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ETHNOMATHEMATICS OF KAWUNG SOLO BATIK AS A LEARNING MEDIA FOR STREAM-BASED GEOMETRY TRANSFORMATION

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ABSTRAK

Penelitian ini merupakan penelitian studi kepustakaan yang menggunakan teknik eksploratif dengan pendekatan etnografi. Tujuan penelitian ini adalah untuk mengeksplorasi batik kawung Solo sebagai media pembelajaran transformasi geometri. Bentuk batik yang disebut dengan "batik kawung" adalah berbentuk lingkaran-lingkaran geometris yang menyerupai buah kawung, disebut juga kolang-kaling atau enau. Pesan yang terkandung dalam motif kawung adalah seseorang harus menjadi individu yang unggul, baik, dan suka membantu orang lain. Hasil penelitian menunjukkan bahwa 1) Motif Kawung mempunyai pola berulang secara periodik dalam interval tertentu, 2) Batik Kawung mengandung pola simetris, konsep kongruensi dan kongruensi, 3) Pada motif batik Kawung terdapat unsur transformasi geometri seperti pencerminan, perputaran. dan bergeser. yang nantinya dapat digunakan sebagai media pembelajaran matematika sebagaimana tujuan penelitian ini. Media pembelajaran ini dirancang untuk mengintegrasikan unsur Science, Technology, Reading, Engineering, Arts, and Mathematics (STREAM), sehingga dapat memadukan keterampilan literasi, estetika seni, dan matematika dalam pembelajaran yang lebih komprehensif.
Kata Kunci: etnomatematika, kawung solo, batik solo, transformasi geometri

ABSTRACT

This research is a literature study assessment that uses exploratory techniques with an ethnographic approach. The aim of this research is to explore Solo kawung batik as a learning medium for geometric transformations. The form of batik called "kawung batik" is in the form of geometric circles that resemble kawung fruit, which is also known as kolang-kaling or sugar palm. The message contained in the kawung motif is that a person must be an individual who is superior, good, and helps others. The results of this research show that 1) Kawung motifs have periodic repeating patterns at certain intervals, 2) Kawung batik contains symmetrical patterns, concepts of congruence and congruence, 3) In Kawung batik motifs there are elements of geometric transformation such as mirroring, rotation and shifting. which can later be used as a mathematics learning medium as is the aim of this research. This learning media is designed to integrate elements of Science, Technology, Reading, Engineering, Arts, and Mathematics (STREAM), so that it can combine literacy skills, art aesthetics, and mathematics in more comprehensive learning.
Keywords: ethnomathematics, kawung solo, batik solo, geometric transformation

INTRODUCTION

Mathematics is one of the main subjects taught at all levels of education. This is because mathematics is the mother of other sciences and one of the most important sciences. However, mathematics is still considered by some students. All of this is because mathematics is still taught theoretically, formally and lack of using learning media that facilitate students' understanding. Therefore, one solution to the problems in mathematics learning is the role of educators to create a comfortable classroom atmosphere so that the mathematics learning process is more optimal (Syahdan, 2021).

Educators can conceptualize or relate mathematics to various other relevant fields. For example, the relationship between mathematics and local culture. According to Hardianti, from culture, mathematics can be explored and born and can be used as a source of contextual mathematics teaching that exists in the environment around students. This further proves that there is a relationship between mathematics and culture (Syahdan, 2021).

Mathematics is considered as the basis of most educational processes, where mathematics is considered as a source of thinking concepts that can help in solving everyday problems. Mathematics is also considered as part of human culture, and learning mathematics makes mathematics belong to everyone. Even mathematics is considered as a result of human culture (Dhiki & Bantas, 2021).

Culture is a routine that contains important and fundamental elements of value that are passed down from generation to generation. The habits that are carried out are inseparable from mathematical values, so that they produce unique and varied results. This can be seen from the forms and cultural products that exist, especially in Indonesia, such as art, building forms, wood carvings, jewelry, and so on. Without us realizing it, mathematical concepts actually exist in local culture or what is commonly called ethnomathematics (Syahdan, 2021).

Community understanding of ethnomathematics as a learning method that enriches local traditions and cultures is still lacking. Many traditional values contained in local wisdom have not yet been fully instilled in mathematics learning in the context of society. When ethnomathematics is used in mathematics learning in schools and community environments, this can lead to a lack of appreciation for this cultural heritage and can even threaten its sustainability (Sufia et al., 2023).

Contemporary acculturation from Western countries is brought about by globalization. The existence of traditional art is starting to decline as a result of the abundance of modern art. Some of the younger generation think that something traditional, such as traditional art, is old-fashioned and not in accordance with current conditions. As a result, they begin to forget traditional art and find modern art more suitable and interesting for them. As globalization develops, the sense of nationalism and love for traditional art is decreasing, and pride in one's own culture and nation can disappear over time (Nurhasanah et al., 2021). The importance of combining mathematics and culture, especially emphasizing the love for national products that have become the identity of the nation, so that it can be used as an example of the application of mathematics in everyday life so that it will not fade or disappear. One of the cultures in Indonesia is batik. Batik is a result of a combination of art and technology (Christanti et al., 2020).

