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LEARNING GEOMETRY TRANSFORMATIONS USING BATIK MOTIFS: SYSTEMATIC LITERATURE REVIEW

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ABSTRAK

Artikel ini bertujuan untuk mendeskripsikan hasil penelitian tentang pembelajaran transformasi geometri menggunakan motif batik yang dapat dijadikan bahan ajar bagi peserta didik. Metode penelitian yang dipilih dalam penelitian ini adalah metode SLR (*Systematic Literature review*) menggunakan protokol PRISMA. Proses seleksi yang dilakukan mengacu pada empat tahap dalam PRISMA yakni *identification*, *screening eligibility*, dan *included*. Pengumpulan data dilakukan dengan mendokumentasikan dan mereview semua artikel terkait transformasi geometri menggunakan motif batik. Artikel yang digunakan sebanyak 7 artikel. Hasil penelitian menunjukkan bahwa pembelajaran transformasi geometri menggunakan motif batik bisa digunakan dalam proses pembelajaran dan memberikan dampak positif bagi peserta didik.

Kata Kunci: Transformasi Geometri, Motif Batik, *Sistematic Literatur Review*, Kompetensi

ABSTRACT

This article describes the results of research on learning geometric transformations using batik motifs as teaching material for students. The research method chosen was the Systematic Literature Review (SLR) method, using the PRISMA protocol. The selection process followed the four stages of PRISMA: identification, screening, eligibility, and inclusion. The study involved documenting and reviewing seven articles related to geometric transformations using batik motifs. The findings indicate that the use of batik motifs in teaching geometric transformations can positively impact students' learning.

Keywords: Geometric Transformation, Batik Motifs, Systematic Literature Review, Competence

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I. INTRODUCTION

Knowledge of geometric transformations is highly beneficial for students in developing spatial and geometric reasoning abilities, as well as strengthening their mathematical proofs (Edward, 1997). These abilities can enable students to explore abstract mathematical concepts related to congruence, symmetry, similarity, and parallel lines. They can enrich students' experience of geometric thinking and imagination and improve their spatial abilities (Patterson, 1973). Students must truly master the concept of transformation geometry. Students must truly master the concept of transformation geometry. However, this concept is still difficult for them to understand.

This material on transformation geometry is still considered difficult for students (Maulani & Setiawan, 2021). According to Sudarja et al.'s (2018) research, students faced challenges in connecting geometric transformations to mathematical concepts when expressing their ideas in writing or drawing. Further research has shown that students often struggle to comprehend the various concepts and transformations, such as translation, reflection, rotation, and combinations thereof (Clements & Burns, 2000:42; Olson, Zenigami & Okazaki, 2008:25; Rollick, 2009:397). In general, students often make mistakes when working on questions about geometric transformations due to a lack of mastery of the underlying concepts (Maulani & Zanthly, 2020). Therefore, there is a need for solutions to enhance the quality of mathematics education in the area of geometric transformations.

Mathematics learning can be more meaningful when the learning process involves real-world problems or contexts (Wijaya, 2012). In mathematics learning, the use of context can enhance the meaning of mathematical concepts. Context can aid students in comprehending the abstract representation of mathematical concepts. According to Zulkardi and Putri (2006), context can be defined as a situation or natural phenomenon/event that is related to the mathematical concept being studied. Therefore, the use of context in mathematics learning is crucial and can serve as a starting point for creating meaningful learning.

This literature review will use batik design as a starting point for learning geometric transformations. The choice of this context is based on its potential to foster students' creativity and problem-solving skills. By using batik design as a context, it is hoped that participants will be more enthusiastic about learning and find it easier to understand and apply the concept of geometric transformation to everyday problems. The creation of batik motifs often involves mathematical concepts, which may not be immediately apparent to artists who focus solely on aesthetics. However, upon closer examination, many batik motifs can be seen to incorporate mathematical principles (Yolanda & Putra, 2022).

Research on learning geometric transformations using batik as a context has shown that it can be effective, as demonstrated by studies conducted by Risdiyanti & Prahmana (2018), Novrika,

Putri & Hartono (2016), Lestariningsih (2017), Maskar & Anderha (2019), Hidayati & Sugeng (2021), and others. However, further research is needed to investigate the impact of using batik design as a context for learning geometric transformations on students' creative abilities. Previous research on the Systematic Literature Review (SLR) related to ethnomathematics exploration of batik motifs by Yolanda and Putra (2022) found that such exploration had a positive effect on students' learning effectiveness, motivation, self-confidence, and ability to understand concepts. It is evident that incorporating batik motifs in education has a positive impact. However, there has been no discussion on enhancing students' creative abilities, despite the current need for teachers to design learning experiences that can nurture students' talents and creativity. This will enable them to create works or products that can aid them in their lives and even alleviate the burden on their families (Agusta, 2021). This aligns with the 21st century learning competencies, particularly life skills, with the highest level of competency being in the area of creation.

