

Ethnomathematics: Philosophical Values and Mathematical Concepts of Yogyakarta Batik Teachers as Modern and Contemporary Batik Motifs

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Abstract

Ethnomathematics can be interpreted as a combination of mathematics and ethnography. In other words, ethnomathematics is a cultural group that applies mathematics. A country full of rich cultural heritage is Indonesia. Batik is one of Indonesia's cultural heritages that has been recognized by the world through UNESCO. Therefore, we as Indonesian citizens should defend our culture so that it is not recognized by other countries. One of the efforts that can be made is to recognize the diversity of batik types in Indonesia. One type of batik with unique characteristics by acculturating modern times is Brand Guru Batik in Sleman. The uniqueness of this batik design is that the motif is inspired by the lessons taught at school, namely Mathematics. The purpose of this research is to describe the mathematical concept and philosophical values in Guru Batik design. This research is a qualitative research with an ethnographic approach. The results of the research obtained are that the mathematical concepts contained in Guru Batik are the concepts of transformation, symmetry, and the concept of congruence besides that there are also philosophical values in it. The philosophical values contained in this batik include the use of the Surabaya symbol which means that humans must always keep their promises and the Wahyu Tumurun motif which means the descent of revelation on the night of Lailatul Qadar. Some of the motifs used in the Guru Batik design can be useful in strengthening students' memories of math subject matter, especially on the sub-matter of flat buildings. For example, the Luas Bangun Datar motif when used by students will certainly increase the memory of flat building materials such as the area of a circle, the area of a triangle, the area of a rectangle and the area of a kite.

Keywords: Batik, Ethnomathematics, Mathematical, Modern, Philosophical

Introduction

Math has a special language and rules that people use to calculate quantities, sizes and shapes. Like culture, math has its own language, symbols and intelligence to understand things in society. On the other hand, various math learning topics are not directly related to the lives of students who are now growing (Laurens, 2017). culture becomes more significant in bringing mathematics closer to society, especially in Indonesian society which consists of various cultures (Mumpuni & Marsigit, 2022). On the other hand, it is not only students who think so, but the general public also thinks that math has no influence in life, in fact there is a relationship between mathematics and culture that exists in life (Son, 2017). The science that connects culture with mathematics is known as ethnomathematics.

Ethnomathematics is a new thing that connects the concept of mathematics and the hereditary activities of society (laurens, 2017). This term was proposed by (D'Ambrosio, 1985) who revealed that the affix of the word ethno refers to phenomena that form cultural signs such as language, character, religion, values, traditional clothes, food, habits, and traditions. The word mathematics describes mathematics in general including calculation, measurement, categorization, and conclusion making. Therefore, the word ethnomathematics is the application of mathematical concepts made by a group of people in different cultures. Ethnomathematics is the range of mathematical activities that exist and develop in society. This includes: mathematical concepts, for example, such as the cultural heritage of temples and inscriptions; pottery and traditional tools. Local units; Ethnomathematics Batik motif design; a game of concepts, knowledge, hereditary, as well as study, settlement or pattern approach (Irawan et al., 2019).

Indonesia has many cultures. However, the regions in Indonesia have very diverse cultures. Batik is one of the Indonesian cultures that cannot be separated by time. Batik symbols are so diverse that many are even related to a person's social strata, citizen identity, and historical and cultural heritage (Astriandini & Kristanto, 2021). Therefore, UNESCO has designated batik as a humanitarian heritage for oral and intangible culture since 2009 (UNESCO, 2009). Each region in Indonesia has its own way of describing its identity and culture. The culture and identity are made in batik which is formed in the type and motif (Astriandini & Kristanto, 2021). In Yogyakarta, there are many types of batik, one of which is the Yogyakarta Batik Teacher brand, this brand is a batik business located at Yogyakarta State University (UNY) which was pioneered by Dheni Nugroho with the aim of making this Batik Teacher design applicable to all teaching staff in Indonesia. The identity in this batik is seen from the motif, the brand's motif emphasizes modern contemporary motifs, inspired by subjects such as building spaces, sports equipment, and physics formulas. On the other hand, this batik motif contains geometry concepts and some transformation concepts.

