

Improving Mathematical Literacy Based on Ethnomathematical Approach in Congklak Game

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Abstrak

Hasil Program International Student Assessment (PISA) pada tahun 2018, dalam kategori literasi, Indonesia menduduki peringkat ke-74 dari 79 negara, sedangkan untuk penilaian kemampuan matematika dan kemampuan sains, Indonesia berada di peringkat ke-73 dan peringkat ke-71 dari peringkat ke-79 negara peserta PISA. Dalam hal ini pengaruh literasi berperan besar dalam kemampuan matematika. Literasi matematika merupakan kemampuan memahami, memecahkan masalah, memanipulasi untuk di tuangkan sebagai bentuk matematis. Etnomatematika sebagai peranan penting dalam meningkatkan literasi matematis, karena etnomatematika memuat sebuah unsur budaya, adat istiadat maupun permainan tradisional. Pada unsur etnomatematika memiliki unsur pola matematika. Tujuan dari penelitian ini adalah untuk mengetahui peningkatan kemampuan literasi matematika melalui pendekatan etnomatematika pada permainan congklak permainan tradisional yang memuat unsur pola matematis berupa operasi hitung. Penelitian ini dilakukan pada kelas VA dan VB di SDN Menes 1, Pandeglang, Banten. Penelitian ini merupakan kuantitatif dengan metode penelitian quasi experiment dan desain penelitian ini adalah Pretest-Posttest Control Group non-equivalen Design. Instrumen penelitian ini adalah dengan pengumpulan data dari tes kemampuan literasi matematis etnomatematika pada Congklak dan wawancara. Hasil penelitian menunjukkan bahwa adanya perbedaan peningkatan kemampuan literasi matematis antara kelas VB kelas Eksperimen dan VA kelas Kontrol. Peningkatan kemampuan literasi matematis kelas VB lebih tinggi dari kelas VB.

Kata kunci : Kemampuan Literasi Matematis, Etnomatematika, Congklak

Abstract

The results of the International Student Assessment Program (PISA) in 2018, in the literacy category, Indonesia was ranked 74th out of 79 countries, while for the assessment of mathematics ability and science ability, Indonesia was ranked 73rd and 71st respectively. -79 countries participating in PISA. In this case, the influence of literacy plays a major role in mathematical abilities. Mathematical literacy is the ability to understand, solve problems, manipulate to be expressed in mathematical form. Ethnomathematics plays an important role in increasing mathematical literacy, because ethnomathematics contains an element of culture, customs and traditional games. The element of ethnomathematics has elements of mathematical patterns. The aim of this research is to determine the increase in mathematical literacy skills through an ethnomathematics approach to the traditional game congklak which contains elements of mathematical patterns in the form of arithmetic operations. This research was conducted in VA and VB classes at SDN Menes 1, Pandeglang, Banten.

This research is quantitative with a quasi-experimental research method and the research design is a non-equivalent Pretest-Posttest Control Group Design. The instrument of this research was data collection from ethnomathematics mathematical literacy skills tests in Congklak and interviews. The research results showed that there was a difference in increasing mathematical literacy skills between the VB experimental class and the Control class VA. The increase in mathematical literacy skills in the VB class is higher than in the VB class.

Keywords: Mathematical Literacy Ability, Ethnomathematics, Congklak

1. INTRODUCTION

Result *Program International Student Assessment (PISA)* in 2018, in the literacy category, Indonesia was ranked 74th out of 79 countries, while for the assessment of mathematics ability and science ability, Indonesia was ranked 73rd and ranked 71st out of the 79th rank of PISA participating countries. Indonesia's ranking achievement in the PISA assessment has always been constant since the beginning of Indonesia's participation in the assessment, namely from 2000 to 2018, (Hewi & Shaleh, 2020). With the results that are in the position at the bottom of the ranking, it has the consequence of thinking that the quality of education in Indonesia is not in accordance with the standards of the global community and is below other countries. The government's effort to make improvements to the PISA assessment results is a curriculum change, but in fact the PISA results have not undergone significant changes, especially in mathematical literacy results (Hewi & Shaleh, 2020). Math skills are very important because they are the foundation for many other disciplines and also have great relevance in everyday life such as science, technology, the employment sector, personal finance. Therefore, PISA results reflecting mathematical literacy skills have significant implications in evaluating the quality of education. The mathematics learning process needed today is contextual and realistic learning using varied methods, (Rahmawati Z & Muchlian, 2019) In addition to using varied methods, you can use the right approach to improve mathematical literacy skills.

