Kognitif
Jurnal Riset HOTS Pendidikan Matematika
Volume - 6 No - 2 2026 Page 642 – 655
ISSN 2776-9704 P-ISSN 2776-9984
https://doi.org/10.51574/kognitif.v6i2.5111

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How to cite: Sukmadianti, A. A., Evendi, E., & Astuti, A. M. (2026). Effect of the Ethnomathematics Approach on Junior High School Students' Mathematical Metaphorical Thinking Skills. *Kognitif: Jurnal Riset HOTS Pendidikan Matematika*, *6*(2), 642–655. https://doi.org/10.51574/kognitif.v6i2.5111

To link to this artcle: https://doi.org/10.51574/kognitif.v6i2.5111

Opened Access Article

Published Online on 31 May 2026

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Kognitif: Jurnal Riset HOTS Pendidikan Matematika
https://doi.org/10.51574/kognitif.v6i2.5111 Volume 6, No 2, April - June 2026, pp. 642 – 655

Effect of the Ethnomathematics Approach on Junior High School Students' Mathematical Metaphorical Thinking Skills

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Article Info

Article history:

Received Mar 19, 2026
Accepted May 29, 2026
Published Online May 31, 2026

Keywords:

Ethnomathematics
Jompa Traditional House
Local Culture
Mathematics Learning
Metaphorical Thinking
Quasi-Experimental

ABSTRACT

This study was motivated by the low level of students' mathematical metaphorical thinking skills, which stem from a learning process that still focuses on conventional methods. Therefore, an ethnomathematics approach is needed to link mathematical concepts with local culture and students' real-life experiences, making learning more meaningful and easier to understand. This study aims to examine the effect of the ethnomathematics approach on the mathematical metaphorical thinking skills of junior high school students. This study employs a quantitative approach using a quasi-experimental method with a pretest–posttest control group design. The sample consists of two classes: an experimental class and a control class, each comprising 21 students. The research instrument consisted of an essay test to measure students' mathematical metaphorical thinking abilities, which was developed based on indicators of mathematical metaphorical thinking and had undergone validity and reliability testing. In addition to the test, this study also used an observation sheet to observe student activities and the implementation of learning during the application of the ethnomathematics approach. Documentation was used as supporting data in the form of photos and records of learning activities. The data used in this study consisted of quantitative data in the form of test results, as well as supporting qualitative data from observations and documentation. Data analysis was conducted using normality tests, homogeneity tests, and independent samples t-tests. The results showed that the ethnomathematics approach had a significant effect on students' mathematical metaphorical thinking skills. The average posttest scores of the experimental class were also higher than those of the control class. These findings suggest that the ethnomathematics approach can help students understand abstract mathematical concepts through concrete experiences and local culture, thereby making learning more meaningful.

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Introduction

Mathematics education plays a crucial role in developing students' higher-order thinking skills, including analytical, logical, and creative thinking, which are essential competencies in the 21st century. Mathematics is not merely a collection of formulas and procedures but also a way of thinking that supports problem-solving in various real-life contexts. However, various research findings indicate that students' mathematical literacy—their ability to formulate, apply, and interpret mathematics in various everyday contexts, particularly at the junior high school level—remains relatively low. Mathematical literacy in this study refers to students' ability to use mathematical concepts to solve contextual problems, not merely procedural calculations. This situation highlights the need for more innovative teaching approaches that emphasize conceptual understanding rather than mere memorization (Anwar & Ramadhani, 2025; Nurniyati et al., 2024; Putra & Haqiqi, 2022).

Mathematics instruction in schools still largely relies on conventional, teacher-centered approaches, such as lectures and repetitive drills. This situation often results in mathematical concepts being disconnected from students' real-world experiences, leading to low learning motivation and limited conceptual understanding. Another consequence is that students experience difficulty in establishing connections between concepts and mathematical representations—key components of higher-order thinking skills (Atikasuri & Kusaeri, 2024; Ardiyanti & Malasari, 2024).

