

IMPLEMENTATION OF ETHNOMATHEMATICS IN BANTEN MUKARNAS BATIK MOTIFS IN IMPROVING STUDENTS' MATHEMATICAL CREATIVE THINKING SKILLS AT MTs AL-KHAIRIYAH RANCARANJI PADARINCANG

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Abstract. This research aims to explore the implementation of Ethnomathematics of Banten Mukarnas batik motifs in improving students' mathematical reasoning and creative thinking skills. Ethnomathematics was chosen to connect mathematical concepts with local culture so that students can see the relevance of mathematics in everyday life. The method used in this study is a quasy experiment with a Pretest-Posttest Control Group Design. The sample was selected using random sampling technique. The data collection technique was carried out by providing test questions for students' mathematical creative thinking ability. The analysis was carried out quantitatively on the learning process and measuring students' creative thinking skills before and after the application of Ethnomathematics. From the results of the posttest data analysis of the experimental and control classes, the *sig. (2-tailed)* of $0.001 < 0.05$ and an average of 89.42 in the experimental class, while in the control class, the average was 76.61. So, it can be concluded that there is a difference in the ability of students to think creatively and mathematically using the ethnomathematics-based learning model assisted by the Banten Mukarnas batik motif compared to students who obtain the conventional learning model.

Keywords: Ethnomathematics-Based Learning, Banten Mukarnas Batik Motifs, Mathematical Creative Thinking Ability

Abstrak. Penelitian ini bertujuan untuk mengeksplorasi implementasi Etnomatematika motif batik Mukarnas Banten dalam meningkatkan kemampuan penalaran matematis dan berpikir kreatif siswa. Etnomatematika dipilih untuk menghubungkan konsep matematika dengan budaya lokal sehingga siswa dapat melihat relevansi matematika dalam kehidupan sehari-hari. Metode yang digunakan dalam penelitian ini adalah *quasy experiment* dengan *Pretest-Posttest Control Group Design*. Sampel dipilih dengan menggunakan teknik *random sampling*. Teknik pengumpulan data dilakukan dengan memberikan soal tes kemampuan berpikir kreatif matematis siswa. Analisis dilakukan secara kuantitatif proses pembelajaran dan pengukuran kemampuan berpikir kreatif siswa sebelum dan sesudah penerapan Etnomatematika. Data yang diperoleh dianalisis menggunakan uji normalitas, uji homogenitas, dan uji t. Dari hasil analisis data posttest kelas eksperimen dan kontrol diperoleh nilai *sig. (2-tailed)* sebesar $0,001 < 0,05$ dan rata-rata pada kelas eksperimen sebesar 89,42, sedangkan pada kelas kontrol rata-rata sebesar 76,61. Jadi, dapat disimpulkan bahwa terdapat perbedaan kemampuan berpikir kreatif dan matematis siswa yang memperoleh model pembelajaran berbasis etnomatematika berbantuan motif batik Mukarnas Banten dibandingkan dengan siswa yang memperoleh model pembelajaran konvensional.

Kata Kunci: Pembelajaran Berbasis Etnomatematika, Motif Batik Mukarnas Banten, Kemampuan Berpikir Kreatif Matematis

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INTRODUCTION

Education is one of the areas of community progress, which means educating the country's life and fostering the ability of students to become individuals who fear God Almighty and be creative, independent, and responsible citizens (Saputri & Herman, 2022). Mathematics is not only studied in the school environment but is also closely related to the daily activities people learn unconsciously. They know mathematics in daily activities, such as counting, measuring, giving patterns, etc. So, almost all daily activities in society are related to mathematics. Daily activities will form a habit, showing the culture of a community group. The relationship between culture and mathematical concepts is what is called ethnic mathematics. Ethnic mathematics is "applied mathematics" developed in identifiable cultural groups, such as ethnic groups, labor groups, and children of a certain age. They are increasing awareness and insight into the existence of mathematics in cultural elements, improving mathematical thinking, and encouraging the relevance of the concepts learned to the real world (Noto et al., 2018).

