JOURNAL OF INNOVATION AND RESEARCH IN PRIMARY EDUCATION | ISSN 2829-775X
Vol. 4, No. 3, 2025, 1251-1260
https://doi.org/10.56916/jirpe.v4i3.1531

Ethnomathematics in Sidoarjo Batik Motifs: An Ethnographic Study of Mathematical Concepts in Local Cultural Artifacts

Nur Fitriyah*
Faculty of Education, State University of Surabaya, Indonesia

Wiryanto
Faculty of Education, State University of Surabaya, Indonesia

Rooselyna Ekawati
Faculty of Mathematics and Natural Sciences, State University of Surabaya, Indonesia

Neni Mariana
Faculty of Education, State University of Surabaya, Indonesia

Tatag Yuli Eko Siswono
Faculty of Mathematics and Natural Sciences, State University of Surabaya, Indonesia

***Corresponding Author:** 24010855126@mhs.unesa.ac.id

Keywords
Ethnomathematics
Cultural Mathematics
Geometry In Art
Mathematics Education
Local Wisdom

Article History
Received 2025-05-28
Accepted 2025-07-29

Abstract
This study explores the integration of mathematical concepts within the traditional batik motifs of Sidoarjo, Indonesia, through a qualitative ethnographic approach. Focusing on three selected motifs Beras Wutah, Kembang Tebu, and Udang Bandeng—the research aims to identify and describe inherent mathematical elements such as symmetry, geometry, patterns, and proportional reasoning embedded in the design and production process. Data were collected through direct observation, semi-structured interviews with local batik artisan Ir. Nurul Huda, and documentation analysis at the Batik Tulis Al-Huda Gallery in Sidokare, Sidoarjo. The data were analyzed using Spradley's ethnographic method, which includes domain, taxonomic, and componential analysis. Findings reveal that Sidoarjo batik motifs are rich in mathematical structures. The Beras Wutah motif displays tessellation and reflective symmetry; Kembang Tebu illustrates rotational symmetry and repetitive geometric patterns; while the Udang Bandeng motif incorporates proportional scaling and spatial reasoning. In total, 15 distinct geometric patterns and 9 types of symmetries were identified across the three motifs. These mathematical ideas, though traditionally unformalized, demonstrate deep-rooted local knowledge that aligns with formal mathematical principles. The integration of ethnomathematical perspectives into classroom instruction has the potential to contextualize learning, enhance students' engagement, and foster cultural appreciation. This study focuses on primary education (grades 4 to 6), where such contextual mathematics learning can significantly support students' conceptual understanding. It concludes that batik, as a cultural artifact, holds significant educational value in mathematics education. Incorporating local cultural resources like batik into curriculum design not only supports culturally responsive teaching but also bridges abstract mathematical concepts with tangible real-world experiences. The findings advocate for the inclusion of ethnomathematics in primary education as a strategy to make mathematics more accessible, meaningful, and inclusive for diverse learners.

INTRODUCTION

Batik is one of Indonesia's cultural heritage that has high aesthetic and philosophical value. Every region in Indonesia has a distinctive batik motif that reflects its local cultural identity and history (Farid, 2023). Batik was officially recognized as an intangible cultural heritage by UNESCO in 2009, which affirmed the importance of preserving this art globally (Zayyadi, 2018). The process of making batik is not only a decorative art, but also contains a deep symbolic and philosophical meaning, which is a medium of communication of cultural values (Pristianto, 2022). In the context of education, the introduction of batik as part of local culture can be an effective strategy to strengthen the younger generation's love for cultural heritage. In addition, batik has elements that can be associated with mathematical concepts, especially geometry, so it has the potential to be used as an interesting and contextual learning medium. Learning mathematics with local media can help students understand abstract material more easily and meaningfully (Wiryanto & Jannah, 2022). Therefore, the integration of batik culture in mathematics learning in elementary schools is a strategic effort that needs to be developed.

