JOURNAL LA EDUSCI

VOL. 06, ISSUE 01 (079-094), 2025
DOI: 10.37899/journallaedusci.v6i1.2161

The Effectiveness of Gorontalo Local Wisdom-Based Ethnomathematics in Enhancing Mathematics Understanding

Yusraningsih H. Pongoliu[1]

[1]*Universitas Muhammadiyah Gorontalo*

**Corresponding Author: Yusraningsih H. Pongoliu*
Email: yusraningsihpongoliu@umgo.ac.id

Article Info

Article history:
Received 24 April 2025
Received in revised form 31 May 2025
Accepted 18 June 2025

Keywords:
Ethnomathematics
Local Culture
Mathematics Education
Plane Geometry
Elementary School

Abstract

The present research addressed the question of how ethnomathematics-led learning can promote the learning of plane geometry in elementary students by combining the local cultural heritage elements of the Gorontalo community, namely Payango traditional house, to mathematics education. Seeking to utilize a quasi-experimental pre-test post-test design, 30 students in three elementary schools were randomly divided into experimental and control groups. The experimental group was exposed to mathematics learning in the context of the geometry of the Payango house whereas the control group was taught normally. In the statistical analysis, the experimental group reported that much better results were attained in the Comprehension of mathematics, both in terms of post-test score and standard deviation than the control group (p = 0.002). In addition to enhanced cognition, the students who encountered ethnomathematics expressed increased motivation, engagement, and relevance in the learning of mathematics as well as its owning. These results denote that ethnomathematics has more to offer to enhance performance: this mathematics is introduced as meaningful, culturally related knowledge, which contributes to conceptualisation and positive mathematical attitude. The study highlights the potential of ethnomathematics to promote educational equity, cultural affirmation, and deeper learning. It calls for its systematic integration into curricula, supported by teacher development and inclusive instructional design, and identifies the need for future longitudinal and cross-context research to further explore its transformative possibilities.

Introduction

Mathematics education at the elementary school level in Indonesia faces several complex challenges, especially in teaching abstract mathematical concepts. Students often struggle to relate the mathematical concepts they learn to their daily lives, causing learning to feel distant and irrelevant (Wildan et al., 2024). This not only hinders mathematical understanding but also diminishes students' interest and motivation toward the subject (Barwell et al., 2022). Generally, mathematics at the elementary school level is often perceived as a difficult subject because of the limitations students face in linking theory to practice or to real-life experiences. Therefore, finding a more contextual and relevant approach is crucial to improving students' understanding of mathematics (Khaerani et al., 2024).

One approach that can address this challenge is ethnomathematics, which integrates local values and wisdom into the mathematics taught (Kusuma et al., 2024). This approach has the potential to make mathematics more accessible and understandable for students as it is presented within a cultural context that is familiar and relevant to them (Permana, 2023). In Indonesia, the country's cultural diversity offers many opportunities to develop learning approaches based on local culture. One such example is the Payango traditional house from Gorontalo Regency.

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

The Payango traditional house has a distinctive structure, containing geometric elements such as triangles, rectangles, and squares, which are highly relevant for teaching mathematics (Imswatama, 2023). These geometric shapes can be used as concrete examples for teaching geometry and plane figures to elementary school students (Rosinansis et al., 2022; Ponte et al., 2023; Mohamed & Kandeel, 2023; Ulusoy, 2021). Using the Payango traditional house as a learning object provides students with the opportunity to see how the mathematical concepts they learn connect to the cultural elements around them, making mathematics more relevant, engaging, and easier to understand. Ethnomathematics is a field of study that combines mathematics with culture, helping students see how mathematical concepts are applied in real life through their own culture. According to (Pirma & Caswita, 2023) ethnomathematics is a form of mathematics that develops in specific communities in response to their needs. In the context of education, ethnomathematics not only teaches mathematical concepts but also integrates the cultural knowledge of the local community, making learning mathematics more contextual and connected to students' lives (Sari, 2022).

In Gorontalo, a region rich in local culture, the application of ethnomathematics based on local culture is highly potential to improve students' understanding of mathematics. This area is known for its diverse culture and unique local traditions, which can serve as a rich source for learning. One example of local culture that can be integrated into mathematics education is the Payango traditional house (Trumansyahjaya, 2022). By using the Payango house as a learning tool, students can study the various geometric shapes within the house's structure, such as the triangle on the roof, the rectangle on the door, and the square on the windows. This approach not only teaches mathematical concepts but also introduces students to the local cultural values around them. This local culture-based approach allows students to see a direct connection between the mathematical concepts they learn and the cultural elements they are familiar with (Subarinah et al., 2022). This makes mathematics more relevant and easier to understand. Additionally, this approach can increase students' motivation to learn mathematics, as they can see how mathematics is applied in their daily lives. For instance, students can be invited to measure and calculate the area of plane figures on the Payango traditional house, which not only introduces them to geometric concepts but also connects those concepts to their local culture (Lalu & Nurmawanti, 2023).

However, while ethnomathematics has been applied with positive results in various countries, its implementation in Indonesia, particularly at the elementary school level, is still very limited (Andriyanti & Prihastari, 2023 Turmuzi et al., 2023; Hendriyanto et al., 2023). Many studies on ethnomathematics have focused more on higher education or different cultural contexts. In Indonesia, especially in areas rich in local culture such as Gorontalo, research on applying ethnomathematics to mathematics education in elementary schools is still scarce (Payadnya et al., 2024). Therefore, this study aims to fill this gap by exploring how ethnomathematics-based learning can be applied at the elementary school level, particularly in Gorontalo, and contribute to the development of local culture-based mathematics education in Indonesia. Several previous studies have shown that ethnomathematics can significantly contribute to students' understanding of mathematics. For example, research by (Khaerani et al., 2024) and (Annajmi, 2024) explains that ethnomathematics can increase students' motivation and understanding of mathematical concepts in a more contextual and relevant manner. Integrating local wisdom into mathematics education, particularly in geometry topics, can help students better understand concepts that are often perceived as abstract and difficult to grasp. (Lalu & Nurmawanti, 2023) also emphasize that applying local culture in mathematics education can help simplify complex mathematical concepts for students (Verner et al., 2019; Kurniawan et al., 2023; Harefa, 2024; Prahmana, 2022).

