

ETHNOMATHEMATICS BASED LEARNING IN SOUTH SULAWESI AND WEST SULAWESI, IS IT NECESSARY?

Muhammad Nurhusain^{1*}, Hamzah Upu², Djadir³

¹Mathematics Education Study Program, STKIP YPUP Makassar, Jl. Andi Tonro No. 17, Makassar, Indonesia

^{2,3} Doctoral Program on Mathematics Education, Universitas Negeri Makassar, Jl. Andi Jemma Makassar, Indonesia

ABSTRACT

Mathematics is still considered a field of study that is free of cultural values by some circles. Faced with this understanding, the Ethnomathematics program was developed as a bridge between mathematics and culture. For this reason, it is necessary to know the urgency of Ethnomathematics to be incorporated into mathematics learning through Ethnomathematics-based Learning as an effort to contextualize mathematics based on a culture in South Sulawesi and West Sulawesi. This research was a survey study with 147 Junior High School Mathematics Teachers in South Sulawesi and West Sulawesi as respondents. The instrument was a questionnaire, distributed online via Google form. Data collected were analyzed descriptively. The results showed that 100% of respondents understood that Indonesia is rich in cultural diversity, but only 89% of respondents stated that Indonesian culture, especially in South Sulawesi and West Sulawesi, had not been accommodated into mathematics classes, 73% of respondents had never heard or read about Ethnomathematics, 100% of respondents had a desire to learn about Ethnomathematics or Ethnomathematics-based Learning, 96% respondents agreed that Ethnomathematics is integrated into Mathematics Learning, 94% of respondents stated that it is necessary to plan and develop an educational curriculum that includes an Ethnomathematical approach, and 96% of respondents agree that it is necessary to develop an Ethnomathematics based Learning Model. It was concluded that most respondents stated that Ethnomathematics Based Learning needs to be developed and applied in learning Mathematics in schools, especially in South Sulawesi and West Sulawesi.

Keywords: Ethnomathematics, Ethnomathematics-based Learning, Mathematics Learning, Culture.

1. Introduction

Every great culture has one system of mathematical knowledge (Aikenhead, 2017). Historical facts show that the birth of mathematics cannot be separated from the culture of an era (Muhtadi et al., 2017). Mathematics grows and develops from cultural habits, or is generally accepted and recognized (Susiana et al., 2020). Mathematics is considered to be an integral part of the greater human cultural heritage (Orey & Rosa, 2010). However, there are still some people who think that mathematics is a universal and cultural research field. Especially in schools, mathematics is considered a free subject of value, both cultural

and social values (Rosa & Orey, 2011). In general, many people still view mathematics as a subject far away from the reality and culture of everyday life (Prahmana & D'Ambrosio, 2020). Therefore, an ethnomathematics program was developed to refute this understanding (Rosa & Orey, 2006, 2011).

On the other hand, Indonesia is a rich and diverse country (Muslimahayati & Wardani, 2019). This country composed of many tribes has its own culture and different characteristics (Astuti, 2019). However, Samo et al. (2018) stated that so far, contextual learning has been widely used in contextual learning, but it has not adapted to the richness of Indonesian culture. In fact, more Curriculum 2013 written by Samo et al. (2018) have been providing ample space to accommodate contextual issues as an introduction to learning activities. Therefore, it is necessary to integrate

^{*)} Corresponding Author.

E-mail: husain.math@stkip.ypup.ac.id

Phone: 082346987629

culture into mathematics learning activities through ethnic mathematics courses to adapt to the richness of Indonesian culture. Brandt & Chernoff (2015) suggested that “it’s time to integrate ethnic mathematics into every math classroom. The reason is that ethnomathematics conforms to theoretical constructivism, enabling students to build understanding and knowledge through what they have learned and taught before”. Therefore, related to the problem of mathematics education in Indonesia, a transformational effort is needed to bring mathematics closer to the other, we can use culture as the background for learning mathematics in school (Prahmana & D’Ambrosio, 2020).