Batik in Indonesia is considered to have a wealth of symbols and philosophies of life for the Indonesian people. However, Batik is rich in national culture and philosophy. Solo Batik is one of the cultural products of Surakarta. Therefore, it is necessary to conduct research on the mathematical concepts contained in Solo batik. The artwork of Solo batik motifs is expected to be used as a learning medium that is a source of learning to increase students' insight and motivation to learn. (Faiziyah et al., 2021).

The Solo community has used mathematics in their survival, especially in determining the combination and position of colors, planes, lines and dots, and textures so as to create a complete and harmonious beauty in the batik. paintings that are their hallmark. These things are interesting to explore the mathematical concepts contained in the Solo Batik motif in relation to transformation geometry (Faiziyah et al., 2021).

Transformation Geometry is one of the challenging mathematics materials. This was stated by Prabandari that students become tired, bored, and lethargic in the process of learning mathematics, especially in the material of transformation geometry which they think is quite challenging (Hutajulu et al., 2023). This is because abstraction is needed in the process of

working on it so that in the learning process teachers can use learning media that can change the abstract into something more concrete. One of the media that can be used is the kawung batik motif media. Learning media that can change abstract things into something more concrete with learning based on (Science, Technology, Reading, Engineering, Arts and Mathematics) STREAM .

In addition to combining science, technology, and engineering, STREAM-based learning also combines elements of literacy (reading) and arts. The literacy element helps students understand the cultural and philosophical context behind batik motifs, while the arts element helps students understand creativity and aesthetics in the learning process. Students are not only prepared to face real-world problems, but STREAM also helps them understand cultural and aesthetic values using a holistic approach (Setiawaty et al., 2024).

STREAM (Science, Technology, Reading, Engineering, Arts, and Mathematics) is a modern educational approach that combines these essential subjects in a way that emphasizes interdisciplinary learning. Students have an incredible opportunity to apply what they learn in the real world thanks to STREAM. This helps them develop creative, problem-solving, and critical thinking skills, which are all vital skills in a rapidly changing world. Local wisdom has not been fully integrated into classroom learning and its values have not fully fused into a powerful new force in education. The expected results of the impact of education on preserving each local culture are very poor (Setiawaty et al., 2024).

Several studies on batik have been conducted by researchers. Previous research conducted by Rahayu, et al entitled "The Concept of Traditional Javanese Batik Ethnomathematics as a Development of Mathematics Learning Media" , in this study only refers to Javanese batik as a whole (Irawan et al., 2022). In addition, there is also previous research conducted by Purwoko, et al. Entitled "Development of E-modules Based on Ethnomathematics of Adi Purwo Batik Motifs for Junior High School Students" , in this study using Adi Purwo Batik as its learning media (Sintiya et al., 2021). There is also research conducted by Sari entitled "Exploration of Saho Balikpapan Batik on Geometric Transformation Material" , in this study using Saho Batik as its object (Sari, 2023). There is also research conducted by Monalisa, et al entitled "Ethnomathematics Exploration of Sekar Jagad Blambangan Batik as Student Teaching Material" , in this study using Sekar Jagad Batik as its object (Akmalia, 2020). However, from the several studies above, there has been no research that examines the ethnomathematics of Solo Kawung batik as a learning medium for STREAM-based geometric transformation. Based on this explanation, researchers are interested in exploring Solo Kawung Batik as a Learning Medium for STREAM-Based Geometric Transformation.

METHODOLOGY

This study employs an exploratory research design to investigate the elements of geometric transformation found within the Kawung Batik motif. The research adopts an ethnographic approach, which, as described by Spratley, combines empirical and theoretical methods to achieve an in-depth description and analysis of culture through intensive fieldwork (Faiziyah et al., 2021). The primary focus of this research is the geometric transformation concepts inherent in the Kawung Batik motif.

The object of the study is the geometric transformation concepts present in Kawung Batik, while the subject is the Kawung Batik motif itself. The primary research instrument is the researcher (human instrument), who plays a central role as the main data collector. This role cannot be replaced, as the researcher is responsible for

interpreting and analyzing the data. Additionally, the study is supported by secondary instruments, including observation and documentation guidelines.

Observation techniques are employed to identify mathematical forms and concepts embedded in the Kawung Batik motif. Documentation techniques are used to collect visual data, such as images of the batik's geometric patterns. After gathering data, the Kawung Batik motif is analyzed by examining its design elements, identifying geometric transformation patterns, and describing the associated mathematical concepts.

