Ethnomathematics Learning to Improve Students' Understanding for Numeracy Concepts

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A B S T R A K

Terdapat penerapan beberapa jenis permainan tradisional dalam pembelajaran matematika, misalnya dengan menggunakan media congklak untuk meningkatkan kemampuan berhitung. Penerapan permainan tradisional membantu siswa lebih mudah mempelajari materi pembelajaran matematika. Penelitian ini bertujuan untuk mengintegrasikan permainan congklak untuk mengenalkan konsep operasi hitung pada siswa sekolah dasar dalam pembelajaran matematika. Penelitian ini menggunakan pendekatan kuantitatif dengan metode penelitian eksperimen. Subyek penelitian ini adalah siswa sekolah dasar negeri 51 di Kabupaten Bengkalis, Provinsi Riau, Indonesia. Teknik pengumpulan data yang digunakan dalam penelitian ini menggunakan teknik tes. Kisi-kisi instrumen penelitian yang digunakan adalah tes kemampuan konsep berhitung siswa. Hasil dari penelitian ini adalah ditemukan peningkatan pemahaman konsep berhitung siswa yang diberikan pembelajaran berhitung dengan menerapkan metode pembelajaran yang menerapkan etnomatematika melalui permainan congklak jauh lebih baik daripada siswa yang diberikan pembelajaran berhitung dengan menerapkan cara lama. Sehingga dapat dinyatakan bahwa penerapan Etnomatematika dalam Pembelajaran dapat meningkatkan Pemahaman Konsep Berhitung Siswa secara signifikan dibandingkan pembelajaran dengan menggunakan metode guru biasa.

A B S T R A C T

The Implemented several types of traditional games in learning mathematics, for example by using congklak media to improve numeracy skills. The application of traditional games helps students learn mathematics learning material more easily. This study aims to integrate congklak games to introduce the concept of arithmetic operations to elementary school students in learning mathematics. This study uses a quantitative approach to the experimental research method. The subjects of this study were students of state elementary school 51 at Bengkalis Regency, Riau Province, Indonesia. Data collection techniques used in this study using test techniques. The research instrument grid used was a test of students' numeracy concept abilities. The resut of this study is finding increasing students' understanding of numeracy concepts students who are given learning to count by applying learning methods that apply ethnomathematics through the congklak game is much better than students who are given learning to count by applying the old way. So it can be stated that the application of Ethnomathematics in Learning can improve Students' Understanding of Numeracy Concepts significantly compared to learning using the usual method.

1. INTRODUCTION

The purpose of learning mathematics is knowledge that is used to facilitate transactions in everyday life. The description of learning mathematics so far is the struggle of students in understanding the basic concepts of mathematics (Ding et al., 2022; Khanal et al., 2021; Kinach, 2002; Wang et al., 2021) The concept of numeracy is an initial learning that must be mastered by elementary school students

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(Björklund et al., 2020; Kinach, 2002; Russell et al., 2022). That cosept is a basic mathematical concept that is used in everyday life through games and everyday interactions (Vandervert & Moe, 2021; Xu et al., 2022). The basic concepts of mathematics that are very important are the ability to count, compare and contrast, recognize shapes and positions, and solve problems (Civil et al., 2020; Fonseca, 2020; Gal et al., 2020; Woolcott et al., 2021). The ability to understand the concept of numeracy in elementary schools is still relatively low. Ethnomathematics presents mathematical concepts from the school curriculum in such a way that these concepts relate to students' culture and everyday experiences, thus enhancing their ability to draw meaningful relationships and deepening their understanding of mathematics (Fouze & Amit, 2018; Sirate, 2011). Ethnomathematics began to be widely studied by researchers in Indonesia starting from research on the Baduy people who always develop and use mathematical concepts in dealing with everyday life problems, while these people do not attend formal education (Arisetyawan et al., 2014; Karnilah, 2014). One of the teacher's strategies in learning that stimulates student problem solving is Realistic Mathematics Education (RME) (Hidayati & Prahmana, 2022; Tanujaya et al., 2017). Therefore, this study uses RME as a learning approach.

