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Learning Geometry of Flat Buildings Based on Batak Traditional Houses to Improve Numeracy Skills in Elementary Schools

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ABSTRACT. Numeracy is a fundamental skill in elementary mathematics education, yet conventional teaching methods often fail to connect abstract concepts with students' lived experiences. This study was motivated by the need for more contextual and meaningful learning models, particularly through the integration of local cultural heritage. The research aimed to: (1) determine whether there is a significant difference in numeracy skills between fourth-grade students at SD Swasta Muhammadiyah 2 Padangsidimpuan who received geometry instruction based on Rumah Adat Batak (Rumah Bolon) and those who received conventional instruction, and (2) examine the improvement in students' numeracy skills after participating in the culturally integrated learning. A quasi-experimental method was employed using a pretest-posttest control group design. The sample consisted of 64 students divided into an experimental class and a control class. A multiple-choice numeracy test was used as the research instrument. Data were analyzed using a t-test and N-Gain calculation. The results revealed a significant difference between the two groups ($t = 2.138$; $p = 0.036 < 0.05$), with the experimental group achieving higher scores. The average N-Gain score of 0.42 indicated a moderate improvement in numeracy skills. These findings suggest that geometry instruction incorporating Rumah Bolon effectively enhances students' numeracy in a more meaningful way. The study implies that integrating local cultural contexts into mathematics curricula can strengthen conceptual understanding and support national numeracy goals. This approach offers a promising pathway for culturally responsive pedagogy in Indonesian elementary education.

Keywords: *Geometry Learning, Flat Building, Batak Traditional House, Numeracy Skills, Elementary School*

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INTRODUCTION

Mathematics plays an important role in education. To increase competitiveness in facing the challenges of the 21st century, the six basic literacy include: (1) Literacy, (2) Numeracy Literacy, (3) Science Literacy, (4) Digital Literacy, (5) Financial Literacy, and (6) Cultural and Civic Literacy (Anderha & Maskar, 2021). Numeracy skills in primary school include numeracy skills, understanding mathematical concepts, and applying strategies in a real-world context (Alimuddin & Yuzrizal, 2020; Winata et al., 2021; Rosidi, Ahmad Alfan; Nimah, 2022). Geometry materials, especially flat buildings, are an important component in building students' numeracy competencies (Janson Silaban et al., 2024; Hidayat et al., 2020). However, a number of studies say that students'

ability in flat building materials is still not optimal and needs a more contextual and meaningful learning strategy (Utami & Irawati, 2024; Hanan & Alim, 2023; Azhirakeisha & Afriannisa, 2024; Citra et al., 2025).

One of the relevant contextual learning approaches in geometry learning is to integrate local cultures, such as traditional house architecture. In this case, Batak traditional houses, especially the Bolon House, have various forms of flat buildings that can be seen on the roof, walls, doors, windows, pillars, and stairs. These elements can be used as contextual learning media in mathematics subjects (Fatimah et al., 2022; Kholisa, 2021). This approach is in line with the independent curriculum that emphasizes learning based on the cultural context and environment around students (Ni Luh Purnamasuari Prapnuwanti et al., 2024; Taib et al., 2024; Kurniawan et al., 2024; Sugiharto et al., 2024). Through the introduction of local cultural elements, students are expected to be able to understand geometric concepts in a more concrete and meaningful way.

The integration between local culture and geometry materials can increase students' motivation to learn because they feel close to the object being studied (Ndani et al., 2025; Mailani et al., 2024). In addition, culture-based learning approaches have been proven to improve numeracy literacy because students are trained to relate mathematical concepts to the social and cultural realities they experience (Sulistyawati Wiwik, Wahyudi, 2022; Mailani, Nur Rarastika, et al., 2024). Some previous studies have shown that the use of local contexts in mathematics learning can provide a significant improvement in students' critical thinking and problem-solving skills (Nur et al., 2020; Nur et al., 2021; Nursyahidah et al., 2018).

However, there is still a small amount of research that specifically develops a flat building geometry learning model based on Batak traditional houses. In fact, the roof structure, pillars, and ornaments on the Bolon House are very rich in geometric shapes, such as triangles, rectangles, parallelograms, and trapezoids (Naibaho et al., 2024; Anggi Brigita Cesaria Saragih et al., 2024). By making traditional houses as learning objects, students not only gain a better understanding of mathematical concepts, but also contribute to efforts to preserve the culture of their ancestors (Wahyudin, 2018; Payadnya et al., 2024; Iskandar et al., 2022). This is also in line with the principles of integrated thematic learning that are characteristic at the elementary school level (Sari et al., 2020; Lili Kasmini et al., 2020; Reinita & Wahyuni, 2020).