The ethnomathematics approach serves as one alternative to address these issues (Batiibwe, 2024; Azhar et al., 2025). Ethnomathematics connects mathematical concepts with cultural elements, such as traditional weaving patterns, local architectural forms, or community activities in daily life. This approach is based on the view that mathematics evolves from human cultural activities within a specific society. The connection between mathematics learning and local culture makes the learning process more meaningful and relevant to students' lives (Nuryadi et al., 2019; Payadnya et al., 2024; Wahyuni et al., 2013). A number of studies also show that ethnomathematics can improve students' critical thinking skills, engagement in learning, and mathematical literacy (Ikrimah & Argarini, 2025; Mulyadi et al., 2025; Susanto et al., 2023).

The traditional Jompa house is one of the cultural heritages of the Bima people that is rich in ethnomathematical values. The structure of the Jompa house reflects various mathematical concepts such as geometry, similarity, symmetry, spatial structure, and proportional reasoning. The roof design, building patterns, and arrangement of the house's components can be utilized as contextual learning tools in mathematics education. Integrating local culture through the traditional Jompa house provides a more concrete and meaningful learning experience for students because mathematical concepts are directly connected to cultural objects that are familiar in students' daily lives. Therefore, the traditional Jompa house can serve as an ethnomathematics-based learning resource to help students understand abstract mathematical concepts through the context of local culture.

Figure 1. Jompa traditional house

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Ethnomathematics-based learning experiences provide students with opportunities to build knowledge through concrete activities. Activities such as observing cultural artifacts, recognizing patterns, analyzing structures, and constructing mathematical models enable students to understand concepts more deeply. This type of contextual learning has been shown to enhance students' conceptual understanding and creative thinking skills (Atikasuri & Kusaeri, 2024; Rua et al., 2025). Furthermore, ethnomathematics fosters meaningful learning by connecting abstract mathematical ideas to familiar real-world situations (Payadnya et al., 2024).

The ability to understand mathematical concepts is closely linked to the ability to think metaphorically. Metaphorical thinking is a cognitive process that connects abstract concepts with real-world experiences through specific analogies. This process helps students understand complex mathematical ideas through previously familiar representations, thereby strengthening conceptual understanding (Nurjasia et al., 2021; Zahro, 2022). Conceptual metaphor theory explains that human reasoning processes are formed through metaphorical mapping across domains of experience. Several studies also indicate that the application of metaphorical thinking models can significantly improve students' mathematical literacy and conceptual understanding (Susanto et al., 2023; Fadilah, 2019). The indicators of mathematical metaphorical thinking ability in this study refer to research that encompasses the ability to recognize analogies, construct metaphorical representations, and apply those representations to mathematical problem-solving (Nurjasia et al., 2021).

Mathematical metaphorical thinking ability encompasses several key stages, including recognizing analogical relationships, constructing metaphorical representations, and applying these representations to mathematical problem-solving (Nurjasia et al., 2021). In reality, many students still struggle to develop these abilities due to a lack of learning contexts that are relevant to their daily lives. Ethnomathematics can serve as an effective tool for building metaphorical mappings because cultural objects contain mathematical patterns and structures that can be used as sources of analogy in learning. The integration of ethnomathematics with a metaphorical thinking approach is viewed as capable of supporting the development of students' cognitive and affective abilities in mathematics learning (Susanto et al., 2023; Muhammad et al., 2025).

In this study, mathematical metaphorical thinking skills were developed through the study of blocks and cubes by utilizing the context of the Jompa traditional house of the Bima people. Students were guided to connect the shape and structure of the traditional house with concepts of three-dimensional shapes, such as faces, edges, vertices, surface area, and volume. The process of metaphorical thinking occurs when students associate abstract mathematical concepts with real objects they are familiar with in their daily lives. Through activities such as observing building shapes, recognizing spatial patterns, and representing the structure of the traditional house in mathematical models, students can build a more concrete and meaningful understanding of the concepts.