Ethnomathematics, according to (Furuto, 2014), is described as the confluence of culture, tradition, sociocultural origins, and mathematics, among other things, ethnomathematics encourages study and adaption of concepts both inside and outside of the classroom. Moreover, (Umbara et al., 2021) argue that ethnomathematics may be seen as a collection of mathematical traditions and practices that hold the belief that mathematics is generated from reason, which is considered as indisputable reality in their culture. Furthermore, ethnomathematics is defined by Borba (1990) as “the way individuals employ particular cultural notions in mathematics in the context of relational and geographical elements of their life”. According to Rosa & Orey (2003), ethnomathematics is used to explain and understand the world, as well as to manage the challenges that people encounter, such as the big problem of humanity. According to D’Ambrosio & D’Ambrosio (2013), an essential component of the Ethnomathematics Program is working with diverse cultural contexts to demonstrate mathematical concepts and practices from other cultures. By thus, ethnomathematics appear as a new category to the discourse of conceptual education of mathematics and as the interaction between mathematics and culture.

Several researchers recommend ethnomathematics-based learning, including: Aikpitanyi & Eraikhuemen (2017) said that “Curriculum planning and development must include an ethnomathematical approach in the curriculum of educational institutions”. In addition, Odili & Okpobiri (2011) recommend that “It is necessary to develop a primary mathematics curriculum which is aligned with the legacy of the mathematical community. teachers must be confronted on ethnomathematics as part

of the program teacher Education”. Furthermore, Sunzuma & Maharaj (2019) recommend that teachers helped to develop awareness will approach ethnomathematics. Knowledge about the approach ethnomathematics will assist in making approaches pedagogical teacher is more flexible and centered on students. Further, according to Brandt & Chernoff (2015), “Ethnomathematics potentially help students feel accepted, become more accept others, and even help in the fight against racism”. Over with it, the culture is very determine how the way of view of students in responding to anything, including the understanding of a concept of mathematics, so it takes an approach to learning mathematics are able to connect between mathematics to culture them (Wahyuni et al., 2013).

In the end, the researcher intends to research which aims to reveal the opinions of teachers in the field of mathematics studies regarding the need for ethnomathematics-based learning to be applied in the classroom. One of the expected benefits of this research is that it can be used as a basis for developing an ethnomathematics-based learning model.

2. Research Methods

Research is survey research with descriptive quantitative approach. Survey research is research taking sample from one population and use the questionnaire as a means of collecting the data which the principal (Prakoso & Wahyuni, 2015). This survey research conducted to solicit responses of teachers about the necessity ethnomathematics based learning in South Sulawesi and West Sulawesi. Respondents in this study were junior high school mathematics teachers spread across South Sulawesi and West Sulawesi as many as 147 respondents.

The data collection technique used in this study was the spread of questionnaires of randomly distributed online description forms. The data obtained and presented in tables and graphs with the computation percentage. Data collected were analyzed descriptively as the existence without intending make conclusions that apply to public or generalization.

3. Results and Discussion

Data obtained through the deployment of questionnaires through a google form to junior high school mathematics teachers in South Sulawesi and West Sulawesi. Questionnaires

consists of 7 grains of questions, namely: (1) Did you that Indonesia is rich with diversity of culture? (2) In your opinion, has cultural diversity in Indonesia been accommodated in Contextual Mathematics Learning, especially Culture in South Sulawesi and West Sulawesi? (3) Have you ever read or heard about Ethnomathematics before? (4) Do you have a desire to understand ethnomathematics and learning based ethnomathematics? (5) Do you agree that it is time for Ethnomathematics to be integrated into every mathematics class? Please give reasons! (6) Do you agree that curriculum planning and development should include an ethnomathematics Approach in the curriculum of educational institutions? Please give reasons! (7) Do you agree that it is necessary to develop an ethnomathematics-based learning model, to accommodate the richness of culture in Indonesia? Please give reasons!

3.1. Teacher's Knowledge of Cultural Diversity and Ethnomathematics

Indonesia is a country that is rich in culture (Astuti, 2019), a culture that instills mathematical ideas, methods, and techniques using mathematical models (Prahmana et al., 2021). Through ethnomathematics, this culture can be preserved and provide understanding to students in learning mathematics. For that, Mathematics Teachers need to know the culture and ethnomathematics itself. The following is the data on teacher responses to culture and their understanding of ethnomathematics in Table 1.

