Systematic Literature Review: Ethnomathematical Context of Batik Motifs in Mathematics Learning

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ABSTRACT

This study aims to determine whether ethnomathematics of batik motifs can be used as a mathematics learning approach and implemented in schools. The results of identifying articles from 2013 to 2023 through systematic literature review (SLR) referring to the Preferred Reporting Items for Systematic Review and Meta Analysis (PRISMA) obtained 12 sinta articles from a database of 200 articles. The findings of the SLR are two types of articles that are implemented directly to students in schools and research that only examines ethnomathematics from various batik motifs, the material obtained from the analysis is geometric transformation material and quadrilateral triangles obtained from all articles.

ABSTRAK

Penelitian ini bertujuan untuk mengetahui apakah etnomatematika motif batik dapat dijadikan sebagai pendekatan pembelajaran matematika dan diimplementasikan di sekolah. Hasil identifikasi artikel dari tahun 2013 sampai 2023 melalui systematic literature riview (SLR) mengacu pada *Preferred Reporting Items for Systematic Review and Meta Analysis* (PRISMA) diperoleh 12 artikel sinta dari databased 200 artikel. Temuan dari SLR terdapat dua jenis artikel yang di implementasikan langsung ke siswa di sekolah dan penelitian yang hanya mengkaji etnomatematika dari berbagai motif batik, materi yang diperoleh dari hasil analisis adalah materi transformasi geometri dan segitiga segiempat yang diperoleh dari semua artikel.

INTRODUCTION

The rapid development of science and technology provides its own challenges for the Indonesian people to be able to compete in the 21st century (Atiyah & Priatna, 2023). Mathematics is a basic knowledge that is studied at every level of education. This shows that mathematics is an important field of study (Pertiwi et al., 2022). Effective mathematics learning requires not only an understanding of mathematical concepts, but also their connection to the local cultural context. Mathematics and culture are two aspects of life that

cannot be separated from each other. Culture emerges in society as a result of the distinctive ways in which humans adapt to their environment (Supiyati, Hanum & Jailani, 2019). In mathematics education, providing meaningful and engaging contexts for learning is essential in promoting deep understanding and application of mathematical concepts (Wahyudi et al., 2021). In learning mathematics, children still have difficulty understanding abstract knowledge, therefore, they need strategies to translate these ideas into a more concrete form so that they can be used in everyday life (Brandt & Chernoff, 2015).

Ethnomathematics, a culture-based approach to mathematics education, has been shown to improve students' math skills and motivation (Sunandar, 2017). The field of ethnomathematics, which explores the relationship between mathematics and culture, can also enhance the effectiveness of mathematics education in multicultural classrooms (W. Wahyudin, 2018). One way to achieve this is through the use of mathematical modeling, which can help students understand algebraic concepts (Santri et al., 2018).

Ethnomathematics also plays an important role in preserving local cultural wisdom and identity (Chrissanti, 2019). The integration of ethnomathematics into the school mathematics curriculum is seen as a way to bridge the gap between formal mathematics and everyday mathematical practice (Abi, 2017). The application of ethnomathematics in culturally rich batik motifs is evident in the production process, which involves the use of wax to create intricate patterns (Clarice, 2018). These aspects of batik production and appreciation demonstrate the integration of cultural values and mathematical principles, making it a prime example of ethnomathematics in practice. Batik motifs are culturally rich and have significant meanings, by incorporating batik motifs into mathematics learning, students can develop an appreciation of local art and culture, as well as provide opportunities to explore mathematical concepts such as symmetry, patterns and transformations. (Noerhasmalina & Khasanah, 2023). Ethnomathematics as a mathematics learning approach aims to create meaningful learning (Sharma & Orey, 2017), However, it has the potential to create a different learning atmosphere in each region and allows for social disparities due to cultural differences. The purpose of this research is to find out whether the systematic literature review (SLR) study on ethnomathematics of batik motifs can be used as a mathematics learning approach and implemented in schools. Specifically, the current review contains the following five (5) research questions

1. Are the research results used for Mathematics learning?
2. What batik motifs have been studied?
3. What topics are integrated in the research?
4. Who are the subjects in the ethnomathematics research?