The ethnomathematics approach was applied through learning activities that integrated local cultural elements into the mathematics curriculum. The teacher guides students to observe the parts of the Jompa traditional house, then identify the concepts of rectangular prisms and cubes present in the building's structure. Next, students are given activities to analyze spatial figures and solve mathematical problems based on the cultural context used. Such learning allows students to learn mathematics through experiences closely tied to their cultural environment, making the learning process more contextual, active, and easier to understand. The ethnomathematics approach is related to the ability to think mathematically in a metaphorical way because learning takes place by connecting mathematical concepts with students' real-life experiences. In ethnomathematics instruction, local culture can be used as a medium to help students understand abstract mathematical concepts. When students observe cultural forms, patterns, or structures in their surroundings, they can connect those experiences with the mathematical concepts they are learning. This process aligns with metaphorical thinking, which involves connecting new concepts to previously known experiences (Nurjasia et al., 2021; Zahro, 2022). The use of cultural contexts also makes learning more meaningful because students learn through situations closely related to their daily lives. Activities such as identifying three-dimensional shapes, recognizing patterns, and analyzing cultural structures can help students develop mathematical analogy and representation skills. Therefore, the ethnomathematics approach is believed to influence students' mathematical metaphorical thinking abilities because learning emphasizes not only the use of formulas but also conceptual understanding through cultural experiences familiar to students (Susanto et al., 2023 ; Muhammad et al., 2025).

Previous research has primarily focused on the influence of ethnomathematics on students' critical thinking, problem-solving, and mathematical representation skills (Iskandar et al., 2022). Studies examining the relationship between ethnomathematics and mathematical metaphorical thinking skills remain relatively limited (Atikasuri & Kusaeri, 2024; Ikrimah & Argarini, 2025). Research on metaphorical thinking in mathematics education has also generally failed to optimally integrate cultural contexts (Nurjasia et al., 2021). This situation highlights the need for research examining how an ethnomathematics approach can support the development of students' mathematical metaphorical thinking skills. The novelty of this study lies in the integration of an ethnomathematics approach based on the Jompa traditional house with mathematical metaphorical thinking skills in solid geometry material at the junior high school level, a topic that has rarely been empirically studied. This study aims to analyze the effect of the ethnomathematics approach on the mathematical metaphorical thinking skills of junior high school students. The results of this study can contribute to the development of mathematics learning that is responsive to local culture while strengthening empirical evidence regarding the integration of ethnomathematics and metaphorical thinking in mathematics education.

Method

Research Design

This study employed a quantitative approach using a quasi-experimental method to examine the effect of the ethnomathematics approach on students' mathematical metaphorical thinking skills. A quasi-experimental design was chosen because it allows researchers to test causal relationships through controlled treatments, even though random assignment is not fully implemented (Naamy, 2019; Sugiyono, 2020). The design used is a pretest–posttest control group design, involving two groups: an experimental group receiving ethnomathematics-based instruction and a control group receiving conventional instruction. Both groups were administered a pretest to measure initial ability and a posttest to measure learning outcomes following the intervention. This design allows for a comparison of student performance before and after the treatment, ensuring that any observed differences can be attributed to the applied learning approach.

Population, Sample, and Research Variables

The population of this study consists of all eighth-grade students at SMPN 1 Lambu, comprising four classes with a total of 86 students. This population shares nearly identical

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characteristics because they are in the same grade level, follow the same curriculum, and receive the same instructional materials. Therefore, the population is considered sufficiently representative for this study. These shared characteristics (academic ability, age, and curriculum) make the population homogeneous, rendering it suitable for a quasi-experimental study. The sampling technique used was purposive sampling. This technique was chosen because the selection of the sample was based on specific considerations aligned with the research objectives. These considerations included students' relatively equivalent academic ability based on previous mathematics scores, nearly equal student numbers in each class, and the classes' readiness to serve as the experimental and control groups. Based on these considerations, Class VIII A, consisting of 21 students, was selected as the experimental class, and Class VIII B, consisting of 21 students, was selected as the control class. The independent variable (X) in this study is the ethnomathematics approach, while the dependent variable (Y) is students' mathematical metaphorical thinking ability.