Table 1. Teacher's Response to Culture and Ethnomathematics

No.	Questions	Answers	
		Yes (%)	Not (%)
1	Did you that Indonesia is rich with all the various diversity culture?	100	0
2	According to you, whether to a variety of diversity of culture in Indonesia had been accommodated in Learning Mathematics Contextual, especially Culture in South Sulawesi and West Sulawesi?	11	89
3	Have you ever read or heard of Ethnomathematics before?	27	73
4	Do You have a desire to understand Ethnomathematics and Ethnomathematics Based Learning?	100	0

Based on Table 1, it is known that 100% of respondents understand that Indonesia is rich in cultural diversity. However, according to 89% of respondents stated that their culture has not been accommodated in learning, especially Mathematics Learning. This illustrates that the cultural wealth that is owned has not been used as a means of the learning process. Another fact, 73% of respondents stated that they have never read or heard about ethnomathematics, so it is illustrated that ethnomathematics needs to be socialized to teachers of Mathematics Studies. However, 100% of respondents stated that they have a desire to understand ethnomathematics and ethnomathematics-based learning. Thus, training programs related to ethnomathematics and ethnomathematics based learning are also needed. Correspondingly, Sunzuma & Maharaj (2019) recommend "that teachers helped to develop awareness will approach ethnomathematics." Knowledge about the approach ethnomathematics will assist in making approaches pedagogical teacher is more flexible and centered on students. In addition, Umar & Muawiya (2019) recommend that Mathematics teachers should be trained through workshops, conferences, and seminars on the use of ethnomathematical teaching approaches in their lessons.

3.2. Response Teachers Against Integration Ethnomathematics to the Grade Math

A survey of the opinions of junior high school mathematics teachers in South Sulawesi and West Sulawesi on the integration of ethnomathematics into mathematics classes is needed to find out whether ethnomathematics-based learning needs to be applied in South Sulawesi and West Sulawesi. The survey results are presented in Figure 1.

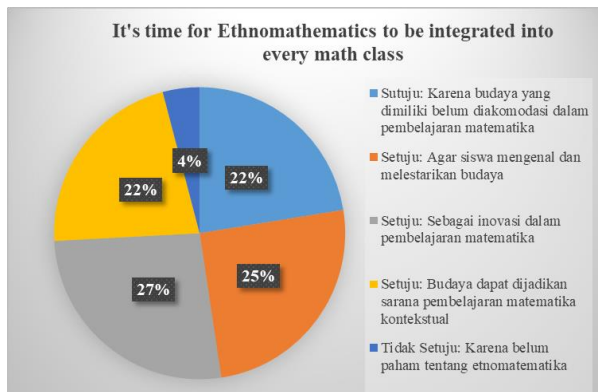


Figure 1. Response Teacher towards integration ethnomathematics into the classroom mathematics

The results of the survey are shown in Figure 1, it was revealed 22 % of respondents agreed with the integration ethnomathematics into math class. The reason is because the culture that is owned has not been accommodated in learning mathematics. These respondents are in line with (Samo et al., 2018) which states that so far, contextual learning has been applied in learning with contextual aspects in general and has not accommodated the richness of Indonesian culture.

In addition, 25% of respondents agreed with the excuse that culture needs to be preserved so that students are able to know and understand the values of the culture that pitch bladder inside. Students need to understand every value of Indonesian culture in order to distinguish positive and negative things and be able to protect themselves from threats from negative cultures that come from outside. In line with that, the culture is very determine how the way of view of students in responding to anything, including the understanding of a concept of mathematics, so it takes an approach to learning mathematics are able to connect between mathematics to culture them (Wahyuni et al., 2013).

Furthermore, 27% of respondents expressed their agreement on the grounds that the integration of ethnomathematics into the classroom is a learning innovation which is certainly expected to improve student achievement. This learning innovation is in line with the demands of the 2013 Curriculum (Koesnandar, 2020).

Furthermore, 22% of respondents agreed with the reason that their culture can be used as a means of learning mathematics which contextually can connect teaching materials with students' daily lives, especially the culture around students. In line with that, we can use culture as a context for learning mathematics in schools (Prahmana & D'Ambrosio, 2020).

In general, 96% of respondents agree that it is time for ethnomathematics to be integrated into mathematics learning. Only 4% of respondents said not agree with the reasons not yet understood about ethnomathematics. Brandt & Chernoff (2015) recommend that "It is time for ethnomathematics to be integrated into every mathematics classroom. The reason, ethnomathematics fit with the theory constructivism ism so that students build understanding and knowledge through what they have learned and been taught previously". In addition, Umbara et al. (2021) said that the integration of culture in the current mathematics curriculum is very important based on the results of the ethnomathematical studies that have been carried out. Therefore, it is time for cultural integration in the mathematics curriculum, particularly in South and West Sulawesi, and Indonesia in general.