METHODS

A systematic literature review, also known as SLR, is a method for conducting research. A systematic literature review (SLR) is a type of literature review that identifies, evaluates, and interprets all available data on a research question and to answer a pre-proposed research question (Iskandar et al., 2022). By using "Publish or Perish", researchers can collect database articles that match the topic or PICOC that has been determined, namely

Ethnomathematics "AND "batik motifs" AND Mathematics learning" from 2013 to 2023. The steps from the results of the search for database articles are then the process of identification, filtering, and eligibility as well as abstraction and data analysis. PICOC topics can be seen in table 1.

Table 1. Topic PICOC

Population	Students, Teachers, Community
Intervention	Ethnomathematics, batik motifs in math learning
Comparison	n/a
Outcomes	Geometry concept understanding, increased learning motivation, academic achievement
Context	Ethnomathematics and batik motifs

CONVIDENCE results from PICOC results obtained PRISMA as below, can be seen in Figure 1.
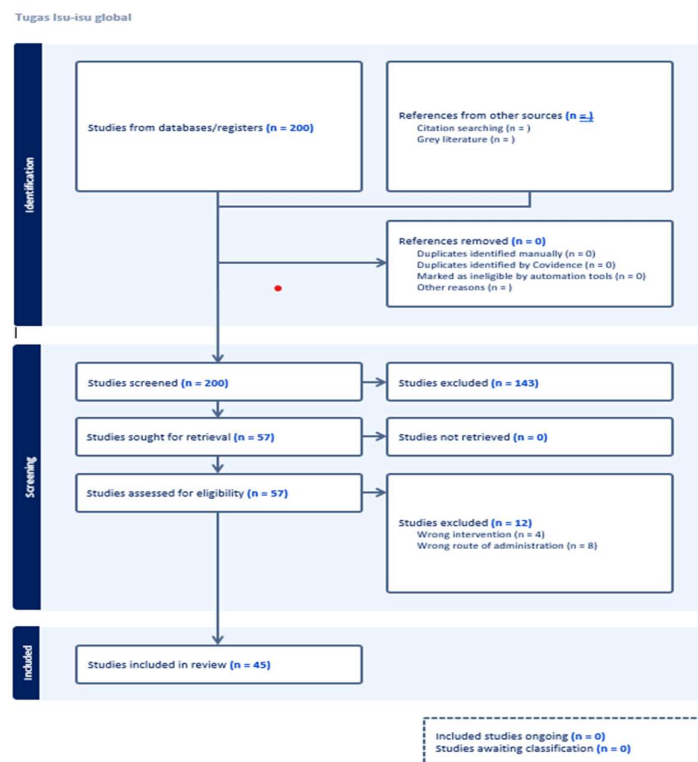

Figure 1. PRISMA Flowchart

From the PRISMA flowchart, we get 20 articles that have been screened from 200 articles that match the topic, then regrouped according to the Sinta article category, and 12 articles are produced. Then the 12 articles were analysed and categorized based on criteria in table 2.

Tabel 2. Selection Criteria (Inclusion and Exclusion)

Inclusion	1. The articles used only discuss ethnomathematics and batik motifs. 2. Only journal studies will be included 3. Articles published in 2013-2023 4. Articles written in English
Exclusion	1. Articles that are not Articles that are used only discuss ethnomathematics and batik motifs 2. In addition to journal studies 3. Articles published outside 2013-2023 4. Articles that are not written in English

Based on table 2 obtained 12 articles from journals on the google scholar database. list of journals obtained in table 3