Sidoarjo Regency is one of the areas in East Java that has a batik cultural heritage with distinctive motifs and full of philosophical meaning. Sidoarjo batik motifs such as rice wutah, sugarcane, and milkfish shrimp illustrate the potential of natural resources and the social life of the local community. For example, the wutah rice motif symbolizes the abundance of agricultural products, especially rice, which is an important part of the regional economy. The sugarcane flower motif reflects the fertility of sugarcane plantations and sugar production in Sidoarjo, while the milkfish shrimp motif shows the richness of fishery resources in the coastal area. Each motif has a complex and repetitive geometric structure, which can be analyzed to identify mathematical patterns and concepts such as symmetry, basic shapes, and repetition (Astriandini et al., 2021). This knowledge opens up opportunities to use batik as a mathematics learning medium based on local wisdom in elementary schools. Thus, the use of Sidoarjo batik motifs in learning not only strengthens cultural introduction, but also improves students' mathematical understanding contextually and authentically.

The preservation of batik as the nation's cultural heritage is a challenge as well as a need for the next generation. One effective way to preserve batik is to introduce it early through education in elementary school (Fitroh et al., 2023). Through the integration of batik in mathematics learning, students can learn while understanding the cultural values contained in batik motifs. This approach also aims to change the negative perception of mathematics that is often considered difficult by students by providing a context closer to their daily lives (Faturrahman & Soro, 2021). The right learning media can increase learning motivation and help students learn independently according to their abilities (Solihin & Habibie, 2024). Therefore, the design of batik-based learning media is essential to bridge abstract mathematics concepts with students' real experiences. This is in line with the opinion of Nareswari et al. (2023) who stated that media is a communication tool that connects messages from teachers to students effectively. With effective learning media, the mathematics learning process can be more fun and meaningful.

Batik as a learning medium has the potential to instill cultural character values in students. Through batik activities, students not only learn about art and culture, but also develop creativity and fine motor skills (Nuryami & Apriosa, 2024). This kind of learning can also reduce students' dependence on gadgets by inviting them to engage in positive activities that involve traditional arts. In addition, batik as a local learning medium encourages holistic learning, which integrates cognitive, affective, and psychomotor aspects (Yolanda & Putra, 2022). Character education based on local culture is very important in shaping children's personalities that respect the traditions and identity of the nation. Mathematics learning that uses cultural context can also improve students' ability to apply mathematical concepts in daily life. Therefore, the use of batik as a learning medium has dual benefits, namely cultural and academic. This makes batik a relevant and contextual learning vehicle in elementary schools.

Culture-based mathematics or ethnomathematics is an approach that connects mathematical concepts with the local cultural context of students. This approach can improve the understanding and relevance of mathematics learning because it relates the material to students' real lives (Yolanda & Putra, 2022). By using Sidoarjo batik motifs as a learning context, students can understand mathematical concepts such as symmetry, patterns, lines, and geometric shapes in a more meaningful way. Ethnomathematics also fosters a sense of love and concern for local culture while strengthening national identity. Previous research has shown that batik can be used as an effective medium in mathematics learning, especially in geometry materials (Solihin & Rahmawati, 2024). However, there is still limited research that explicitly focuses on mathematical structures embedded in specific Sidoarjo batik motifs such as Beras Wutah, Kembang Tebu, and Udang Bandeng, and how they can be pedagogically applied in primary mathematics education. Based on this research gap, two key questions guide this study: (1) What specific mathematical concepts are embedded in Sidoarjo batik motifs? and (2) How can these concepts be pedagogically applied in elementary school mathematics learning? Therefore, the exploration of mathematical concepts in Sidoarjo batik is very important to support the development of learning media rooted in local wisdom.

Based on this description, this study aims to explore the mathematical concepts contained in the Sidoarjo batik motif as a learning medium with local wisdom in elementary schools. This research is important to provide an overview of how Sidoarjo batik motifs that are rich in philosophy and cultural values can be used in mathematics learning, especially geometry materials. In addition, this research is expected to be the basis for the development of innovative and contextual learning media. By combining cultural arts and mathematics, students not only gain academic knowledge, but also engage in the preservation of local culture. This is expected to increase the motivation and learning outcomes of mathematics students in elementary school. This research also contributes to the development of ethnomathematics as a culture-based learning approach. Finally, this research is a strategic step in strengthening character education and love for local culture from an early age in the world of formal education.