Education is practically inseparable from cultural values. Culture is part of education (Widyastuti, 2021). The two are very close because they complement and support each other. Culture in national education is the core of a process. The higher the culture, the higher the education or way of educating it. Education not based on cultural principles and rules will cause students to be uprooted from their cultural roots. So, all levels of parents, teachers, and the government play a role in teaching culture through education. The ability to think creatively is considered important because it will make students. Students have high curiosity, love to try, and love to play to help students create new ideas based on existing knowledge and can solve problems from various perspectives. The ability to think creatively helps students create new ideas based on existing knowledge to solve problems from different perspectives.

The lack of students' mathematical creative ability is one factor in their low mathematical ability (Hanany & Sumaji, 2021). As a result, a teacher needs to encourage students to master these skills to improve critical thinking skills, mathematical reasoning, and creative thinking skills. A good learning model as a good intermediary in mathematics learning is needed to improve these abilities. The learning model is a conceptual framework that guides learning designers and teachers in planning and implementing learning activities. It systematically describes the procedure for organizing the learning experience to achieve a specific learning goal. Culture-based mathematics learning around us is the meaning of Ethnomathematics.

Ethnomathematics is learning mathematics with a form of learning related to language, symbols, codes, objects, customs, art, or anything else in culture (Kulsum, 2022). In this case, mathematics is a scary scourge for students and a very difficult subject for students to

understand. Even though they unconsciously find things related to mathematics every day. This is a challenge for teachers to achieve success in transferring knowledge. Moreover, students can capture and understand what is conveyed. Ethnomathematics is mathematics from a cultural perspective. The various tribes living in Banten produce a more diverse Banten culture, one of which is Banten batik. In this case, the researcher wants to implement Banten Batik, one of the batik that UNESCO has internationally recognized. Banten motifs have twelve (12) patented motifs. Banten Batik has a characteristic of icy colors, a combination of young (pastel) colors that give a soft impression, which describes the characteristics of Banten's expressive and gentle people. Banten Batik is a colonial heritage of the Indonesian nation that originated from Banten. Banten Batik has 75 special Banten decorations that are applied to 54 batik patterns. This research was conducted to find out the meaning of Banten batik patterns or motifs and to understand numerical ideas in Banten batik motifs. This research includes personal exploration with ethnographic methodology because what is being studied is about culture. The study results show that besides having a philosophical meaning in each pattern/motif, Banten batik motifs also contain numerical ideas or mathematical concepts such as geometric transformations, spatial structures, and so on.

The ability to think creatively is considered important because it will make students. Students have high curiosity, love to try, and love to play to help students create new ideas based on existing knowledge and can solve problems from various perspectives. The ability to think creatively helps students create new ideas based on existing knowledge to solve problems from different perspectives (Huliatunisa, 2020).

Based on the results of interviews with mathematics teachers at MTs Al-Khairiyah Rancaranji, only some students understand when the teacher explains the material and sample problems. When students are faced with problems that are slightly different from the example problems, they also have difficulty solving them, and the sample problems must be from the book held by each student. This is due to the student's deep-thinking ability to manipulate mathematical material so poorly that it cannot develop his creativity in solving problems effectively to the maximum. Students can see problems from various perspectives and solve problems with various alternatives in the world of education. The emphasis in the learning process is more on memorizing and finding the correct answer to the questions given. Higher thinking processes, including Creative thinking in mathematics learning, are rarely trained and lack the development of ideas in their minds.

Based on the description above, the author is interested in researching with the title "Implementation of Ethnomathematics in Banten Mukarnas Batik Motifs in Improving Students' Mathematical Creative Thinking Reasoning Skills in Junior High School" because the author wants to improve students' mathematical creative thinking skills by making an academic contribution to the development of mathematics learning methods by preserving the local culture of Banten through education

METHOD

This research is quantitative research, which is used to test theories and find relationships with variables. This research is included in the type of experimental research with a method (Quasi-Experimental Design). Namely, this design has a control group but does not function fully to control external variables that affect the implementation of experiments. Judging from the data and data analysis, this study is quantitative research because the data collected is in the form of numbers, and the data processing process and hypothesis testing are done using relevant statistical analysis.