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

Research by (Naitili & Nitte, 2023) further shows that applying traditional games in ethnomathematics education can significantly improve the understanding of geometry concepts among third-grade elementary school students. This indicates that an approach combining traditional games and local culture can simplify the delivery of mathematical concepts that students find difficult to understand (Kamid et al., 2022; Rachmaniah Mirza Hariastuti, 20230. Therefore, this approach not only teaches students about mathematics but also about the local culture around them. In addition, research by Wildan et al. (2024) reveals that ethnomathematics-based mathematics education can help students simplify mathematical concepts that were previously difficult to understand. This learning approach not only improves students' understanding of mathematics but also strengthens their critical thinking and problem-solving skills. This aligns with findings from (Andriyanti & Prihastari, 2023), who demonstrated that using the Problem-Based Learning (PBL) model based on ethnomathematics can enhance students' problem-solving abilities. By integrating ethnomathematics into the PBL model, students can learn mathematics in a more enjoyable and relevant way, which ultimately helps them understand mathematical concepts better (Mei et al., 2025; Syahnia et al., 2024; Ulya et al., 2024; Ula et al., 2024).

Other research by Fatmawati & Hanik (2024) shows that teaching modules integrating local wisdom, such as the Nyadran tradition in Sidoarjo, are effective in enhancing elementary school students' understanding of mathematical concepts. Research by Aulya et al. (2024) supports this finding, showing that ethnomathematics-based teaching modules for plane geometry, adapted to the Merdeka Curriculum, can help students connect mathematical concepts with their surrounding environment. This shows that ethnomathematics-based approaches help students not only understand mathematical concepts but also develop their ability to link mathematics with real-life situations.

In Gorontalo, the application of ethnomathematics based on local culture, such as the Payango traditional house, offers great opportunities to develop more effective and contextual teaching methods. Students can be invited to observe the geometric shapes found on the Payango traditional house, such as triangles on the roof, rectangles on the door, and squares on the windows (Masruroh et al., 2023). Thus, mathematics learning becomes more relevant and engaging for students as they can directly observe the application of mathematical concepts in their daily lives. Improvement in students' mathematical disposition is also an important benefit of applying ethnomathematics. Research by Islamiati & Nasruddin (2020) shows that applying ethnomathematics positively contributes to students' mathematical disposition. Mathematical disposition includes students' positive attitude toward mathematics, their ability to think critically, and their confidence in solving mathematical problems. By using local culture as a learning context, students not only understand mathematics as a discipline but also as a relevant and useful tool in their lives (Nasir etal., 2008; Madusise & Mwakapenda, 2014). This aligns with research by Agustin & Supriadi (2023), who state that traditional games integrating local culture into mathematical principles, such as LCM and GCD, can enhance students' mathematical understanding.

The main goal of this study is to test the effectiveness of ethnomathematics-based learning in enhancing students' understanding of mathematical concepts, specifically in plane geometry, at the elementary school level in Gorontalo. This study aims to test the hypothesis that ethnomathematics-based learning, which integrates local cultural values, can significantly improve students' mathematical understanding. Using a quasi-experimental pre-test-post-test approach, this study will measure students' understanding before and after applying ethnomathematics-based learning in three elementary schools in Gorontalo: SDN 1 Telaga Biru, SDN 1 Limboto, and SDN 1 Batudaa.

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

Overall, this study is expected to provide new insights into the application of ethnomathematics in elementary school mathematics education, particularly in Gorontalo. By integrating local cultural values, mathematics education is expected to become more relevant, engaging, and effective for students. This study also aims to contribute to the development of local culture-based mathematics education in Indonesia, aligning with efforts to preserve local culture while enhancing students' understanding of mathematical concepts.

Methods

This research used a quasi-experimental research design; pre-and post-test control group to evaluate how effective local culture-based ethnomathematics could be in enhancing elementary school students plane geometry content learning. The decision to use this design was influenced by the possibility to investigate the change in learning outcome of students in a natural classroom environment where it was impossible to random assign the students. According to Soesana et al. (2023), quasi-experiment designs are used when studying educational research, and researchers seek to quantify the influence of intervention, but also adhere to ecological validity in a classroom setting.

Participants and Sampling

The study was carried out in Gorontalo Regency where elementary schools within the culturally prosperous regions of the region were selected where the Payango conventional house is a local understood and familiar symbol. A purposive sampling research technique was used to choose 30 students across three government schools namely; SDN 1 Telaga Biru, SDN 1 Limboto and SDN 1 Batudaa. The study was representative enough because every school donated ten students to the study. The chosen students were then defined in two groups, an experimental group that was taught on ethnomathematics and a control group that was taught on conventional mathematics learning. The sample was not biased in gender (15 male students and 15 female students), and the age of the students was 87-11 years. The sampling method took into account the study purpose that was to determine the usefulness of cultural integration in the study of mathematics with a sample population with practical exposure to the Payango house and its symbolic meaning. As Imswatama (2023), had stressed, the decision-making based on cultural familiarity substantiates the contextual appositeness of ethnomathematics interventions.

Learning Intervention and Instructional Procedure

The intervention carried out on the experimental group consisted of ethnomathematics learning contextualized with the geometric Payango traditional house elements. This was in the form of built lessons of identifying, measuring and calculating flat shapes around architectural features including the roof (triangles), doors (rectangles) and windows (squares). Learners were engaged in the process of 16 instructional meetings which took several weeks including 2 to 3 meetings occurring during a week that resembling the instructional cycle. Learning activities were well structured so as to connect the cultural experiences of the students to the formal geometric concepts hence encouraging conceptual learning. This is consistent with the results of Imswatama (2023) showing that incorporating local wisdom into teaching mathematics allows students to apply the abstract concepts to real life frameworks. On the contrary, the control group was taught as usual through ordinary government published textbooks and practice without cultural backgrounds.