Mathematical literacy is the ability of students to understand and apply various applications of mathematics, such as facts, principles, manipulation, and problem solving in everyday life, both past and present (Kosasih et al., 2022). Mathematical literacy has an important role in training students' reasoning to solve problems by analyzing facts and good procedures, so it is very useful for students in solving problems in everyday life that have an impact on the quality of human resources. Mathematical literacy skills can help students in implementing mathematical concepts in real life by applying various effective and efficient methods to solve a problem, conduct rational assessments, and conduct analysis to the stage of drawing conclusions (Genc & Erb, 2019). The importance of mathematical literacy in Indonesia has not been comparable to the quality of education, especially for elementary school students because mathematical literacy must be instilled from an early age, namely when students are at the elementary school level (Kurnia et al., 2018). Mathematical literacy. Mathematical literacy skills (*Mathematical Literacy*) is an individual's ability to formulate, use and interpret mathematics in a variety of contexts, including reasoning mathematically and using mathematical concepts, procedures, facts and tools to explain and forecast events, (Madyaratri et al., 2019).

According to (Syafri, 2017c) In short, ethnomathematics is a form of mathematics that has been integrated into culture. Through ethnomathematics students can understand mathematical concepts, (Fajriyah, 2018). In culture-based mathematics learning or called ethnomathematics, students can understand and apply learning through culture in their home area where the culture has various elements such as customs, old buildings, art or other elements, (Lail & Budiarto, 2022). In addition, traditional games are part of mathematics learning because they have patterns in mathematics such as addition, subtraction, division, multiplication and other calculation operations (Hariastuti et al., 2022).

One of the tasks of a teacher in the learning process is to create an environment that can encourage students to learn actively, (Rifa'i & Sartika, 2018) One of them is with traditional games that can be used in learning so that students can learn as well as get to know traditional games. There are many types of traditional children's games, one of which is the traditional game congklak (T. Handayani et al., 2020). Teachers know the traditional game congklak but not many teachers know the benefits of this game to develop aspects of child development, it is revealed from the teacher's statement which states that the traditional game congklak is just a game that can make children happy, happy and able to develop children's cognitive in counting, (Harbiyah & Lukmanulhakim, 2022). According to (Ed. et al., 2023) "Congklak is a board with 16 holes, each player has an 8-hole side of the congklak board, which is divided into 7 small holes and 1 large hole". The traditional game congklak contains mathematical concepts, the existence of mathematical concepts contained in the traditional game congklak proves that mathematics learning is not only obtained from learning at school, but can also be explored through traditional games commonly played by students.

One of the efforts to improve the mathematical literacy of elementary school students is by using an ethnomathematical approach to traditional games (Ajmain et al., 2020). Ethnomathematics is a learning approach that is carried out by teaching mathematics by linking mathematics with the cultural work of the nation itself and also involving the needs and lives of its people, (Zaenuri et al., 2018). The traditional game used in this study is the Congklak game. Congklak is a traditional game that is less popular with children in this digital era. How to play congklak is done by two people facing each other and done with a congklak board tool called a dakon. The congklak game itself is actually a game played from our previous ancestors but for most do not understand directly that this game contains ethnomathematical elements, (F. F. Handayani & Munastiwi, 2022).



Figure 1. Traditional Game of Congklak

Based on the presentation that has been delivered, the specific purpose of this study is to improve the literacy of elementary school students through an ethnomathematical approach to congklak games. It can be said that the ability of elementary school mathematical literacy through an ethnomathematical approach in the traditional game Congklak. With the ethnomathematical approach to congklak games, it can be expected to increase the understanding of elementary school students in mathematics subjects.

2. METHOD

This type of research is quantitative using methods *quasi-experiment* Quantitative Research Design *pretest – posttest control group design*, (T. Handayani et al., 2020) In this study there were two classes chosen by *random sampling* namely the experimental class (VB) and the control class (VA) with the number of samples of each class of 22 students. Then a pre-test is given to find out the initial state of whether there is a difference in improvement between the experimental class and the control class. For the experimental class, an ethnomathematical approach with congklak media was given, after which a test post was given to find out whether there was a significant improvement between the experimental class and the control class.