In this study, the researcher used a research design, *Pretest-Posttest Control Group Design*. This is in line with Sugiyono's (2012) opinion, which states, "The design of experimental research includes *Pretest-Posttest Control Group Design*." Using this design, the experimental and control groups have the same characteristics because they are randomly taken from a homogeneous population. In this study, the researcher wanted to determine whether students' mathematical creative thinking skills could improve after being given ethnomathematics-based learning compared to conventional learning. This research was carried out at MTs Al-Khairiyah Rancaranji Padarincang, which started in July 2024 for 1 month with a schedule of class VII. A as an experimental class and VII.E as a control class. The instruments in the study consist of two, namely: (a) learning tool instruments in the form of Learning Implementation Plans (RPP) and Student Worksheets (LKPD); (b) supervision instruments in the form of interview tests to Batik Banten Mukarnas in the Cipocok Jaya area, Serang City and written tests of 5 description questions to measure students' mathematical creative thinking skills.

Data analysis theory includes a). Description of the pretest and post-test analysis results in the experimental and control classes on flat building materials, b). The prerequisite analysis consisted of normality and homogeneity in the normality test using *Shapiro-Wilk* and the homogeneity test using *Levene statistic*, c). The hypothesis test used the t-test with the H0 criterion; there was no difference in the mathematical creative thinking ability of students who used ethnomathematics-based learning with conventional learning, and H1, there was a

difference in the mathematical creative thinking ability of students who used ethnomathematics-based learning with conventional learning.

RESULTS AND DISCUSSION

This study was conducted to test how much students' mathematical creative thinking skills improved through ethnomathematics-based banten mukarnas batik motifs in grade VII students of MTs Al-Khairiyah Rancaranji Padarincang. The research sample consists of two classes: an experimental class that uses ethnomathematics-based learning and a control class that uses conventional learning methods. This research took place from the beginning of July 2024 for 1 month with an experimental class (VII.A) and a control class (VII.E).

Description of the Results of Mathematical Creative Thinking Ability

Table 1. Results of pretest and posttest descriptive analysis

	Descriptive Statistics				
	N	Minimum	Maximum	Mean	Std. Deviation
Pretest Experiment	38	47	92	75.63	10.997
Post-Test Eksperimen	38	75	100	89.42	7.096
Pretest check-ups	38	43	78	60.63	7.171
Post-Test Control	38	57	90	74.61	7.821
Valid N (listwise)	38				

The table shows that the average score of students' mathematical creative thinking ability test before being given the *pretest* in the experimental class was 75.63, with the highest score of 92 and the lowest score of 47. Meanwhile, the average score of the student's mathematical creative thinking ability test after being given a posttest was 89.42, with the highest score being 100 and the lowest score being 75.

Moreover, the average score of the student's mathematical creative thinking ability test before the treatment (*pretest*) in the control class was 60.63, with the highest score of 78 and the lowest score of 43. Meanwhile, the average score of the student's mathematical creative thinking ability test after being given a posttest was 76.61, with the highest score being 90 and the lowest score being 57. Thus, after being treated in the experimental and control classes, the results show that students' mathematical creative thinking skills can be optimized by using ethnomathematics-based learning.

Normality and Homogeneity Test

The Shapiro-Wilk normality test showed that the *control class and the experiment's pre/post-test data* were normally distributed, with a significance value of > 0.05 each. The homogeneity test using *Levene Statistic* also showed that the data variance of the two samples was homogeneous, with the value of $F_{cal} < F_{tabel}$ and $Levene\ Statistic > 0.05$ significance value. This suggests that the data can be further analyzed using hypotheses.

Uji Hipotesis

Hypothesis testing was conducted to test whether ethnomathematics-based learning on the Banten Mukarnas batik motif can improve students' mathematical creative thinking skills. The hypotheses tested were:

- H0: There is no difference in the mathematical reasoning ability of students using ethnomathematics-based and conventional learning.
- H1: There is a difference in the mathematical reasoning ability of students who use ethnomathematics-based learning and conventional learning.

