

Exploration of Ethnomathematics in the Cultural Collection of the La Galigo Museum at Fort Rotterdam, Makassar

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ABSTRACT

Cultural heritage is an important source for understanding how past societies applied knowledge in their daily lives, including the integration of mathematics into cultural practices. Ethnomathematics is a relevant approach for exploring these relationships through artifacts and historical structures. This study aims to identify and analyze ethnomathematical values in the cultural collection at the La Galigo Museum, located inside the Rotterdam Fort in Makassar. This study uses a descriptive qualitative approach with ethnographic methods. Data were collected through observation, interviews, documentation, and literature review, then analyzed using the Miles and Huberman model. The results of the study show that Fort Rotterdam and La Galigo Museum are potential sources for exploring the relationships among mathematics, culture, and history. Rotterdam Fort is the result of the acculturation of Gowa-Makassar and Dutch colonial cultures and demonstrates the application of mathematical concepts. The La Galigo Museum, located within the Rotterdam Fort complex, enriches the study of ethnomathematics through various cultural artifacts, such as tenun gambara (gambara weaving), bagan tancap, pinisi, alang (rice barns), and bola/balla' (traditional houses). This collection shows various applications of ethnomathematical concepts in geometric structures. In addition, the grouping of artifacts based on their function, characteristics, and cultural context also reflects the application of set concepts. These findings confirm that mathematics has been present in local cultural and technological practices long before formal education developed. This study offers a valuable contribution to the development of culturally contextual mathematics learning.

Keywords: *Ethnomathematics, Cultural Heritage, Fort Rotterdam, La Galigo Museum, Mathematics Learning.*

1) INTRODUCTION

Mathematics is not only present in numbers and formulas, but also in the lives and cultures of communities. The branch of science that studies the relationship between mathematics and culture is known as ethnomathematics. Through ethnomathematics, the mathematical values contained in cultural products can be revealed and understood as part of the local wisdom that has developed in a society. This approach provides a perspective that mathematics is not a stand-alone science, but rather

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is integrated into everyday life and historical heritage (D'Ambrosio, 1985; Rosa & Orey, 2016). The relationship between culture and mathematics is known as ethnomathematics. Mathematical concepts embedded in cultural practices and the recognition that humans develop specific ways of performing mathematical activities are referred to as ethnomathematics. Learning about the concept of ethnomathematics connects the culture of a region with the mathematical concepts being studied, as a bridge to contextualize mathematics.

One of the historic buildings in the city of Makassar, South Sulawesi, is Fort Rotterdam, a fort left behind by the Gowa-Tallo Kingdom, also known as Fort Jumpandang or Fort Ujung Pandang. Initially, this fort was built of clay materials. Later, it was replaced with limestone from the Karst Mountains in the Maros region. Fort Ujung Pandang suffered severe damage during the VOC invasion led by Cornelis J. Speelman from 1655 to 1669. At that time, the Kingdom of Gowa-Tallo, under the leadership of Sultan Hasanuddin, was forced to surrender Fort Ujung Pandang to the Dutch. This was part of the Bongaya Agreement, which Sultan Hasanuddin was forced to sign after losing the Makassar War. Fort Ujung Pandang was renamed Fort Rotterdam after falling into Dutch hands, in accordance with Speelman's birth name. Fort Rotterdam was rebuilt in Dutch architectural style and became the center of Dutch colonial power in Sulawesi. Fort Rotterdam has a museum that displays cultural relics from South Sulawesi that can be explored in relation to mathematics learning. For example, in the subject of triangles. The shape of a triangle in modern life is less impressive and meaningful to students. They need to understand that triangles have existed around them since ancient times, so that learning is not only about theory and concepts but also about recognizing mathematical terms through cultural heritage and studying their historical value.