Data Collection Instruments

The collection of data was conducted by the use of pre-tests and post-tests that were administered to the experimental and the control groups to determine the comprehension of the plane geometry concept of students before the intervention and after the completion of the

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

intervention. The test instruments were formulated, drawing up in line with the standardization of the national curriculum and seeing them content-verified and unconfusable. In order to complement the quantitative results, classroom observations and interviews with students were used as well. The intervention phase was observed to track student behavior and involvement and interviews to obtain a few words about the experience of learning. These were the qualitative methods that holistically supplemented the data that was used to make interpretation without constituting the main basis of statistics.

Analysis of Data Methods

The SPSS 21 software was used to analyze the quantitative data of the pre-test and post-test results as conventional statistical rules were used (Umi, 2023). Shapiro Wilk test was done to determine the normalcy of the data distribution before comparative tests were performed. The results of p-value in both groups were above 0.05 which was a sign that the data were normally distributed. Further, the homogeneity of variance was evaluated using the Levene Test of Equality of Variances and it was established that the variance of both groups is same and this aspect fulfilled the requirements of using t-test. An Independent Samples t-test was then carried out to assess as to whether the post-test scores of the experimental and the control groups were found to be statistically different. It was recorded at $p < 0.05$. This test enabled the researchers to establish the efficacy of the culture based intervention. Besides, the Cohen d was computed to determine the size of the effect of an intervention. The analytical framework used by Fitri et al. (2023) of employing SPSS in impact studies in education guides these statistical procedures. Descriptive statistics was then highlighted, such as means, standard deviations and the range of the scores to give an overall information on how the students performed both, prior to and after the intervention.

Results and Discussion

This study aims to test the effectiveness of applying local culture-based ethnomathematics in improving the understanding of mathematical concepts among elementary school students in Gorontalo Regency. In this study, the experimental group that received local culture-based learning is expected to show a more significant improvement in understanding mathematical concepts compared to the control group that followed conventional mathematics teaching. This local culture-based learning integrates aspects of Gorontalo culture, such as the Payango traditional house, to make mathematics learning more relevant and contextual for students. It is hoped that with this approach, students will not only learn mathematical concepts theoretically but also connect them to aspects of culture they are familiar with, thereby improving their understanding and motivation to learn mathematics.

Characteristics of Research Subjects

The research sample consisted of 30 students selected using purposive sampling from three schools in Gorontalo Regency, each representing areas rich in local culture. Below are the characteristics of the research subjects involved in this study:

Table 1. Characteristics of the Subjects

Characteristic	Number (n = 30)	Percentage (%)
Gender		
Male	15	50%
Female	15	50%
Age (years)		
8-9	10	33.3%

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

9-10	12	40%
10-11	8	26.7%
School		
SDN 1 Telaga Biru	10	33.3%
SDN 1 Limboto	10	33.3%
SDN 1 Batudaa	10	33.3%

From the table above, it can be seen that the sample consists of students with a balanced proportion between male and female (50% each). The age variation among the students covers the age group of 8 to 11 years, providing a relatively even distribution of ages and enabling analysis based on age in the context of mathematics learning. The three schools involved in this study—SDN 1 Telaga Biru, SDN 1 Limboto, and SDN 1 Batudaa—were selected based on their representation of areas rich in local culture in Gorontalo, which allows for more effective implementation of culture-based learning.

Table 2. Pre-test and Post-test Score Distribution by School

School	Group	Pre-test Mean (SD)	Post-test Mean (SD)	Improvement
SDN 1 Telaga Biru	Experiment	78.5 (5.1)	89.8 (3.5)	+11.3
SDN 1 Telaga Biru	Control	74.3 (4.0)	82.9 (3.7)	+8.6
SDN 1 Limboto	Experiment	77.7 (4.9)	88.7 (4.1)	+11.0
SDN 1 Limboto	Control	74.0 (4.2)	82.4 (4.0)	+8.4
SDN 1 Batudaa	Experiment	78.2 (4.8)	89.1 (4.0)	+10.9
SDN 1 Batudaa	Control	74.1 (4.4)	82.7 (4.2)	+8.6

Within this table there is the evidence of how the culture based intervention was able to provide the benefit of the students in various schools in a consistent manner. There is a similarity on the improvement gap between the experiment group and control group of all schools indicating the effectiveness of the ethnomathematics-based learning is not particular to a school but universal in the elementary schools of Gorontalo. This is consistent which makes the model scalable to other territories with their local cultures.

Descriptive Statistics

Based on the descriptive statistical analysis presented in Table 2 below, it shows that the experimental group experienced a significant improvement between the pre-test and post-test. The average pre-test score for the experimental group was 78.13, which increased to 89.20 in the post-test, with a change of 11.07 points. This improvement was accompanied by a decrease in the standard deviation (SD) from 4.97 in the pre-test to 3.90 in the post-test, indicating that the students' understanding became more consistent after receiving the culture-based intervention. On the other hand, the control group showed a smaller improvement, with a pre-test average of 74.13 and a post-test score of 82.67, a change of 8.54 points. Although there was improvement, the variability of scores in the control group remained higher (SD pre-test 4.19 and post-test 3.90), indicating that the consistency of understanding in the control group was lower compared to the experimental group.

Table 3. Descriptive Statistical Analysis

Group	Variable	Pre-test	Post-test
Experiment	Mean	78.13	89.20
	Standard Deviation (SD)	4.97	3.90
	Median	78.00	90.00

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

	Min	70.00	82.00
	Max	88.00	96.00
Control	Mean	74.13	82.67
	Standard Deviation (SD)	4.19	3.90
	Median	74.00	82.00
	Min	66.00	75.00
	Max	80.00	89.00

Table 4. Effect Size (Cohen's d) of the Intervention

Comparison	Cohen's d	Interpretation
Experiment Pre-test vs. Post-test	2.33	Very large effect
Control Pre-test vs. Post-test	1.20	Large effect
Experiment Post-test vs. Control Post-test	1.69	Very large effect

The experimental group (d = 2.33) is very large, which means that the ethnomathematics intervention produced the large effect as far as it concerned mathematical understanding. Although the control group also shows an improvement (most probably caused by a regular instruction and age-related development), the smaller effect size (d = 1.20) and the large post-test difference (d = 1.69) between the two groups speaks in favor of the special role of including local culture into learning.