Table 2. Results of hypothesis test of students' mathematical creative thinking ability

Independent Samples Test										
		Levene's Test for Equality of Variances					t-test for Equality of Means		95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Hasil Belajar Siswa	Equal variances assumed	5.748	.019	-6.495	74	<.001	-13.789	2.123	-18.020	-9.559
	Equal variances not assumed			-6.495	63.260	<.001	-13.789	2.123	-18.032	-9.547

Based on the independent *samples test output table*, the Sig. (2-tailed) value was obtained of $<.001$ which means $P < 0.05$. Thus, it can be concluded that H_0 was rejected and H_1 was accepted, so there was a difference in the experimental or control classes before and after treatment. This means that students' mathematical creative thinking skills can improve after being given treatment.

Ethnomathematics Discovery Results

Build Flat on the Mandalikan Motif



Figure 1. Flat build circle and split ribs

Mandalikan batik displays a harmony of motifs that combine geometric elements, creating a proportional balance that exudes mathematical beauty in every detail. This motif has a rhombus shape on a chain box, small flowers on the edges, and large flowers between the triangular star motifs. Meanwhile, the name Mandalikan is taken from the title of one of the princes of Banten, namely Prince Mandalikan.

Flat Builds on Baduy Batik Motifs

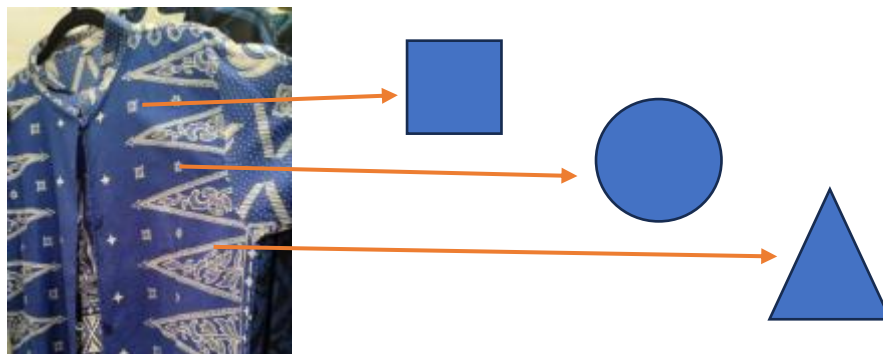


Figure 2. Build a square, circle, triangle flat

Baduy batik is an art craft that is increasingly in demand by the community from outside and within the Banten area, especially the people of Lebak Regency. Batik arts and crafts in Baduy are increasingly showing their existence, as evidenced by the application of typical batik. Baduy is in the uniform of civil servants (PNS), and some youths and teenagers wear Baduy batik clothes. The following is an explanation of the motifs that have mathematical elements in the picture or the banten baduy batik motif:

- **Triangle:** The triangular shape in the baduy batik motif generally reflects the geometric elements used in the batik design. Triangles can appear in various positions and orientations and often have a certain symbolic or aesthetic value according to the traditions and

meanings associated with batik baduy. This triangle could be part of a larger pattern or be the main element in the batik design.

- **Circles:** Using circular flat shapes in Baduy batik motifs can include depicting circular shapes in the geometric patterns that make up the batik design. Circles can be decorative elements, encircling or arranging other patterns, or they may have a certain symbolic meaning according to the tradition or story desired by the batik designer. Thus, the shape of the circle in baduy batik can be an integral part of the artistic expression and cultural meaning you want to convey.
- **Square:** The square shape in Baduy batik reflects the traditional mathematical understanding of the Baduy people. This pattern often indicates symmetry, which means the design is balanced and consistent. Baduy batik creates a harmonious and aesthetic design using geometric shapes such as squares. The repetition of patterns is also important, as it helps create unity in the design. This shows how the Baduy people applied mathematical principles in their art but profoundly.