Recently, many studies related to the exploration of ethnomathematics have been commonly studied by previous researchers, especially about batik. Some studies reveal that various types of batik motifs as research objects only contain cultural elements without acculturation in today's modern era (Arwanto, 2017; Harahap & Mujib, 2022; Ulum, 2018). Based on this, there has been no research on ethnomathematics in a modern brand that combines old culture with current modern culture. Therefore, this research will discuss batik that has experienced acculturation between old culture and contemporary culture as it is today. One of these brands is the Guru Batik brand in Yogyakarta, this brand has a variety of batik as an object of research that contains mathematical concepts such as the concept of plane geometry, points, lines, transformations, the concept of similarity and the concept of congruence.

Based on the explanation above, this research was conducted by exploring the design of Guru Batik Yogyakarta in terms of philosophical values and mathematical concepts. Thus, the purpose of this research is to describe the motifs of Guru Batik Yogyakarta in terms of philosophical values and mathematical concepts.

Methods

This research is an ethnographic qualitative research. Ethnography is used to describe, elaborate, and analyze the cultural elements of a society or ethnic group. Determining informants, researchers pay attention to what prerequisites should be met to become informants in order to obtain informants who are able to provide the information needed by researchers so that an informant is obtained who is able to work well together. The criteria that must be met or the requirements of informants in this study are very important, because not everyone in the research location can be used as informants. The instrument in this research is a human instrument, namely the researcher acts as the first instrument that cannot be replaced by anyone. So that researchers are directly involved in research and act as data collectors through library data collection, interviews, observation and documentation.

The data analysis technique used in this research has several steps. The first step is data reduction, in this step the aim is to convert image or recording data into written form and select information that is needed or not needed, after that the presentation of data involves collecting information and organizing information so that the results can be well organized. At this stage, researchers present data which is the result of data reduction. After presenting the data, the next step is to interpret the data through data analysis. The final step is to present all the results of data analysis that have been processed by researchers.

Result

Based on the data that has been collected, five types of batik motifs from the Batik Teacher brand in Yogyakarta are obtained, namely the Lampung Siger Flat Build motif in Figure 1., the Rinonce Space Build motif in Figure 2., the Turus Lima motif in Figure 3., the Surabaya motif in Figure 4., the Broad Flat Build motif in Figure 5. and the Wahyu Tumurun motif in Figure 6..



Figure 1. Lampung Siger Flat Building Motif



Figure 2. Rinonce Space Building Motif



Figure 3. Turus Lima Motif



Figure 4. Surabaya Motif



Figure 5. Flat Building Area Motif



Figure 6. Wahyu Tumurun Motif

Discussion

1.1. Konsep Transformasi pada Motif Guru Batik Yogyakarta

One of the transformation concepts applied to Guru Batik's batik motifs is the concept of translation and rotation. The transformation concept used in the process of making batik at Guru Batik Yogyakarta is the concept of translation. Translation is part of a type of transformation that aims to move elements in the shape with the same size both distance and direction (Kurniasih & Handayani, 2017; Edi, 2021). Rotation is a transformation that connects between points by rotating the point or in other words, rotation is the event of moving an object (image) through a curved line with the center at a certain point and with a certain angle of rotation in a clockwise or counterclockwise direction so that the position of the object changes (Hanafi et al., 2017).

The last transformation concept is reflection. Reflection is a shift in geometry between the position after displacement with the axis of symmetry and the position before displacement with the axis of symmetry (Roebyanto, 2014; Hada et al., 2021). One example of translation is found in 4 kinds of Guru Batik motifs, among others: 1) Lampung Siger Space Building motif; 2) Rinonce Space Building motif; 3) Turus Lima motif; 4) Surabaya motif. The example of the concept of transformation of translation, rotation and reflection types is the Luas Bangun Datar motif. Lampung Siger Space Building Motif, in Figure 7. there is a siger Lampung space building motif. From a philosophical point of view, this motif is made by combining mathematical elements and elements of Lampung culture (siger).