This research was conducted in grade 5 at SDN Menes 1, Menes Pandeglang District, in Odd Semester 2023/2024. Because judging from the results of observations and interviews with class teachers.

This school is used as a research location because the school has not used learning with an ethnomathematical approach. This study used two classes with random sampling techniques, namely the VA class had 22 students as the Control class while the VB class had 22 students as the Experiment class. Thus it can be known the difference before the treatment and after the treatment. In the experimental class, students use congklak media to solve literacy problems that have been provided, before using congklak media students are given a pre-test, after that students are given educational treatment of students using congklak media, as well as the control class is also given a pretest to find out their initial abilities, which distinguishes between the experimental class and the control class, namely from the treatment, Where the control class to solve mathematical literacy problems uses congklak media while in the control class students are only given conventional learning, but both are given the same literacy questions, thus it can be seen the improvement before treatment and after the treatment. The following is a research design between the experimental class and the control class as follows.

Tabel 1. Pretest – Posttest Control Group Design

Class	Pre Test	Treatment	Post Test
Experiment	O_1	X	O_2
Control	O_3	-	O_4

Information:

X = Learning with an Ethnomathematical approach

O_1 & O_3 = Both classes were observed with a pretest to determine the initial mathematical literacy ability expected to be the same.

O_2 = Experimental class given treatment

O_4 = Untreated control class (Sugiyono, 2018)

The implementation of research at the beginning of the Odd Semester was carried out offline, with the situation of the previous class transition period. Ethnomathematics-based mathematical literacy ability test instrument through traditional congklak game which has been tested for validity in table 2 and obtained 5 valid, reliable description questions in the very high category that have been tested for reliability in table 3. The following are 5 questions of mathematical literacy skills through an ethnomathematical approach in traditional congklak games.

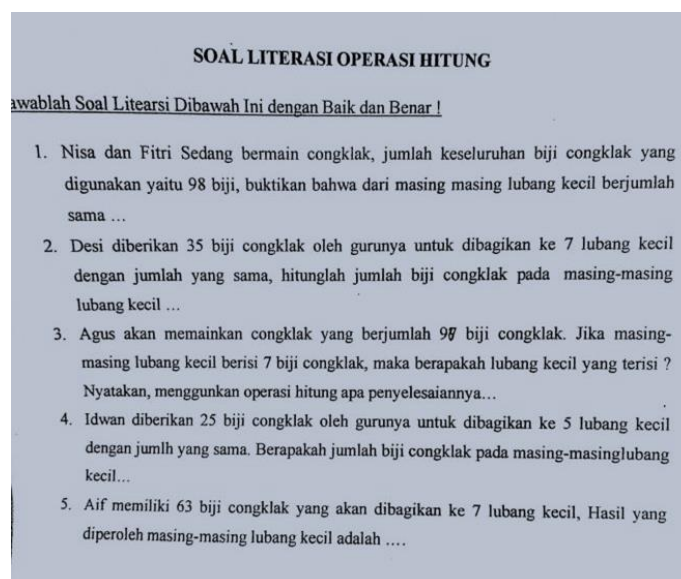


Figure 2. Mathematical Literacy Ability Test Instrument

A question can be said to be valid if based on the comparison of the value of r calculate with r table. If the value of r is calculated $> r$ table then it can be bound to be valid if the value of r is calculated $< r$ table then it can be said to be invalid At 5% significant in the distribution of r values of statistical tables that show n 15 then obtained the value of r table 0.541 based on significant values if the significance value < 0.05 then valid if the significance value > 0.05 then invalid.

Table 2. Question Point Validation

		B1	B2	B3	B4	B5	Sum
B1	Pearson Correlation	1	.908**	.904**	.894**	.896**	.945**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	22	22	22	22	22	22
B2	Pearson Correlation	.908**	1	.994**	.981**	.911**	.987**
	Sig. (2-tailed)	.000		.000	.000	.000	.000
	N	22	22	22	22	22	22
B3	Pearson Correlation	.904**	.994**	1	.989**	.918**	.990**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
	N	22	22	22	22	22	22
B4	Pearson Correlation	.894**	.981**	.989**	1	.904**	.982**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
	N	22	22	22	22	22	22
B5	Pearson Correlation	.896**	.911**	.918**	.904**	1	.954**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
	N	22	22	22	22	22	22
Sum	Pearson Correlation	.945**	.987**	.990**	.982**	.954**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	22	22	22	22	22	22

** . Correlation is significant at the 0.01 level (2-tailed).

In table 2 above to test the validity of the question by looking at the value of significance in the amount. Because the value of the number of significance in the 5 questions above is $0.000 < 0.05$, the 5 questions are valid.