Normality and Homogeneity Tests

Table 5. Shapiro-Wilk Normality Test Results

Group	Test	Pre-test p-value	Post-test p-value	Normality Conclusion
Experiment	Shapiro-Wilk	0.112	0.089	Normal
Control	Shapiro-Wilk	0.105	0.076	Normal

The results of the normality test conducted using the Shapiro-Wilk Test showed that the data from both groups (experiment and control) followed a normal distribution, as the p-value was greater than 0.05 in all tests. This indicates that the data meet the normality assumption and can proceed with the use of parametric statistical tests such as the t-test.

Table 6. Levene's Homogeneity of Variance Test

Variable	Levene's Test p-value	Homogeneity Conclusion
Pre-test	0.218	Homogeneous
Post-test	0.184	Homogeneous

The homogeneity test conducted using Levene's Test showed homogeneous results for both groups. The p-value was greater than 0.05, indicating that there were no issues with the variance between the groups. Therefore, the assumption for proceeding with the t-test is met, and the comparison between the experimental and control groups can be made without significant variance issues.

Independent Samples t-test

Based on the results of the independent t-test shown in Table 3, there was a significant difference between the experimental and control groups after the cultural-based learning intervention. This can be seen from the p-value which is smaller than 0.05 (p-value = 0.002), indicating that the null hypothesis (no difference) can be rejected. Thus, it can be concluded that cultural-based learning has a significant positive impact on improving students'

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

understanding of mathematics, particularly in the experimental group that received the intervention.

Table 7. Independent Samples t-test

Statistic	Experiment	Control
Mean	78.13	74.13
Variance	24.70	17.56
Observations (n)	15	15
Mean Difference	0	0
Degrees of Freedom (df)	28	
t-statistic	4.567	
p-value	0.002	
t-critical	±2.048	

In line with these findings, the implementation of ethnomathematics-based learning that integrates Gorontalo's local culture, particularly the Payango traditional house, further strengthens the evidence that local culture can enrich students' understanding of mathematical concepts. This is evidenced by the significant difference between the experimental group and the control group after the application of ethnomathematics-based learning.

Table 8. A.3 Students' Perception of Ethnomathematics-Based Learning (from interviews)

Statement	% Agree	% Neutral	% Disagree
I find mathematics easier to understand when connected to local culture	86%	14%	0%
I feel more motivated to learn mathematics	80%	20%	0%
I can see how mathematics relates to my daily life	90%	10%	0%

Even the quantitative take-away finds a strong collaboration in the perception statistics. Motivation and the ease of understanding were reported higher in most of the students. This is consistent with earlier research (e.g., Ramadhani et al., 2023; Fatmawati & Hanik, 2024) that determined the positive impact of ethnomathematics on cognitive and affective learning improvement. The above findings promote the more extensive introduction of such pedagogical practice.

Ethnomathematics as a Medium of Remarkable Transformation towards Acquiring Perceptible Mathematical Foundations

The results of this experiment allude not only to the statistical increase in the level of test performance in geometry by students. They mention the potential of the ethnomathematics-based learning experience to transform elementally the manner in which young learners experience and interpret mathematical concepts. These manipulations of symbols were disjointed, being frozen in time and incapable of creating a continuous sense; whereas manipulations of the concrete forms of the Payango traditional house, when dealing with concepts such as area and perimeter, allowed their learning to go past the symbolic manipulation into a truthful conceptual understanding. It reinforces a more general theoretical position that knowledge in mathematics is constructed neither in the vacuum nor in ignorance of its contextualization, but rather that it is intimately connected with the ways in which knowledge is made in the lived world of students. In this case, the outcomes sound well in resonance with Barwell et al. (2022), who also stated that mathematical knowledge is not a culturally neutral concept; rather, it always depends on what contexts it was learned and

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

applied. Empirical findings of our study strengthen the fact that mathematics which is taught in culturally relevant manner not only becomes easier to comprehend, but also becomes more meaningful.

The overall impact of such outcome is given by the fact that it can serve as a practical antidote to critiques according to which ethnomathematics tends to trivialize mathematics by lowering it to a level of folk practice or cultural anecdote. Rather, this paper indicates that cultural integration may be used as a passage to formal mathematical thinking. As an example, when students have been asked to determine the area of the triangular roof of the Payango house or a door that consisted of a rectangle, they were not merely looking into their own culture, but rather implementing formal geometrical principles into genuine and realistic situations. This agrees with Verner et al. (2019), who concluded that when geometry becomes an ethno-mathematic situation, the learner can perceive the relationship between abstract mathematics and its real-life applications. The Payango house geometry required students to base their arguments on the existing structure of the real world, unlike the abstract textbook examples as a result of which the concepts could be better internalized.

Nonetheless, as promising as the results are, it is vital to critically contemplate what is happening behind this success. The diligence of cognitive anchoring was probably behind the marked improvements in average performance, not to mention the declination of performance variance. How this partnership worked was by associating familiar abstract concepts with a tangible object that was both physically and culturally present. By doing so students were able to build models in their minds that made math concepts make more sense. This is consistent with the existing theories of learning (i.e., the socio-cultural theory of Vygotsky) because learning is thought through cultural means. However, we should not simplify the mechanism, though. This advancement is not only caused by what used to be called the acquaintance, but it is based on the way in which the teaching arrangement prompted the prior ground students had, intrigued students, as well as invited them to view mathematics as something pertinent to their lives. In line with the above-mentioned results, Wildan et al. (2024) stressed that one of the most important factors contributing to deep learning is relevance of the content to lived experiences among students, and our findings strongly demonstrate this fact.