According to Ciciria (2015) the siger is a unifying symbol of Lampung society. The shape, color, and various decorative accessories imply the unity and unity of tribes, sub-tribes, and descendants of the Lampung Pepadun and Saibatin communities. With this symbol, the Pepadun and Saibatin tribes are bound by a culture, lineage, socio-cultural life and even a sense of solidarity. Initially this batik was created for teachers from North Lampung, but gradually this batik can be owned by anyone not only for teachers from North Lampung. On the other hand, when viewed in terms of the siger motif, namely in Figure 7. the r motif is shifted a few units up and then shifted a few units to the right so that the r' motif is formed. Furthermore, the r'' motif is shifted several santuan to the right and several units down so that the r''' motif is formed. Finally, the motif of batik Bangun Ruang Siger Lampung is formed.

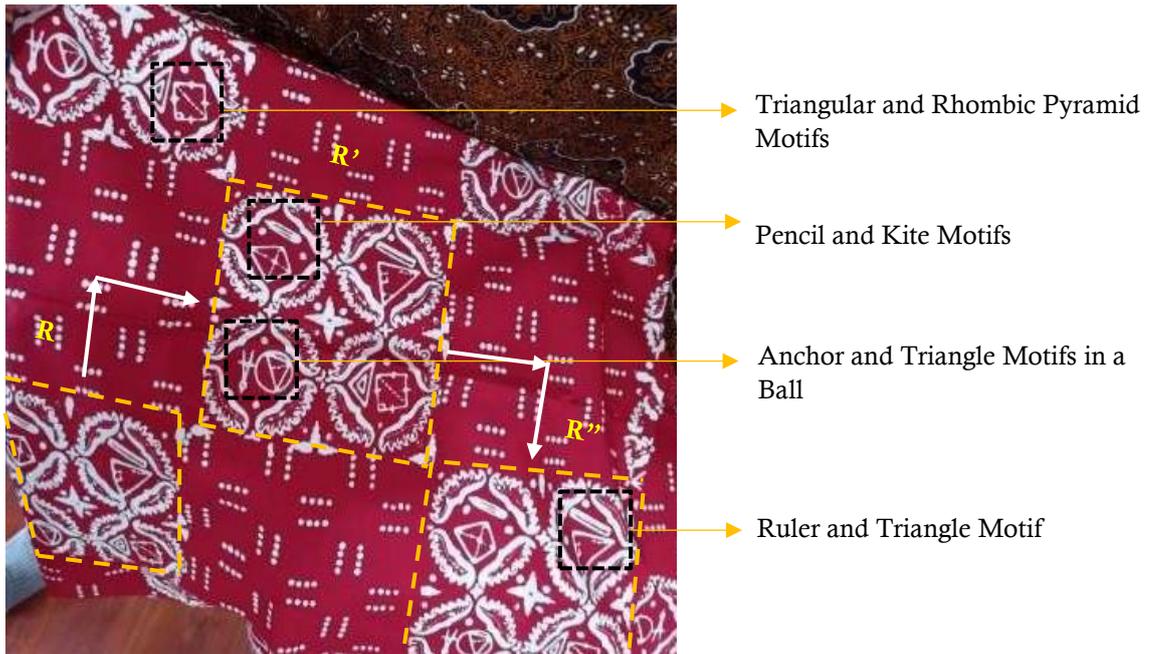


Figure 7. The concept of translation in Lampung Siger Flat Building Motifs

Rinonce Bangun Ruang motif, in Figure 8. can be seen the design of this motif. In terms of philosophy, Bangun Ruang Rinonce has the meaning of mathematics, while Rinonce means a series so that if combined Bangun Ruang Rinonce means mathematical concepts that are interrelated in everyday life. In the picture below, it can be seen that motif p is shifted several units to the right so that motif p' is obtained, then shifted several more units to the right so that motif p'' is obtained. Furthermore, shifting once again so that the p''' motif is obtained. In the end, the batik motif Bangun Ruang Rinonce is obtained as in the picture below.