METHODS

This study uses a type of qualitative research with an ethnographic approach that aims to describe the cultural characteristics inherent in individuals or groups in a particular community. The main focus of the research is to explore the mathematical concepts contained in the Sidoarjo Batik motif. Data were collected through observation, interview, and literature documentation studies to obtain an in-depth picture of the relationship between batik and mathematical concepts. The main instruments in this study are the researcher himself as a data collector and direct observer, while the supporting instruments are interview guidelines, observation sheets, and field documentation used to strengthen the validity of the data.

Data collection was conducted intensively from March 1 to March 30, 2025, involving multiple visits and repeated observations at the research site. Interviews and field observations were conducted at the Al-Huda Tulis Batik Gallery in Sidokare, Sidoarjo, a location that is also the production site of various batik motifs such as Beras Wutah, Kembang Tebu, and Udang Bandeng, which are the focus of this research.

To ensure the credibility of findings, data validation strategies were applied, including triangulation of data sources (observations, interviews, documents), triangulation of informants (artisan, assistants, and local community members), and member checking by confirming interpreted data with key informants. These steps were essential in enhancing the trustworthiness and dependability of the ethnographic data.

Data analysis was carried out using Spradley's ethnographic method, which includes the following stages:

1. Domain analysis to identify broad cultural categories related to batik production and patterns;
2. Taxonomic analysis to classify the types of mathematical concepts (e.g., symmetry, tessellation) within the motifs;
3. Componential analysis to compare and contrast the features among motifs and understand the deeper symbolic-mathematical structures;
4. Thematic analysis to synthesize recurring cultural themes linked to mathematical reasoning in batik.

   These stages allow the data to be interpreted systematically and contextually in line with ethnographic traditions.

The selection of informants was carried out by purposive sampling technique, which was selected based on the consideration of the informant's ability to provide data according to the research objectives. The criteria for the selected informants include understanding the process of making batik, knowing the development of Sidoarjo written batik, and understanding the importance of preserving Sidoarjo batik culture. This selection is made to ensure informants have in-depth knowledge and first-hand experience relevant to the object of research. Prospective informants who met these criteria were obtained from the batik community in Sidokare, Sidoarjo, and Ir. Nurul Huda was selected—a batik artisan from Jetis Batik Village who also serves as the chairman of the Sidoarjo Batik Association. In addition to the main artisan, two assistants and a local historian were also interviewed to provide broader perspectives.

RESULTS AND DISCUSSION

Research Results

This study extensively explored the mathematical concepts embedded within the traditional motifs of Sidoarjo Batik, specifically focusing on three prominent motifs: Beras Wutah, Kembang Tebu, and Udang Bandeng. Through detailed observations, in-depth interviews with the batik artisan Ir. Nurul Huda, and documentation at the Galeri Batik Tulis Al-Huda, the research revealed a rich integration of geometry, pattern theory, and spatial reasoning in both the motifs and the batik-making process. These findings affirm the potential of Sidoarjo Batik as an effective local wisdom-based medium for teaching elementary school mathematics.

Detailed Mathematical Concepts in Batik Motifs

Beras Wutah Motif

The Beras Wutah motif is characterized by numerous small, oval shapes distributed throughout the fabric. These ovals mimic scattered grains of rice, symbolizing abundance. Geometrically, these ovals demonstrate the principle of translation symmetry, where the same shape repeats uniformly across the fabric. The motif also shows reflection symmetry along multiple axes, creating a balanced and harmonious visual pattern. The repetitive distribution forms a tessellation-like arrangement, introducing students to concepts of repeating patterns and congruent shapes. Additionally, the spatial layout of the ovals aligns with grid-like structures, helping students visualize coordinate placement and understand the concept of spacing and alignment in two-dimensional planes. These geometric principles encourage students to recognize order and predictability within seemingly complex designs.