Instruments

The research instruments consisted of an essay test, an observation sheet, and documentation. The essay test was used to measure students' mathematical metaphorical thinking skills and consisted of three questions based on blocks and cubes within the cultural context of the traditional Jompa house. The test was designed based on indicators of mathematical metaphorical thinking skills and aligned with the core competencies for blocks and cubes in the current curriculum. Observation sheets are used to observe student activities and measure the implementation of ethnomathematics-based learning and student engagement during the learning process. Meanwhile, documentation consisted of photographs of learning activities as supporting data. The mathematical metaphorical thinking test was designed based on indicators of mathematical metaphorical thinking that refer to the theory of metaphorical thinking from (Nurjasia et al., 2021; Zahro, 2022). Before being used in the study, the test instrument was first tested for validity and reliability. Validity was assessed through expert judgment and empirical testing using a pilot study. The instrument's reliability was calculated to determine the level of consistency among the items. The test results indicated that the instrument is suitable for use in the study.

Table 1. Indicators of Mathematical Metaphorical Thinking Ability

No	Indicator	Description
1	Identifying analogies	Students identify similarities between mathematical concepts and real-life situations
2	Building representations	Students represent abstract concepts in concrete forms
3	Connecting concepts	Students connect mathematical concepts to cultural contexts
4	Using metaphors	Students use analogies to solve mathematical problems (Nurjasia et al., 2021; Zahro, 2022).

The mathematical metaphorical thinking test consists of three essay questions on the topic of blocks and cubes, designed based on indicators of mathematical metaphorical thinking. The questions were developed by integrating the cultural context of the traditional Jompa house of the Bima people. The questions are designed to encourage students to connect the concepts of three-dimensional shapes with cultural objects through analogies and mathematical representations.

Table 2. Examples of Test Instruments and the Aspects They Measure

No	Sample Questions	Measured Aspects
1	Examine the diagram of the storage space in the traditional Jompa house, which is modeled as a rectangular prism with a length of 12 cm, a width of 5 cm, and a height of 6 cm. Explain the mathematical reason why this storage space can be modeled as a rectangular prism, and determine its volume.	Ability to identify similarities between mathematical concepts and local cultural objects
2	One of the storage units at Jompa has equal length, width, and height, so it can be likened to a cube. If its volume is 216 cm^3, determine the length of the cube's edge and explain the mathematical reason why it is more appropriate to liken it to a cube rather than a rectangular prism.	The ability to represent abstract concepts in concrete forms and to connect mathematical concepts with culture
3	Another storage space is analogized as a rectangular prism with a length of 18 cm, a width of 10 cm, and a height of 7 cm. Determine the volume of the prism and explain the mathematical basis for the analogy between the storage space and the rectangular prism.	The ability to use analogies to solve math problems

Data Collection and Analysis Methods

Research data were collected through essay tests, observation sheets, and documentation. Essay tests were administered as pretests and posttests to assess students' mathematical metaphorical thinking skills regarding blocks and cubes. The test questions were open-ended and designed based on indicators of mathematical metaphorical thinking skills, such as the ability to identify analogies, construct representations, connect mathematical concepts with culture, and apply metaphors in problem-solving. Observation sheets were used to observe student activities and the implementation of the learning process during the application of the ethnomathematics approach. Meanwhile, documentation was used as supporting data in the form of photos of learning activities and research archives. Data analysis was conducted using SPSS with a significance level of $\alpha = 0.05$, including prerequisite tests and hypothesis testing. The prerequisite tests consisted of the Shapiro–Wilk normality test and Levene's test for homogeneity of variances. In addition, an independent samples t-test was used to test for differences between the experimental and control groups, both at the pretest stage (to ensure initial equivalence) and at the posttest stage (to determine the treatment effect). The pretest was used to ensure that both groups had equivalent initial abilities before the treatment was administered. This analytical procedure ensures the validity and reliability of the conclusions regarding the impact of the ethnomathematics approach on students' mathematical metaphorical thinking abilities (Utami & Irawati, 2024).

Research Findings

Pretest Results

A description of the initial abilities of students in the experimental and control classes was obtained through the administration of a pretest. A summary of the pretest data analysis results is shown in Figure 2.

