and her head does not hit the roof of the rotating shaft. All the details of the size of the ayunan jantra are designed so that teenagers can ride it. The size is in accordance with the average height, and anatomical structure of the adolescent body (Indonesia, n.d.).

From this research, there is one thing that is not considered and not explored in detail, namely about adolescent boys as people who move the ayunan jantra. From observation, it is teenage boys who move the ayunan jantras, not others. This research does not further explore whether the men who are allowed to move the ayunan jantra must also be teenagers or not. Other literature also does not address this issue (Desa, 2023; Bareng, 2023).

Another limitation of this research is that it does not discuss more about the physics concepts that move the ayunan jantra. Researchers are looking for literature on how to discuss the physics concepts that work on ayunan jantras, but this is not the capacity of researchers so that it can be explained. The physics concepts identified in the ayunan jantra movement are force, energy, and oscillatory motion (Yu et al., 2024; Wahid et al., 2019).

The results of ethnomathematics are expected to be useful for mathematics learning (Gerdes, 1994; Yudhi & Septiani, 2024; Nursanti et al., 2024). A lot of literature has designed learning using ethnomathematics such as, developing an interactive learning model using Visual Basic for Applications (VBA) for Microsoft Excel with ethnomathematics content on fractions, which aims to improve the mathematical reasoning skills of elementary school students (Rohaeti et al., 2020). Another research is designing learning set material using the context of shadow puppets (Prahmana & Istiandaru, 2021).In addition, research to develop E-Modules in the context of Sundanese gamelan for learning mathematics in junior high school (Supriyadi, Turmudi, et al., 2024). Although not all of them can be mentioned, the examples that have been mentioned illustrate that the findings of ethnomathematics in a culture can be used for learning. Therefore, there are several mathematical concepts that can be taught through the cultural context of ethnomathematics on the ayunan jantra, including the concepts of circle,

line and angle, and comparison. Circle material is related to the rotation of the ayunan jantra, for example the length of the swing trajectory (circumference concept). Line and angle material is related to the angle formed between the arm and the rotating axis of the seat when a certain slope. In addition, the comparison material is specifically about the comparison of rotation to time (velocity).

CONCLUSION

This research shows that the ayunan jantra is not only symbolically and culturally valuable, but also contains many mathematical concepts. Some of the main findings of this research are the concept of geometry in the structure of the ayunan jantra including the geometric elements of the rectangular shape of the seat, the perpendicular position of the swing arm, and the rotating axis that allows for rotational movement. Then, the application of proportion and comparison to calculate the size of the support pole, the length of the swing arm, and the dimensions of the seat, showing how proportion and comparison are used in manufacturing to create balance and efficiency in movement. In addition, the traditional principle of measurement is reflected in the sizing of swing components, where proportions of human body height are used to measure elements such as support pole height and swing arm length. The principle of oscillation, although not discussed in detail, identifies the physics concepts that occur in a swing during rotation, oscillatory motion and angular velocity. The integration of these concepts will make the ayunan jantra a symbol of harmony between culture and mathematics. The results of this research are expected to be further applied in culture-based mathematics learning, where students understand mathematical concepts through local cultural backgrounds. This research also contributes to preserving Balinese cultural heritage by developing ethnomathematics-based learning.

ACKNOWLEDGMENTS

The researcher thanks all the managers of the TeBa Majalangu subak tourism village, Denpasar, Bali, especially Mr. I Made Semara Putra. Thanks to his cooperation, we have completed our research on the ayunan jantra. may the TeBa Majalangu subak tourism village remain successful, advanced, and always under His protection.

REFERENCES

Astawan, I. G. (2020). Analisis Kebutuhan Pengembangan Model Pembelajaran Trikaya Parisudha di Sekolah Dasar. *Sekolah Dasar: Kajian Teori Dan Praktik Pendidikan*, *29*(1), 1–18.

Bareng, N. (2023). *Ini fakta-fakta tradisi ayunan jantra di Tenganan Bal*. https://www.ngopibareng.id/read/ini-fakta-fakta-tradisi-ayunan-jantra-di-tenganan-bali

D'Ambrosio, U. (1985). Ethnomathematics and Its Place in the History and Pedagogy of Mathematics. *For the Learning of Mathematics*, *5*(1), 44–48.

Darmayasa, J. B., Wahyudin, & Mulyana, T. (2019). Ethnomathematics: Predicting the Average Height of the Bali Mula Ancestors using Linear Regression. *JIPM : Jurnal Ilmiah Pendidikan Matematika*, *8*(1), 1–8. https://doi.org/10.25273/jipm.v8i1.3863

Desa, K. (2023). *Tradisi ayunan jantra, simbol poros kehidupan manusia*. https://kolomdesa.com/2023/03/06/tradisi-ayunan-jantra-simbol-poros-kehidupan-manusia

Diputra, G. N. O., Pradnyana, P. B., Astuti, N. P. E., Darmayanti, N. W. S., & Putra, I. K. D. A. S. (2022). Etnomatematika pada Klakat Upacara Adat Bali. *Jurnal Elementry*, *5*(1), 64–69. https://doi.org/https://doi.org/10.31764/elementary.v5i1.5303

Filiestianto, G., & Al-jabar, S. Z. (2022). Eksplorasi Etnomatematika Rumah Panggung Betawi Si Pitung Dalam Pandangan Aktivitas Fundamental Matematis Bishop. *Jurnal Pembelajaran Matematika Inovatif*, *5*(4), 1197–1208. https://doi.org/10.22460/jpmi.v5i4.1197-1208

Flick, U. (2018). *An introduction to qualitative research* (6th ed.). Thousand Oaks, CA: SAGE Publications. https://elearning.shisu.edu.cn/pluginfile.php/35310/mod_resource/content/2/Research-Intro-Flick.pdf

Geertz, C. (1973). *The Intepretation Of Cultures*. New York: Basic Books Inc.