According to (Sugiyono, 2018a) Reliability tests are degree of consistency and stability of data or findings. The reliability test of this research instrument uses the Cronbach Alpha technique. According to (Sugiyono, 2018b) An instrument is considered reliable when the reliability coefficient is at least 0.6. If the measuring instrument has a Cronbach Alpha value of < 0.6 , then the measuring instrument is not reliable. Reliability criteria are as follows: If the value of the reliability coefficient > 0.6 then the instrument has good reliability and is reliable (reliable). If the value of the reliability coefficient < 0.6 then the instrument does not have good reliability and cannot be trusted (unreliable).

Table 3. Question Item Reliability Test

Cronbach's Alpha	N of Items
.985	5

Based on table 3 above, it is known that Cronbach's Alpha value is 0.985, so the measuring instrument which in this case uses description questions to measure mathematical literacy ability has good reliability with a very high category because $0.985 > 0.6$.

Data analysis techniques are carried out through the N-Gain test to determine the increase in students' mathematical literacy abilities, the N – Gain normality test to determine whether or not the data is normal with reference to the significance of shapiro wilk because the sample is less than 50 (Sugiyono, 2013), homogeneity test to determine whether or not a data is homogeneous and T-test to determine the difference between the experimental class and the control class with the data obtained being normally distributed and homogeneous. To determine the increase in students' mathematical literacy skills using the formula:

To determine the interpretation score of N – Gain, according to the book (Sugiyono, 2013) The N-Gain index criteria can be seen in table 4

$$N - Gain = \frac{(Skor\ pre\ tes - Skor\ pos\ tes)}{(100 - Skor\ pre\ test)}$$

Table 4. Gain Score Interpretation

Score Gain	Interpretasi
$g > 0,70$	Tall
$0,30 < g \leq 0,70$	Keep
$g \leq 0,30$	Low

Based on Sugiyono's book, the criteria for testing statistical hypotheses are presented as follows:

$\mu_1 = \mu_2$: *Ho*: There was no significant improvement between student learning presentations and the application of congklak media

$\mu_1 \neq \mu_2$: *Has*: There is a significant increase between student achievement and the application of congklak media (Sugiyono, 2013).

3. RESULTS AND DISCUSSION

From the results of the mathematical literacy ability test that there was an increase in students' mathematical literacy ability between the experimental class and the control class with the results of the pre-test and test post. The following are the results of descriptive statistical testing on the N – Gain test obtained in table 5.

Table 5. Descriptive N – Experimental and Control Class Gain

Class	N	Minimum	Maximum	Mean	Std. Deviation
Experiment	22	.20	.74	.5305	.16232
Control	22	.00	.54	.2982	.14873
Total Amount	44	1.00	2.00	1.5000	.50578

Based on the descriptive output table N - Gain above in the pre-test test results and test post, it is known that the average value (*mean*) of N - Gain for the experimental class is 0.5305. Based on the table of categories of interpretation of the N – Gain score above medium, it can be concluded that the use of ethnomathematical approach methods with congklak game media can improve mathematical literacy skills in grade V students of SDN Menes 1. Furthermore, it is known that the average value (*mean*) N - Gain for the control class on the pre-test and test post results is 0.2982.

Based on the table of interpretation categories of the N – Gain score above low, it can be concluded that there is no increase if you do not use an ethnomathematical approach with traditional congklak

game media. Next test normality N – Gain experimental class and control class to see whether the data is normally distributed or not, the normality test results can be seen in table 6.