One context that can be used is the culture that is applied in realistic mathematics learning and modified according to the local context where the school is located (Damayanti & Putranti, 2016; Haris & Llma, 2011; Oktiningrum et al., 2016; van den Heuvel-Panhuizen, 2005). As a result, it can lead to pleasure in contextual learning if it is taught in schools. In addition, the cultural context can be used as a solution in cultivating cultural values and student characters that are almost extinct due to the influence of modernization (Muhtadi et al., 2017; Risdiyanti & Prahmana, 2017; Sembiring et al., 2008). Each regional traditional game has its own characteristics (Harahap & Jaelani, 2022; Nursyahidah et al., 2018). Previous study explains that jinggi, which is a jingki game from Indonesia, originates from Italy, Rome, which is known as the jingkit game (Lestari, 2022). Hopscotch comes from the words hop and Scotch. The game is also very familiar to the participants both in terms of culture and everyday life. Previous study stated that traditional games are fun because they contain concepts (Prahmana et al., 2012).

Ethnomathematics is the study of the relationship between mathematics and culture (Angraini et al., 2022; D'Ambrosio, 2016; Rosa & Orey, 2016). The process of learning mathematics for students is part of the development and application of mathematical concepts in everyday life (Madani et al., 2018; Saleh et al., 2018; Tanujaya et al., 2017). Ethnomathematics is presents the concept of mathematics from school curriculum by the way in which these concepts are related with students' cultural and everyday experiences, there by enhancing their ability to decipher meaningful relationships and deepen their understanding of mathematics (Abdullah, 2017; Risdiyanti & Prahmana, 2017).

The results of research using traditional games are known to increase learning achievement in understanding students' mathematical concepts. Research shows that the modified traditional game-assisted drill method has an effect on junior high school students' mathematical problem-solving abilities. there is an effect of traditional game-based learning on the social skills of elementary school students (Fitriyah & Khaerunisa, 2018). Other research shows that traditional game-based thematic learning models and scientific approach orientations are proven to be positive and have a significant effect on the creative thinking abilities of elementary school students (Kawuryan et al., 2016). Moreover there is study that shows ethnomathematics-based mathematics teaching materials have proven to be effective in improving problem-solving abilities and mathematical critical thinking of junior high school students (Imswatama & Lukman, 2018).

Several previous studies have implemented several types of traditional games in learning mathematics, for example by using congklak media to improve numeracy skills (Nataliya, 2015), Introduction to the Concept of Counting Operations through the Congklak Game in Mathematics Learning. (Siregar et al., 2014). Ethnomathematics Exploration of the Concept of Counting Operations in the Traditional Kempreng Games (Elly, 2020; Zakiah & Nina, 2020). One game that can teach facts, skills, concepts, and mathematical principles is congklak. Congklak is a traditional game that has developed in almost all regions. Congklak is considered one of the effective mediums to improve students' mathematical ability, so this game can be used as a reference for teaching mathematics (Cahyaningrum & Utomo, 2022; Nataliya, 2015; Siregar et al., 2014). Playing congklak has an effect on children's cognitive abilities. Given the importance of numeracy skills, it is important that the ability to count is instilled from the start, various ways and methods that must be done appropriately so as not to damage the pattern of child development (Rida et al., 2020; Saribu & Simanjuntak, 2018).

Congklak is a game that is loved by many Indonesian children, especially young women. This game has a different name in each region, but the most widely nicknamed is Congklak. This game tool or media is very flexible, because it can take advantage of the objects around it. For example, if there is no coglak board, it can be replaced by digging a small hole in the ground, making a circle on the floor, and the seeds can be replaced with small pebbles and other seeds. Congklak is an exciting game, it's easy to get game material

from the surrounding environment (Febriyanti et al., 2019). This trains mathematical logical intelligence and helps children improve their mathematical abilities. According to the results of a series of existing studies, the congklak game is an effective medium for increasing students' interest in learning mathematics during the learning process at the elementary school level Traditional games contain many cultural values and ancestral heritage of the Indonesian nation. If the game is something fun, then the traditional game is a habit that is usually done by the ancestors. This is because these games contain cultural values, so that traditional games are not just ordinary active games (Fouze & Amit, 2018; Rida et al., 2020).