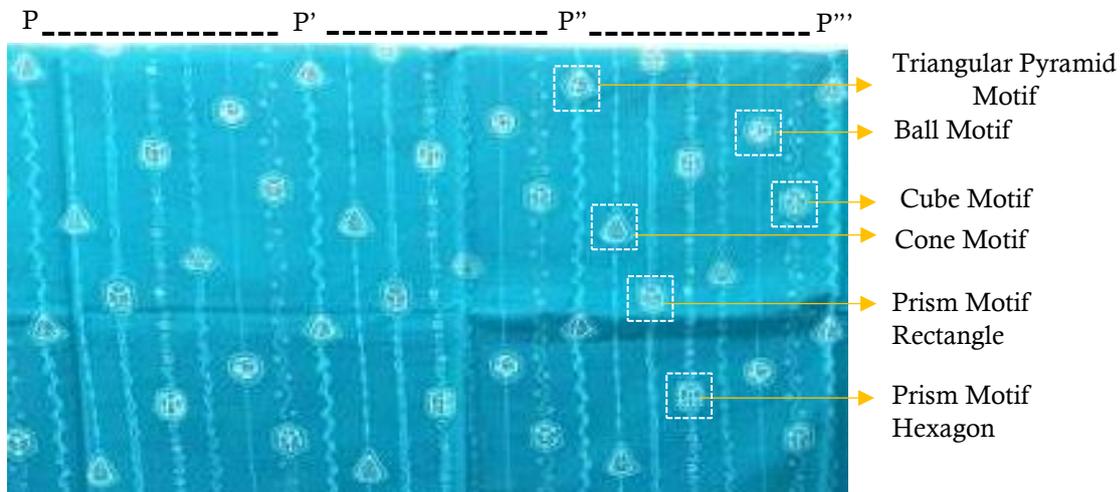


Figure 8. Concept of Translation in Rinonce Spatial Building Motifs

Turus Lima motif, in Figure 9. can be seen the design of this motif. The philosophical aspect of this Turus Lima motif is inspired by the Turus of Statistics. When viewed from the picture below, the s motif is shifted a few units up, then a few units to the right so that s' is obtained. Furthermore, the s motif is shifted several units down and several units to the right so that s'' is obtained. In the end, the Turus Five motif is formed.

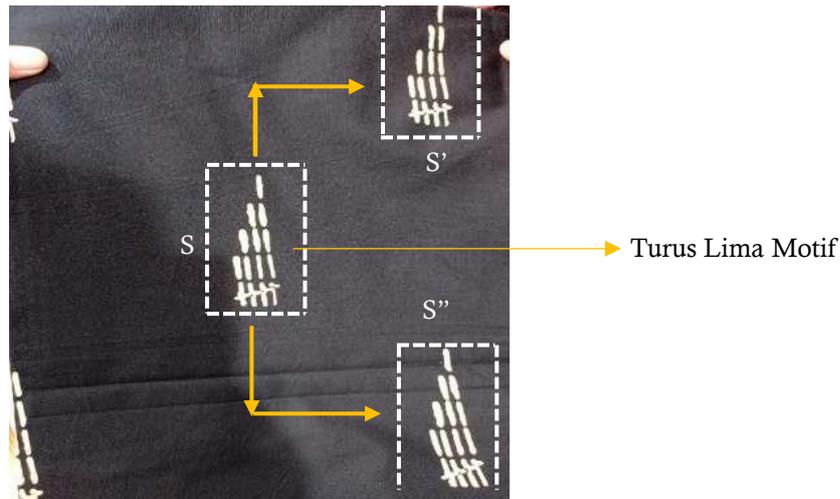


Figure 9. The Concept of Translation in the Turus Lima Motif

In Figure 10. below is the Surabaya motif. Philosophically, this batik is inspired by the symbol of the city of Surabaya, which is located in the province of East Java. Sura is told as the name of a shark and Baya is the name of a crocodile (Primadia 2017). The moral of this story is that humans must always keep their promises (Anaqah, 2020). Furthermore, when viewed in mathematical terms, this motif has the concept of translation or shift. In Figure 10. below the p motif is shifted several units down so that the p' motif is formed, then the p'' motif is shifted several units down so that the p''' motif is obtained. In the end, a batik with the Surabaya motif is formed.