Table 6. Normality Test N – Experimental and Control Class Gain

		Shapiro-Wilk		
Class		Statistic	df	Say.
Value	Experiment	.917	22	.067
	Control	.969	22	.682

The data is said to be abnormal if the significance value < 0.05 . The data is said to be normal if the significance value > 0.05 (Sugiyono, 2013). Based on the results of the N – Gain normality test of the experimental class and the control class on Shapiro Wilk from table 6, it is known that in the experimental class the results of the pre-test and post-test values obtained of 0.067 mean a significant value of > 0.05 ($0.067 > 0.05$). Then the data is declared normally distributed. The following in the Control class, the results of the pre-test and test post were obtained at 0.682, meaning that a significant value of 0.05 to 0.682 then the data was declared normally distributed. It can be concluded that for the data normality test with pre-test results and test posts between the experimental class and the control class is said to be normal. Next, test the homogeneity of N – Gain to see whether the data of the pre-test results and test posts are homogeneous or not. <

Table 7. Homogeneity N – Experimental and Control Class Gain

		Levene Statistic	df1	df2	Say.
Value	Based on Mean	.399	1	42	.531
	Based on Median	.113	1	42	.738
	Based on Median and with adjusted df	.113	1	40.423	.738
	Based on trimmed mean	.336	1	42	.565

Based on the results of the N-Gain homogeneity test in the experimental class and the control class from the results of the pre-test and postes, the average significance value was 0.531. According to (Sugiyono, 2013) The significant level used is $\alpha = 0.05$. The value of homogeneity data N – Gain 0.531 > 0.05 , it can be concluded that the data on the results of literacy ability in VA and VB grade students are homogeneous.

To test the difference in mathematical literacy skills between the control class and the experimental class using *parametric* tests with statistical hypothesis testing using a significance level of 0.05. Statistical hypothesis testing is calculated through SPSS Statistics 25 using the T-test as in table 7.

Table 8. Difference Test N – Experimental and Control Class Gain

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Say.	t	df	Sig. (2- tailed)	Mean Differenc e	Std. Error Differenc e	95% Confidence Interval of the Difference	
									Lower	Upper
Value	Equal variances assumed	.399	.531	4.949	42	.000	.23227	.04694	.13755	.32700
	Equal variances not assumed			4.949	41.683	.000	.23227	.04694	.13753	.32702

Based on table 8 on the difference test N – Gain experimental class and control class known si value. *Leavene's test for equality of variance* is $0.531 > 0.05$, so it can be interpreted that the data variance

between the experimental class and the control class is homogeneous or in the same sense. Furthermore, based on the *output table in the equal variances assumed section*, the sig value is known. (2 tailed) of $0.000 < 0.05$, it can be concluded that there is a significant difference between the test post results between the experimental class and the control class. Then from the output table, it is known that *the mean difference* value is 0.04694, this value shows the difference between the average test post results of students.

In the research that has been done on the game of congklak this is relevant to the research before his according to (Siswati B. H. et al., 2023) His research entitled "Learning with Congklak Ethnomathematics" aims to reveal ethnomathematical elements found in traditional congklak games and how they apply in mathematics learning in elementary schools. This research method is ethnographic with a qualitative approach. The results of the research obtained are that there is a mathematical element in the congklak game in the form of numeration. Congklak games can foster honest, sportsmanlike and conscientious character. Congklak can hone fine motor and gross motor skills of students. The application of congklak ethnomathematics can motivate students and make students excited in learning mathematics.



Figure 2. Students Perform Counting Operations with Congklak Game Media

This is in line with research (Saribu & Simanjuntak, 2018) in the results of his research entitled "The Effect of Congklak Traditional Game on the Numeracy Ability of Beginners of Children Aged 4-5 Years in KB Tunas Harapan, Sunggal District, Deli Serdang Regency". The congklak game shows the influence of traditional congklak games on the early numeracy skills of children aged 4-5 years in KB TUNAS HARAPAN District. Sunggal Kab Deli Serdang.

This research was also conducted (Matulesy & Muhid, 2022) in his research entitled "The Effectiveness of Congklak Traditional Game to Improve Students' Math Skills" Congklak is considered one of the effective means in improving students' mathematical skills, so this game can be used as a reference for teaching media in mathematics. In research conducted using the method *literature review* by collecting literature sources, studies, journals and media. It can be said that congklak is the right medium in learning mathematics. From the various presentations of the results of the research above, it can be seen that congklak games are effectively used as a medium for learning mathematics and this game is a good reference for addition, subtraction, multiplication and division.