This study aims to integrate congklak games to introduce the concept of arithmetic operations to elementary school students in learning mathematics*. various literature from various sources and media,* addressed without leaving cultural values. Based on the explanation above, a study was conducted entitled "Implementation of Ethnomathematics in Learning to Improve Students' Understanding of Numeracy Concepts " which aims to find out whether students' understanding of the concept of counting has increased.

2. METHOD

This study uses a quantitative approach to the experimental research method. Research design The experiment used in this study was a quasi-experimental design with a nonequivalent control group design. The *Experimental research* is a *quantitative* research method with a scientific approach. The quasi-experimental research involves collecting numerical data and statistical analysis then comparing groups with different conditions or treatments to find cause-and-effect relationships (Barrera et al., 2021; Krass, 2016; Syaiful et al., 2022). The subjects of this study were students of state elementary school Bengkalis Regency, Riau Province, Indonesia. The sample of this research is students of state elementary school Bengkalis Regency who are in class 1A and class 1B. Class 1b students were appointed as the experimental class in this study, so that in class 1B as many as 27 students were taught the concept of counting using a learning method that applied an ethnomathematics approach through the congklak game. while class 1A students were designated as the control class in this study. So that in class 1A as many as 27 students were given learning the concept of counting using the old learning method, namely using the lecture method and giving assignments in the form of questions related to understanding the concept of counting.

Data collection techniques used in this study using test techniques. The research instrument grid used was a test of students' numeracy concept abilities (Abbeduto et al., 2020; Abdollahi et al., 2021; Pietrabissa et al., 2020). That is, the test given is in the form of questions that describe students' ability to understand the concept of counting, so that student answers can be used as a benchmark for students' ability to understand the concept of counting. Furthermore, the instruments that have been provided are tested for validity by experts. Then tested the validity of empirical reliability. Testing the validity of the data can be done using the Pearson product moment and its reliability has been tested using Cronbach's alpha. Validity will tell you how good a test is in a given situation; the difficulty will tell you how reliable the score on that test will be (Sheikh et al., 2015; Son et al., 2020; Zmnako & Chalabi, 2019). You cannot draw valid conclusions from test scores unless you are sure that the test is reliable. Even when a test is reliable, it may not be valid. You should be careful that whatever test you choose is reliable and applicable to your situation (Abdollahi et al., 2023; Fontes et al., 2019; Serrano-villar & Rodríguez-grande, 2018).

The research hypothesis was tested using the 1-way hypothesis, namely $H_0: \mu_1 \leq \mu_2$ and $H_1: \mu_1 > \mu_2$. Before testing the hypothesis, a normality test was carried out on the data. The resulting data is first calculated for each N-Gain score so that prerequisite testing can be carried out. The resulting N-Gain score is continued with the normality test using the Kolmogorov Smirnov test assisted by SPSS IBM 26 and the homogeneity test using Levene's test assisted by SPSS IBM 26. Because the resulting data is not normally distributed and homogeneous, the data analysis in this study uses hypothesis testing. through the U-Mann Whitney test which is a 2-sample independent test that can be done with the assumption that the normality of the data is not met. Whitney's U-Man test not only tests the difference in Median, but also tests the Mean because in various cases the Median of the two groups can be the same, but the P-Value is small <0.05 which means there is a difference. The reason is that the mean of the two groups is significantly different. So it can be concluded that this test does not only test the median difference but also the average difference (Dedecker & Saulière, 2017; Salov, 2019; Tai et al., 2022).