By exploring the La Galigo Museum located in Fort Rotterdam, it is hoped that connections between mathematical concepts and the historical, cultural, and philosophical values of the Makassar people can be discovered. This study also shows that mathematical concepts do not appear only in the context of modern science but have been used for generations as part of local wisdom. In addition,

this study is expected to contribute to the development of contextual mathematics learning in schools by using historical buildings as a source of culture-based learning that can foster appreciation for the nation's history and culture.

Previous ethnomathematics research shows that integrating cultural artifacts into learning can improve students' understanding of mathematical concepts while fostering cultural awareness. A study by Rosa and Orey (2011) explains that cultural artifacts can be effective mathematical representations in tracing patterns, geometric shapes, and logical structures in traditional communities. Meanwhile, Okta et al. (2025) integrated coastal cultural elements (e.g., boat design, fishing net/fishing patterns) into geometry learning in high school and demonstrated an increase in students' understanding of geometric concepts.

Therefore, this study aims to identify and analyze ethnomathematical values in the cultural collection at the La Galigo Museum, located inside the Rotterdam Fort in Makassar.

2) METHODS

This study uses a qualitative approach with ethnography to examine the cultural meaning and application of ethnomathematics concepts in the architecture of Fort Rotterdam and the La Galigo Museum collection in Makassar City. The research location was selected purposively because it has historical value and mathematical potential in the structure of the building and its artifacts, and the informants consisted of museum managers, historians, and cultural observers who were determined through purposive sampling. Data were collected through direct observation of geometric elements such as symmetry, proportion, and spatial patterns; semi-structured interviews to explore design philosophy and cultural values; documentation in the form of photographs, sketches, and field notes; and literature studies to strengthen the theoretical basis. Data validity was tested through source and technique triangulation, as well as peer discussion to minimize bias. The data was then analyzed using the Miles and Huberman model, which includes data reduction, data presentation in narrative and visual forms, and drawing conclusions to interpret the relationship between mathematical concepts, historical values, and Makassar culture in the research objects.

3) RESULTS AND DISCUSSION

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The results of the study show that the La Galigo Museum, located within Fort Rotterdam, contains various representations of ethnomathematical concepts that are evident in both the architectural structure of the building and the cultural artifacts stored within it. Historically, Rotterdam Fort, which was built during the Gowa Kingdom and later renovated by the Dutch colonists, shows the integration of two architectural styles: its original shape resembled a turtle, which is rich in philosophical meaning in Gowa culture, and its colonial structure is symmetrical, well-proportioned, and arranged based on European spatial geometry principles. The rectangular shape of the building, the linear spatial pattern, and the repetition of windows and vents are evidence of the application of the concepts of symmetry, proportion, and mathematical regularity in colonial architecture. The La Galigo Museum, which occupies a former VOC warehouse, also displays these geometric characteristics through its symmetrical facade, repetitive floor plan, and proportionally stable building structure.

The cultural collection at the museum shows that geometric elements are not only present in colonial buildings, but are more strongly reflected in the cultural artifacts of the Bugis-Makassar people. Various objects such as phinisi carvings, traditional musical instruments, household appliance motifs, and weaving patterns demonstrate the use of concepts of fold symmetry, rotational symmetry, tessellation, proportionality, pattern rhythm, and aesthetic proportions. In traditional woven fabrics in particular, the repetition of lines, color arrangements, and motif rhythms indicate an understanding of number patterns and repetitive sequences that have been passed down from generation to generation. In maritime artifacts such as boat models, navigation tools, and sailing equipment, applied mathematical concepts such as distance measurement, sail size comparison, and orientation based on wind direction or star position are evident. This confirms that the sailing activities of the Gowa people have long relied on practical mathematical concepts, long before the advent of modern formal education.

The relationship between the artifacts in the La Galigo Museum and mathematical concepts, namely geometry, is presented in Table 1.