3.3. Teacher's Response to the Need for Curriculum Planning and Development That Include Ethnomathematics Approach

A survey of the opinions of junior high school mathematics teachers in South Sulawesi and West Sulawesi on the need for curriculum planning and development that includes an ethnomathematics approach. The survey results are presented in Figure 2.

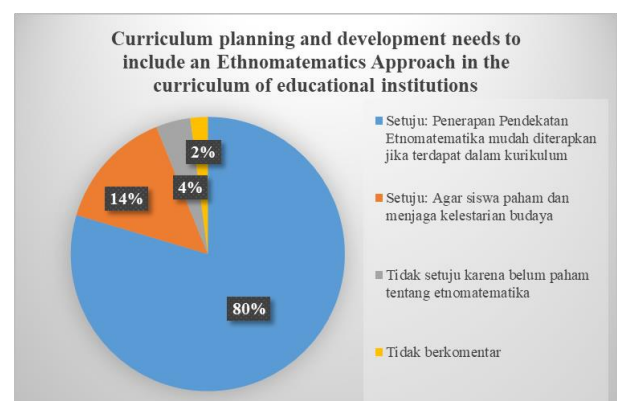


Figure 2. The Need for Curriculum Planning and Development That Include Ethnomathematics Approach

Through Figure 2, it is revealed that 15% of respondents agree with the reason that in order for students to understand and preserve culture, it is necessary to incorporate an ethnomathematics approach into the curriculum. Meanwhile, there are 80% of respondents agree that it is necessary to plan and develop a curriculum that includes an

ethnomathematics approach. In general, 94% of respondents agree that it is necessary to plan and develop a curriculum that includes an ethnomathematics approach. While the remaining 4% chose not to agree because they did not understand about ethnomathematics and 2% did not comment on the questions asked. The reason for the need for curriculum planning and development that includes an ethnomathematical approach is that ethnomathematical-based learning will be easy to implement if it is contained in the curriculum of the education unit.

This is in line with Aikpitanyi & Eraikhuemen (2017) which says that “the planning and development of the curriculum should include approaches ethnomathematics in the curriculum of institutions of education”. Further, Odili & Okpobiri (2011) recommends that “It should be developed curriculum mathematics primer in harmony with the heritage of mathematics community. Teachers must be confronted on ethnomathematics as part of the program Teacher Education”. According to Rosa & Orey (2011), the approach ethnomathematics to the curriculum of mathematics meant to make math school more relevant and meaningful to the students and to improve the quality of education of students, and (Rosa et al., 2016) confirms the view of mathematics that is more relevant in the culture.

3.4. Response Teacher Against The need for development of Model Education Based Ethnomathematics

A survey of the opinions of junior high school mathematics teachers in South Sulawesi and West Sulawesi on the need to develop an ethnomathematics-based learning model. The survey results are presented in Figure 3.

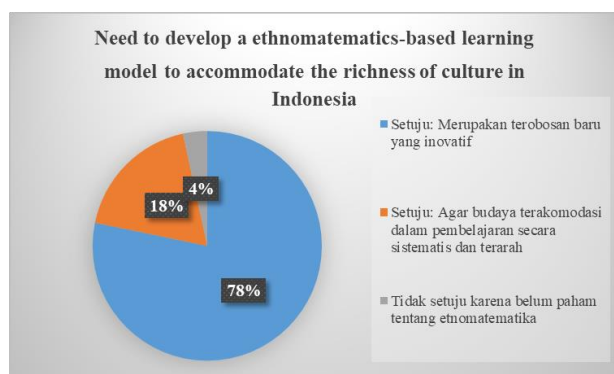


Figure 3. The need for development of Model Education Based Ethnomathematics

According to Figure 3, there are 78% of respondents agreed that the necessary development model of learning based ethnomathematics. The reason is that the ethnomathematics-based learning model is a new breakthrough in the world of education. This model can be used as a solution to the problems that occur today, that there are still many teachers who have difficulty developing innovative learning models (Koesnandar, 2020). Meanwhile, 18% of respondents stated their agreement that with the existence of an ethnomathematics-based learning model, Indonesia's culture, especially in South Sulawesi and West Sulawesi, could be accommodated in systematic and directed mathematics learning.

In general, 96% of respondents agree that it is necessary to develop an ethnomathematics-based learning model. The remaining 4% of respondents did not agree with the development of the model on the grounds that they did not understand ethnomathematics.

