Learning Trajectory Flat Building Material Using Batik Besemah Context for Elementary School Students

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Article Info	Abstract
	This Students experience difficulties understanding the properties of flat shapes because learning is monotonous, so there is a need for innovation in learning shape materials. This research aims to produce a learning trajectory for elementary school students using flat building materials in the besemah batik context. This research uses a design research method consisting of three steps: preparing for the experiment, designing the experiment, and retrospective analysis. Data collection was carried out by providing student activity sheets and interviews. Data is analyzed by reducing data, presenting data, and making conclusions. The results of the research show that learning the trajectory of flat shapes using the context of besemah batik consists of four activities, namely 1) observing the besemah batik pattern, 2) redrawing the besemah batik pattern, 3) writing down the characteristics of flat shapes. based on the pattern image on besemah batik, and 4) write definitions of various flat shapes and represent various flat shapes in the drawing. Based on the research, it can be concluded that the resulting learning trajectory can help students understand flat shape materials.

INTRODUCTION

Flat shapes are a geometric material in mathematics taught at elementary, middle, and tertiary levels [1]. One of the graduate competency standards for elementary school students is understanding the concept of flat shapes and spatial shapes, both elements and properties [2]. For this reason, it is essential to have an excellent conceptual understanding of plane shapes from a basic level to avoid difficulty learning plane shapes at the next level. In mathematics, students must understand the basic concepts of the previous material so that they can easily understand the following material [3].

The reality in the field is that students have difficulty understanding the properties of flat shapes [2], [4]. Students also have difficulty distinguishing between types of flat shapes and their elements [1]. Students' ability to understand concepts for plane material is also relatively low [5]. The causes of mathematics learning difficulties are influenced by the teacher and the media used during learning [4]. The learning approach used does not stimulate students to think [6]. Learning about flat shapes in elementary schools tends to be monotonous and boring, so students have

difficulty understanding the material presented [1], [7]. During learning, teachers also tend not to involve supporting media so that students understand concepts less than optimal [5].

When teaching material to elementary school students, it is best to involve real contexts that can be seen, heard, or experienced by students [2]. Freudental views mathematics as a human activity, so teaching mathematics must be connected to the context of everyday life [8]. Zulkardi believes that in mathematics learning, real context can be used to understand formal mathematical concepts through a mathematical process [9]. A teaching method involving the context of social and cultural problems in Indonesia is known as Indonesian Realistic Mathematics Education (PMRI) [8]. PMRI was adapted from the *Realistic Mathematic Education theory* in the Netherlands and to the real context in Indonesia [10].

Using real contexts in learning mathematics is essential to reduce difficulties and help understand abstract mathematics. Besides that, students can easily remember what they learn because mathematics problems related to real contexts are engaging for students [11]. Zulkardi and Putri stated that the use of context aims to support the process of rediscovering a concept, model, or application of a formula and to help students understand mathematical problems before solving them [12].

Based on problems related to flat shape material, there is a need for innovation in learning flat shapes. Therefore, the researcher designed a learning trajectory for flat shape material using the context of besemah batik. The choice of context for besemah batik, apart from making it easier for students to understand the concept of flat shapes, also aims to introduce students to the typical Pagaralam culture, namely besemah batik. Previous research has been carried out using batik as a context for learning, such as using the context of Sidoarjo batik to teach transformation [13] Kawung batik for rotation [8] using batik cloth motifs to teach reflection [14]. However, no researchers have yet used besemah batik to teach flat shapes. So, through this learning activity, it is hoped that there will be new findings in mathematics learning, namely learning trajectory material about flat shapes using the context of besemah batik, which helps students understand the concept of flat shapes.

METHODS

This type of research is a design research type of validation study. Design research research has 3 research stages: preparing for the experiment, the design experiment, and retrospective analysis [9]. In preparation for the experiment stage, the researcher will conduct a literature review related to the flat shape material, PMRI, and besemah batik, then discuss with the mathematics teacher to design an alleged learning trajectory called the Hypothetical Learning Trajectory (HLT) and an activity sheet on the flat shape material. The design experiment stage is divided into two phases: pilot experiment and teaching experiment. In the pilot experiment stage, the researcher will try out the activity sheet designed on 6 grade 4 students with high, medium, and low abilities selected through purposive sampling by asking the teacher for help to determine a suitable subject. The researcher analyzes the students' responses regarding the activity sheet given to students and makes necessary revisions to the HLT. Next, a teaching experiment was carried out in one class of elementary school students. The data obtained from the results of the teaching experiment were then compared with the HLT previously designed at the retrospective analysis stage. At this analysis stage, a description of the learning trajectory of learning flat shapes will be produced using the context of besemah batik.