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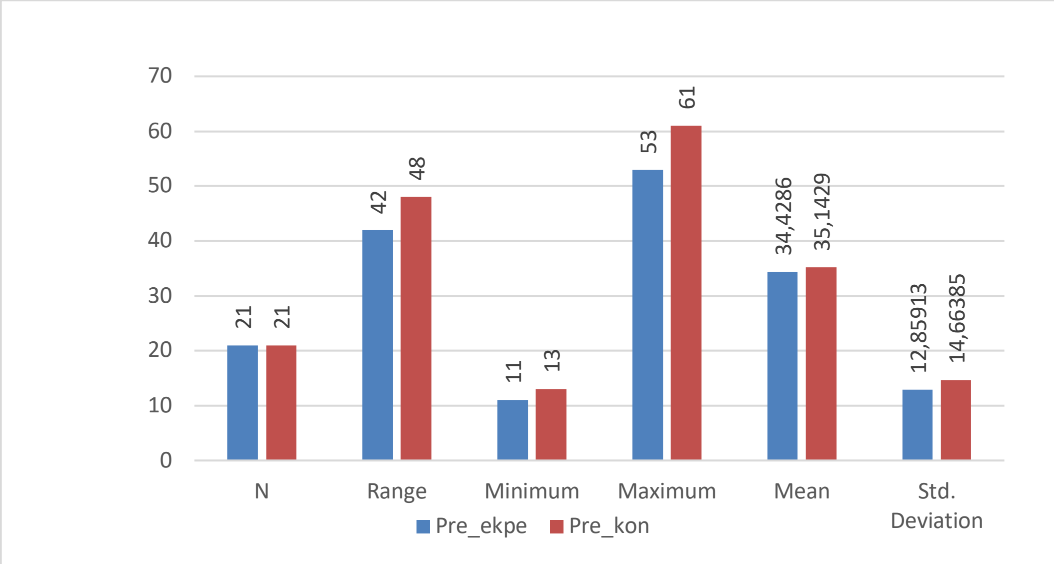

Figure 2. Descriptive Statistics of Pretest Data for the Experimental and Control Classes

Based on Figure 2, it is evident that the experimental class, consisting of 21 students, achieved a minimum score of 11 and a maximum score of 53, with a score range of 42. The mean score was 34.43, with a standard deviation of 12.86. As for the control class, which also had 21 students, the minimum score was 13 and the maximum score was 61, with a range of 48. The average pretest score in the control class was 35.14 with a standard deviation of 14.66. These results indicate that the students' initial ability in the control class was slightly higher than that of the experimental class. Furthermore, the standard deviation and range in the control class were larger, indicating that the students' initial abilities in the control class exhibited a higher level of variability compared to the experimental class.

Posttest Results

A description of the students' mathematical metaphorical thinking abilities in the experimental and control classes after the intervention was obtained through the posttest results. A summary of the posttest data is presented in Figure 3.