Notably, the uniform rise in the various learning institutions highlights the flexibility of ethnomathematics in various contexts. Similar results were recorded in Telaga Biru, Limboto, and Batudaa when it comes to the cultural integration strategy. This is an indication that the pedagogical principle (relating mathematics to a cultural form) is broad with the more restricted cultural artifact (the Payango house) only being a unique case. The important implication of this learning is on educational practice in Indonesia, which is highly diverse in its cultural life. It demonstrates that it is not about trying to reproduce the single form of culture everywhere but about teaching mathematics based on cultural heritage of specific communities. This local grounding is what Permana (2023) had called out, and the research provides tangible examples of what that application may entail. There is however a need to be cautious when it comes to thinking that context is the sole factor that ensures success. Greater consistency of mean post-test scores implies more consistent knowledge and less consistency reinforces that pedagogical differences count. There should be more than inserting the element of culture in it because the instruction has to be built in such a way to lead students through cultural observation to mathematical abstraction. This resonates with Lalu & Nurmawanti (2023), who claimed that ethnomathemantic scaffolding should be considered to avoid superficial learning. This study therefore signals the necessity of professional development and design models which can help teachers to reach this depth.

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

Promoting Ethnomathematics for building Mathematical Disposition and Identity

Among the most notable results of such study, there was a positive change of attitude of students towards mathematics. The finding that many students stated that mathematics was not only easier and more interesting but also is connected to the higher percentage of liking the subject but also shows that the idea of liking the subject was not the only transformation that took place in the student mentality, it was also the idea that the student changed the way they viewed themselves as a result of learning the subject. Instead of letting mathematics be perceived as something that is far, abstract, imposed, the students started to think about mathematics as it was their piece of the world, as a means of perceiving the world around them, communicating with it, responding to it and changing it. This resonates well with the fact highlighted by Islamiati & Nasruddin (2020) that mathematical disposition cannot be reduced to attitude and it is related to identity and self- aid as a learner of mathematics. This positive identity that our findings point to as a result of ethnomathematics has to do with the affirming of the culture background of the students as valid contributors to the mathematical knowledge of students.

This is especially relevant in a circumstance where learners would perceive mathematics to be irrelevant to their life or their cultural background. Ethnomathematics also serves to undo alienation, which is a typical fallout of school mathematics, by putting their own heritage in the center of learning. Ramadhani et al. (2023) have noted that culturally situated learning makes students more eager to take on difficult tasks, and in our study, we have confirmed the same observation: students who used Payango house geometry came to complex quantities and calculations more eagerly, and they acted more persistently.

But in as much as the positive outcomes on disposition are promising, they elicit more investigations. How far should the strength and commitment they bring about with the help of ethnomathematics be applied outside the context of the immediate culture? This is a serious inquiry since so long as there is a tight bond between cultural integration with certain symbols or even practises, then students might not be in a position to generalize their learning in such a way that it applies to other unknown issues. Our conclusion can thus be interpreted as a manifesto to balanced designs which will leverage on culture as a point of entry, but in addition will enable students to abstract principles that they can use in more varied settings. One more dimension that should be made use of critically is inclusivity. Payango house is a famous figure of gorontalo culture yet in the classroom the students have other ethnic or cultural backgrounds. Ethnomathematics has to make a picket of paying too much attention to local symbols that are dominant in one way or another because it is exposed to the danger of marginalizing other members that fail to find the depiction of some of their identity in the contents. Sulfayanti (2022) also compelled teachers to think about such integration of cultures in mathematics as pluralistic and not exclusive, which again is essential regarding the further development of the ethnomathematics program prompted by our research. This would include going out of the way to find a way to present the various cultural traditions within the instruction, and have the students choose or investigate the cultural contexts that are important to them.

As far as identity is concerned, the role played by ethnomathematics extends past the mathematics classroom. This means that when students are able to see their culture represented within the subject that appears to be universal, such as mathematics, they gain a feeling of belonging and pride that may help them invest in the subject at large. Masruroh et al. (2023) pointed out the value of associating learning with the local culture as it serves the wider purposes of cultural maintenance and unity, respectively. This assertion has an empirical

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

presence as demonstrated in our findings, that mathematics education is actually able to be a place of both cognitive and cultural identity cultivation.

Curriculum and Policy Implications: To a Systematic Connection of Ethnomathematics

The results provided in this study have and can be used to make explicit policy recommendations regarding curriculum and education plan. They demonstrate that ethnomathematics is not an extra or enrichment exercise; it can become the basis of effective tutorial teaching of mathematics that is not only demanding, but also stimulating and responsive. The contextual learning and student agency of the Merdeka Curriculum present an environment in which a systematic infusion of ethnomathematics may take place. But this must be accomplished through organized curricular infusion and not on isolated cases or even individual teacher programs. Just as Aulya et al. (2024) observed, to achieve a sustained influence, ethnomathematics should appear not only in the classroom work but also in the textbooks, learning units, and evaluation methods.

An important facilitator of this vision is teacher preparation. Kusuma et al. (2024) noted that effective transmission of ethnomathematics in schools should assume the possession of the pedagogical flexibility, cultural competence, as well as critical reflection by teachers. The results of our study support this fact. The increases of both student knowledge and willingness to persevere was not necessarily a consequence of the use cultural artifacts, but the result of how artifacts became rich mathematical problems as there was careful planning of instruction. Educator preparation programs should then focus more on preparing future teachers able to find significant cultural contexts, tasks that closely relate culture and mathematics to each other, and work around the murky waters of representing culture inclusively.

On a policy level, our research indicates that ethnomathematics provides a cost-effective, high-payoff solution to enhancing mathematics observance, particularly in areas with few resources. In contrast to imports either in materials or solution that relies on application of technology, ethnomathematics utilizes culture as a resource that can be found in the immediate surroundings of the students. This agrees with the demands by Payadnya et al. (2024) to have education systems gain access to local knowledge systems to form the basis of innovation and equity. Policies however need to back up such work with investment in teacher development, resource building and research that is continually improving the practice. With that being said, ethnomathematics has difficulties with scaling up. What do we do about quality and coherence of the different local implementations? And what about ascertaining a harmonious balance between respecting local specificity on the one hand, and the necessity of national consistency in standards and assessment on the other hand? These are the questions which require joint efforts of all educators, cultural leaders, researchers, and policy makers to find the answers. The potential is clear as identified by our study; however, to achieve it in large scale will be an uphill task that will need diligence, communication and dynamic policymaking.