The researcher aims to conduct a systematic review using the Systematic Literature Review (SLR) method to examine the literature on learning geometric transformations in a batik context and its impact on students' creativity skills. The researcher aims to conduct a systematic review using the Systematic Literature Review (SLR) method to examine the literature on learning geometric transformations in a batik context and its impact on students' creativity skills. The review will consider student activities, batik contexts, and study criteria published in the last five years (2019-2023). The research formulation includes:

1. How can the results of research on learning geometric transformations through batik design be described?
2. Describe the batik motifs used in research and their philosophies.
3. What is the description of the batik motif used in the concept of geometric transformation?
4. How would you describe the impact of learning geometric transformations in the context of batik design?

II. METHOD

A. *Systematic Literature Review*

A quantitative descriptive approach was used to conduct a Systematic Literature Review (SLR) to justify the study of students' creative thinking abilities after studying geometric transformations in the context of designing batik. The research process involved data collection, analysis, and conclusion drawing (Juandi & Tamur, 2020). During the data collection stage, researchers trace and gather primary research data from national and international articles. The researchers use electronic databases such as Google Scholar and Scopus, utilizing the Publish or Perish application. Subsequently, relevant articles that meet the inclusion criteria are extracted and analyzed.

B. Inclusion Criteria

The inclusion criteria used include: (1) Articles reporting research results in mathematics education, (2) Articles analyzing the use of geometric transformation content using batik motifs on creativity skills, (3) Articles published between 2019 and 2023, and (4) Articles that include research material. The inclusion criteria for this systematic literature study are as follows: Any articles that do not meet these inclusion criteria will be excluded. In addition, a search of the reference lists for articles that met the inclusion criteria was conducted to identify any other relevant studies related to the research.

C. Research Instrument

This systematic literature review (SLR) utilises a research tool known as a protocol to establish inclusion and exclusion criteria based on the year of study, title selection, abstract, and relevant keywords aligned with the research objectives. The protocol assists in ensuring that the selected studies adhere to the established criteria, thereby enhancing the accuracy and relevance of the research findings. By using the PRISMA protocol, researchers can minimise bias in study selection and ensure that the data obtained can be optimally used to answer research questions. The selection process follows the four stages of PRISMA, namely identification, screening, eligibility, and inclusion (Liberati et al., 2009).

D. Study Selection Process and Data Analysis

During the identification stage, researchers conducted a literature search using the keywords 'Geometry Transformation', 'Batik', 'Creative Thinking', 'Motif', and 'Transformation' on the Google Scholar and Scopus databases through Publish or Perish. A total of 189 primary studies were found. During screening, 76 articles were excluded as they were quotations, books, or theses and could not be accessed. During the eligibility stage, researchers reviewed the titles, abstracts, and keywords of primary studies relevant to the research topic. 58 articles were excluded as they did not meet the inclusion criteria, such as the absence of discussions on geometric transformation, batik, and creative thinking. Subsequently, during the inclusion stage, the researchers thoroughly examined the contents of the articles based on the research criteria. Out of the initial pool of 48 articles, only 7 met the research criteria and were selected for further assessment and discussion. Please refer to the PRISMA diagram below for details:

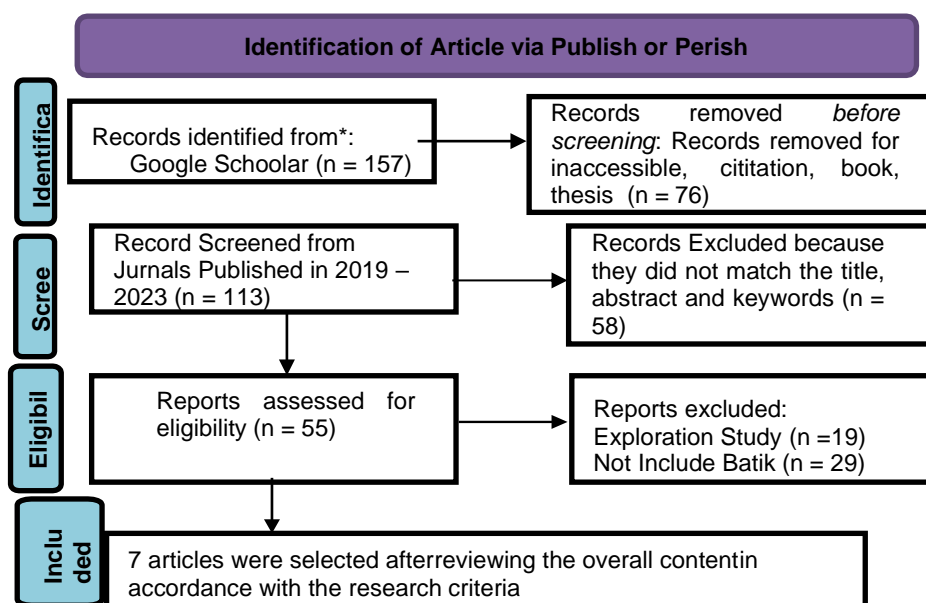


Figure 1. Shows the PRISMA Diagram for Learning Geometry Transformations using Batik Context

III. RESULTS AND DISCUSSION

Table 1 presents 7 articles documenting data on geometric transformations in a batik context.

Tabel 1. Motif Batik yang digunakan dalam Pembelajaran beserta Filosofinya

No	Researcher	Journal	Research Results
1	Lydiati (2020)	Jurnal Ideguru	The use of batik motif media to assist in the REACT strategy for learning geometric transformations can enhance mathematical connections.
2	Buchori & Harun (2020)	Lebesgue : Jurnal Ilmiah Pendidikan Matematika, Matematika dan Statistika	The e-module on Geometry Transformation, based on Culturally Responsive Teaching (CRT), is designed to help students understand the concept of geometric transformation through the use of cultural context. Specifically, it utilises the Kawung batik motif. The validation results by media experts indicate that the material is suitable for use.
3	Maskar & Ratu (2019)	Mathema Journal	The approach of learning geometric transformations using the Lampung filter cloth motif can facilitate inductive presentation of material, stimulate students' creativity and scientific thinking, foster open-mindedness, and enhance students' understanding of their culture.
4	Hidayati & Sugeng (2021)	Jurnal Primatika	The use of geometric transformations in batik design helps students develop critical and creative problem-solving skills to achieve the desired batik pattern. Lia Mado's batik design has been successfully translated into batik cloth, incorporating Geometry Transformation concepts. The utilization of the Desmos application to visualize Lia Mado's batik designs supports digital literacy in mathematics.
5	Hartindya, Sunardi & Yuliati (2022)	Aksioma	The RME Ethnomathematics-oriented learning tools developed for Nusantara Batik have been deemed valid, practical, and effective, and have significantly improved students' higher-level thinking abilities.

6	Agusta (2021)	Jurnal Lingkar Mutu Pendidikan	Using the context of batik motifs for ethnomathematics learning can enhance students' engagement and foster their creativity in learning geometry.
7	Faiziyah, dkk (2020)	Universal Journal of Educational Research	Indonesian batik motifs can be used to teach geometry of transformation due to the presence of transformation concepts in the design activity. The use of ethnomathematics-based student worksheets can enhance thinking fluency, flexibility, elaboration, and originality, which are aspects measured in creativity.

Based on the search results, seven literature studies were obtained that met the inclusion and exclusion criteria after reading the title, abstract, keywords, and full content. The results indicate that one article was published in 2019, three articles were published in 2020, two articles were published in 2021, and one article was published in 2022.

The use of Batik motifs in learning geometric transformations.

Based on the analysis of seven selected articles, researchers have concluded that batik motifs can be effectively utilised in teaching geometric transformations. The findings are presented in Table 2.