Table 3. Article that Matches the Topic

No	Journal Name	Sinta	Number of Publication	Impact	HS-Index	Citation
1	Jurnal Pembelajaran matematika dan Sains	5	3	3	5	89
2	International Jornal of Trends in Mathematics Educations Reseach	3	4	0.80	16	947
3	Jornal of Honai Math	2	4	2,27	12	256
4	Jurnal Didaktik Matematika	2	3	2,38	29	3,278
5	JRAMaTHEdu	2	4	6,06	25	1,783
6	Jurnal Math Educator Nusantara	3	4	2,9	18	1,675
7	Journal of Primary Education	3	6	0	9	536
8	Journal of Educations Reseach	4	6	1,75	15	1,052
9	Journal on Mathematics educations	1	7	6,17	52	10,296
10	International Journal on Emerging Mathematics Education	3	3	0	20	1,11
11	Kalamatika: Jurnal Pendidikan Matematika	3	3	1,33	22	1,821
12	Journal of Reseach	2	6	6,06	25	1,783

RESULTS AND DISCUSSION

In particular, the review of the observations of the current articles contains four research questions. The research questions (Research Questions) are as follows:

RQ 1. Are the research results used for Mathematics learning?

RQ 2. What batik motifs have been studied?

RQ 3. What topics are integrated in the research?

RQ 4. Who are the subjects in the ethnomathematics research?

The articles that will be made into research will be analyzed according to research quations, can be seen in table 4:

Table 4. Article Analysis

Author(s)/Year(s)	RQ1	RQ2	RQ3	RQ4
Maryati, Rully Charitas Indra Prahmana/2021	Yes	Motif anyaman bambu	Transformations geometry learning trajectory	SMP
Yohanis Ndapa Deda , Stanislaus Amsikan/2019	Yes	Motif Kain Tenun masyarakat Kefamenanu, yaitu motif Buna, motif Futus, motif Sotis, dan motif Mapauf	Geometry such as reflection, rotation, translation, triangles and square	SD and SMP
Naufal Ishartono, Dewi Ayu Ningtyas/2021	No	Batik Sidoluhur Solo	geometry concepts	Interview to batik craftsmen
Vyvy Hindun Permatasari , Meyta Dwi Kurniasih/2021	Yes	Pola Tumpal Batik Betawi	plane geometry (triangles and rectangles)	SMP Muhammadiyah 4 Jakarta
Astuti, Zulfah, Erisya Hermira, Mira Elviana, Putri Ernalira, Yola Malinda/2023	No	Busana Ninik Mamak (Kabupaten Kampar)	Concepts of geometry and geometric transformations	Interview, observation and documentation
Devi Purwanti, Zaenuri2 & Mohammad Asikin/2021	Yes	Motif batik Selotigo	Material on the perimeter and area of flat shapes (square, rectangle, and triangle)	SD Negeri Sidorejo
Mei Lestari, Wanti Rahayu, Ari Irawan/2022	Yes	Motif Batik Jawa (Provinsi Jawa Barat, Jawa Tengah, Jawa Timur)	Geometry material (Android-based ethnobatic application)	SD
Ariesta Kartika Sari, Mega Teguh	No	Rumah tradisional tanean lanjang di Madura	Geometric concept	Study literatur

Author(s)/Year(s)	RQ1	RQ2	RQ3	RQ4
Budiarto, Rooselyna Ekawati/2022			2-dimensional shapes (i.e. rectangle, trapezoid, triangle)	
Adinda Indah Permita, Tien-Trung Nguyen, Rully Charitas Indra Prahmana/2022	No	Motif batik Gringsing (Pulau Jawa)	Geometric transformation	Interview, observation, and literature study
Sudrajat, Andi Winarto, Bintang Wicaksono/2023	Yes	Batik Kalimantan. Motif batik Tidayu (Kalimantan Barat), motif batik bintik (Kalimantan Tengah), motif batik Empiek (Kalimantan Timur), motif batik motif mendung (Kalimantan Barat), motif batik Sasirangan Hiris Pudak (Kalimantan Selatan), motif batik Pating Muang motif batik Pating Muang (Kalimantan Tengah)	Geometry (rectangles, circles, triangles, points, lines, minimum and maximum curves, reflections, translations, and fractions)	SD
Dwi Warli, Suryani Musa/2022	No	Motif batik Bomba kota Palu	Straight line, curved line, parallel line, point, angle, rectangle, triangle, circle, jajargenjang and the concept of congruence	Interview, observation, documentation, and library data collection

a. Research Question 1 (RQ1)