Figure 10. Translational concept in Surabaya motifs

Figure 11. below is the shape of the Luas Bangun Datar motif. In terms of philosophy, this motif is inspired by the formulas of flat area in mathematics. One of the formulas used include: (1) circle area; (2) triangle area; (3) kite area; and (4) rectangle area. On the other hand, mathematically, this motif applies the concepts of translation, rotation and reflection. In Figure 11. below there are several transformation concepts applied. First translation, motif A is shifted a few units to the right to form motif A'. Second rotation, motif B is rotated 180° clockwise to form motif B' and motif C is rotated 180° counterclockwise to form motif C'. Third reflection, motif D is mirrored against the Z symmetry axis to form motif D'.

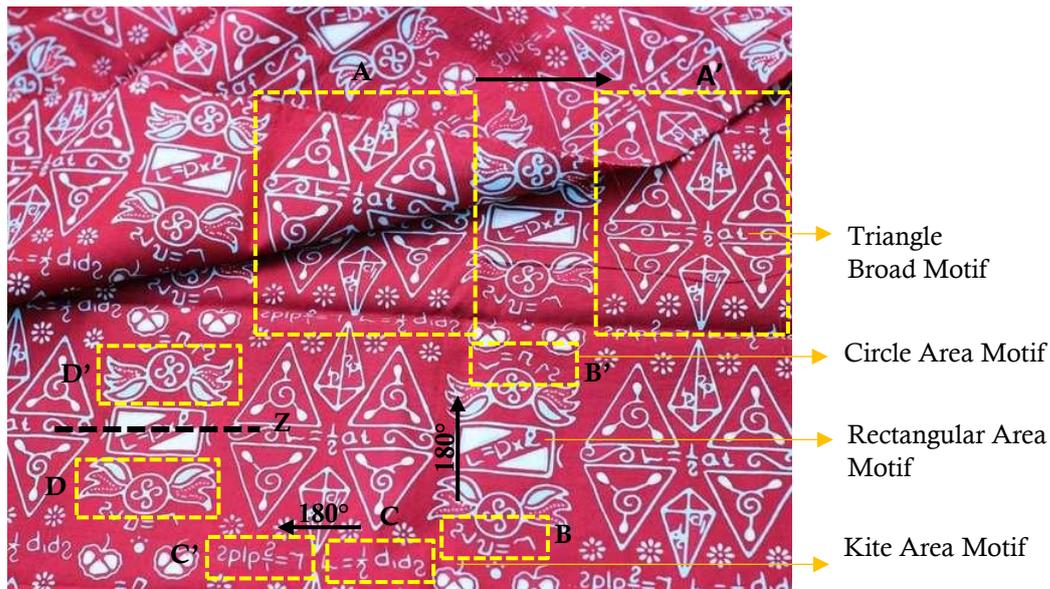


Figure 11. Concepts of Translation, Rotation, and Reflection in the Area Motif of Flat Buildings

1.2. *The Concept of Symmetry in Yogyakarta Batik Master Motifs*

The concept of symmetry referred to here is the concept of folding symmetry. Folding symmetry is the number of folds that a flat plane can make into two equal parts (Astuti, 2018). Batik with this concept is made by sketching the batik by making the motifs first (Arwanto, 2017). In Figure 1.6 below is a symmetrical batik motif, the yellow line shows the concept of folding symmetry in the Wahyu Tumurun batik motif of folding symmetry vertically and horizontally. Based on the results of the interview, the batik picture motif above is referred to as the Wahyu Tumurun motif.