Table 1. Detailed Mathematical Concepts in Sidoarjo Batik Motifs and Their Educational Implications

Motif	Geometric Features	Mathematical Concepts	Description	Educational Implications for Elementary Students
Beras Wutah	Small ovals, repeated patterns	Translation symmetry, reflection symmetry, tessellation, congruency, spacing	Repeated small oval shapes arranged systematically with mirrored reflections and uniform spacing	Introduces concepts of symmetry, pattern repetition, congruence, and grid arrangement
Kembang Tebu	Circular flower, petals & leaves	Rotational symmetry, central angles, ratio and proportion	Flower petals arranged at equal angles around a center; proportional sizes between petals and leaves	Demonstrates rotation, division of circles into equal parts, proportional reasoning
Udang Bandeng	Curved lines, arcs, intersections	Bilateral symmetry, rotational symmetry, curvilinear shapes, positive/negative space	Dynamic curved shapes with mirrored halves and balanced areas of motif and background	Introduces curve geometry, symmetry, area concepts, and spatial balance

Kembang Tebu Motif

The Kembang Tebu motif depicts floral patterns arranged in circular clusters with multiple petals and leaves. This motif prominently exhibits rotational symmetry, whereby the motif rotates around a central point at equal angles (e.g., 60°, 90°, or 120°) to create a uniform flower shape. Each petal and leaf maintains proportional size relationships, illustrating the mathematical concept of ratio and proportion. Furthermore, the angles between petals provide an authentic example of central angles in a circle, enabling learners to grasp how angles divide a circle evenly. This natural occurrence of geometry through cultural art helps demystify abstract mathematical concepts by rooting them in tangible, observable forms.

Udang Bandeng Motif

The Udang Bandeng motif features dynamic curved lines representing shrimp and milkfish, combined with symmetrical elements. This motif showcases complex curvilinear geometry, incorporating arcs, loops, and intersections. It also exemplifies bilateral symmetry, where one half mirrors the other, and rotational symmetry around specific points in the design. Importantly, the motif balances positive space (the motif shapes) with negative space (the background), an essential concept in understanding area and spatial reasoning. This interplay between filled and empty spaces can be used to introduce concepts of area measurement and visual balance in geometric figures.

Mathematical Concepts Embedded in the Batik-Making Process

Beyond the motifs themselves, the process of creating Sidoarjo Batik at Galeri Batik Tulis Al-Huda demonstrates mathematical thinking in the form of sequential algorithms and procedural steps. The batik-making process involves:

1. Drawing the basic outline of the motif on the cloth, which requires precise spatial planning and proportion.
2. Applying wax (canting) to preserve certain areas from dye, requiring controlled, repetitive motions and pattern consistency.
3. Dyeing the fabric through successive color baths, understanding layering sequences and timing.
4. Wax removal and finishing, requiring careful steps to reveal the final design.

This process models an algorithmic approach — a stepwise method where order and precision are essential to produce the intended outcome. This aspect of batik-making can serve as a concrete example for students to understand algorithmic thinking and procedural problem solving, which are fundamental skills in both mathematics and computer science.

Figure 1. Illustration of Sidoarjo Batik Motifs and Corresponding Mathematical Features

Figure 1 presents the three Sidoarjo Batik motifs analyzed in the study. On the left is the Beras Wutah motif, displaying its repeating oval patterns and reflection symmetry. The center shows the Kembang Tebu motif with clear rotational symmetry and petal proportionality. The right illustrates the

Udang Bandeng motif, highlighting curved lines, bilateral symmetry, and spatial balance between motif and background.

Pedagogical Potential of Sidoarjo Batik as a Learning Medium

Integrating Sidoarjo Batik into elementary mathematics learning offers multiple benefits. First, it contextualizes abstract mathematical concepts within familiar cultural artifacts, making learning more meaningful and engaging for students. Teachers can use the batik motifs to teach fundamental geometry concepts such as shapes, symmetry, angles, and patterns in an authentic, culturally rich context. Moreover, involving students in batik-related activities promotes multisensory learning—visual, tactile, and cognitive engagement—that deepens understanding. It also fosters appreciation for local culture, instilling values of cultural identity and preservation alongside mathematical knowledge. This dual focus on culture and mathematics supports holistic education and nurtures students' intrinsic motivation to learn.

The study concludes that Sidoarjo Batik motifs and their production processes embody a wealth of mathematical principles relevant to elementary education. From symmetry and geometric shapes to patterns and algorithmic sequences, the batik serves as an effective and culturally appropriate medium to teach and enrich mathematical learning. Using batik in classrooms not only facilitates understanding of mathematical concepts but also reinforces cultural heritage, making education both meaningful and sustainable.