The first research question relates to the results of research used for mathematics learning (Yes or No). In the articles obtained, there are two types of ethnomathematics research with batik motifs, the first type only looks at the context of batik ethnomathematics which connects mathematics with local culture not until it is applied to students, it can be seen in the source of the articles obtained (Ishartono & Ningtyas, 2021; Permita et al., 2022; Prahmana & D'Ambrosio, 2020; Sari et al., 2022; WARLI & Musa, 2022; Zulfah et al., 2023) and the second type of batik ethnomathematics context applied to students in learning, can be seen in the source of the article obtained (Deda & Amsikan, 2019; Devi Purwanti et al., 2021; Hindun Permatasari & Dwi Kurniasih, 2021; Lestari et al., 2022; Sudrajat et al., 2023; Maryati & Prahmana, 2021). The results of the research analysis used for learning Mathematics can be seen in Figure 1.
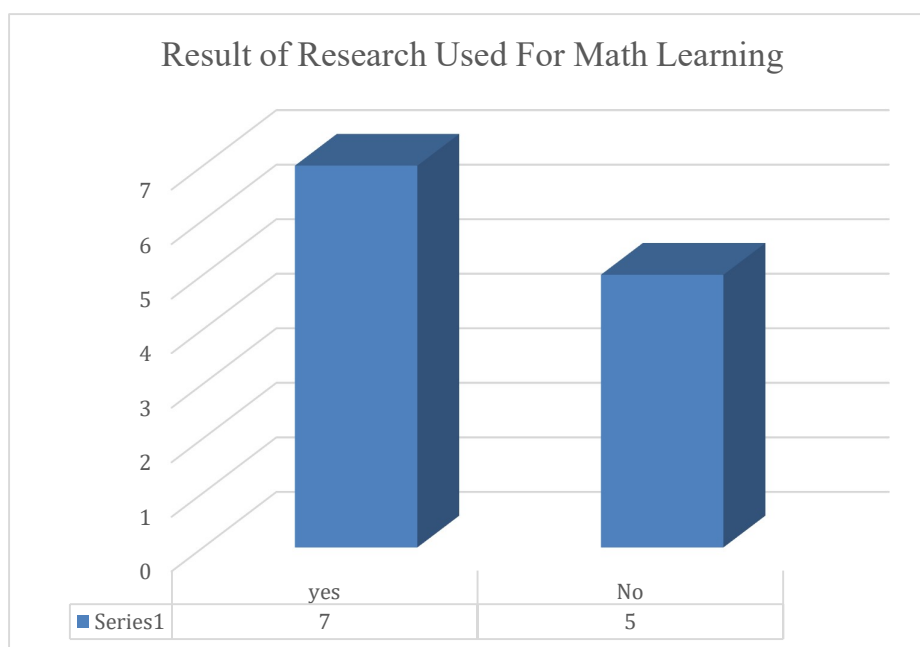
Figure 1. Research results used for Math learning

b. Research Question 2 (RQ2)