Table 1: *Ethnomathematics Exploration of Artifacts at La Galigo Museum*

Name of Cultural Manifestation	Picture	Description of Cultural Forms and Their Relationship to Geometric Shapes
<i>Tenun Gambara</i>		<i>Tenun Gambara</i> is a woven fabric made from cotton thread, to which colored thread can be added to create patterns. It is used as a shroud in the Bulukumba region. The patterns found on <i>Tenun Gambara</i> resemble triangles
<i>Bagan Tancap</i>		<i>Bagan Tancap</i> is a traditional fishing tool in the form of a tall bamboo structure that is planted in the water. At the bottom there is a net for catching fish, while at the top there is a small hut/house made of bamboo and palm leaves where fishermen keep watch and wait for their catch. Certain parts of the <i>Bagan Tancap</i> resemble triangles and parallelograms
<i>Pinisi</i>		<i>Pinisi</i> is a traditional Bugis-Makassar wooden sailing ship with two main masts and seven sails, symbolizing the ability of Indonesian ancestors to sail across the seven seas. For hundreds of years, the Pinisi has been used as a means of transportation, trade, and also as a war fleet. The strong Bugis-Makassar maritime culture gave birth to the principle of <i>kualleangi tallangna toalia</i> , which means it is better to sink than to surrender and return to land. During the reign of Sultan Hasanuddin, nicknamed “ <i>Ayam Jantan dari Timur</i> ,” the power of the Gowa naval fleet reached the regions of South Sulawesi and Nusa Tenggara. Some parts of <i>Pinisi</i> resemble triangles.
<i>Alang</i>		<i>Alang</i> (rice barn) serves as a place to store or collect agricultural products, such as rice, corn, and others. It is usually built next to or behind the main house (residence). The front part of the roof resembles a triangle and the front wall resembles a rectangle.

Bola/Balla'



The Bugis people refer to traditional houses as *Bola*, while the Makassar people call them *Balla'*. The construction of houses, from determining the location to the direction they face, follows traditional customs and beliefs that have been passed down from generation to generation. Houses are usually oriented towards one of the main cardinal directions. According to Mattulada, Bugis-Makassar houses are divided into three types based on social strata, one of which is *Saoraja* (Bugis) or *Balla' Lompoa* (Makassar), which is a palace-shaped noble house with a multi-level staircase and a roof above the *sapana*. The ridge of the noble house is marked by seven layers of *timpa laja* (Bugis) or *sambu layang* (Makassar), while other types have three layers. The front of the roof resembles a triangle, the inside resembles a trapezium, and the windows resemble rectangles.

The next stage of analysis expands the discussion of ethnomathematics to the concept of sets through the grouping of museum artifacts based on their function, characteristics, and cultural context. There are four sets (village and traditional artifacts, maritime artifacts, cross-civilization historical artifacts, and urban development artifacts) which illustrate how cultural objects can be classified based on shared characteristics.

a. Set A: Village Artifacts and Customs

$A = \{\textit{Tempat Ari-Ari Perak, Tempat Ari-Ari Tanah Liat, Panne Allosengeng, Karawi Dan Jempang, Pakkeri, Baju Bodo Bersusun, Wadah Erong, Liang Pak Dan Liang Parene, Buah Maja, Senjata Tajam, Perdagangan, Rumah Adat Suku Toraja, Rumah Adat Makassar Bugis, Tenun Gambar, tenun paruki, sarung tenun sutera, Dapur Tradisional Sulawesi Selatan dan Peralatannya, Balla Assung, Baka Boko, Lamming Tudangeng, Miniature Balla Assung}\}.$

The artifacts in set A reflect various aspects of village life and customs in South Sulawesi. The similarities in the characteristics of the elements can be seen in their functions related to domestic activities, belief systems, traditional ceremonies, storage and processing of crops, traditional textiles, and traditional house architecture. Thus, set A represents the entire basic cultural elements of the Bugis-Makassar and Toraja communities, which include traditional houses, traditional clothing, household appliances, ritual objects, and various local handicraft products.