The study utilizes qualitative data, which includes observation and documentation results. The data undergo a systematic processing procedure comprising three stages:

1. Data Reduction
   This involves filtering and organizing the collected data to focus on the elements most relevant to the study objectives.
2. Data Presentation
   The data is then organized into structured formats, such as narratives or visual representations, to facilitate understanding and analysis.
3. Drawing Conclusions
   Finally, the data is interpreted to generate meaningful insights and conclusions regarding the geometric transformation elements in Kawung Batik.

This structured approach ensures a comprehensive exploration of the mathematical concepts within the Kawung Batik motif, contributing to a deeper understanding of its ethnomathematical significance.

RESULT AND DISCUSSION

Kawung Solo Batik Motif

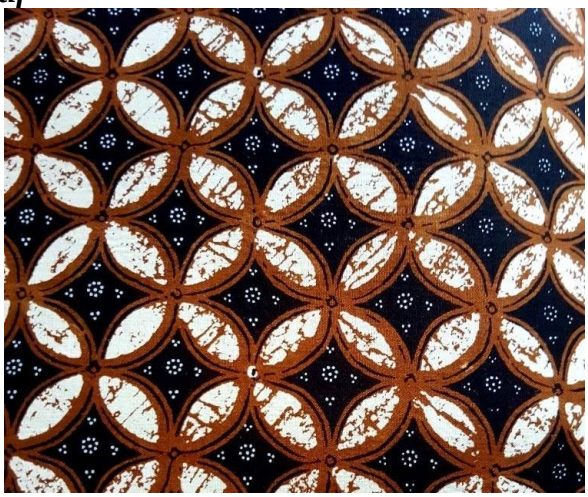

Figure 1. Kawung Batik Motif

Local culture includes kawung batik. The form of batik called "kawung batik" is a geometric circle that resembles kawung fruit, which is also known as kolang-kaling or aren. As a local culture, kawung batik must have a deep philosophy and meaning. This kawung motif is also sometimes depicted as a lotus flower with four blooming crowns. The lotus flower is a symbol of purity and longevity. The language of batik, which includes motifs or patterns, colors, names, and functions, shows the local identity of kawung batik. This kawung batik motif depicts an ideal society. The message contained in this kawung motif is that a person must be a superior, kind individual and help others (Syahdan, 2021). The Kawung batik motif has a circle shape like a Kawung fruit that is neatly and geometrically arranged (Faiziyah et al., 2021).

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The Javanese philosophical teachings about "Sangkan Paraning Dumadi", or the process of a human life, commonly referred to as "sedulur papat lima pancer" or "keblat papat lima pancer", is the philosophical meaning contained in the Kawung motif. The pancer (center) in question is the human being itself. According to the perspective of life or Javanese philosophy, when a baby is born (comes out of the mother's womb), he is accompanied by four siblings, or papat, namely blood, amniotic fluid, ariari or placenta, and umbilical cord. It is believed that these will follow, guard, and protect the baby so that it is born safely (Muhadiyatiningsih & Hikmawati, 2018).

The kawung motif also shows that humans are the pancer (center) of four sources of natural energy: the winds of four directions: east, south, west, and north. East is where the sun rises as the beginning of life in the morning, which is a symbol of the source of energy; South is the direction of the blazing sun, which is associated with the equator or the peak of everything; and west is the direction of sunset, which is the direction of declining luck, but at that time humans have found peace and maturity in their lives. North is the path of death, where humans return to the Creator (Muhadiyatiningsih & Hikmawati, 2018).

Ethnomathematics in the Kawung Solo Batik Motif

The association of Kawung motifs with mathematics is given as follows: a) Periodic Repeating Pattern. Kawung motifs have a periodic repeating pattern, which means the same pattern always occurs at certain intervals. Geometry creates an aesthetic appearance, and the neatly arranged circle pattern follows geometric rules. The circle structure in Kawung shows this periodic repeating pattern; b) Pattern Arrangement. To make Kawung batik, the hand must be skilled at arranging repeating patterns precisely and consistently. This includes the use of mathematical concepts related to pattern arrangement, such as rules for repeating patterns with the right distance and direction; c) Transformation Concept. Kawung motifs are the result of changes in the shape of a circle. This transformation can be rotation, translation, or reflection, which produces complex and regular patterns. This transformation concept is part of mathematics related to learning repeating patterns (Sufia et al., 2023).

All points on the geometric plane are rotated towards a line that is the same distance away is called reflection. The Kawung batik motif is an example of the application of cultural reflection in learning. The Kawung batik motif has a circle shape that is arranged geometrically like a kawung fruit. The kawung batik motif is formed by an ellipse shape that is reflected by vertical and horizontal lines (Faiziyah et al., 2021).