In the context of numeracy, the introduction of flat buildings through the visual media of Batak traditional houses can facilitate the understanding of broad concepts, circulation, and relationships between buildings in a more contextual and applicative manner. This ability is part of the basic numeracy indicators, which include mathematical representation, understanding spatial relationships, and the application of mathematical strategies in real-world contexts (Sihombing & Tambunan, 2021; Simanjuntak et al., 2024). Therefore, it is very important to design a learning model that is able to accommodate the integration between the cognitive aspects of mathematics and the richness of local culture in order to optimally improve students' numeracy skills (Sulistyawati Wiwik, Wahyudi, 2022; Anwar & Ramadhani, 2025).

Based on the description above, this study aims to test the effectiveness of learning flat building geometry based on Batak Traditional Houses (Bolon Houses) in improving the numeracy skills of elementary school students. This research is expected to make a theoretical contribution to the development of culture-based contextual learning models, as well as practically provide an alternative to innovative and fun mathematics learning strategies (Br Panjaitan & Sukmawarti, 2022). Furthermore, the results of this research are expected to be an important reference for educators and curriculum developers in implementing contextual and culturally valuable learning. By integrating the rich local culture, such as the Batak Traditional House (Rumah Bolon), into the mathematics learning process, it is hoped that it can support the achievement of students' overall numeracy competencies and increase their motivation and learning engagement. This approach

not only enriches the learning experience, but also strengthens students' cultural identities so that learning becomes more meaningful and relevant to daily life.

METHOD

This study uses a quantitative approach with a quasi-experimental (*quasi-experimental) design*)(Alin Sholihah & Mahmudi, 2015). The purpose of the study is to see (1) Is there a significant difference in numeracy ability between grade IV students of SD Private Muhammadiyah 2 Padangsidimpuan who receive geometry learning based on Batak Traditional House (Rumah Bolon) and students who receive conventional learning?, (2) How to improve the numeracy ability of grade IV students after participating in geometry learning based on Batak Traditional House (Rumah Bolon)?. The population in this study is all grade IV students at SD Private Muhammadiyah 2 Padangsidimpuan which is the location of the research. The research sample consisted of two classes, namely the experimental class which amounted to 34 students and the control class which also amounted to 34 students. The class selection was carried out by *purposive sampling* to ensure relatively homogeneous student characteristics (Kensiwi et al., 2025). The experimental class was given flat building geometry learning based on the Batak Traditional House (Rumah Bolon), while the control class received conventional learning. The research design can be seen in the table below.

The experimental class was given flat building geometry learning based on the Batak Traditional House (Rumah Bolon), while the control class received conventional learning. The research design can be seen in the table below.(Alin Sholihah & Mahmudi, 2015).

RESULT AND DISCUSSION

Result

1. Normality Test

Before the data is analyzed, a normality test is first carried out as one of the requirements in quantitative analysis. This test aims to find out whether the post-numeracy ability data is normally distributed in the experimental group and the control group. The normality test of the numeracy ability postes data in both groups was carried out using the Shapiro-Wilk test with the help of the SPSS version 26.00 program. The normality test in this study used a significance level of $\alpha = 0.05$. The following are the results of the normality test of the post-student numeracy ability data in the experimental class and the control class.

Table 1. Results of the Normality Test Postes Students' Numeracy Ability

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Postest IVA	.174	34	.010	.938	34	.054
Postest IVB	.149	34	.055	.958	34	.208

Table 1 shows that the post-post scores of students' numeracy ability test results in the experimental class and the control class had a significance value (Sig) > 0.05. Thus, H_0 is accepted and H_a is rejected. This means that the postage data of the numeracy ability test results in the two classes is distributed normally.

2. Homogeneity Test

The test of the homogeneity of the postes score of the results of the students' numeracy ability test in the experimental class and the control class aimed to find out whether the data obtained came from a homogeneous population. Homogeneity analysis was performed using the Levene test with the help of the SPSS program version 26.00, as shown in the following Table 2.

Table 2 Results of Quantification Ability Homogeneity Test

Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
.404	1	66	.527

Table 2 above shows that the post-numerical ability of the experimental class and the control class has a Sig. value of > 0.05, so H0 is accepted and Ha is rejected. Thus, the variance postes of the numeracy ability of students in the experimental class and the control class came from the population having the same variance or homogeneous variance.

3. Uji Hypothesis

Table 3. Analysis of students' numeracy ability with the t test

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
POSTES	Equal variances assumed	.404	.527	2.138	66	**.036**	7.059	3.301	467	13.650
	Equal variances not assumed			2.138	65.282	.036	7.059	3.301	.466	13.652

Based on Table 3 above, the values of Tcal = 2.138 and Ttable = 2.0 were obtained, where Thitung > Ttable and obtained a value of sig = 0.036 this sig value was far below the criterion of 0.05, so that Ha was accepted and H0 was rejected. This means that the numeracy skills of students who receive flat building geometry learning based on Batak traditional houses (bolon houses) are better than students who receive ordinary learning.