b. Set B: Coastal and Maritime Artifacts in South Sulawesi

$B = \{Perahu\ Pinisi, Perahu\ Lambo, Bagan\ Tancap, Bubu, Bagang\ Perahu, Alat\ Tangkap\ Ikan, Kompas\ Kapal, Jangkar, Lampu\ Stroking, Lepa-Lepa, Lepe-Lepa\ Batangeng, Palu\ Kayu, Pabat, Pabat, Bor, Gergaji, Kapak, Jala\ Buang, Tagalak, Kalulu, Battaleng, Singkolo, Parang, Catok, Bassi, Ketam, Bingkung\}$

The artifacts in set B represent all aspects of the maritime life of the people of South Sulawesi. The elements of this set include various types of traditional boats, navigation tools, fishing equipment, and tools used in the manufacture, maintenance, and operation of ships. The common characteristics of the members of set B lie in their functions related to sailing, fishing, and maritime technology. The presence of artifacts such as Pinisi, Lambo, bagang, bubu, various types of nets, as well as hammers, chisels, drills, and saws demonstrates not only the community's ability to sail and catch fish, but also their technical skills in shipbuilding and marine resource management. Thus, set B reflects a strong coastal cultural identity and maritime expertise that has been passed down from generation to generation.

c. Set C: Historical and Cross-Civilization Artifacts

$C = \{Salokoa, Sudanga, Ponto\ Janga-Jangaya, Kalung(Kolara), Manik-Manik, Gelang\ Perunggu, Kapak\ Corong, Kapak\ Batu, Archa\ Budha, Naskah\ La\ Galigo, Rumah\ Adat, Tasbih, Lontara\ Kerajaan, La\ Tea\ Riduni, Keris\ Lamakawa, Bendera\ Kamummue, Bendera\ Macanga, Alat\ Serpib, Peluru, Sambangen\ Pulaweng, Tasbih, Al-Qu'ran, Sikkiri\ Tujua, Pistol, Katana, Arca\ Polinesia\ Manil-Manikkapak\ Batu, Kapak\ Lonjong, Tembikar\ Berbias, Batu\ Ike, Mata\ Panah\ Bergerigi, Alat-Alat\ Serpib, Sampah\ Dapur, Arca\ Terakottaarca\ Binatang, Batu\ Phallus, Tenun\ Curek\ La'ba, Kapak\ Genggam, Kapak\ Penetak, Alat\ Serpib, Macam-Macam\ Fosil, Miniatur\ Meriam, Naskah\ I\ Laga\ Ligo\}$.

The artifacts in set C represent the long history and dynamic civilization of the people of South Sulawesi. The elements contained therein include relics from various periods, ranging from prehistoric times (such as stone axes, oval axes, flaked tools, fossils, and kitchen waste), the royal era (such as *Pusaka Salokoa, Sudanga, Keris Lamakawa, Lontara Kerajaan*, and *Naskah La Galigo*), to the colonial era and cross-cultural interactions (marked by the presence of pistols, katanas, statues from outside the region, and miniature cannons).

In addition, there are also religious artifacts such as the Qur'an, prayer beads, and other ritual objects. The similarity between these collections lies in the historical and documentary value of each

artifact. These objects are not only material evidence of the development of technology, art, and belief systems, but also serve as cultural archives that reflect the relationship of local communities with various civilizational influences, both local and foreign. Therefore, set C depicts a complete panorama of the cultural evolution of South Sulawesi from the early days of civilization to the modern period.

d. Set D: Artifacts of City Growth and Development

$D = \{Gelang\ Karang, Alat\ Musik\ Tradisional, Bendi, Sepeda, Kopi, Cengkeh, Ota-otang, Naskah\ Sindereng, Padenring, Lontara\ Kerajaan\ Bone, Stempel-stempel\ Kerajaan\ Bone, Lontara\ Akkarungnge, Pala, Merica, Kopra, Perahu\ Pinisi, Lontara\ Luwu\}$.