Geometric transformations are widely used in batik. Transformation is a change in the position or size of a shape. Changes that do not change the size or shape of an object are called "rigid transformations", and include shifts or translations, reflections or mirroring, and rotations or rotations (Sari, 2023). The following are geometric transformations found in the Kawung motif:

Rotation

Rotation is a shift from one point to another in a geometric plane by rotating about the center of the point. (Yanti & Haji, 2019). The rotation in the kawung batik motif is done to find out the rotation that occurs in each selected point. The rotation is done in a counterclockwise direction, namely in Figure 2.

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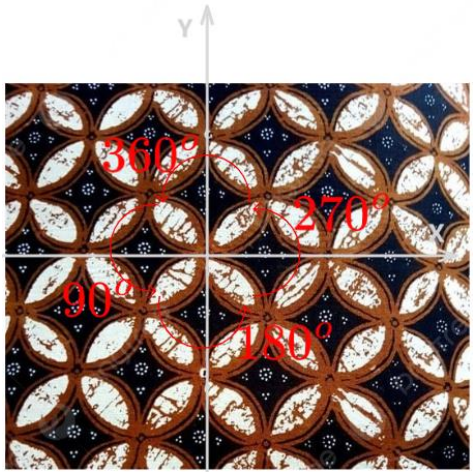

Figure 2. Rotation of the Kawung Motif

The following is an illustration of the counter- clockwise rotation of the kawung motif :

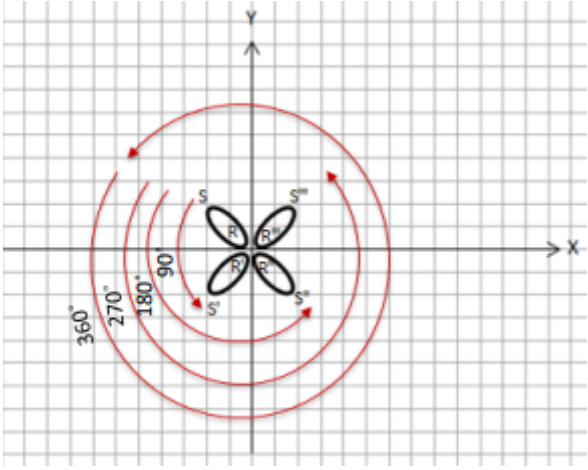

Figure 3. Illustration of Rotation in the Kawung Motif

Measurements were made on the kawung motif illustrated by Figure 3. with the center point (0,0) kawung-1 located at the starting point S (-2,2) and R (0,0) then the compass was rotated to the left until it reached the end point S' (-2,-2) and R' (0,0) after measurements were made using a bow a 90˚ angle was formed with the direction opposite to the clock hand. Kawung-1 which is at the starting point S (-2,2) and R (0,0) then the compass was rotated to the left until it reached the end point S" (2, -2) and R" (0,0) after measurements were made using a bow a 180˚ angle was formed with the direction opposite to the clock hand.

Then kawung-1 which is at the starting point S (-2,2) and R (0,0) then the compass is rotated to the left until it reaches the end point S'" (2,2) and R'" (0,0) after the measurement is carried out using a bow, an angle of 270˚ is formed with the direction opposite to the clock hand. Kawung-1 which is at the starting point S (-2,2) and R (0,0) then the compass is rotated to the left until it reaches the end point S (2, -2) and R (0,0) after the measurement is carried out using a bow, an angle of 360˚ is formed or in other words, it returns to its original place with the direction opposite to the clock hand. The results of the measurements whose direction of rotation is opposite to the clock hand are shown in Table 1. below:

Table 1. Results of Rotation Measurement on Kawung Motif

No.	Starting Point	End Point	Results
1.	S (-2,2) R (0,0)	S' (-2,-2) R' (0,0)	90˚ Rotation
2.	S (-2,2)	S” (2,-2)	180˚ Rotation

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No.	Starting Point	End Point	Results
	R (0,0)	R” (0.0)	
3.	S (-2,2) R (0,0)	S”' (2,2) R”' (0.0)	270˚ Rotation
4.	S (-2,2) R (0,0)	S (-2,2) R (0,0)	360˚ Rotation

Reflection

Reflections have the same shadow size, but they move in opposite directions (Albab et al., 2014). In this kawung batik motif, two points are taken as the main points to find out whether the shadow of the main point is the other point by using the X axis, Y axis, line y = –x, and line y = x as the axis for reflection. The reflection is presented in Figure 4.