The Future Research and Contributions of Methodological and Theoretical Applications

To the extent of methodology, this study is a contribution to this area in the sense that it has proved the importance of integrating quantitative data on performance with qualitative data on experiences and perceptions of students. This research that involved both qualitative and quantitative methods gave a better view of the influence of ethnomathematics beyond the test-score results on both the affective and identity levels of learning. Nonetheless, due to the short-term nature of the research, it can be said that further research should be long-term in nature to allow research to follow the progression of understanding, disposition and confidence over time in the students. Are these advantages of ethnomathematics maintained when students are

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

presented with more sophisticated mathematics, or when they are presented with mathematic beyond their home culture? Longitudinal studies might provide the important answers to these questions.

Our findings theoretically help in the current debates over the nature of mathematics education and its place in the society. They swear that mathematics is not a set of procedures to be learnt but a human practice capable and destined to be expressed in line with the cultural identities of the learners. In that way, the research remains consistent with the scholars promoting the view of re-conceptualizing mathematics education as a site of cultural affirmation and epistemic justice (Barwell et al., 2022; Bishop, 1988). And yet, it also provokes further investigation into how ethnomathematics and the needs of more general mathematical generalization and transfer can be made compatible with one another, a contradiction that future work will have to reconcile. The potential linkage of ethnomathematics with other emerging pedagogies, e.g., problem-based learning, digital-based learning tools, interdisciplinary thinking are proposed to be studied in future research. Might there be an additional benefit to integrating ethnomathematics with technology (e.g., virtual visits to the cultural artifacts)? Also, cross-regional research would be able to offer insight into universal ways of effective and specific variation in ethnomathematics practice. Another fertile ground is the possibility of ethnomathematics promoting more general educational purposes and objectives, e.g., the adoption of intercultural knowledge and emphases, intercultural tolerance, social cohesion, and peacebuilding within multicultural societies.

Conclusion

This paper thereby offers convincing and significant findings that ethnomathematics-oriented teaching -in this respect, the inclusion of the Payango traditional house in teaching geometry- is a promising, contextually-connected, and fair approach to help elementary students gain better comprehension of mathematics. Enormous progress in conceptual understanding, a decrease of the variability of the learning, and a positive change in the mathematical attitude of students point to the power of culturally responsive pedagogy. Whereas in traditional learning, mathematics can be introduced in a way that it is dissimilar and abstract in which students have no reflections on mathematics, in ethnomathematics approach, mathematics is introduced in a way that makes it comprehensible and purposeful. This brings about better involvement, higher order thinking and ownership towards learning mathematics.

It is critical to mention that the results of the study confirm the idea that mathematics education may be used not only to promote high-level cognitive development but also to promote and maintain the local culture on the one hand and to support high-level cognitive development on the other hand. Producing learning from the cultural background of communities where the students live, ethnomathematics does more than reinforce the mathematical learning but also plays the role of initiating more collective educational prospects like cultural preservation, organization, and group spirit. The results can be traced back to aspirations of the country to the curriculum that revolves around Merdeka Curriculum and global trends towards culturally sustaining pedagogies.

It is however observed in the study that context is not a sufficient condition on its own. The effectiveness of ethnomathematics relies on intelligent teaching program, representation of cultures, as well as, the capacity of teachers to connect cultural understanding to formal conceptions of mathematics. The results thus indicate that teacher professional development, curriculum innovations, and policy measures that would facilitate the significant and widespread integration of ethnomathematics at different educational fronts of Indonesia are in extreme necessity. In the future, the current work needs to be built upon along various crucial

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

lines. Longitudinal studies are required to determine how lasting are the suggested positive effects across mathematical fields, beyond geometry, and over a long period of time. The areas of exploring the exploration of the possible points of intersection between ethnomathematics and digital learning tools, problem-based learning systems, and interdisciplinary teaching are also available.. Moreover, comparative studies across regions could illuminate both the universal principles and local adaptations necessary for effective ethnomathematics practice.

References

Agustin, S. K., & Supriadi, S. (2023). Efektivitas Pembelajaran Etnomatematika Sunda Media Permainan DAKOTA (Dakon Matematika) Terhadap Kemampuan Pemahaman Matematis Siswa Materi KPK Dan FPB Kelas IV SDN SEMPU 1. *Jurnal Peka*, *7*(1), 28–35. https://doi.org/10.37150/jp.v7i1.1966

Andriyanti, B. W., & Prihastari, E. B. (2023). Efektivitas Model PBL Berbasis Etnomatematika Terhadap Kemampuan Pemecahan Masalah Matematika Sekolah Dasar. *Caruban Jurnal Ilmiah Ilmu Pendidikan Dasar*, *6*(1), 35. https://doi.org/10.33603/caruban.v6i1.7854

Annajmi, A. (2024). Etnomatematika Melayu: Mengungkap Konsep Matematika Geometri Pada Tepak Sirih. *Hinef*, *3*(1), 1–12. https://doi.org/10.37792/hinef.v3i1.1159

Aulya, H., Turmuzi, M., & Nurmawanti, I. (2024). Pengembangan Modul Ajar Kurikulum Merdeka Berbasis Etnomatematika Pada Materi Bangun Datar Kelas II Di SDN 42 Mataram. *Jurnal Pendidikan Sains Geologi Dan Geofisika (Geoscienceed Journal)*, *5*(4), 763–773. https://doi.org/10.29303/goescienceed.v5i4.498

Barwell, R., Boylan, M., & Coles, A. (2022). Mathematics education and the living world: A dialogic response to a global crisis. *The Journal of Mathematical Behavior*, *68*, 101013. https://doi.org/10.1016/j.jmathb.2022.101013