The artifacts in set D illustrate the process of urban growth and development in South Sulawesi, which took place through the dynamics of trade, government administration, transportation, and cultural activities of the community. The components of this collection include important trade commodities such as coffee, cloves, nutmeg, pepper, and copra, which formed the basis of the city's economy; means of transportation such as bendi and bicycles, which represent the mobility of the community; and administrative documents in the form of *Sindereng* manuscripts, *Lontara Akkarungnge*, and royal stamps, which show the bureaucratic system and governance during the city's development.

In addition, the presence of Pinisi boats in this collection confirms the relationship between the city and maritime trade networks. Other artifacts such as traditional musical instruments and Luwu lontarak reflect the development of art, culture, and literacy in urban communities. Thus, set D shows how various economic, social, administrative, and cultural aspects play a role in shaping the structure of modern cities in South Sulawesi.

Previous studies form an important foundation for this study. The study by Laukum et al. (2024), which examined Fort Rotterdam and the La Galigo Museum using a qualitative ethnographic approach with a focus on geometry, symmetry, proportion, and patterns, has the strongest relevance because the objects and approach are almost the same, while our study provides further insight through the compilation of artifact tables and set concept analysis. The research by Suryani and Abdullah (2020) on South Sulawesi cultural artifacts, focusing on symmetry, patterns, and geometric shapes through a qualitative descriptive method, also strengthens the analytical context of the museum collection. Wulandari's (2019) study of Pinisi boats, which highlights triangular, trapezoidal, and proportional elements through literature studies and observations, is relevant for explaining maritime artifacts at the La Galigo Museum. Hadrawi's (2010) research, which discusses the history and structure of Fort

Rotterdam in a historical-descriptive manner, provides a basis for understanding the context of the building for ethnomathematical analysis. Meanwhile, the study by Ilmiyah and Prasetyo (2020) on patterns, symmetry, and culture-based mathematics learning and the research by Widada et al. (2018) on cultural geometry through a qualitative approach reinforce the theoretical and methodological aspects, while also confirming the relevance of using cultural artifacts as a source of mathematics learning.

4) CONCLUSION

This study shows that the La Galigo Museum collection located in Fort Rotterdam contains various ethnomathematical values reflected through geometric concepts. These mathematical elements are not only part of the architectural design, but are also closely related to philosophical values, maritime symbolism, and the cultural identity of the Makassar people. Artifacts such as *tenun gambara* (gambara weaving), *bagan tancap*, *pinisi*, *alang* (rice barns), and *bola/balla'* (traditional house) are examples of this. The collection shows various applications of ethnomathematical concepts in geometric structures. In addition, the grouping of artifacts based on their function, characteristics, and cultural context also reflects the application of set concepts. These findings confirm that ethnomathematics is an important approach to understanding the development of mathematical concepts in the lives of communities before the advent of formal education, while also enriching culture-based mathematics learning. Furthermore, this research opens up opportunities for further study of colonial buildings and other cultural artifacts that have the potential to reveal broader mathematical representations in Indonesia.

REFERENCES

- Ascher, M. (2002). *Mathematics elsewhere: An exploration of ideas across cultures*. Princeton University Press. <https://doi.org/10.1515/9781400824646>
- Barton, B. (1996). Making sense of ethnomathematics: Ethnomathematics is making sense. *Educational Studies in Mathematics*, 31, 201–233. <https://doi.org/10.1007/BF00376356>
- Barton, B. (2008). *The language of mathematics: Telling mathematical tales*. Springer. <https://doi.org/10.1007/978-0-387-71541-2>
- Bishop, A. J. (1990). Western mathematics: The secret weapon of cultural imperialism. *Race & Class*, 32(2), 51–65. <https://doi.org/10.1177/030639689003200204>
- Bogdan, R. C., & Biklen, S. K. (1992). *Qualitative research for education: An introduction to theory and methods* (2nd ed.). Allyn & Bacon.