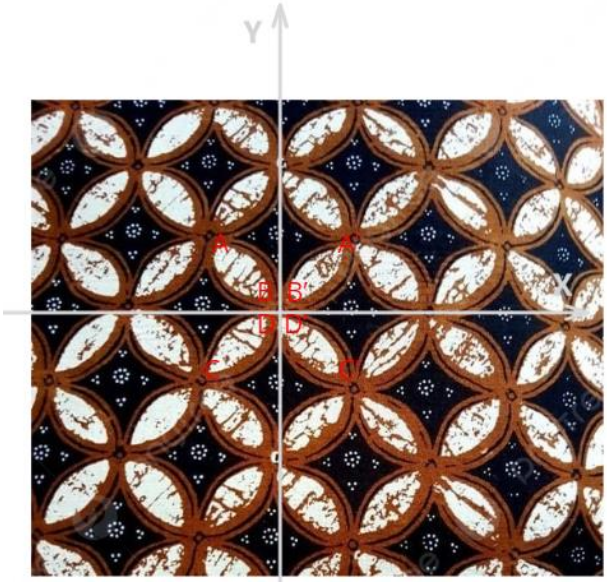

Figure 4. Reflection in the Kawung Motif

The following is an illustration of the reflection on the Y axis in the kawung motif in Figure 5.

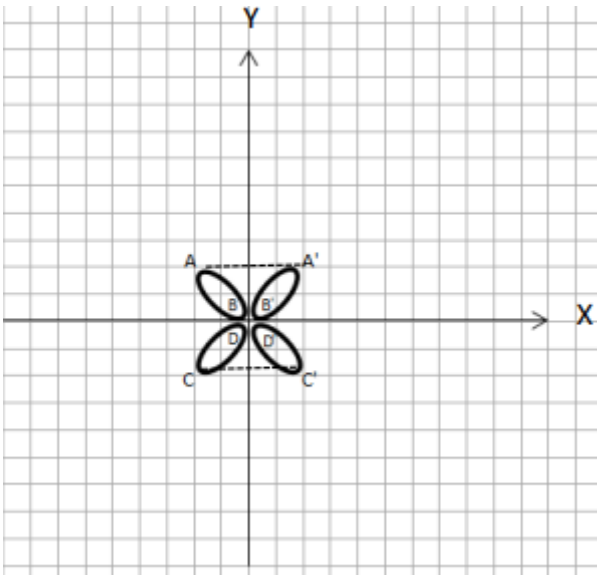

Figure 5. Illustration of Reflection on the Y-Axis

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From the measurements carried out, it shows that in the 1st kawung, the distance from the Y axis to the coordinates of point A (-2,2) is 1.2 cm, and the distance from the Y axis to the coordinates of point A' (2,2) is 1.2 cm. While the coordinates of point B (0,0) coincide with point B' (0,0) which is located at the base point. The distance from the Y axis to the coordinates of point C (-2, -2) is 1.2 cm, and the distance from the Y axis to the coordinates of point C' (2, -2) is 1.2 cm. While the coordinates of point D (0,0) coincide with point D' (0,0) which is located at the base point.

From figure 5. which shows that two points are taken in the 1st kawung, namely point A (-2,2), point B (0,0) to be used as the starting point and point A' (2,2) and point B (0,0) to be used as the end point using the Y axis as the axis for reflection. Then selected from the 2nd kawung, namely point C (-2,-2) and point D (0,0) to be used as the starting point and point C' (2, -2) and point D (0,0) using the Y axis as the axis for reflection.

Next, there is an illustration of the reflection on the X-axis in the kawung motif which is shown in Figure 7 below.

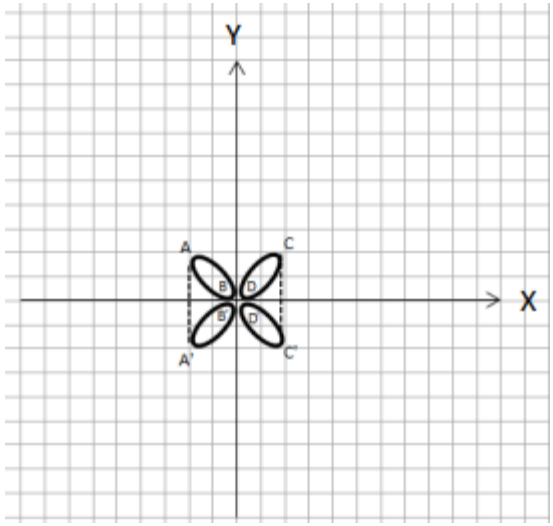

Figure 7. Illustration of Reflection on the X-Axis

From the measurements carried out, it was concluded that in the 1st kawung, the distance from the X axis to the coordinates of point A (-2,2) is 1.2 cm, and the distance from the X axis to the coordinates of point A' (-2,-2) is 1.2 cm. While point B (0,0) which coincides with point B' (0,0) is located at the base point. The distance from the X axis to the coordinates of point C (2, 2) is 1.2 cm, and the distance from the X axis to the coordinates of point C' (2, -2) is 1.2 cm. While point D (0,0) which coincides with point D' (0,0) is located at the base point.