Building Flat Banten Tower Motif

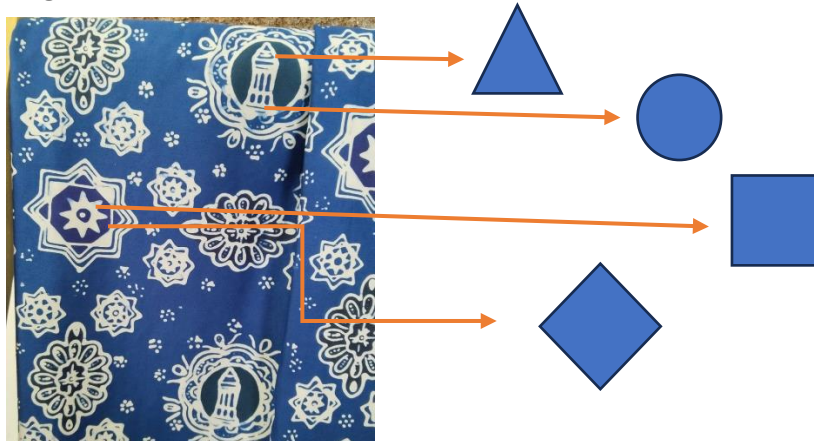


Figure 3. Flat triangle, circle, square, ribbed

The Banten Tower batik motif originated in Banten, a province in Indonesia. This motif is often inspired by the Banten Tower, a tower located in Banten and is part of the Banten Grand Mosque complex. The tower is known for its unique architectural design and symbolic meaning in the local culture. The following is an explanation of the motifs that have mathematical elements in the picture or the batik motif of the Banten Tower:

- A square is a flat building with four sides of equal length and four equally large angles (90 degrees). In Batik Menara Banten, the Square is often used as a basic element in a

symmetrical pattern that depicts balance and order. This reflects stability and harmony, which is important in Banten culture.

- A rhombus is a flat shape with four sides of equal length, but the angles do not have to be 90 degrees; pairs of opposite corners of equal magnitude. In Batik Menara Banten, the Belah ketupat symbolizes prosperity and simplicity. This shape is often used in batik motifs to show relationships between elements or as a symbol of strength and wholeness.
- A triangle is a flat build with three sides and three corners. The type of triangle can vary depending on the length of the sides (equilateral, equilateral, arbitrary) or the size of the angles (right triangle, obtuse triangle, pointed triangle). In Batik Menara Banten, the triangle symbolizes the relationship between nature, humans, and the Creator. In batik motifs, triangles can be used to compose patterns that indicate direction or purpose and spiritual stability.
- A circle is a flat figure with no angles, with each point on its curved line being the same distance from the center point. In Batik Menara Banten, the Circle often symbolizes eternity, unity, and interconnectedness between elements. In batik motifs, circles can depict the life that continues to revolve and the connection between the past, present, and future.

Improving students' mathematical creative thinking skills through Banten Mukarnas Batik Motif

Based on the data processing results that the researcher has carried out, it can be concluded that ethnomathematics-based learning through the Banten Mukarnas batik motif affects students' mathematical creative thinking skills. The average result of the posttest was greater than the average score of the pretest before being given ethnomathematics-based learning. Ethnomathematics-based learning, especially through the Banten Mukarnas batik motif, has the potential to improve students' mathematical creative thinking skills because, through ethnomathematics-based learning, they learn to identify, explore, prove to conclude, or determine the pattern of a mathematical form by observing a cultural problem.

Data was obtained through the learning process and then analyzed by researchers. It was found that students' mathematical reasoning skills could be optimal after being given ethnomathematics-based learning, where students were invited to explore and conclude a problem. This can be seen in Appendix 13. The post-test results in the experimental class are better than those in the control class, with the largest score item of 5 points, which means that the answers to the student's test results meet the indicators of mathematical reasoning ability. The following is an example of the answer result from one of the students after being given a

posttest in the experimental class:

Level 1 (Smoothness)