Table 2. Batik Motifs Used in Learning and Their Philosophy

No	Researcher and Year	Batik Motifs Used	Philosophy of Batik Motifs
1	Lydiati (2020)	The Parang, Ceplok, and Slope motifs all feature geometric designs.	The article discusses the Yogyakarta geometric batik motifs and their cultural significance. However, it does not provide a clear explanation of the underlying philosophy.
2	Buchori & Harun (2020)	Kawung Batik Motif	Not explained
3	Maskar & Ratu (2019)	Lampung Tapis Cloth Motif	Not explained
4	Hidayati & Sugeng (2021)	Lia Mado Batik Motif	Not explained
5	Hartindya, Sunardi & Yuliati (2022)	Archipelago Batik Motifs	Not explained
6	Agusta (2021)	Ondel-Ondel and Tanjidor Batik Motifs, Shoot Shoot Motifs	Not explained
7	Faiziyah, dkk (2020)	Slobog Batik Motif	Not explained

Concept of Geometric Transformation in Batik Motifs

The study of 7 articles revealed the existence of a geometric transformation concept in batik motifs. Table 3 presents the application of this concept to batik motifs.

Table 3. Concept of Geometric Transformation in Batik Motifs

No	Researcher and Year	Batik Motifs Used	Philosophy of Batik Motifs
1	Maskar & Ratu (2019)	Lampung Tapis Cloth Motif	Reflection, Rotation
2	Hidayati & Sugeng (2021)	Lia Mado Batik Motif	Translation, Reflection and Rotation

3	Agusta (2021)	Ondel-Ondel and Tanjidor Batik	Translation, Reflektion, Rotation, and Dilatation
4	Faiziyah, dkk (2020)	Slobog Batik Motif	Rotation

The Impact of Using Batik Motifs in Mathematics Learning

Based on the seven selected articles, it is evident that the application of batik motifs in mathematics learning has a positive impact on students. Table 4 presents the results of the analysis of this positive impact.

Table 4. The Positive Impact of Using Batik Motifs in Mathematics Learning

No	Researcher and Year	Positive impact
1	Lydiati (2020)	Improving Mathematical Connections
2	Maskar & Ratu (2019)	Material can be delivered inductively, which can stimulate students' creativity and scientific thinking, foster open thinking, and help students gain a better understanding of their culture.
3	Hidayati & Sugeng (2021)	This text appears to already meet the desired characteristics. No changes have been made
4	Hartindya, Sunardi & Yuliati (2022)	Significantly influences the higher-order thinking skills of students
5	Agusta (2021)	Enhancing Student Activity and Creativity
6	Faiziyah, dkk (2020)	Enhancing Creative Thinking Skills

Mathematics learning can be enhanced by incorporating batik motif art culture, particularly as an initial step in the learning process. This is because linking mathematical concepts with students' lives makes learning more meaningful. By incorporating batik motif art culture into mathematics learning, students can gain a deeper understanding of the subject matter. Batik is a significant part of Indonesia's cultural heritage and is a defining characteristic of Indonesian culture. The complexity of its motifs and the philosophical value of the decorative patterns depicted in the canting review are noteworthy features. According to Kustiyah (2017), batik is the art of drawing on cloth for clothing. This art involves not only drawing but also imbuing the motifs with philosophical meaning.

Several studies have shown that using batik motifs as a learning medium can enhance students' communication skills, aid in interpreting concepts, and facilitate the introduction and connection of local wisdom with mathematics (Lubis & Yanti, 2018). Additionally, it has been found to improve students' perseverance (Dewi et al., [year]). In 2020, Farida et al. found that batik motifs can be used to develop students' spatial abilities. Additionally, Afifah et al. (2020) discovered that batik motifs can be used to develop students' mathematical abilities and communication skills. Zahroh (2020) found that batik motifs can influence students' interests, while Subekhi & Oktavia (2021) found that batik motifs can improve students' mathematical abilities. On average, research suggests that batik motifs are suitable for use as a learning medium in theory, but empirical evidence is still needed to support this claim.

Batik motifs predominantly employ geometric concepts, particularly geometric transformation. This demonstrates that creating batik requires mathematical proficiency. Literature studies indicate the need for more rigorous learning activities to enhance students' creative abilities and foster their capacity for creation. This passage aligns with the 21st-century skills, where the highest skill is creativity. Batik holds economic value and can support industry managers, craftsmen, and traders. An effective design process can expedite the batik cloth production process, enabling producers to meet market targets (Wahyuni et al., 2019).

IV. CONCLUSION

It can be concluded that batik motifs are a useful tool for learning geometric transformations. Using batik motifs has a positive impact on improving mathematical connection skills, stimulating creativity and scientific thinking, fostering open thinking, and supporting critical thinking and creativity processes. Additionally, it helps to improve high-level skills and allows students to gain a better understanding of their culture. This literature review examines the use of batik motifs in transformational learning and its potential to enhance students' creativity skills. The review aims to provide a basis for learning design developers.

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