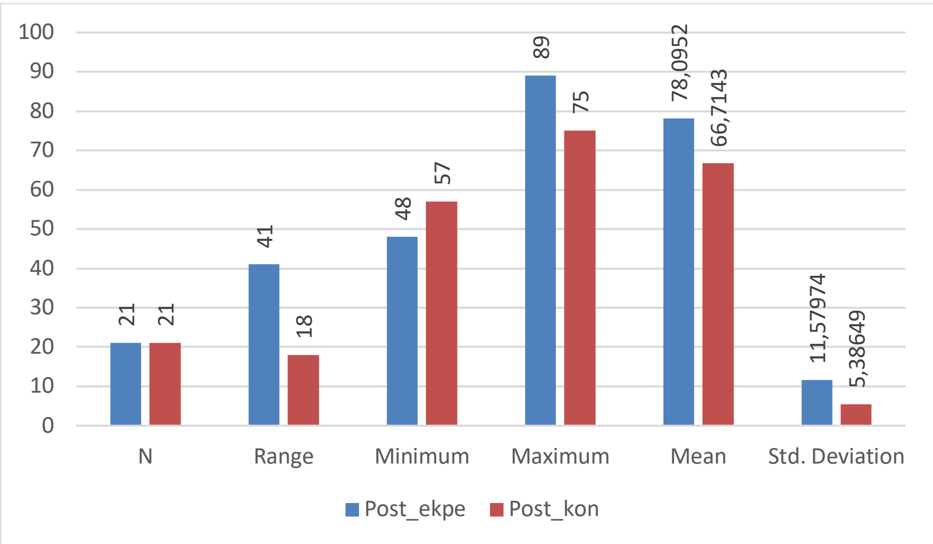

Figure 3. Descriptive Statistics of Posttest Data for the Experimental and Control Groups

Based on Figure 3, it is evident that in the experimental class, consisting of 21 students, the minimum score was 48 and the maximum score was 89, with a score range of 41. The mean score in the experimental class was 78.10, with a standard deviation of 11.58. Meanwhile, the control class, which also had 21 students, obtained a minimum score of 57 and a maximum score of 75 with a range of 18. The mean score in the control class was 66.71 with a standard deviation of 5.39. These data indicate that the average mathematical metaphorical thinking ability of students in the experimental class was higher than that of the control class. Additionally, the standard deviation in the experimental class was greater than that in the control class, indicating that the level of variation in students' abilities in the experimental class tended to be more diverse.

Application of the Uma Jompa-Based Ethnomathematics Approach to Rectangular Prisms and Cubes

Instruction in the experimental class was conducted by applying an ethnomathematics approach based on the traditional Uma Jompa house of the Bima community to the topics of rectangular prisms and cubes. During the learning activities, the teacher utilized a teaching aid shaped like an Uma Jompa as a medium to help students understand the concepts of three-dimensional shapes in a more tangible and contextual manner.

In the first session, students were introduced to the concepts of rectangular prisms and cubes through an activity involving the observation of the Uma Jompa model. Students were asked to identify parts of the structure that resembled rectangular prisms and cubes, and then to recognize the elements of three-dimensional shapes, such as faces, edges, and vertices. Based on observations during the lesson, most students showed interest and actively participated in the discussion. In the second session, students worked in groups to analyze the size and shape of the parts of the Uma Jompa teaching aids. This activity was designed to help students understand the concepts of surface area and volume of three-dimensional shapes through cultural objects they are familiar with in their daily lives. The results of the observation showed that students began to be able to connect mathematical concepts with the local cultural context.

In the third session, students were given ethnomathematics-based problem-solving questions related to the structure of the Uma Jompa. Students were asked to determine the volume of three-dimensional shapes and explain the mathematical relationship between the form of the traditional house and the concepts of rectangular prisms and cubes. Based on documentation of the learning activities, students appeared to be more active in discussions and found it easier to understand mathematical concepts through the use of concrete media based on local culture. The documentation of the activities showed that students were more active in culture-based learning compared to conventional learning. The results of the observation sheets indicated that student activity during ethnomathematics-based learning fell into the "active" category, marked by increased participation in group discussions, the ability to identify cultural objects, and engagement in problem-solving. The implementation of the learning process was rated as "good," with a high level of student engagement throughout the learning process.

Prerequisite Tests

Normality Test

Based on the results of the normality test using the Shapiro-Wilk test, it was found that the significance value of the pretest data for the experimental class was 0.582. In addition, the

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posttest data for the experimental class yielded a significance value of 0.137. In the control class, the significance value for the pre-test data was 0.492. Similarly, the post-test data for the control class had a significance value of 0.443. This indicates that all data are normally distributed because the significance values are greater than 0.05.

Table 3. Results of the Shapiro-Wilk Normality Test

Variables	Class	Sig.
Pretest Score	Experiment	0.582
Posttest Score	Experiment	0.137
Pretest Score	Control	0.492
Posttest Score	Control	0.443

Based on the results of the homogeneity test using Levene's test in Table 4, the significance value for the posttest data is 0.068. Since this significance value is greater than 0.05, the variance of the posttest data between the experimental and control classes is considered homogeneous. The pretest results show that there is no significant difference between the experimental and control classes, indicating that both groups have equivalent initial abilities. Additionally, the significance value for the pretest data is 0.951. This value is also greater than 0.05, so the variance of the pretest data for both classes is deemed homogeneous.