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- Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). SAGE Publications.
- Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). SAGE Publications.
- D'Ambrosio, U. (1985). Ethnomathematics and its place in the history and pedagogy of mathematics. *For the Learning of Mathematics*, 5(1), 44–48.
- D'Ambrosio, U. (2001). *Etnomathematics: Link between traditions and modernity*. Sense Publishers. <https://doi.org/10.1007/978-94-915-013-5>
- Emzir. (2012). *Metodologi penelitian kualitatif: Analisis data*. Rajawali Pers.
- Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education* (8th ed.). McGraw-Hill.
- Gerdes, P. (1994). Reflections on ethnomathematics. *For the Learning of Mathematics*, 14(2), 19–22. <https://doi.org/10.2307/40248094>
- Gerdes, P. (1996). Ethnomathematics and mathematics education. In A. J. Bishop et al. (Eds.), *International handbook of mathematics education* (pp. 909–943). Springer. https://doi.org/10.1007/978-94-009-1465-0_26
- Hadrawi, M. (2010). Sejarah Benteng Rotterdam sebagai pusat kolonial Belanda di Sulawesi Selatan. *Balai Pelestarian Sejarah dan Nilai Tradisional Makassar*.
- Ilmiyah, F., & Prasetyo, Z. K. (2020). Etnomatematika dalam budaya Nusantara untuk pembelajaran. *Jurnal Riset Pendidikan Matematika*, 7(1), 1–14. <https://doi.org/10.21831/jrpm.v7i1.29653>
- Knijnik, G. (2012). Encounters between formal and informal mathematics: A cultural perspective. *Educational Studies in Mathematics*, 80, 87–100. <https://doi.org/10.1007/s10649-011-9366-8>
- Laukum, Z., Ramadhani, R., & Nur, A. (2024). Analisis nilai etnomatematika pada arsitektur Benteng Rotterdam dan Museum La Galigo. *Jurnal Pendidikan dan Kebudayaan*, 15(1), 55–68.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). SAGE Publications.
- Moleong, L. J. (2019). *Metodologi penelitian kualitatif (Edisi revisi)*. PT Remaja Rosdakarya.
- Okta, R., Pratiwi, D., & Yuliana, S. (2025). Coastal ethnomathematics in geometry learning: A study at senior high schools in Panimbang Regency. *International Journal of Education and Economic Research*, 3(1), 27–35.
- Orey, D. C., & Rosa, M. (2006). Ethnomathematics: Cultural assertions and challenges towards pedagogical action. *Journal of Mathematics and Culture*, 1(1), 57–78. <https://doi.org/10.15390/EB.2015.4018>
- Pelras, C. (2006). *The Bugis*. Blackwell Publishing.
- Prasetyo, Z. K. (2019). Kajian etnomatematika dalam budaya lokal. *Jurnal Ilmiah Pendidikan Matematika*, 2(3), 178–188. <https://doi.org/10.26737/jipm.v2i3.1178>

- Rahim, A. (2017). *Arsitektur kolonial Belanda di Indonesia: Kajian sejarah dan budaya*. Penerbit Ombak.
- Rosa, M., & Orey, D. C. (2011). Ethnomodeling: A pedagogical action for disclosing ethnomathematics findings. *Journal of Mathematical Modelling and Application*, 1(3), 58–75. <https://doi.org/10.13140/RG.2.1.4155.7526>
- Rosa, M., & Orey, D. C. (2016). *Ethnomathematics and its pedagogical action in mathematics education*. Springer.
- Spradley, J. P. (1980). *Participant observation*. Holt, Rinehart and Winston.
- Suryani, I., & Abdullah, M. (2020). Etnomatematika dalam benda budaya Sulawesi Selatan. *Jurnal Pendidikan Matematika*, 14(1), 23–34
- Widada, W., et al. (2018). Ethnomathematics and mathematics learning in South Sumatra cultures. *Journal of Physics: Conference Series*, 943, 012046. <https://doi.org/10.1088/1742-6596/943/1/012046>
- Wulandari, S. (2019). Kajian etnomatematika pada perahu pinisi. *Jurnal Pendidikan Matematika*, 13(2), 101–109. <https://journal.unhas.ac.id/jpm>