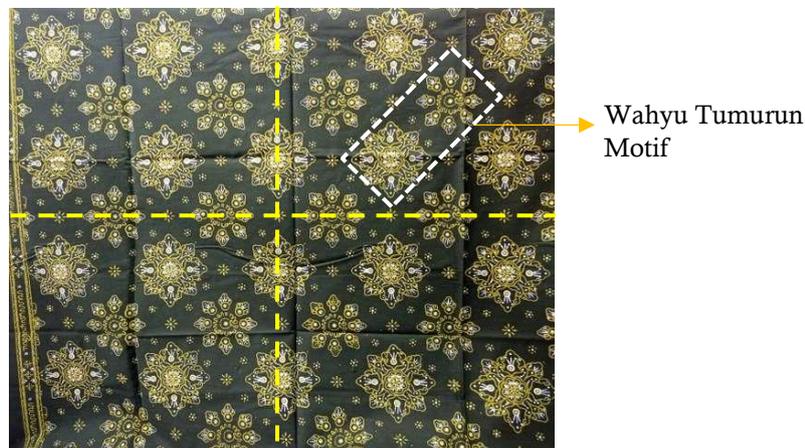


Figure 12. The Concept of Symmetry in Wahyu Tumurun Motifs

The philosophical concept of this batik is that Wahyu means revelation, while Tumurun means hereditary so that if interpreted as a whole Wahyu Tumurun means revelation that comes down or hereditary revelation. Wahyu Tumurun batik motifs have certain meanings and philosophies. According to Sari (2019) the flying crown pattern which is the main motif symbolizes glory. The philosophy describes the hope that the wearer will receive guidance, blessings, grace, and abundant grace from God Almighty. Hope to achieve goals, position or rank. While in special cases such as marriage, this motif implies the blessing of inner and outer life in household life, harmony and happiness that lasts and is maintained forever. The depth of the meaning of domestic life is what makes this special motif often worn in Javanese traditional wedding ceremonies.

Conclusion

Based on the results of data analysis and discussion above, it can be concluded that Guru Batik contains mathematical elements, namely the concept of transformation including translation, rotation and reflection and the concept of symmetry (folding symmetry) and the concept of congruence. The philosophical values contained in this batik include the use of the Surabaya symbol which means that humans must always keep their promises and the Wahyu Tumurun motif which means the descent of revelation on the night of Lailatul Qadar.

Some of the motifs used in the Guru Batik design can be useful in strengthening students' memories of mathematics subject matter, especially on the sub-matter of flat shapes. For example, the Luas Bangun Datar motif when used by students will certainly increase the memory of flat building materials such as the area of a circle, the area of a triangle, the area of a rectangle and the area of a kite. Suggestions for future researchers to research the philosophical and mathematical concepts of batik, but with different locations such as Bantul, Purwokerto, and so on.