Discussion

This study shows that Sidoarjo batik motifs contain complex and diverse mathematical concepts, such as symmetry, pattern, and proportion. This is in line with the findings of Hanafi et al. (2022) who revealed that batik motifs are not only aesthetically valuable, but also loaded with mathematical values that can be used as learning media. The symmetry found in the motifs of Wutah Rice and Sugarcane Flower is a clear example of the application of relevant geometric concepts in the basic mathematics curriculum. In addition, the repetitive pattern in batik motifs serves as a form of tessellation that strengthens the understanding of the concepts of repetition and regularity. This study confirms that mathematics learning based on local culture is able to increase students' motivation and understanding (Safira et al., 2021). In addition to the cognitive aspect, the aesthetic value of batik also contributes to the affective aspect of students in the learning process. Thus, the integration of cultural arts in mathematics education can bridge the cultural and science aspects holistically. Therefore, the use of batik as a learning medium has great potential to be applied more widely in the context of formal education.

The analysis of the Cane Flower motif featuring rotational symmetry provides a concrete picture of the division of the circle and the concept of the central angle. This is especially important considering that the concept of angles and circles is often abstract material for students. By using motifs that are familiar and have cultural value, students can easily understand the division of circles visually and applicatively (Sufia et al., 2023). In addition, this pattern also contains the concept of size comparison between petals and leaves which is closely related to ratio and proportion. This research supports Setiawan & Listiana (2021) where the context of local culture becomes a bridge to understand abstract concepts. This kind of approach can overcome the constraints of abstraction in mathematics and improve concept memory. This shows the importance of developing cultural-based learning materials that are relevant to students' daily lives. Therefore, the integration of batik motifs in mathematics learning not only enriches the material but also strengthens the cultural and educational interweaving together.

The milkfish shrimp motif that contains curved shapes and bilateral symmetry enriches the dimension of students' understanding of geometry, especially in the concept of curvillinar geometry. This is very important because material on curved shapes often receives less attention in elementary school mathematics learning. The curved shape of this motif provides a real example of the application of geometric shapes that are not only in the form of straight lines, thus expanding students' knowledge of the variations of mathematical shapes (Nuryami & Apriosa, 2024). In addition, the understanding of positive and negative spaces in this motif is related to the concept of field area that can be applied in area measurement (Mahardika, 2023). This research indicates that the introduction of these concepts through batik media can make it easier for students to internalize geometric ideas that are difficult to understand theoretically. The multisensory approach applied in the learning process using batik also strengthens memory and understanding of mathematical concepts. The concept of negative and positive spaces also introduces students to visual balance which is closely related to aesthetic principles in art (Irawan et al., 2022). Thus, batik as a learning medium has great potential to develop cognitive and aesthetic aspects simultaneously.

In addition to the motif aspect, the process of making written batik at Al-Huda Gallery shows the application of algorithmic concepts and systematic step sequences. This is relevant to mathematical learning theory which emphasizes the importance of procedural and algorithmic in problem solving (Habibi & Prahmana, 2022). Every stage in the batik process, from motif depiction to color dyeing, can be used as a procedure-based learning model. This model supports the development of students' logical and systematic thinking skills that are essential in mathematical comprehension (Zahroh et al., 2021). This gradual procedure in making batik can also strengthen the concept of sequence and repetitive patterns. Thus, batik media is not only relevant in the teaching of geometry but also in the development of logic and algorithm concepts. This is in line with the research of Solihin et al. (2025) who affirm that the integration of culture and mathematics enriches the way material is delivered. Therefore, the development of learning media that contains elements of local culture such as batik is highly recommended to be applied in elementary schools.

This study also found that the use of batik media is able to increase students' learning motivation, as revealed by several previous studies. The use of local culture as a learning context provides a deeper and more relevant meaning so that students feel closer to the material being studied (Aminah, 2023). This increased motivation has a positive impact on students' active involvement in the learning process and the achievement of learning outcomes. This research strengthens the theory of constructivism which emphasizes meaningful learning through real experience (Mustafa & Roesdiyanto, 2021). In addition, culture-based learning develops character values and local pride that are very important in character education (Murmanan et al., 2023). Thus, the use of batik as a learning medium not only improves the cognitive aspect but also the affective aspects of students. These findings are an important basis for teachers to develop learning innovations based on local culture (Muzakkir, 2021). Therefore, the integration of cultural values and mathematics needs to be systematically encouraged in the basic education curriculum.