Table 4. Results of Homogeneity Test

Variables	Levene Statistics	Sig.
Posttest Score	3.530	0.068
Pretest Score	0.004	0.951

Hypothesis Testing

T-Test

Based on the results of the independent samples t-test, a significance value (two-tailed Sig.) of 0.000 was obtained. Since this value is less than 0.05, H_0 is rejected and H_1 is accepted. This means that there is a significant effect of using the ethnomathematics approach on students' mathematical metaphorical thinking skills. Furthermore, based on the posttest mean scores, the experimental class had a mean score of 78.10, while the control class had a mean score of 66.71. This difference indicates that student learning outcomes in the experimental class were higher than those in the control class. Therefore, it can be concluded that learning using the ethnomathematics approach is more effective than conventional learning in improving students' mathematical metaphorical thinking skills, based on the results of statistical analysis.

Table 5. Independent Sample t-test

Levene Sig	t	df	Sig (2-tailed)	Mean Difference
0.068	4.234	40	0.000	18.619

Discussion

Based on the research findings, there is a significant difference in students' mathematical metaphorical thinking abilities between those taught using the ethnomathematics approach and those receiving conventional instruction. These results are supported by hypothesis testing using an independent samples t-test, which yielded a significance value of 0.000 ($p < 0.05$). Therefore, it can be concluded that the ethnomathematics approach has a statistically significant effect on students' mathematical metaphorical thinking abilities based on the comparison of posttest mean scores. Descriptive analysis shows that the mean posttest score in the experimental class was 78.10, which is higher than that of the control class, which had a mean of 66.71. This difference indicates that students who learned through the ethnomathematics approach experienced a greater improvement in their mathematical metaphorical thinking skills. Thus, the effect of this approach is not only statistically significant but also practically meaningful in improving student learning outcomes based on the results of the statistical analysis.

These findings are consistent with the theory of ethnomathematics, which emphasizes that mathematics learning can be meaningfully connected to cultural practices and everyday life. Ethnomathematics is viewed as an effort to explore mathematical ideas embedded in cultural contexts, thereby making learning more relevant and meaningful for students (Nuryadi et al., 2019; Wahyuni et al., 2013). Cultural activities such as traditional crafts, architecture, and social practices inherently contain mathematical concepts that can be utilized in contextual mathematics learning (Payadnya et al., 2024; Rua et al., 2025). Instruction in the experimental class integrated spatial shape concepts—specifically rectangular prisms and cubes—with the structure and design of the Jompa traditional house, which is closely tied to students' cultural lives. Students identified various mathematical elements, such as geometric shapes in the roof, symmetry patterns in the building, and spatial relationships in the house's construction. The connection between mathematical concepts and local culture helps students understand abstract concepts through more concrete, real-world experiences. This learning process supports the development of mathematical metaphorical thinking skills through the use of analogies and meaningful representations.

The ethnomathematics approach also provides students with the opportunity to understand mathematical concepts through experiences they encounter in their daily lives. Culturally-based learning helps students build a more concrete conceptual understanding while encouraging active exploration of the relationship between culture and mathematics (Nuryadi et al., 2019; Pratiwi et al., 2024). Mathematical metaphorical thinking ability in this study is evident through students' ability to connect abstract concepts with concrete experiences using analogies or metaphors. This process involves activities such as connecting, exploring, analyzing, transforming, and applying blocks, cubes, volume, surface area, and the relationships between elements of three-dimensional shapes in problem-solving (Nurjasia et al., 2021; Zahro, 2022).