From Figure 7. it is shown that two points are selected in the 1st kawung, namely point A (-2,2), point B (0,0) to be used as the starting point and point A' (-2,-2) and point B' (0,0) to be used as the ending point using the X axis as the axis for reflection. Then in the 2nd kawung, point C (2, 2) and point D (0,0) are selected to be the starting point and C' (2, -2) and point D (0,0) using the X axis as the axis for reflection.

Next, there is an illustration of reflection on the y = -x and y = x axes in the kawung batik motif shown in Figure 8.

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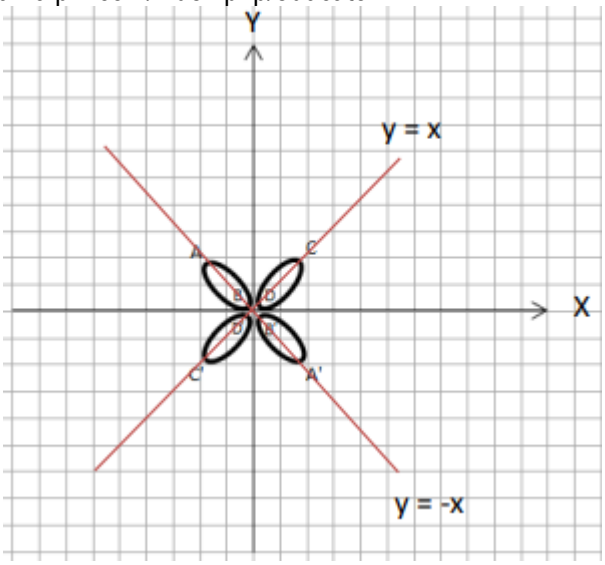

Figure 8. Illustration of reflection on the lines y = -x and y = x

From the measurements carried out, it shows that in the 1st kawung the position in Cartesian coordinates changes due to reflection on the line y = -x and the line y = x. From Figure 8. two points are selected in the 1st kawung, namely point A (-2,2), point B (0,0) and two points are selected in the 2nd kawung, namely point C (2, 2) and point D (0,0). The 1st kawung is reflected by the line y = -x with the center point at (0,0) which produces points A' (2,-2) and point B' (0,0). Furthermore, the 2nd kawung is reflected by the line y = x with the center point at (0,0) which produces points C' (-2, -2) and point D (0,0).

From the measurements taken, the reflection on the kawung motif is grouped in Table 2 as follows:

Table 2. Results of Reflection Measurements on the Kawung Motif

No.	Axis	Starting Point	End Point	Distance
1.	Y axis	A (-2,2)	A' (2,2)	A to Y = 1.2 cm A' to Y = 1.2 cm
		B (0.0)	B' (0,0)	0
		C (-2,-2)	C' (2,-2)	C to Y = 1.2 cm C' to Y = 1.2 cm
		D (0,0)	D' (0,0)	0
2.	X-axis	A (-2,2)	A' (-2,-2)	A to X = 1.2 cm A' to X = 1.2 cm
		B (0.0)	B' (0,0)	0
3.	Line y = -x	A (-2,2)	A' (2,-2)	A to y = -x which is 1.2 cm A' to y = -x which is 1.2 cm
		B (0.0)	B' (0,0)	0
4 .	Line y = x	C (2,2)	C' (-2,-2)	C to y = x is 1.2 cm C' to y = x is 1.2 cm
		D (0,0)	D' (0,0)	0

Translation

Translation is the shift of a plane, line, or point in a certain direction and distance. (Yanti & Haji, 2019). The shift in the kawung batik motif is done by shifting the 1st kawung to the

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right, to the left, to the top, or to the bottom without changing its size and shape at all, as shown in Figure 9.

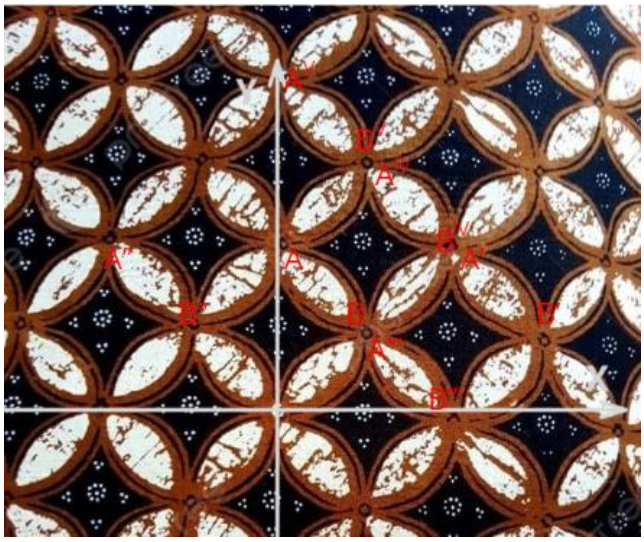

Figure 9. Shift in the Kawung Motif

The following is an illustration of the shift made in the kawung batik motif in Figure 10.