This study was conducted in the odd semester of the 2023/2024 academic year in class 4 of SD Negeri 1 Pagaralam. Data were collected using student activity sheets and interviews. Student activity sheets to find out whether the designed learning path can help students understand the flat shape material. Interviews were conducted to strengthen the results of the answers on the student activity sheets. Data analysis was carried out by reducing data, namely selecting important data and discarding data that was not needed in the study, then presenting the reduced data and drawing conclusions [15].

RESULTS AND DISCUSSION

After, the researcher discussed with the teacher and designed the HLT and student activity sheet for flat building materials using the context of besemah batik and tested the student activity sheet on 6 4th-grade elementary school students. Next, the researcher conducted a teaching experiment by giving the activity sheet to a 4th-grade class at SD Negeri 1 Pagaralam. Through activity sheets designed using the context of besemah batik, students are helped to understand the concept of flat shapes through the activities designed. The results of students' answers regarding the activities designed are described as follows:

Activity 1: Students Observe the Besemah Batik Pattern
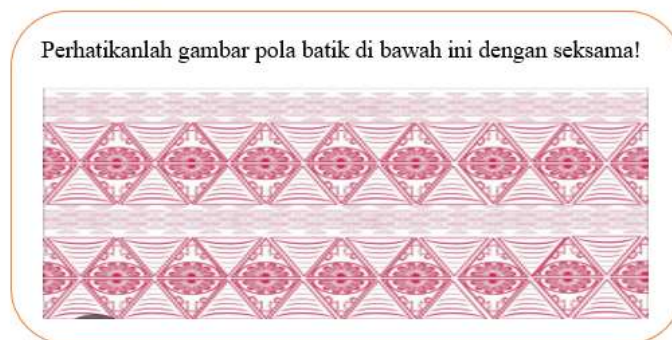
Figure 1. Batik Besemah Pattern

In activity 1, students are asked to observe the batik pattern, then write the name of the batik in the picture presented and write the area where the batik comes from. Figure 1 shows a typical besemah batik from the Pagar Alam area. Examples of student answers can be seen in Figure 2.

Figure 2. Sample Student Answers Activity 1

In Figure 2, it can be seen that students know the batik's name and where the batik comes from. Students can also write down information they know about batik. This shows that the context used in learning is real and close to students so that students can recognize the context of batik used in this learning and answer questions well.

Activity 2: Students Redraw the Besemah Batik Pattern

In activity 2, students are asked to redraw the besemah batik pattern; then, students are asked to draw separately the shape of the pattern on the besemah batik image. Examples of student answers are included in Figure 3.
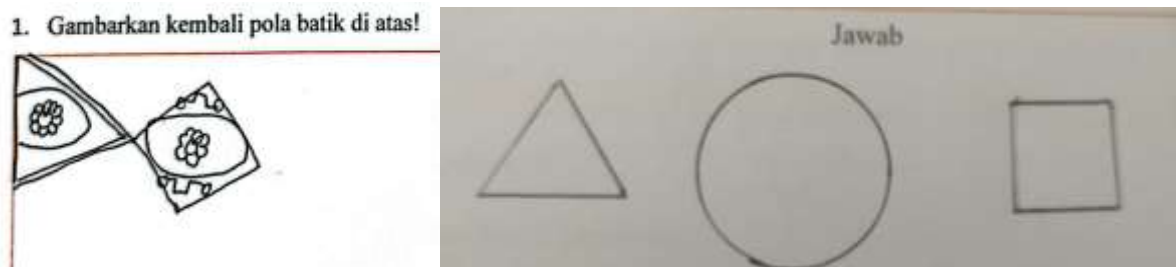

Figure 3. Example of Student Answers Activity 2

Based on Figure 3, it is known that students can redraw the pattern on besemah batik even though it is not perfect. Students can also describe the basic shapes of the besemah batik pattern, including triangles, circles and rectangles. This shows that students can arrange and decipher the flat shapes in the besemah batik pattern.

Activity 3: Students write down the characteristics of a flat shape based on the pattern image on Besemah Batik