4. Improvement of Numeracy Skills of Experimental Class Students

The improvement of students' numeracy skills can be seen from the results of the N-Gain calculation in the experimental class. The results of the N-Gain calculation in the experimental class are shown in the following Table 4:

Table 4. Results of Calculation of N-Gain of Numeracy Ability in Experimental Classes

Data Statistics	Numeracy Ability Test	
	Pretest	Postest
$\sum$	940	2010
$\bar{X}$	27,64	59,11
Average *N-Gain*	0,42	

Based on Table 4, it can be seen that the average N-Gain of students' numeracy ability in the experimental class was 0.42. Thus, it can be concluded that the improvement of students' numeracy skills after participating in the learning of flat building geometry based on Batak traditional houses (Rumah Bolon) is in the medium category.

Discussion

This research is located at Muhammadiyah Private Elementary School 2 Padangsidimpuan, involving grade IV students in the 2024/2025 school year. The study compared two classes: class IVA (as an experimental group) and class IVB (as a control group). The objective is to see (1) Is there a significant difference in numeracy ability between grade IV students of SD Private Muhammadiyah 2 Padangsidimpuan who receive geometry learning based on Batak Traditional House (Rumah Bolon) and students who receive conventional learning?, (2) How to improve the numeracy ability of grade IV students after participating in geometry learning based on Batak Traditional House (Bolon House)?. This study used a type of experiment, in which the two groups received different treatments. Class IVA received special treatment (the implementation of learning based on the Ratak Traditional House (Rumah Bolon), while class IVB continued to learn as usual without special treatment.

The results of the data normality test postes numeracy ability showed that the data was distributed normally in both groups, experiments and controls. In addition, the variance homogeneity test also showed a homogeneous population. With the fulfillment of these statistical assumptions, further analysis using the t-test can be carried out validly and reliably. These findings confirm that the flat building geometry learning approach based on Batak traditional houses (Rumah Bolon) has a positive impact on students' numeracy skills when compared to conventional learning methods.

The significance value of the t-test of 0.036 ($p < 0.05$) indicated a significant difference between the experimental and control groups, with the experimental group showing better numeracy ability. In addition, the average N-Gain value of 0.42 indicates an increase in numeracy ability in the medium category. This reinforces the argument that the integration of local cultural values into mathematics learning can effectively improve students' understanding of concepts and motivation to learn. This finding is in line with research (Simamora et al., 2018) which confirms the importance of incorporating local cultures to enrich mathematics learning and improve student learning outcomes.

Theoretically, these results support the ethnomathematical approach developed by (Chrissanti, 2019), which states that mathematics is inseparable from the social and cultural context in which it is used. When mathematics learning is associated with cultural experiences that are familiar to students, such as the shape and structure of the Batak traditional house (Rumah Bolon), students become more cognitively and affectively involved. This cultural context gives new meaning to the concept of geometry, thus facilitating the formation of a deeper understanding.

Research (Nasution & Yusnaldi, 2024) Research (Wulansari et al., 2024) shows that the CTL approach based on local culture can improve students' overall mathematics competence, both in the cognitive and affective domains.

Practically, this research contributes to the development of mathematics learning strategies at the elementary school level, especially in the context of Indonesia, which is rich in cultural diversity. Learning that links mathematical concepts to local culture not only improves learning outcomes, but also strengthens students' cultural identity and builds appreciation for cultural heritage. This is in line with the mission of the Independent Curriculum which encourages learning based on local contexts and strengthening character.

From the point of view of theoretical development, these findings can be considered as a modification of the *Contextual Teaching and Learning* (CTL) approach, by integrating local culture not only as an illustrative context, but as a strategic pedagogical medium in the process of mathematical knowledge construction. This integration expands the ethnomathematical framework that initially emphasized cultural values as a contextual resource, becoming a systematic instructional tool in learning design.

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CONCLUSION

Based on the results of data analysis, it can be concluded that learning the geometry of flat buildings based on Batak traditional houses (Rumah Bolon) has a significant positive influence on the numeracy skills of grade IV students of SD Prista Muhammadiyah 2 Padangsidimpuan. The post-numeracy ability data in the experimental and distributed control groups is normal and has homogeneous variance, so that the analysis using independent t-tests can be validly performed. The results of the t-test showed a tcount value of 2.138 with a significance of $p = 0.036$ (< 0.05), indicating a significant difference in numeracy ability between students who participated in local culture-based learning and conventional learning, with the experimental group showing better results.

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