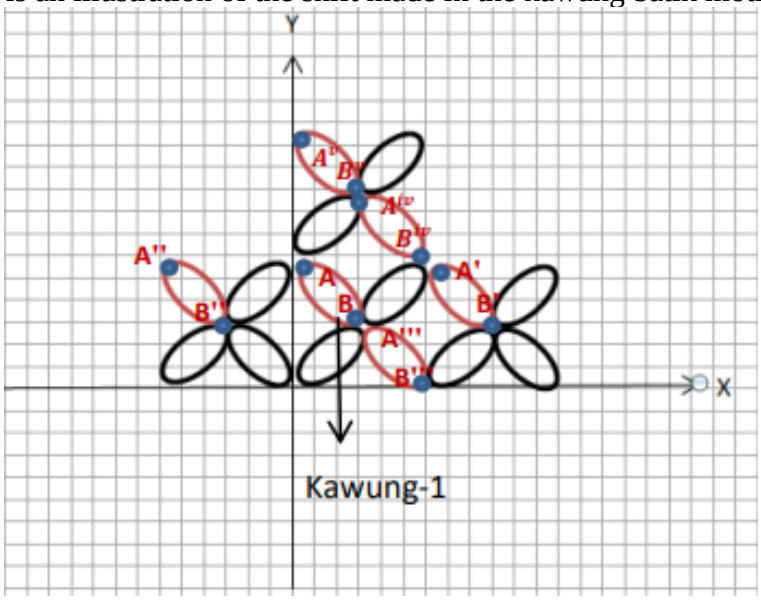

Figure 10. Illustration of the Shift in the Kawung Motif

From Figure 10. it is shown that Kawung 1 is located at coordinates A (0.5; 5.5) and B (3.3) namely two points are selected from the Kawung. Kawung 1 is the center that will be observed for units and direction of shift without changing the size and shape at all. From the measurements carried out on kawung-1 at coordinates point (0.5; 5.5) and B (3.3) to the coordinates of kawung-2 at points A' (6.5; 5.5) and B' (9.3) it moves to the right by 6 units and moves up by 0 units.

Then kawung-1 at coordinates point (0.5;5.5) and B (3.3) to coordinates kawung-3 at point A" (-5.5;5.5) and B ” (-3.3) moves to the left by 6 units and moves up by 0 units. Then kawung-1 at coordinates point A (0.5;5.5) and B (3.3) to coordinates kawung-4 at point A''' (3.5;2.5) and B''' (6.0) moves to the right by 3 units and moves down by 3 units. Then kawung-1 at coordinates point A (0.5;5.5) and B (3.3) to coordinates kawung-5 at point A ^{iv} (3.5;8.5) and B ^{iv} (6.6) moves to the right by 3 units and moves up by 3 units. Then kawung-1 at coordinate point A (0.5; 5.5) and B (3.3) to coordinate kawung-6 at point A ^{v} (0.5; 11.5) and B

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^{v} (3.9) moves to the right by 0 units and moves up by 6 units. From the measurements carried out in the shifting of the kawung motif, they are grouped in Table 3. as follows:

Table 3. Results of the Shift in the Kawung Motif

No.	Starting Point	End Point	Results
1.	A (0.5;5.5)	A' (6,5;5,5)	6 units to the right 0 units and above
	B (3,3)	B' (9.3)	6 units to the right 0 units and above
2.	A (0.5;5.5)	A" (-5.5;5.5)	6 units to the left 0 units and above
	B (3,3)	B ” (-3.3)	6 units to the left 0 units and above
3.	A (0.5;5.5)	A"' (3.5;2.5)	3 units to the right 3 units down
	B (3,3)	B"' (6.0)	3 units to the right 3 units down
4.	A (0.5;5.5)	A ^{iv} (3.5;8.5)	3 units to the right 3 units and above
	B (3,3)	B ^{iv} (6,6)	3 units to the right 3 units and above
5.	A (0.5;5.5)	A ^{v} (0.5;11.5)	0 units to the right 6 units and above
	B (3,3)	B ^{v} (3.9)	0 units to the right 6 units and above

The Use of Kawung Solo Batik Motifs as a Medium for Learning Mathematics

Kawung batik can be used as a medium for ethnomathematics in mathematics learning, especially in geometric transformation material. According to Taskiyah & Widyastuti, mathematics learning involving ethnomathematics can also help strengthen local cultural identity. This mentoring activity will improve the quality of education if ethnomathematics is included in learning. Students who have a better understanding of local cultural values and mathematics will be more motivated to learn and become more creative (Sufia et al., 2023).

The kawung motif is a slice, or cross-section, of a fruit that has four oval-shaped seeds. The kawung batik motif consists of small circles with dots inside them arranged to resemble fish or snake scales, and the background can be filled with other motifs. The elements of the kawung motif consist of four circles with a center point that can be associated with an ellipse when viewed from a mathematical perspective. In addition, one element can be made from one ellipse that is changed using transformation concepts such as translation, reflection, or rotation (Syahdan, 2021).