In activity 3, students are asked to write down the characteristics of a flat shape based on the pattern image on besemah batik. Examples of student answers are included in Figure 4.
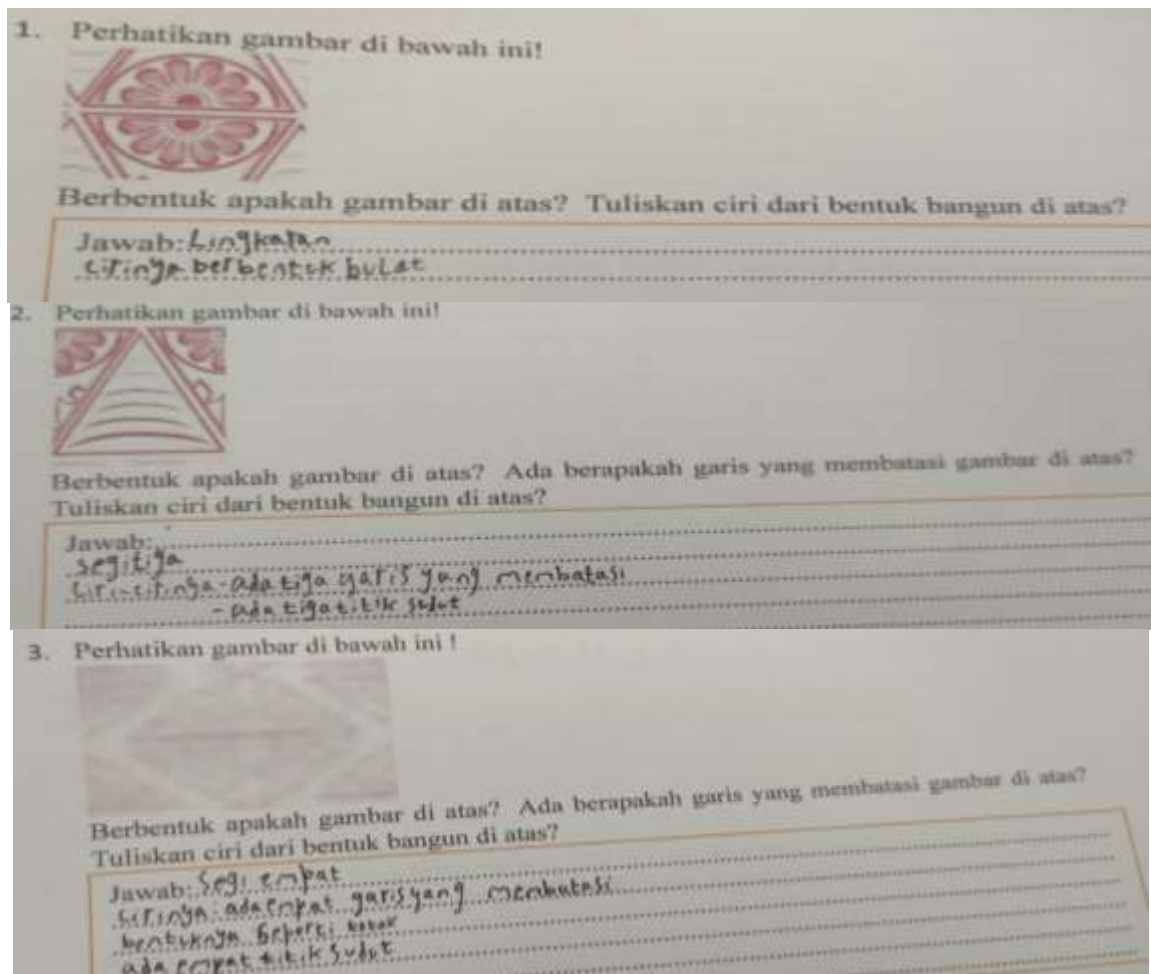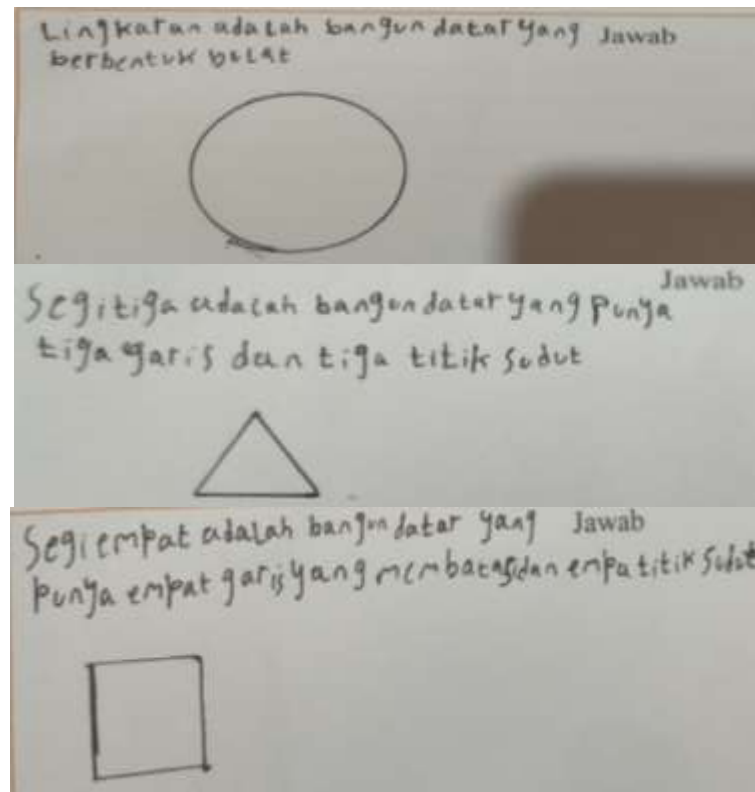
Figure 4. Example of Student Answers Activity 3