The second research question relates to what batik motifs are studied in the articles that have been analyzed in the research obtained. In RQ2, Javanese and non-Javanese batik motifs can be grouped. Articles that discuss the ethnomathematics of Javanese batik according to (Prahmana & D'Ambrosio, 2020) Research Yogyakarta Batik Pattern (motif Babon Angrem, Parang Barong, Parang Klitik, Sidomukti, Semen Bondhat, Sidoluhur, Soblog, dan Sidowirasat), (Maryati & Prahmana, 2021) researching bamboo weaving motifs, (Ishartono & Ningtyas, 2021) discusses Batik Sidoluhur Solo, (Permita et al., 2022) discussing Gringsing batik motifs (Pulau Jawa), (Devi Purwanti et al., 2021) discuss Selotigo batik motifs, (Lestari et al., 2022) discuss Javanese Batik Motifs (Provinsi Jawa Barat, Jawa Tengah, Jawa Timur). Meanwhile, articles that discuss the ethnomathematics of batik outside the Java region according to (Hindun Permatasari & Dwi Kurniasih, 2021) discussing Betawi Batik Thatch Pattern, (Deda & Amsikan, 2019) discusses the Kefamenanu community woven fabric motifs, namely the Buna motif, Futus motif, Sotis motif, and Mapauf motif, (Zulfah et al., 2023) discussing Ninik Mamak Fashion (Kabupaten Kampar), (WARLI & Musa, 2022) discussing Bomba batik motif of Palu city, (Sari et al., 2022) discussing the traditional tanean lanjang house in Madura. From the above analysis, it can be seen what batik motifs have been used as research and their location and can be seen in Figure 2.
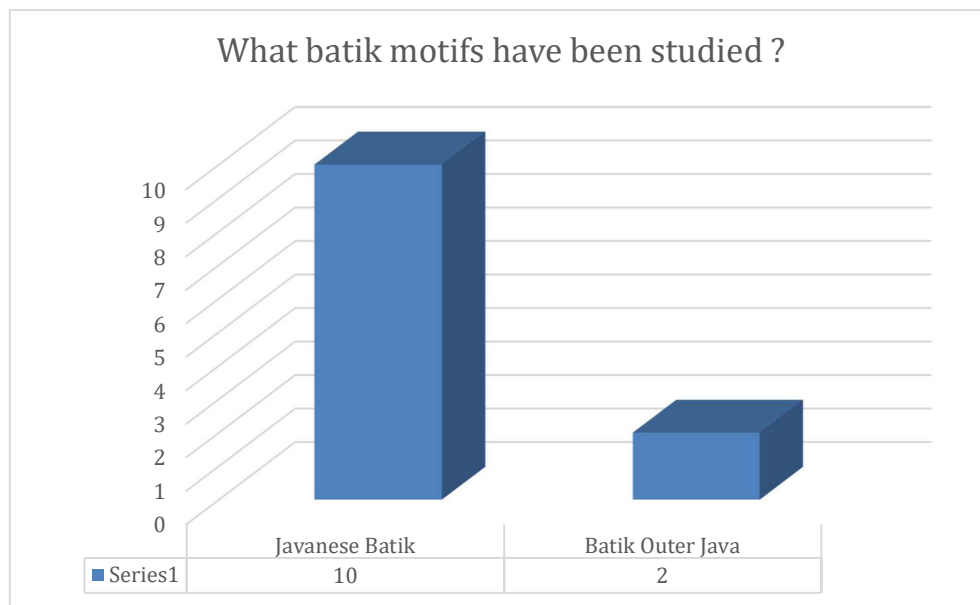
Figure 2. Batik Motif

c. Research Question 3 (RQ3)

The third research question is about what topics are integrated in the research. Judging from the results of the analysis in table 2 above, there are 12 articles that integrate batik ethnomathematics in quadrilateral triangles and geometry transformations such as straight lines, curved lines, parallel lines, points, angles, rectangles, triangles, circles, parallelogram, trapezoids and the concept of congruence, can be seen in Figure 3.
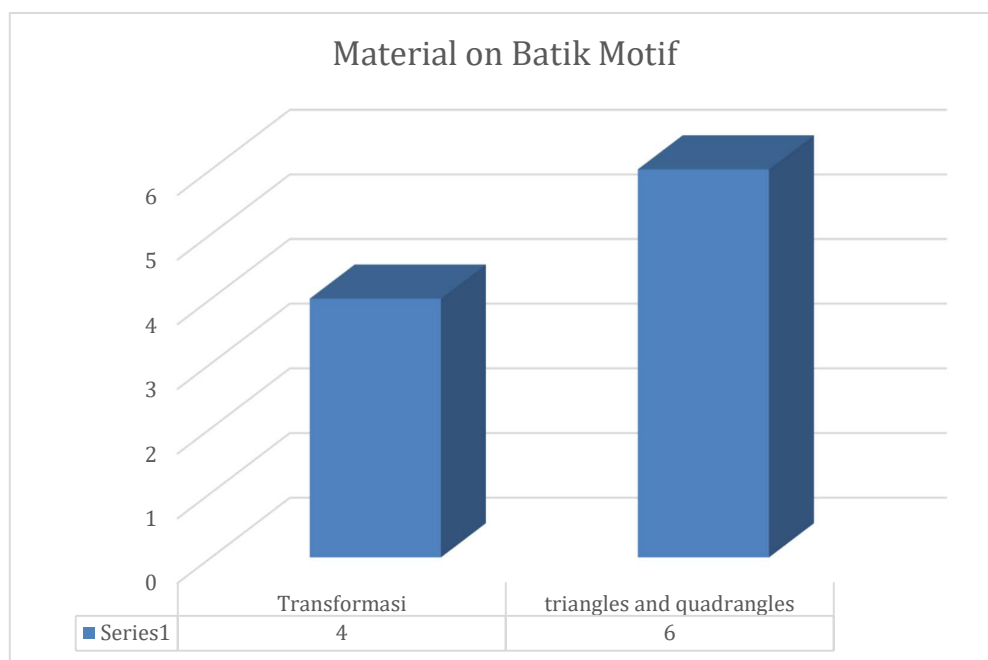