The motifs on each circle in the kawung contain several elements of transformation geometry that are expected to enable students to understand the principles of reflection, rotation and translation in the material of transformation geometry for grade XI. Students can be asked to draw a sketch of the kawung batik motif, then students are asked to do a translation, or reflection or rotation (Handayani et al., 2019). An alternative that teachers can use in learning can be a worksheet as in Figure 11 .

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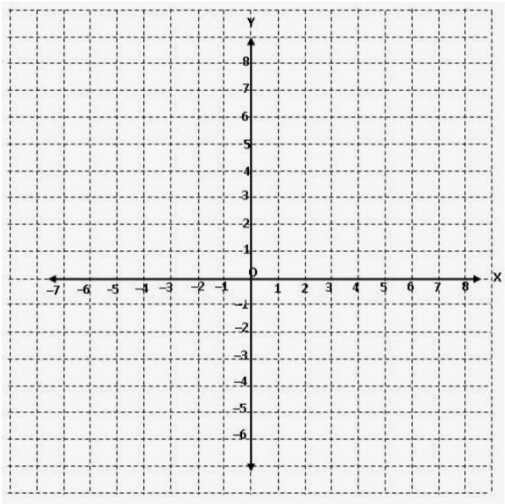

Figure 11. Example of Worksheet

The teacher asks students to describe the kawung batik motif on the worksheet given by the teacher. Then students are asked to reflect on the circle image that has been made, for example reflected on the x-axis. Rotation or translation. After that, students are asked to explain the reasons for using the transformation. So that through this activity, students can further develop their abilities in mathematics, especially geometric transformations (Handayani et al., 2019).

One of the mathematics materials that must be studied in grade XI of high school is geometric transformation, which is found in Solo batik with kawung motifs. Discussion about kawung batik can be used as an example of how geometric transformation is applied in everyday life. After teachers and students learn about geometric transformation material, they can explain how geometric transformation is used in everyday life. One example is the kawung batik motif, which is arranged as shown in the kawung batik motif arrangement section. It is hoped that students will gain a better understanding and understand that geometric transformation material can be found in their surroundings and is useful for improving their learning knowledge. In addition, teachers can give students projects in groups to create free batik motifs that use the geometric transformation material they have learned. The examples given by the teacher can be used to deepen students' understanding of the geometric transformation material they have learned (Christanti et al., 2020).

Kawung batik can be used as a STREAM-based mathematics learning media. Concrete learning media can increase the effectiveness and efficiency of mathematics learning (Khairunnisa & Ilmi, 2020). By using kawung batik media, mathematics learning indirectly also learns mathematics with kawung batik culture, not only learning about mathematical concepts (Sintiya et al., 2021).

The STREAM approach is in line with Vygotsky's theory because it is student-centered and provides small assistance and guidance to students as they develop their knowledge. To achieve national education goals, the implementation of the STREAM approach will complement the five pillars of education in Indonesia: learning to know, learning to do, learning to live together in peace, and learning to improve faith, piety, and noble character. The STREAM approach requires that teachers be responsible for designing and designing learning, creating learning strategies, connecting with students, discovering students' uniqueness, and assessing students openly. Learning new ideas, thinking, pouring out ideas, asking questions, conducting simple research, applying knowledge into action, interacting with others, and

implementing religious aspects as a reinforcement of character education are all the responsibilities of students as learning subjects. (Wulan et al., 2019).

CONCLUSION

The form of batik called "batik kawung" is a geometric circle that resembles the kawung fruit, which is also known as kolang-kaling or aren. As a local culture, kawung batik must have a deep philosophy and meaning. This kawung motif is also sometimes depicted as a lotus flower with four blooming crowns. The Javanese philosophical teachings about "Sangkan Paraning Dumadi", or the process of a human life, which is commonly referred to as "sedulur papat lima pancer" or "keblat papat lima pancer", is the philosophical meaning contained in the kawung motif.

The association of Kawung Batik motif with mathematics is through the existence of geometric transformation in making the batik. Transformation is a change in position or size of a shape. The elements of geometric transformation in Kawung Batik can be rotation, translation, or reflection. Rotation is a shift from one point to another in a geometric plane by rotating the center point. Translation is a shift in a plane, line, or point in a certain direction and distance. Reflection has the same shadow size, but they move in the opposite direction. Rotation, translation, and reflection can later be used as a medium for learning mathematics as the purpose of this study.

Batik Kawung can be a medium for learning mathematics that makes abstract concepts concrete. Learning mathematics using Batik Kawung can be done with STREAM-based learning. The STREAM approach is a learning method that combines five STREAM approach frameworks. It is expected that students can develop their knowledge and apply it in everyday life.

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