The results of interviews with batik artisans show that a deep understanding of the process and meaning of motifs requires intensive cultural enculturation. This is in accordance with the criteria of informants who state the importance of direct involvement and deep cultural knowledge to access authentic information (Astriandini & Kristanto, 2021). The informant, who is the chairman of the batik association in Sidoarjo, also emphasized that the preservation of batik motifs is a concrete form of preserving cultural heritage as well as an educational facility. This research reinforces the idea that culture-based mathematics learning should be supported by the involvement of practitioners and cultural figures as learning resources. The direct involvement of artisans as resource persons also adds to the authenticity of data and enriches cultural understanding in the context of learning (Syahdan, 2021). This approach is in line with social learning theory that emphasizes interaction and experience as the basis of learning (Vygotsky & Cole, 2018). Therefore, cooperation between educators and cultural actors is indispensable in the implementation of culture-based learning. This opens up opportunities for the development of learning models that are more contextual and relevant to the needs of students.

The obstacles encountered in the implementation of batik-based learning are limited resources and time in the teaching and learning process. This is in line with the results of research by Fatimah et al. (2024) who revealed that integrating culture in learning requires careful preparation in terms of materials and methods. In addition, the limited understanding of teachers of the motifs and meanings of batik is also an obstacle in its optimal application. Therefore, increasing the capacity of teachers through training and workshops is very necessary so that they are able to present material in an interesting and contextual manner. The support of educational institutions as well as the development of easily accessible learning media are also important factors in the success of implementation. Nevertheless, the great potential of batik as a learning medium still opens up space for creative and effective learning innovation (Astriandini et al., 2021). With the use of digital technology, batik motifs can also be used as interactive learning media that are interesting for millennial generation students. This shows the need for cross-disciplinary collaboration to optimize the use of local culture in mathematics learning.

Overall, this study provides empirical evidence that the motive and process of making Sidoarjo batik contains rich and applicable mathematical concepts in the context of basic education. These findings are in line with previous research that confirms the importance of cultural integration in learning to improve understanding of mathematical concepts. In addition to the cognitive aspect, this integration also contributes to the development of students' character and cultural appreciation (Solihin et al., 2025). The use of batik as a learning medium is an innovative learning strategy that harmoniously combines cultural and scientific aspects (Wulandari et al., 2020). Therefore, mathematics education based on local culture such as batik should be part of contextual learning strategies in elementary schools (Aditya & Fiantika, 2024). This research also encourages the development of further research on the application of other local cultural media in mathematics learning. Thus, it is important for the government and educational institutions to encourage cultural preservation while improving the quality of education through culture-based learning innovations. This conclusion provides a solid foundation for future holistic and sustainable education development efforts.

CONCLUSION

Based on the results of the research and discussion that has been carried out, it can be concluded that Sidoarjo batik motifs, especially the motifs of Wutah Rice, Sugarcane, and Milkfish Shrimp, contain various relevant mathematical concepts to be used as learning media. These concepts include symmetry, repeating patterns (tessellation), proportions, geometric shapes, and procedural logic, all of which can be found explicitly in the visual elements and the batik-making process. The integration between local culture and mathematics learning provides a contextual approach that is able to improve students' understanding of concepts, learning motivation, and appreciation of regional culture. Direct involvement with batik artisans and the use of ethnographic approaches in this study allowed for authentic and meaningful data. Batik as a cultural heritage not only has aesthetic value, but can also be used as a learning resource that enriches the experience of learning mathematics holistically. This potential greatly supports the development of culture-based learning models that are adaptive to the local characteristics of students. Thus, batik media can be used as an innovative alternative in overcoming abstract mathematics learning challenges, especially at the elementary school level. This study recommends strengthening collaboration between educators, cultural actors, and educational institutions in developing and implementing learning based on local wisdom.