In research conducted by (Amelia & Istikomah, 2021) Congklak games are part of children's cognitive improvement to hone thinking skills, this is relevant to research, (Amelia & Istikomah, 2021). The results obtained in the precycle stage were only 25%, then increased in Cycle I by 38% to 63% and increased again in Cycle II by 25% to 88% of the total number of children in group B Raudhatul Athfal An-Nur Teluk Pandak Village. Based on the results of the study, it can be concluded that through traditional congklak games that are used as actions in the study have been proven to improve the cognitive abilities of group B Raudhatul Athfal children.

Based on data analysis that has been carried out in research,(Arifiyah et al., 2023) It can be concluded that congklak game media has an effect on improving the ability to recognize number concepts in group A students at TK Muslimat NU 272 Baiturrohiem Duduksampeyan, it can be seen from the increase in scores during the pretest and posttest treatment congklak game media.

Traditional congklak games have benefits in addition to improving concept recognition and literacy skills, congklak plays an important role in early childhood logical intelligence here are the research findings that stated regarding congklak. It is Relevant to research,(Budianti et al., 2021) namely: (1) there is an influence of congklak games on the intelligence of mathematical logic of children aged 5-6 years in RA Khairu Ummah; (2) there is an influence of gatheng games on the intelligence of mathematical logic of children aged 5-6 years in RA Khairu Ummah; and (3) there is a difference in the influence between congklak games and gatheng games on the intelligence of mathematical logic of children aged 5-6 years in RA Khairu Ummah. In addition to improving concept recognition and literacy skills, congklak plays an important role in early childhood logical intelligence.

Based on the results of the analysis presented by the results of research at the kindergarten, early childhood and elementary school levels at the lower grade level, this research was conducted at grade V elementary schools. Class V students have less mathematical literacy skills. "Mathematics learning still uses conventional methods, the current constraints of grade V students are still low on mathematical literacy problems and calculations (calculation operations) then to attract the attention of students, the learning must use media or teaching aids". Therefore, researchers conduct learning using an ethnomathematical approach through the media of traditional congklak games, because in the use of congklak indirectly using counting operations, including: a) how students fill small holes using congklak seeds by using the operation of dividing them with the congklak seeds they have, b) when playing it there is an operation to reduce one by one the congklak seeds they hold, c) There is a sum on each hole passed when playing it.

Congklak learning media is only used in experimental classes while in control classes are not given treatment or do not use arrogant media in learning. Based on the results of the T-test shows that there are differences where the results of the experimental class are better than the learning results of the control class, the ability of mathematical literacy with an ethnomathematical approach is better than conventional learning because the ethnomathematical approach provides a more meaningful learning experience and helps develop students' creative thinking to solve problems in mathematical literacy Learning with an ethnomathematical approach is different from conventional learning in grade V SDN Menes 1 which is dominated by teachers. In class students only listen to the explanation of the material given, although students are given exercises on mathematical literacy problems but students do not understand the patterns of mathematical literacy because basically mathematical literacy problems must first understand the patterns, with the existence of an ethnomathematical approach using traditional games congklak students are able to understand the concepts of calculating operations. Congklak media as a medium that helps students understand the material and build their own knowledge.



Figure 3. Ethnomathematical Approach to Congklak Game Media

Mathematical literacy skills can be developed with an ethnomathematical approach optimally because: (1) students can be involved in learning because they feel invited to participate in creating solutions in the context of traditional games that can increase student understanding, (2) ethnomathematical approaches can encourage students to work together. this can improve communication skills, collaborate and learn together, (3) approaches through ethnomathematics can develop Strong students' critical thinking and analytical skills in understanding mathematical literacy. The ethnomathematical approach can provide benefits to improve students' mathematical skills, mathematical literacy and critical thinking skills and can connect mathematics with everyday life to encourage deeper cultural understanding, especially traditional congklak games.

4. CONCLUSION

Based on the results of data analysis for hypothesis testing, it shows that there is a difference in the increase in mathematical literacy ability between the experimental class and the control class, where the mathematical literacy ability in the experimental class by comparing the mean value of 0.5305 is in the gain score of $0.30 < g \leq 0.70$ which means that the increase in the experimental class is in the medium category and the mean value is from the control class, which is 0.2982 which is in the category Low with reference to the gain score of $G \leq 0.30$. Therefore, it can be concluded that the increase in students' mathematical literacy skills in the experimental class is better than in the control class. This is because students are actively involved in the learning process with an ethnomathematical approach and can be used as a learning medium. The ethnomathematics learning model can be a variation of learning applied by teachers in schools.

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