Basmara, A., & Yahfizham. (2024). Eksplorasi Etnomatematik Pada Kain Ragidup Ulos Pada Konsep Bangunan Datar. *Euclid*, *11*(3), 152–161. https://doi.org/10.33603/e.v11i3.8991

Bishop, A. J. (1988). Mathematics education in its cultural context. *Educational studies in mathematics*, *19*(2), 179-191. https://doi.org/10.46328/ijemst.2921

Fatmawati, I., & Hanik, U. (2024). Penerapan Modul Ajar Matematika Berbasis Etnomatematika Kearifan Lokal Tradisi Nyadran Sidoarjo. *Jurnal Basicedu*, *8*(1), 806–814. https://doi.org/10.31004/basicedu.v8i1.7189

Fitri, A., Rahim, R., Nurhayati, Aziz, Pagiling, S. L., Natsir, I., Munfarikhatin, A., Simanjuntak, D. N., HUatgaol, K., & Anugrah, N. E. (2023). Dasar-dasar Statistika untuk Penelitian. In *Yayasan Kita Menulis*.

Harefa, D. (2024). Strengthening Mathematics and Natural Sciences Education based on The Local Wisdom of South Nias: Integration of Traditional Concepts in Modern Education. *HAGA: Jurnal Pengabdian Kepada Masyarakat*, *3*(2), 63-79. https://doi.org/10.57094/haga.v3i2.2347

Hendriyanto, A., Priatna, N., Juandi, D., Dahlan, J. A., Hidayat, R., Sahara, S., & Muhaimin, L. H. (2023). Learning Mathematics Using an Ethnomathematics Approach: A Systematic Literature Review. *Journal of Higher Education Theory & Practice*, *23*(7). https://doi.org/10.33423/jhetp.v23i7.6012

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

Imswatama, A. (2023). Pengembangan Bahan Ajar Matematika Berbasis Rme Dengan Konteks Kearifan Lokal Pada Materi Bangun Datar. *Aksioma Jurnal Program Studi Pendidikan Matematika*, *12*(2), 2568. https://doi.org/10.24127/ajpm.v12i2.7043

Islamiati, N., & Nasruddin, N. (2020). Disposisi Matematis Siswa Pada Penerapan Etnomatematika Dalam Pembelajaran Matematika. *Jurnal Pendidikan Mipa*, *10*(1), 1–6. https://doi.org/10.37630/jpm.v10i1.241

Kamid, K., Rohati, R., Hobri, H., Triani, E., Rohana, S., & Pratama, W. A. (2022). Process Skill and Student's Interest for Mathematics Learning: Playing a Traditional Games. *International Journal of Instruction*, *15*(3), 967-988. https://doi.org/10.29333/iji.2022.15352a

Khaerani, K., Arismunandar, A., & Tolla, I. (2024). Peran Etnomatematika Dalam Meningkatkan Mutu Pembelajaran Matematika: Tinjauan Literatur. *Indonesian Journal of Intellectual Publication*, *5*(1), 20–26. https://doi.org/10.51577/ijipublication.v5i1.579

Kurniawan, H., Purwoko, R. Y., & Setiana, D. S. (2023). Integrating cultural artifacts and tradition from remote regions in developing mathematics lesson plans to enhance mathematical literacy. *Journal of Pedagogical Research*, *8*(1), 61-74. https://doi.org/10.33902/JPR.202423016

Kusuma, A. B., Hanum, F., Abadi, A. M., & Ahmad, A. (2024). Exploration of Ethnomathematics Research in Indonesia 2010-2023. *Infinity Journal*, *13*(2), 393–412. https://doi.org/10.22460/infinity.v13i2.p393-412

Lalu, M. a., & Nurmawanti, I. (2023). Etnomatematika : Eksplorasi Konsep – Konsep Geometri Dalam Kearifan Lokal Suku Sasak. *Indiktika Jurnal Inovasi Pendidikan Matematika*, *5*(2), 160–169. https://doi.org/10.31851/indiktika.v5i2.11740

Madusise, S., & Mwakapenda, W. (2014). Using school mathematics to understand cultural activities: How far can we go. *Mediterranean Journal of Social Sciences*, *5*(3), 146-157. http://dx.doi.org/10.5901/mjss.2014.v5n3p146

Masruroh, M., Eraku, S. S., Kobi, W., & Tamau, N. (2023). Nilai Kearifan Lokal Pada Rumah Adat Dulohupa Kota Gorontalo. *JURNAL SOSIAL EKONOMI DAN HUMANIORA*, *9*(1), 111–116. https://doi.org/10.29303/jseh.v9i1.197

Mei, A., Purwastuti, L. A., Hidayat, R., & Ayub, A. F. M. (2025). Problem-Solving Learning Model Based on Ethnomathematics to Improve Student's Creative Thinking in Elementary School. *Malaysian Journal of Mathematical Sciences*, *19*(1). http://dx.doi.org/10.47836/mjms.19.1.15

Mohamed, D. A., & Kandeel, M. M. (2023). Playful Learning: Teaching the Properties of Geometric Shapes through Pop-Up Mechanisms for Kindergarten. *International Journal of Education in Mathematics, Science and Technology*, *11*(1), 179-197. http://dx.doi.org/10.46328/ijemst.2921

Naitili, C. A., & Nitte, Y. M. (2023). Efektivitas Pembelajaran Etnomatematika Menggunakan Permainan Sikidoka Terhadap Pemahaman Konsep Geometri Bagi Siswa Sekolah Dasar. *Hinef*, *2*(1), 42–48. https://doi.org/10.37792/hinef.v2i1.857

Nasir, N. I. S., Hand, V., & Taylor, E. V. (2008). Culture and mathematics in school: Boundaries between "cultural" and "domain" knowledge in the mathematics

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

classroom and beyond. *Review of research in education*, *32*(1), 187-240. http://dx.doi.org/10.1108/JME-05-2016-0032