Based on Figure 4, it is known that students can redraw the pattern on besemah batik even though it is not perfect. Students can also describe the basic shapes of the besemah batik pattern, including triangles, circles, and rectangles. This shows students can arrange and decipher the flat shapes in the besemah batik pattern. The context of besemah batik makes it easier for students to understand and mention several characteristics of circles, triangles, and quadrilaterals. The findings in this study align with the opinion of Fitrisyah, et al that the use of real context in learning mathematics can help understand abstract mathematics [11]. The interview results also support that students can mention the characteristics of flat shapes. The following is a transcript of the researcher (P) interview results with one of the students (S).

P   :   "Take a look at the picture in question number 1, what shape is the picture? Then what are its characteristics, try to name them!"
S   :   "This is a picture of a circle, ma'am. The shape is round. like a donut and a clock."
P   :   "Then what shape is this second image? What are the characteristics?"
S   :   "If this is a triangular shape, ma'am, there are three boundary lines. Then at the end there are three corner points."
P   :   "Now the picture in question number 3, what shape is this picture? Can you name the characteristics?"
S   :   "This third image is a rectangle. he looks like a cardboard box, ma'am. It has four lines and four corner points, too."

Activity 4: Students write definitions of various plane shapes and represent various plane shapes in pictures

In activity 4, students were asked to write definitions of flat shapes and represent various flat shapes in pictures. Examples of student answers are included in Figure 5.

Figure 5. Example of Student Answers Activity 4

Based on Figure 5, it is known that students can write down the meaning of various flat shapes. Even though the meaning written is incomplete. Then students can also represent the flat shapes of circles, triangles and quadrilaterals in correct drawings. The results of interviews with students also show that students already understand the concepts of circles, triangles and quadrilaterals. The following is a transcript of the conversation between the researcher (P) and the student (S).

P : "After filling in the previous activity sheet, can you name what flat shapes are in the besemah batik pattern?"

S : "I can ma'am. There are lots of triangles, then circles, there are quadrilaterals too."

P : "Try to name the triangle, what does it mean? So what about the picture?"

S : "A triangle is a flat shape formed from 3 lines and 3 vertices. If you draw it (while drawing a triangle). This is what a triangle looks like, ma'am."

P : "Okay, what is a circle? What's the picture like?"

S : "If the circle is a flat, round shape, ma'am. The picture is round like a donut or like a 500 dollar bill."

P : "Now what does a quadrilateral mean? What's the picture like?"

S : "A quadrilateral is also a flat shape but there are four lines and there are also 4 vertices at the ends. The picture is a box, ma'am."

Based on the results of a retrospective analysis by comparing the results of students' answers on the activity sheet at the teaching experiment stage with the HLT that has been formulated, it can be concluded that learning trajectory material about flat shapes using the context of besemah batik can help students understand the concept of flat shapes. In activity 1, students are introduced to the informal flat shape found in the besemah batik pattern. Students unfamiliar with besemah batik learn about Pagaralam's typical batik, namely besemah batik. The design of activity 1 is in line with the RME teaching approach, which begins with context or things that are real for students [6]. The next activity is for students to draw besemah batik patterns and outline the essential patterns that make up besemah batik. Through activity 2, students gain experience identifying different flat shapes. Next, students analyze the characteristics of each flat shape based on the image's shape. Based on a series of previous activities, students can write down the meaning and represent the shapes of various flat shapes (triangle, circle, quadrilateral). This indicates that using the batik besemah context and student activity sheets can take students from the informal stage to the formal stage of mathematics. These findings support Zulkardi and Putri's opinion that real context helps build students' understanding of mathematical concepts [12]. This finding also aligns with the PMRI learning theory, which starts learning with a real context, and all learning activities are focused on student activities [9]. The results of this research are also by Piaget's theory that elementary school students are at the concrete operational stage, so to make it easier to understand concepts, there need to be activities related to real objects or real events that are close to students [12].

CONCLUSION

Based on the results of the research and interviews that have been conducted, it can be concluded that the learning trajectory of the flat shape material uses the context of besemah batik which can help students understand the flat shape material consisting of four activities, namely 1) observing the besemah batik pattern, 2) redrawing the besemah batik pattern, 3) write down the characteristics of flat shapes based on pattern images on besemah batik, and 4) write definitions of various flat shapes and represent various flat shapes in pictures. The researcher suggests that future researchers design a learning trajectory for flat shapes to enable students to solve problems related to flat shapes. Due to the limitations of this research, the researcher only designed a learning trajectory for flat shape material with the aim of students being able to understand the concept of flat shapes, namely knowing the definitions, characteristics, and differences in image shapes of various flat shapes.

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