References

- Anaqah, N. (2020). Video Story Telling: Perseteruan Antara Sura Dan Baya Cerita Fabel Rakyat Provinsi Jawa Timur (Doctoral dissertation, Universitas Airlangga).
- Arwanto, A. (2017). Eksplorasi Etnomatematika Batik Trusmi Cirebon Untuk Mengungkap Nilai Filosofi Dan Konsep Matematis. *Phenomenon: Jurnal Pendidikan MIPA*, 7(1), 40–49. <https://doi.org/10.21580/phen.2017.7.1.1493>
- Astriandini, M. G., & Kristanto, Y. D. (2021). Kajian Etnomatematika Pola Batik Keraton Surakarta Melalui Analisis Simetri. *Mosharafa: Jurnal Pendidikan Matematika*, 10(1), 13–24. <https://doi.org/10.31980/mosharafa.v10i1.831>
- Astuti, T. W. (2018). Penerapan Metode Demonstrasi untuk Meningkatkan Hasil Belajar Matematika Materi Pokok Simetri pada Siswa Kelas V SD Negeri Sayangan No. 244 Tahun Ajaran 2017/2018. *Jurnal Ilmiah Konseling*, 18(1), 39–55.
- Ciciria, D. (2015). Siger Sebagai Wujud Seni Budaya Pada Masyarakat Multietnik di Provinsi Lampung. *Panggung*, 25(2).
- D'Ambrosio, U. (1985). Ethnomathematics and Its Place in the History and Pedagogy of Mathematics. *For the Learning of Mathematics*, 5(February 1985), 44–48 (in 'Classics').
- Edi, S. (2021). Eksplorasi Konten Transformasi Geometri Berbasis Etnomatematika Pakaian Adat Suku Dayak Kenyah. *Prosiding Seminar Pendidikan Matematika*, 3(2721), 2.
- Hada, K. L., Maulida, F. I., Dewi, A. S., Dewanti, C. K., & Surur, A. M. (2021). Pengembangan Media Pembelajaran Blabak Trarerodi pada Materi Geometri Transformasi: Tahap Expert Review. *Jurnal Pendidikan Matematika (Kudus)*, 4(2), 155. <https://doi.org/10.21043/jmtk.v4i2.12047>
- Hanafi, M., Wulandari, K. N., & Wulansari, R. (2017). Transformasi Geometri Rotasi Berbantuan Software Geogebra. *Fibonacci Jurnal Pendidikan Matematika Dan Matematika*, 3(2), 93–102.
- Harahap, L., & Mujib, A. (2022). Eksplorasi etnomatematika pada motif batik Medan. *Journal Ability: Journal of Education and Social Analysis*, 3(2), 61–72. <https://doi.org/10.46306/lb.v1i1>
- Irawan, A., Lestari, M., Rahayu, W., & Wulan, R. (2019). Ethnomathematics batik design Bali island. *Journal of Physics: Conference Series*, 1338(1). <https://doi.org/10.1088/1742-6596/1338/1/012045>
- Kurniasih, M. D., & Handayani, I. (2017). Tangkas Geometri Transformasi. Jakarta: Fakultas Pendidikan dan Ilmu Pendidikan Universitas Muhammadiyah Prof Dr. HAMKA.
- Laurens, Theresia. (2017). Analisis Etnomatematika Dan Penerapannya Dalam Meningkatkan Kualitas Pembelajaran. *Jurnal LEMMA*, 3(1), 86–96. <https://doi.org/10.22202/jl.2016.v1i3.1120>
- Mumpuni, R. H., & Marsigit, M. (2022). Initial perception of junior high students on ethnomathematics-based online learning during the COVID-19 pandemic. *International Journal of Evaluation and Research in Education*, 11(3), 1445–1454. <https://doi.org/10.11591/ijere.v11i3.21822>
- Primadia, A. (2017). Sejarah Kota Surabaya Tempo Dulu dan Asal Usul Nama (#Lengkap).

- SejarahLengkap.Com:<https://sejarahlengkap.com/Indonesia/sejarah-kota-surabaya>.
- Roebyanto, G. (2014). Geometri Pengukuran dan Statistik. Malang: Penerbit Gunung Samudera.
- Sari, D. L. (2019). Clarias Dan Motif Batik Wahyu Tumurun Dalam Gaun Pengantin Wanita (Doctoral dissertation, Institut Seni Indonesia Yogyakarta).
- Son, A. L. (2017). Study Ethnomatematika: Pengungkapan konsep matematika dan karakter siswa pada permainan kelereng masyarakat suku Dawan. *Journal of Medives : Journal of Mathematics Education IKIP Veteran Semarang*, 100-110.
- Ulum, B. (2018). Etnomatematika Pasuruan: Eksplorasi Geometri Untuk Sekolah Dasar Pada Motif Batik Pasedahan Suropati. *Jurnal Review Pendidikan Dasar : Jurnal Kajian Pendidikan Dan Hasil Penelitian*, 4(2), 686. <https://doi.org/10.26740/jrpd.v4n2.p686-696>.