Figure 3. Materials on batik motifs

It can be seen in Figure 1 that the material articles on batik motifs obtained are 6 articles discussing transformation material and 6 articles as many as triangles and quadrilaterals.

d. Research Question 4 (RQ4)

The fourth research question concerns who is the subject of ethnomathematics research can be seen in Figure 4.
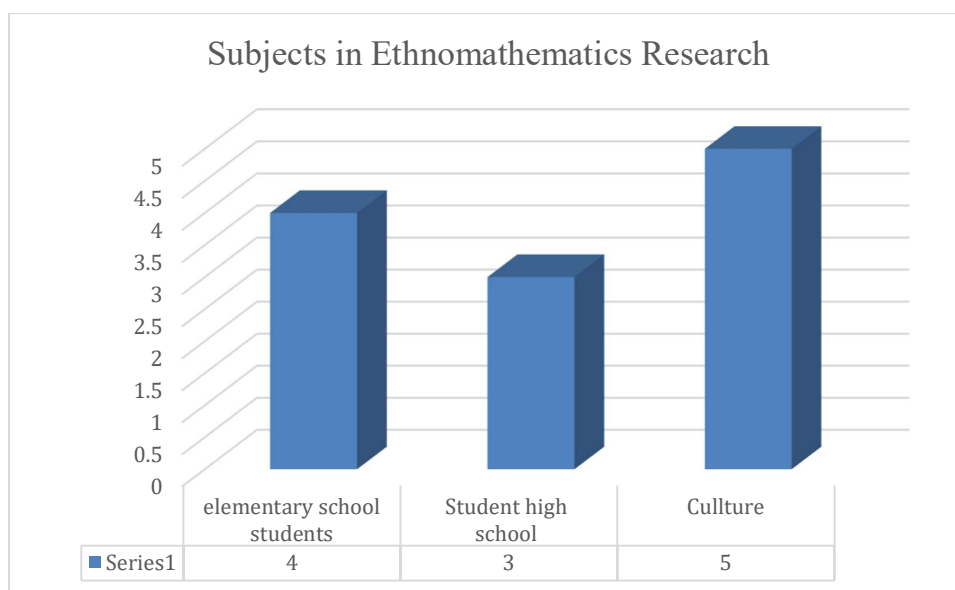

Figure 4. Subjects in Ethnomathematics Research

From figure 4, it can be concluded that there are two types of research subjects carried out, the first is to study batik ethnomathematics and find mathematical concepts contained in batik motifs and mathematical problems directly implemented in schools, in this case elementary and junior high school students, while the second is to study batik ethnomathematics and conduct interviews, observations, documentation and literature studies to find mathematical concepts contained in batik motifs.

CONCLUSIONS

From the questions raised from the research topic, it can be concluded that the literature review on ethnomathematics from various batik motifs is only examined to examine it as a culture in Indonesia and find the concept of geometry (geometry transformation) from batik motifs and there is implemented in mathematics learning in schools. Therefore, ethnomathematics can be used as a recommendation for learning mathematics in schools using cultural examples that are inclusive for all students who come from various cultural backgrounds and their own environment.

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