3. RESULT AND DISCUSSION

Result

Table 1. Class A (control class) and class B (experimental) n-gain scores

| No. | A | | B | |
---	Initials Name	SkorN-Gain	Initials Name	Score N-Gain
1	MSA	0.75	FH	0.63
2	MAA	1.00	FPB	1.00
3	NWM	-1.40	CAA	1.00
4	QAR	-0.98	GZA	0.70
5	QKA	-11.05	HF	0.00
6	RYF	1.00	KQH	0.00
7	RMF	0.66	MRA	0.68
8	RAG	-0.01	MZLZ	0.52
9	CKR	0.25	MRM	1.00
10	SZI	1.00	MY	1.00
11	TSS	0.52	SAA	0.04
12	ZYA	-2.00	VB	-4.99
13	R	1.00	ZAR	0.00
14	MSA	0.75	FH	0.63
15	MAA	1.00	FPB	1.00
16	NWM	-1.40	CAA	1.00
17	QAR	-0.98	GZA	0.70
18	QKA	-11.05	HF	0.00
19	RYF	1.00	KQH	0.00
20	RMF	0.66	MRA	0.68
21	RAG	-0.01	MZLZ	0.52
22	CKR	0.25	MRM	1.00
23	SZI	1.00	MY	1.00
24	TSS	0.52	SAA	0.04
25	ZYA	-2.00	VB	-4.99
26	R	1.00	ZAR	0.00
27	RD	0.25	RY	0.63

Base on Table 1, show the n-gain value for class A (control class) an class B (experiment class). The n-gain score is the result of the pretest and posttest scores of both classes, there is a score of 0 because the pretest score is the same as the posttest or the pretest score is 100. The N-gain score is positive because the posttest score is greater than the pretest score, while the N-gain score is negative because the posttest is smaller than the pretest score. The n-gain scores of the control class and the experimental class were then used for hypothesis testing.

Before testing the hypothesis, it is necessary to carry out a homogeneity test and a normality test as prerequisite tests for carrying out a parametric test. The results of the normality test using SPSS through the lavender test using SPSS IBM 26 are presented in Table 2.

Table 2. Results of the normality test using the Kolmogrov - Smirnov test with the help of SPSS

		Kolmogrov –Smirnov			Shapiro-Walk		
	Class	Statistic	df	Sig.	Statistic	df	Sig.
N-Gain's	A(Control)	0.275	27	0.000	0.533	27	0.000
Score	B(Experiment)	0.361	27	0.000	0.497	27	0.000

Base on Table 2 through the Kolmogorov Smirnov test seen from the sig value resulting from the control class and experimental class data of 0.000. Because the sig value of the control class and experimental class <0.05 or 0.000 <0.05, the distribution of the control class and experimental class data is not normal. The result of homogeneity test is show in Table 3.

Table 3. Results of the Homogeneity Test Using the Levene Test with the Help of SPSS 26

	Levene Statistic		df1	df2	Sig.
N-Gain's Score	Basedon Mean	2.659	1	52	.109
	BasedonMedian	1.421	1	52	.239
	BasedonMedianandwith adjusted df	1.421	1	38.322	.241
	Basedontrimmedmean	1.530	1	52	.222

Table 3 shows the Levene test sig value of 0.109. Because the sig value > 0.05 or 0.109 > 0.05, it can be concluded that the data distribution is homogeneous. So that the research data did not meet the requirements of the parametric test, the data were analyzed using a non-parametric test, namely the U man Whitney test to see the differences between the two groups given different treatments. The results of testing the hypothesis using SPSS IBM 26 through the Mann-Whitney U-test can be seen in Table 4.