REFERENCES

Aditya, W. P., & Fiantika, F. R. (2024). Deskripsi Keterampilan Kolaboratif Siswa Kelas III SD Materi Bangun Datar Melalui Etnomatematika Motif Batik Madura. *Didactical Mathematics*, *6*(1), 30–39.

Aminah, S. (2023). *Bathik matematika (Batik matematika)*. Balai Bahasa Provinsi Daerah Istimewa Yogyakarta.

Astriandini, M. G., & Kristanto, Y. D. (2021). Kajian etnomatematika pola Batik Keraton Surakarta melalui analisis simetri. *Mosharafa: Jurnal Pendidikan Matematika*, *10*(1), 13–24.

Astriandini, M. G., Yosep, D., & Kristanto, D. (2021). Kajian Etnomatematika Pola Batik Keraton

Surakarta Melalui Analisis Simetri. *Mosharafa: Jurnal Pendidikan Matematika* , *10*(1). http://journal.institutpendidikan.ac.id/index.php/mosharafa

Farid, M. (2023). Pemanfaatan Konten Multibudaya Dalam Pembelajaran Seni Budaya Di Sekolah Dasar. *The Elementary Journal*, *1*(1), 20–27. https://doi.org/10.56404/tej.v1i1.48

Fatimah, S., Fajriyah, R. Z., Zahra, F. F., & Prasetyo, S. P. (2024). Integrasi Etnomatematika dalam Pembelajaran Matematika di Sekolah Dasar Berbasis Kesenian Tari Budaya Lampung. *Al-Madrasah: Jurnal Ilmiah Pendidikan Madrasah Ibtidaiyah*, *8*(4), 1631–1640.

Faturrahman, M., & Soro, S. (2021). Eksplorasi Etnomatematika pada Masjid Al-Alam Marunda Ditinjau dari Segi Geometri. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *5*(2), 1955–1964. https://doi.org/10.31004/cendekia.v5i2.734

Fitroh, S. F., Oktavianingsih, E., & Mahbubah, N. A. (2023). Efektivitas ronggosukowati educorner sebagai media pembelajaran stimulasi pengetahuan anak tentang batik pada kegiatan p5 kurikulum merdeka di PAUD. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, *7*(2), 1676–1685.

Habibi, H., & Prahmana, R. C. I. (2022). Kemampuan Literasi Matematika, Soal Model PISA, dan Konteks Motif Batik Tulis Jahe Selawe. *Jurnal Varidika*, *33*(2), 116–128.

Hanafi, M., Syamsuri, S., & Mutaqin, A. (2022). Pengembangan instrumen soal higher order thinking skills (hots) matematika berdasarkan brookhart konteks motif batik pandegelang pada siswa mts. *Media Pendidikan Matematika*, *10*(1), 43–59.

Irawan, A., Lestari, M., & Rahayu, W. (2022). Konsep Etnomatematika Batik Tradisional Jawa Sebagai Pengembangan Media Pembelajaran Matematika. *Scholaria: Jurnal Pendidikan Dan Kebudayaan*, *12*(1), 39–45.

Mahardika, D. (2023). Membuat Desain Pola Batik Matematika Menggunakan Rumus Fungsi Implisit Trigonometri Dalam Bidang Kartesius. *Sebatik*, *27*(1), 223–230.

Murmanan, Gunawan Santoso, Mustakim, & Daryono. (2023). Melalui Gotong Royong dan kolaborasi: Menerapkan Nilai-Nilai Pancasila. *Jurnal Pendidikan Transformatif*, *02*(04), 2023. https://doi.org/https://doi.org/10.9000/jpt.v2i4.640

Mustafa, P. S., & Roesdiyanto, R. (2021). Penerapan Teori Belajar Konstruktivisme melalui Model PAKEM dalam Permainan Bolavoli pada Sekolah Menengah Pertama. *Jendela Olahraga*, *6*(1), 50–56. https://doi.org/10.26877/jo.v6i1.6255

Muzakkir, M. (2021). Pendekatan Etnopedagogi Sebagai Media Pelestarian Kearifan Lokal. *JURNAL HURRIAH: Jurnal Evaluasi Pendidikan dan Penelitian*, *2*(2), 28–39. https://doi.org/10.56806/jh.v2i2.16