4. Conclusions

Based on survey results, found information that 100% of respondents understand that Indonesia is rich in cultural diversity. However, from some of the teachers (89% of respondents) stated that Indonesian culture, especially in South Sulawesi and West Sulawesi yet in accommodation thoroughly into the classroom mathematics. While on the other hand, some teachers (73% of respondents) have never heard or read about ethnomathematics which is a bridge between mathematics and culture. The positive is that all respondents (100%) have a desire to learn about ethnomathematics and ethnomathematics-based learning. Furthermore, 96% of respondents agreed that it was time for ethnomathematics to be integrated into mathematics learning in the classroom. In addition, 94 % of respondents planning and curriculum development, needs to include approaches ethnomathematics. Furthermore, 96% of respondents agree that it is necessary to develop an ethnomathematics-based learning model. In conclusion, ethnomathematics-based learning needs to be developed and applied in mathematics learning in schools, in South Sulawesi and West Sulawesi in particular.

5. References

Aikenhead, G. S. (2017). Enhancing School Mathematics Culturally: A Path of

- Reconciliation. *Canadian Journal of Science, Mathematics and Technology Education*, 17(2), 73–140. <https://doi.org/10.1080/14926156.2017.1308043>
- Aikpitanyi, L. A., & Eraikhuemen, L. (2017). Mathematics Teachers' Use of Ethnomathematics Approach in Mathematics Teaching in Edo State. *Journal of Education and Practice*, 8(4), 34–38. <https://eric.ed.gov/?id=EJ1132939>
- Astuti, S. (2019). Eksplorasi Etnomatematika Kain Ulos Batak Toba Untuk Mengungkap Nilai Filosofi Konsep Matematika. *Jurnal MathEducation Nusantara*, 2(1), 45–50. <https://jurnal.pascaumnaw.ac.id/index.php/JMN/article/view/60>
- Borba, M. C. (1990). Ethnomathematics and Education. *For the Learning of Mathematics*, 10(1), 39–43. <https://www.jstor.org/stable/40247974>
- Brandt, A., & Chernoff, E. (2015). The Importance of Ethnomathematics in the Math Class. *Ohio Journal of School Mathematics*, 71, 31–36. <http://hdl.handle.net/1811/78917>
- D'Ambrosio, U., & D'Ambrosio, B. S. (2013). The Role of Ethnomathematics in Curricular Leadership in Mathematics Education. *Journal of Mathematics Education at Teachers College*, 4(1), 19–25. <https://doi.org/https://doi.org/10.7916/jmetc.v4i1.767>
- Furuto, L. H. L. (2014). Pacific ethnomathematics: Pedagogy and practices in mathematics education. *Teaching Mathematics and Its Applications*, 33(2), 110–121. <https://doi.org/10.1093/teamat/hru009>
- Koesnandar, A. (2020). Pengembangan Model Pembelajaran Inovatif Berbasis Teknologi Informasi Dan Komunikasi (Tik) Sesuai Kurikulum 2013. *Kwangsan: Jurnal Teknologi Pendidikan*, 8(1), 33–61. <https://doi.org/10.31800/jtp.kw.v8n1.p33--61>
- Muhtadi, D., Sukirwan, Warsito, & Prahmana, R. C. I. (2017). Sundanese ethnomathematics: Mathematical activities in estimating, measuring, and making patterns. *Journal on Mathematics Education*, 8(2), 185–198. <https://doi.org/10.22342/jme.8.2.4055.185-198>
- Muslimahayati, & Wardani, A. K. (2019). Implementasi Etnomatematika Masyarakat Suku Anak Dalam (SAD) Kabupaten Batanghari Provinsi Jambi pada Pembelajaran Matematika. *Jurnal Elemen*, 5(2), 108–124. <https://e-journal.hamzanwadi.ac.id/index.php/jel/article/view/957>
- Odili, G. A., & Okpobiri, N. R. (2011). Elechi Amadi's "The Concubine": Ethnomathematics Resource for Teaching Mathematics in Ikwerre Primary Schools. *African Journal of Education and Technology*, 1(2), 84–92. <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.644.1077&rep=rep1&type=pdf>
- Orey, D. C., & Rosa, M. (2010). Ethnomodeling: A Pedagogical Action for Uncovering Ethnomathematical Practices. *Journal of Mathematical Modelling and Application*, 1(3), 58–67. <https://bu.furb.br/ojs/index.php/modelling/article/view/1972>
- Prahmana, R. C. I., & D'Ambrosio, U. (2020). Learning Geometry and Values From Patterns: Ethnomathematics on the Batik Patterns of Yogyakarta, Indonesia. *Journal on Mathematics Education*, 11(3), 439–456. <https://doi.org/10.22342/jme.11.3.12949.439-456>
- Prahmana, R. C. I., Yunianto, W., Rosa, M., & Orey, D. C. (2021). Ethnomathematics: Pranatamangsa System and The Birth-Death Ceremonial In Yogyakarta. *Journal on Mathematics Education*, 12(1), 93–112. <https://doi.org/10.22342/JME.12.1.11745.93-112>
- Prakoso, E. T., & Wahyuni, E. N. (2015). Urgensi Self Efficacy Konselor Sekolah dalam Mengembangkan Pendidikan Karakter Siswa (Penelitian Survey terhadap konselor Sekolah di Kota Malang). *Jurnal Inspirasi Pendidikan Universitas Kanjuruhan Malang*, 5(1), 644–652. <https://doi.org/https://doi.org/10.21067/jip.v5i1.698>
- Rosa, M., D'Ambrosio, U., Orey, D. C., Shirley, L., Alangui, W. V., Palhares, P., & Gavarrete, M. E. (2016). Current and Future Perspectives of Ethnomathematics as a Program. In G. Kaiser (Ed.), *ICME-13 Topical Surveys* (pp. 1–45). Springer Open. <https://doi.org/10.2307/1938839>
- Rosa, M., & Orey, D. C. (2003). Wine and Cheese:

- Ethnomathematics and Modelling! *Bolema, Rio Claro-SP*, 16(20). <http://matpraticas.pbworks.com/w/file/108830845/10541-56308-1-PB.pdf>
- Rosa, M., & Orey, D. C. (2006). Current Approaches in the Ethnomathematics as a Program: Delineating a Path Toward Pedagogical Action. *Boletim de Educação Matemática*, 19(26), 1–26. <https://www.redalyc.org/pdf/2912/291221866003.pdf>
- Rosa, M., & Orey, D. C. (2011). Ethnomathematics: The Cultural Aspects of Mathematics. *Revista Latinoamericana de Etnomatemática*, 4(2), 32–54. <https://www.redalyc.org/articulo.oa?id=274019437002>
- Samo, D. D., Darhim, & Kartasasmita, B. G. (2018). Culture-based Contextual Learning to Increase Problem-Solving Ability of First Year University Student. *Journal on Mathematics Education*, 9(1), 81–93. <https://doi.org/10.22342/jme.9.1.4125.81-94>
- Sunzuma, G., & Maharaj, A. (2019). Teacher-related Challenges Affecting the Integration of Ethnomathematics Approaches into the Teaching of Geometry. *Eurasia Journal of Mathematics, Science and Technology Education*, 15(9), 1–15. <https://doi.org/10.29333/ejmste/108457>
- Susiana, Caswita, & Noer, S. H. (2020). Ethnomathematics: Mathematical Concepts in Tapis Lampung. *Journal of Physics: Conference Series*, 1581(1), 1–8. <https://doi.org/10.1088/1742-6596/1581/1/012056>
- Umar, I. O., & Muawiya, H. U. (2019). Effect of Ethno-Mathematics Teaching Approach on Performance and Retention in Trigonometry Among Secondary School Students in Zaria Local Government Area Kaduna State, Nigeria. *Abacus (Mathematics Education Series)*, 44(1), 104–112. <https://man-nigeria.org.ng/issues/ABA-EDU-2019-14.pdf>
- Umbara, U., Wahyudin, W., & Prabawanto, S. (2021). Exploring Ethnomathematics with Ethnomodeling Methodological Approach: How Does Cigugur Indigenous People Using Calculations to Determine Good Day to Build Houses. *Eurasia Journal of Mathematics, Science and Technology Education*, 17(2), 1–19. <https://doi.org/10.29333/EJMSTE/9673>
- Wahyuni, A., Tias, A. A. W., & Sani, B. (2013). Peran Etnomatematika dalam Membangun Karakter Bangsa. *Seminar Nasional Matematika Dan Pendidikan Matematika*, 113–118. <https://eprints.uny.ac.id/10738/1/P-15.pdf>