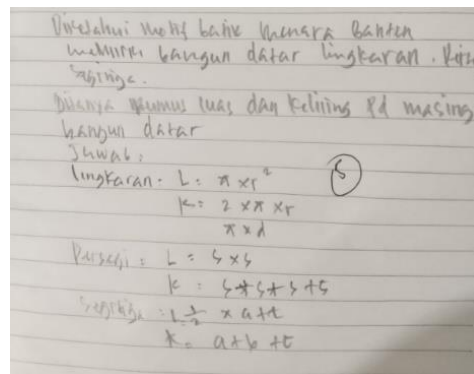


Figure 4. Posttest answer results for student number 1 level 1 (smoothness)

The picture shows the results of the work of high-category students who can answer with 5 points, and number 1 can give answers from the many flat fields that exist in Banten batik motifs correctly.

Level 2 (Flexibility)

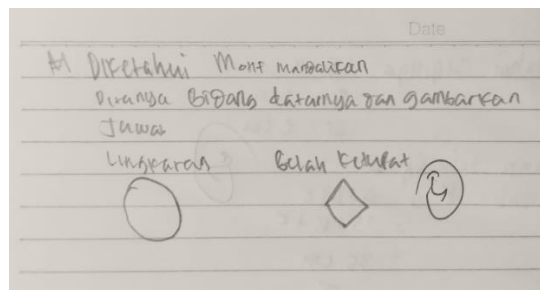


Figure 5. Posttest answer results for student number 2 level 2 (flexibility)

Figure 5 shows the answers to the level of flexibility by students with a high category of ability to determine and draw a flat figure correctly.

Level 3 (Keaslian)

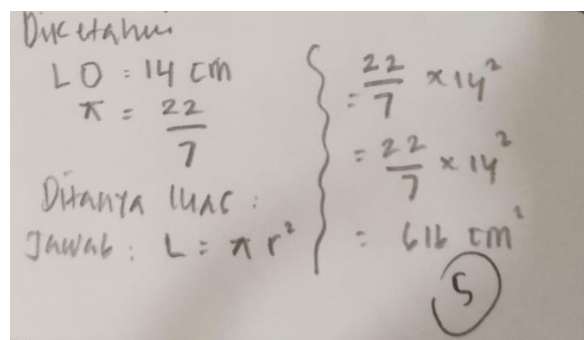


Figure 6. Posttest answer results for student number 4 level 3 (authenticity)

Figure 6 shows the authenticity of answers by students with a high ability to answer a problem correctly and show evidence using the formula correctly.

Diketahui panjang sisi persegi 20 m
 Ditanya: Keliling persegi?
 Jawab: $K_{\square} = \text{sisi} + \text{sisi} + \text{sisi} + \text{sisi}$
 $= 20 + 20 + 20 + 20$
 $= 80 \text{ m}$

Figure 7. Posttest answer results for student number 4 level 3 (authenticity)

Figure 7 shows the authenticity of answers by students with a high category of being able to answer a problem correctly and showing evidence by using the formula correctly.

Level 4 (Elaboration)

Diketahui segitiga $AB = 15 \text{ cm}$
 $AC = 15 \text{ cm}$
 $BC = 5 \text{ cm}$
 Ditanya: Keliling Δ ...?
 Jawab: $K_{\Delta} = \text{a} + \text{b} + \text{c}$
 $= 15 + 15 + 5$
 $= 35 \text{ cm}$
 Jadi keliling $\Delta = 35$

Figure 8. Posttest answer results for student number 5 level 4 (elaboration)

Figure 8 displays elaboration-level answers by students with a high ability to add or detail a question to improve the problem's quality. Based on the results of *the posttest* answers of the students above, the numbers 1 to 5 are included in the high category. It is just that not all students get 5 points. There are still students who get 1 or even 0 points.

CONCLUSION

The results of the research at MTs Al-Khairiyah Rancaranji show that ethnomathematics learning is effective in improving students' mathematical creative thinking skills. This indicates that by connecting mathematical concepts with students' cultural contexts, students' interest and motivation in learning can be improved, thus having a positive impact on their learning achievement. These findings are in line with previous research that suggests that relevant and meaningful learning can improve students' higher-order thinking skills.

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