Learning activities in the experimental class were designed by integrating mathematical content into local cultural contexts familiar to students, such as weaving patterns, traditional architecture, and local community activities. These cultural elements contain mathematical patterns and structures that can serve as sources of contextual learning (Putra & Haqiqi, 2022; Wahyuni et al., 2013). This helps students build stronger connections between abstract mathematical concepts and real-life experiences in their daily lives. This learning situation encourages students to actively engage throughout the learning process. Students do not merely passively receive information but also participate in discovering and constructing mathematical concepts through meaningful learning experiences. Learning that connects mathematics to real-life contexts has been shown to enhance conceptual understanding and foster higher-order thinking skills, including mathematical metaphorical thinking (Nurniyati et al., 2024; Susanto et al., 2023).

Instruction in the control class still employed a conventional, teacher-centered approach through direct explanations and problem-solving exercises. The learning process emphasized mastering formulas without connecting mathematical concepts to real-life contexts. This situation leads students to tend to memorize concepts rather than understand their deeper meaning. Consequently, students struggle to connect abstract concepts with concrete experiences, resulting in suboptimal development of mathematical metaphorical thinking skills (Atikasuri & Kusaeri, 2024; Ardiyanti & Malasari, 2024). The results of this study are consistent with previous research indicating that students with strong metaphorical thinking skills tend to be better able to connect mathematical concepts with familiar models or analogies when solving problems that require higher-order thinking skills (Susanto et al., 2023; Zahro, 2022). The ability to connect mathematical concepts with real-world experiences plays a crucial role in enhancing students' understanding of the material being studied. This study demonstrates that the ethnomathematics approach can serve as an effective alternative learning strategy in mathematics education at the junior high school level. This approach not only helps improve student learning outcomes but also makes students more active during the learning process. Furthermore, incorporating local cultural contexts into instruction can foster students' interest in mathematics while simultaneously enhancing their appreciation for the local culture in their surrounding environment.

Conclusion

Based on the results and discussion of this study, it can be concluded that the ethnomathematics approach has a significant effect on the mathematical metaphorical thinking skills of junior high school students. This is evidenced by the results of the independent samples t-test, which showed a significance level below 0.05, leading to the rejection of H_0 and the acceptance of H_1. Therefore, ethnomathematics-based learning was found to be more effective than conventional teaching in enhancing students' ability to connect abstract mathematical concepts with concrete experiences through metaphors and analogies. By integrating local cultural contexts into mathematics instruction, this approach enables students to develop a deeper conceptual understanding, making abstract concepts easier to grasp and more meaningful. Based on these findings, several recommendations can be proposed. Teachers are encouraged to adopt the ethnomathematics approach as an alternative teaching strategy to enhance students' higher-order thinking skills, particularly mathematical metaphorical thinking, by connecting mathematical content with relevant local cultural contexts. Meanwhile, future researchers are encouraged to expand on this study by exploring different variables, a broader range of subject matter, and various educational levels, as well as conducting more in-depth investigations into mathematical metaphorical thinking to strengthen the theoretical and empirical contributions to mathematics education research.

Acknowledgments

The author would like to express gratitude to SMPN 1 Lambu for granting permission and providing support during the research process. The author also thanks the mathematics teachers and all students of classes VIII A and VIII B who actively participated in this research. In addition, the author would like to thank the State Islamic University of Mataram, the Faculty of Tarbiyah and Teacher Training, the Mathematics Education Study Program, and the supervising lecturers for their guidance, support, and valuable suggestions during the preparation of this article. Based on the results of this study, teachers are encouraged to implement ethnomathematics-based learning to improve students' mathematical metaphorical thinking ability and create more meaningful and contextual mathematics learning experiences.

Conflict of Interest

The authors declare that there is no conflict of interest.

Auhor Contributions

Author A.A.S. contributed to the development of instruments, research design, understanding of theoretical foundations, data collection and processing, data analysis, presentation of results and discussion, revision, and ensuring the consistency of the entire article. Author E.E. contributed to the development of theoretical studies and approved the final manuscript. Author A.M.A. contributed to the development of the theory and approved the final version of the article. The total percentage of author contributions to the conceptualization, drafting, and correction of this article is: A.A.S.: 40%, E.E.: 30%, and A.M.A.: 30%.

Data Availability Statement

The authors declare that the data supporting the findings of this study will be made available by the corresponding author, [A.A.S.], upon reasonable request.

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