Table 4. The Result for Teststatistics

	N-Gain's score
Mann-WhitneyU	251.500
WilcoxonW	629.500
Z	-1.973
Asymp.Sig.(2-tailed)	0.049

In Table 4 it can be seen the results of testing the hypothesis using SPSS IBM 26 through the Mann-Whitney U-Test. Based on hypothesis testing through the U-Mann-Whitney test which can be seen in Table 5 above, it is known that the resulting sig value is 0.049. The U-Mann Whitney test using SPSS has criteria for drawing conclusions, namely if the sig value <0.05 then Ho is rejected and Ha is accepted, whereas if the sig value is > 0.05 then Ho is accepted and Ha is rejected. Because the sig value < 0.05 or 0.049 < 0.05 then Ho is rejected and Ha is accepted. So it can be interpreted that the increase in students' ability to understand of numeracy concepts in the experimental class is higher than control class.

Discussion

In this study, data analysis was focused on comparing the results of improving students' numeracy concept comprehension skills between the two groups. That is Class A as the control class provides learning to count with the learning method commonly used by the teacher, while Class B as the experimental class is given learning to count by applying a learning method that implements ethnomathematics through the congklak's game. Therefore the research hypothesis is Ho: Improving students' ability to understand numeracy concepts in the experimental class ≤ control class. Whereas Ha: Increasing the ability to understand students' numeracy concepts in the experimental class > control class.

The results of the pretest and posttest of each student from the two groups used the n-gain score. From the discussion above, it can be concluded that increasing students' understanding of numeracy Concepts in students who are given learning to count by applying learning methods that apply ethnomathematics through the congklak's game is much better than students who are given learning to count by applying the old way. So it can be stated that the application of Ethnomathematics in Learning can improve Students' Understanding of numeracy Concepts significantly compared to learning using the usual teacher method, namely the lecture method.

This is in line with research (Cahyaningrum & Utomo, 2022; Nataliya, 2015; Rida et al., 2020; Siregar et al., 2014). Indirectly the game of numeracy skills in ethnomathematics-based problem-solving can affect numeracy skills (Iswara et al., 2022; Kleemans et al., 2012; Wolf & McCoy, 2019). Because the emphasis is on the concept of counting students is instilled with the application of ethnomathematics through the congklak game learning is very fun for children. the game is very fun and can not be separated from the children. This is because the game is very fun and can not be separated from children. Feelings of happiness stimulate the brain to produce dopamine in children (Gottschalk, 2019; Nijhof et al., 2018; Yogman et al., 2018). Because the emphasis on students' numeracy concepts is instilled with the application of ethnomathematics through the congklak game which can stimulate dopamine, students are automatically motivated and motivated to increase their creativity and understand the concept of counting easily and without burden. So that students' ability to understand the concept of counting will increase significantly.

This research can contribute to improving students' understanding of numeracy concepts. By applying an ethnomathematics approach, students can engage in more meaningful and contextual learning,

so as to increase their understanding of numeration concepts. In addition, Ethnomatematics encourages students to think about mathematics in the context of their culture and everyday situations. This can develop their critical thinking skills, such as the ability to analyze, solve problems, and see the relationship between mathematical concepts and the real world. This research may be conducted in a limited environment, such as one group of students or a particular school. Therefore, the results of this study may be difficult to generalize to the wider population. It is important to consider the context and special characteristics of the research sample used. There are many factors that can affect students' understanding of numeracy concepts, including environmental factors, educators, and curriculum content. This research may find it difficult to isolate the influence of the ethnomathematics approach exclusively from other factors that might affect student learning outcomes.

4. CONCLUSION

From the discussion above, it can be concluded that increasing students' understanding of numeracy concepts students who are given learning to count by applying learning methods that apply ethnomathematics through the congklak game is much better than students who are given learning to count by applying the old way. So it can be stated that the application of Ethnomathematics in Learning can improve Students' Understanding of Numeracy Concepts significantly compared to learning using the usual teacher method, namely the lecture method. The emphasis on students' numeracy concepts is instilled with the application of ethnomathematics through congklak games which can stimulate dopamine, automatically motivated and motivated students to increase their creativity and understand the concept of counting easily and without burden. So that students' ability to understand the concept of counting will increase significantly.

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