Nareswari, T. J., Putri, V. K., Aldwinarta, F. H., & Setiawan, N. C. E. (2023). Etnochem: Inovasi Media Pembelajaran E-Flipbook Berbasis Kearifan Lokal (Patung Garuda Wisnu Kencana) Terintegrasi Steam Guna Menyukseskan Program Merdeka Belajar. *Prosiding Pekan Ilmiah Pelajar*, *3*, 1–23. https://e-journal.unmas.ac.id/index.php/pilar/article/view/6158/4693

Nuryami, N., & Apriosa, K. D. (2024). Eksplorasi etnomatematika batik Probolinggo sebagai sumber belajar matematika sekolah. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, *7*(1), 177–190.

Pristianto, A. (2022). Pengembangan Komponen Anatomi Manusia Sebagai Inspirasi Desain Batik Muskuloskeletal. *Askara Jurnal Seni Dan Desain*, *1*(1), 64–72. https://doi.org/10.20895/askara.v1i01.591

Safira, F., Prabawati, A. T., Fatimah, F., Safiri, A. D., & Kusuma, J. W. (2021). Etnomatematika: nilai filosofis dan konsep Matematika pada motif batik Banten. *Himpunan: Jurnal Ilmiah Mahasiswa Pendidikan Matematika*, *1*(2), 162–168.

Setiawan, W., & Listiana, Y. (2021). Eksplorasi Etnomatematika pada Batik Mojokerto. *Jurnal Pendidikan Matematika (JPM)*, *7*(1), 62–70.

Solihin, A., & Habibie, R. K. (2024). Pengaruh Integrasi Budaya Karapan Sapi Berbasis Etnomatematika Terhadap Hasil Belajar Geometri Siswa Sekolah Dasar. *Jurnal Penelitian Pendidikan Guru Sekolah Dasar*, *12*(8).

Solihin, A., Mariana, N., Wiryanto, W., Rahmawati, I., & Suryanti, S. (2025). Integrating Ethnomathematics of Zero Waste Culture Based ESD to Enhance Students' Creative Thinking and Sustainability Consciousness. *Journal of Innovation and Research in Primary Education*, *4*(2), 136–147.

Solihin, A., & Rahmawati, I. (2024). Kartu Eksplorasi Etnomatematika-QR Pada Materi Bangun Datar Kelas IV Sekolah Dasar. *Jurnal Review Pendidikan Dasar : Jurnal Kajian Pendidikan dan Hasil Penelitian*, *10*(1), 64–79. https://doi.org/10.26740/jrpd.v10n1.p64-79

Sufia, N. V., Mahmudah, U., Munawaroh, Z., & Fitrotunnida, T. (2023). Kegiatan Pendampingan Untuk Menggali Nilai Tradisional Dalam Matematika Di Kota Pekalongan: Peningkatan Wawasan Motif Batik Melalui Etnomatematika. *Tarbi: Jurnal Ilmiah Mahasiswa*, *2*(2), 595–610.

Syahdan, M. S. S. (2021). Etnomatematika pada Budaya Lokal Batik Kawung. *Jurnal Inovasi Pendidikan Matematika (JIPM)*, *3*(2), 83–91.

Vygotsky, L., & Cole, M. (2018). Lev Vygotsky: Learning and social constructivism. *Learning Theories for Early Years Practice. UK: SAGE Publications Inc*, 68–73.

Wiryanto, & Jannah, M. (2022). *Pengembangan Media Kartu Domino Hitung Matematika-Kode Quick Response (KOMIKA-QR) Pada Materi Pecahan Siswa Sekolah Dasar*.

Yolanda, F. O., & Putra, A. (2022). Systematic Literature Review: Eksplorasi etnomatematika pada motif batik. *Prima Magistra: Jurnal Ilmiah Kependidikan*, *3*(2), 188–195.

Zahroh, H. R., Purnama, K. A., Asalauqi, M. F., Faridayanti, I., & Kusuma, J. W. (2021). Eksplorasi etnomatematika ditinjau dari nilai Matematika pada motif batik Banten. *Himpunan: Jurnal Ilmiah Mahasiswa Pendidikan Matematika*, *1*(2), 154–161.

Zayyadi, M. (2018). *Eksplorasi Etnomatematika Pada Batik Madura*.