Gerdes, P. (1994). Reflections on Ethnomathematics. *For the Learning of Mathematics*, *14*(2), 19–22. https://www.semanticscholar.org/paper/Reflections-on-Ethnomathematics.-Gerdes/3e8f21baf8fa7b1f566d18830d688e60b301adf9

Indonesia, A. (n.d.). *Rekap data antropometri indonesia*.

Malalina, M., Ilma, R., Putri, I., Zulkardi, Z., & Hartono, Y. (2020). Ethnomathematics : Treasure Search Activity in the Musi River. *Numerical: Jurnal Matematika Dan Pendidikan*, *4*(1), 31–40.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Thousand Oaks, CA: SAGE Publications.

Mulyasari, I., & Purbowati, P. (2018). Lingkar lengan atas dan panjang ulna sebagai parameter antropometri untuk memperkirakan berat badan dan tinggi badan orang dewasa. *Jurnal Gizi Indonesia (The Indonesian Journal of Nutrition)*, *7*(1), 30–36. https://doi.org/10.14710/jgi.7.1.30-36

Nursanti, Y. B., Yuda, A. D. M., Lukiswara, D. F., Savitri, R. P., Safitri, R. Dela, & Putri, S. A. N. (2024). Systematics Literature Review: Eksplorasi Etnomatematika pada Permainan Tradisional untuk Penanaman Konsep Bilangan dan Geometri. *Edukatif : Jurnal Ilmu Pendidikan*, *6*(3), 1937–1945. https://doi.org/10.31004/edukatif.v6i3.6563

Prahmana, R. C. I., & D'Ambrosio, U. (2020). Learning Geometry And Values From Patterns Of Yogyakarta, Indonesia. *Journal on Mathematics Education*, *11*(3), 439–456.

Prahmana, R. C. I., & Istiandaru, A. (2021). Learning sets theory using shadow puppet: A study of javanese ethnomathematics. *Mathematics*, *9*(22), 1–16. https://doi.org/10.3390/math9222938

Risdiyanti, I., & Prahmana, R. C. I. (2018). Etnomatika : Eksplorasi Dalam Permainan Tradisional Jawa. *Journal of Medives*, *2*(1), 1–11.

Rohaeti, E. E., Fitriani, N., & Akbar, F. (2020). Developing an Interactive Learning Model Using Visual Basic Applications With Ethnomathematical Contents To Improve Primary School Students' Mathematical Reasoning. *Infinity Journal*, *9*(2), 275–286. https://doi.org/10.22460/infinity.v9i2.p275-286

Rosa, M., & Orey, D. C. (2011). Ethnomathematics : The Cultural Aspects of Mathematics. *Revita Latinoamericana de Rtnomatematica*, *4*(2), 32–54.

Spradley, J. P., & McCurdy, D. W. (1989). *Conformity and conflict: Readings in cultural anthropology* (7th ed.). Boston: Little, Brown and Company.

Supriyadi, E., Dahlan, J. A., Juandi, D., & Sugiarni, R. (2024). Discovering Ethnomathematics in Sundanese Gamelan : Explore Mathematics Aspect in Gamelan. *JTAM:Jurnal Teori Dan Aplikasi Matematika*, *8*(3), 852–864.

Supriyadi, E., Turmudi, T., Dahlan, J. A., & Juandi, D. (2024). Development of Sundanese Gamelan Ethnomathematics E-Module for Junior High School Mathematics Learning. *Malaysian Journal of Learning and Instruction*, *21*(2), 147–186. https://doi.org/10.32890/mjli2024.21.2.6

Wahid, M. A., Tiara, E., Riantin, I. R., & Hamdan, A. M. (2019). Menganalisa Gerak Harmonik Sederhana Pada Pegas Dan Bandul. *Jurnal Phi: Jurnal Pendidikan Fisika Dan Fisika Terapan.*, *5*(1), 6–12. https://jurnal.ar-raniry.ac.id/index.php/jurnalphi/article/download/6398/pdf

Yu, Y., Ma, J., Shi, X., Wu, J., Cai, S., Li, Z., Wang, W., Wei, H., & Wei, R. (2024). Study on the variable length simple pendulum oscillation based on the relative mode transfer method. *PLoS ONE*, *19*(4), 1–17. https://doi.org/10.1371/journal.pone.0299399

Yudhi, P., & Septiani, F. (2024). Pembelajaran Dengan Etnomatematika Dalam Meningkatkan Pemahaman Konsep Matematika Abstrak. *Inovasi Pendidikan*, *11*(1), 59–64. https://doi.org/10.31869/ip.v11i1.5649