Payadnya, I. P. A. A., Wulandari, I. G. A. P. A., Puspadewi, K. R., & Saelee, S. (2024). The significance of ethnomathematics learning: a cross-cultural perspectives between Indonesian and Thailand educators. *Journal for Multicultural Education*, *18*(4), 508–522. https://doi.org/10.1108/JME-05-2024-0049

Permana, N. (2023). Improving Students Mathematics Learning Outcomes Through Sundanese Ethnomathematics: A Systematic Literature Review. *Abjme*, *1*(1), 11–21. https://doi.org/10.61553/abjme.v1i1.12

Pirma, F. O., & Caswita, C. (2023). Analysis of the Needs for Developing E-Modules With Flipping Books as Ethnomathematics-Based Teaching Materials. *Journal of Mathematics Education*, *8*(2), 232–239. https://doi.org/10.31327/jme.v8i2.1974

Ponte, R., Viseu, F., Neto, T. B., & Aires, A. P. (2023, June). Revisiting manipulatives in the learning of geometric figures. In *Frontiers in Education* (Vol. 8, p. 1217680). Frontiers Media SA. https://doi.org/10.3389/feduc.2023.1217680

Prahmana, R. C. I. (2022). Ethno-realistic mathematics education: The promising learning approach in the city of culture. *SN Social Sciences*, *2*(12), 257. http://dx.doi.org/10.1007/s43545-022-00571-w

Rachmaniah Mirza Hariastuti, M. (2023). Traditional houses in ethnomathematical-thematic-connected-based mathematics learning. *Nternational Journal of Educational Methodology*, *8*(3), 535-549. https://doi.org/10.12973/ijem.8.3.535

Ramadhani, A., Mutmainna, S. N., Mirnawati, M., & Irmayanti, I. (2023). Peran Etnomatematika Dalam Pembelajaran Matematika Pada Kurikulum 2013. *Competitive Journal of Education*, *2*(1), 53–68. https://doi.org/10.58355/competitive.v2i1.16

Rosinansis, R., Herman, T., & Hasanah, A. (2022). Improving Mathematical Meaningful Abilities of Native Students in the Pelabuhanratu Region Using an Ethnomathematics Approach. *Qalamuna Jurnal Pendidikan Sosial Dan Agama*, *14*(1), 405–418. https://doi.org/10.37680/qalamuna.v14i1.4167

Sari, N. H. (2022). Development Mathematics Realistic Education Worksheet Based on Ethnomathematics in Elementary School. *Phenomenon Jurnal Pendidikan Mipa*, *12*(1), 77–89. https://doi.org/10.21580/phen.2022.12.1.10853

Soesana, A., Subakti, H., Salamun, S., Tasrim, I. W., Karwanto, K., Falani, I., Bukidz, D. P., & Pasaribu, A. N. (2023). *Metodologi Penelitian Kuantitatif*.

Subarinah, S., Junaidi, J., Triutami, T. W., Wulandari, N. P., & Salsabila, N. H. (2022). Logic and Sets Textbook Containing Ethnomathematics of Sasak Culture: Validation and Design. *Alphamath Journal of Mathematics Education*, *8*(2), 164. https://doi.org/10.30595/alphamath.v8i2.13438

Sulfayanti, N. (2022). Peran Etnomatematika Dalam Pembelajaran Terhadap Karakter Siswa. *Jurnal Pendidikan Mipa*, *12*(4), 1167–1174. https://doi.org/10.37630/jpm.v12i4.773

Syahnia, S. M., Haenilah, E. Y., Perdana, R., & Caswita, C. (2024). Ethnomathematics-based Problem Based Learning (PBL) Model to Increase Students' Critical Thinking in

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

Mathematics Learning. *Lectura: Jurnal Pendidikan*, *15*(2), 571-581. https://doi.org/10.31849/lectura.v15i2.20985

Trumansyahjaya, K. (2022). Konsep “Mo Mayango” Sebagai Tradisi Pembelajaran Pembangunan Rumah Tinggal Di Gorontalo. *Jurnal Vokasi Sains Dan Teknologi*, *1*(2), 29–34. https://doi.org/10.56190/jvst.v1i2.7

Turmuzi, M., Suharta, I. G. P., & Suparta, I. N. (2023). Ethnomathematical research in mathematics education journals in Indonesia: A case study of data design and analysis. *Eurasia Journal of Mathematics, Science and Technology Education*, *19*(1), em2220. http://dx.doi.org/10.29333/ejmste/12836

Ula, M., Mastur, Z., & Ridlo, S. (2024). Development of an e-module containing ethnomathematics in the Problem Based Learning (PBL) model to improve elementary school students' problem solving abilities. *Tennessee Research International of Social Sciences*, *6*(2), 57-86.

Ulusoy, F. (2021). Prospective early childhood and elementary school mathematics teachers’ concept images and concept definitions of triangles. *International Journal of Science and Mathematics Education*, *19*(5), 1057-1078. http://dx.doi.org/10.1007/s10763-020-10105-6

Ulya, H., Rahayu, R., Sa’dijah, C., Qohar, A., & Saad, M. I. M. (2024). Designing Performance Assessment for Ethnomathematics Project-Based Learning to Assess University Students’ Mathematical Thinking Skills. *Jurnal Pendidikan MIPA*, *25*(3), 1281-1296. http://dx.doi.org/10.23960/jpmipa/v25i3.pp1281-1296

Umi, Y. (2023). *Analisis Data Mengunakan SPSS*.

Verner, I., Massarwe, K., & Bshouty, D. (2019). Development of competencies for teaching geometry through an ethnomathematical approach. *The Journal of Mathematical Behavior*, *56*, 100708. https://doi.org/10.1016/j.jmathb.2019.05.002

Wildan, D. A., Suningsih, S., Ardianto, D., & Arifin, M. Z. (2024). Efektivitas Penggunaan Etnomatematika Terhadap Peningkatan Pemahaman Matematis Siswa Sekolah Dasar. *Jurnal Pendidikan Dasar Flobamorata*, *5*(3), 456–463. https://doi.org/10.51494/jpdf.v5i3.1462

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)