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Implementation of ethnomathematics through bitingan games on the numerical literacy skills of third-grade students

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ABSTRACT

This study aims to examine the differences in numeracy literacy skills among Grade III students of SDI Tahfidz Preneur Daarul Ahsan who were taught through the application of ethnomathematics using bitingan games and those who received instruction through discovery learning. In addition, this research describes the improvement in students' numeracy literacy skills following the implementation of ethnomathematics through bitingan games. The study employed a quasi-experimental method with a Control Group Pretest–Posttest design. There were two classes: an experimental class and control class. The experimental group received learning treatment through ethnomathematics-based bitingan games, while the control group was taught using the discovery learning. The data collected consisted of pretest and posttest scores. Data were analyzed using both descriptive and inferential statistical techniques. Descriptive statistics included the total number of participants, minimum and maximum scores, mean, standard deviation, and variance, providing an overview of students' performance distribution. Inferential statistics, consisting of normality tests, homogeneity tests, and t-tests, were applied to determine the significance of differences between the two groups. Furthermore, the n-gain test was used to assess the extent of improvement in students' numeracy literacy skills. The results revealed a significant difference in numeracy literacy skills between students who received ethnomathematics through bitingan games and those who received discovery learning. Based on the descriptive statistical analysis, the experimental group's mean score was higher than that of the control group. The improvement in numeracy literacy skills in the experimental class was classified as moderate with an average n-gain value of 0.52. However, not all students in the experimental group achieved the same level of improvement, as variations were observed across low, moderate, and high improvement categories.

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1. INTRODUCTION

Enhancing the nation's well-being is one of the mandates articulated in the preamble of the 1945 Indonesian Constitution. Efforts to improve the quality of life are further supported by the objectives of national education outlined in Article 3 of Law Number 20 of 2003. These objectives are implemented through the national curriculum, which is currently governed by the Minister of Education, Culture, Research, and Technology Regulation Number 12 of 2024, establishing the Merdeka Curriculum as the prevailing framework in Indonesia. The Merdeka Curriculum aims to facilitate meaningful and effective learning that fosters faith, piety to God Almighty, noble character, and encourages students to develop their creativity, ideas, and initiative as lifelong learners embodying Pancasila values. Its focus is on preparing students to face global challenges, with particular emphasis on developing numeracy literacy skills.

Numeracy literacy is a key competency within the Merdeka Curriculum, applicable at both primary and secondary levels. Its goal is to cultivate students' ability to understand a world filled with numbers and data, think rationally and systematically, and solve problems critically in various contexts. Furthermore, early numeracy education plays a vital role in students' learning development, as significant cognitive growth occurs during the first years of schooling (Dierkx et al., 2025). Through these skills, students are expected to become global citizens equipped to navigate technological advancements (Darwanto et al., 2021). According to data released by the Programme for International Student Assessment (PISA) in 2022, Indonesia's average mathematics score was 366, representing a 13-point decline from the 2018 PISA score of 379. This decline indicates the urgent need to optimize mathematics instruction in order to strengthen students' numeracy literacy skills.

Given its importance, the development of numeracy literacy plays a vital role in student growth. It can be integrated into classroom mathematics instruction through activities such as conducting simple numeracy projects, engaging in basic research with peers, and exploring the use of numbers, mathematical symbols, charts, tables, and diagrams in their surroundings (Kemdikbud, 2017).

These activities serve as initial steps to familiarise students with the significance of numeracy literacy in everyday life. Examples of applying numeracy skills include reading the time, estimating arrival times, calculating price differences, analysing shopping receipts, interpreting air quality index charts, predicting weather conditions, making decisions, and estimating the likelihood of winning a game or competition (Rakhman et al., 2019).

Beyond the classroom and daily activities, numeracy literacy—an integral part of mathematical competence—is also embedded within various cultural expressions. It can be found in material culture such as temples, artifacts, and batik patterns (Turmudi, 2018), as well as in intangible cultural practices like dance and traditional games (Gazanofa & Wahidin, 2023; Harahap & Jaelani, 2022). Games, in particular, are closely linked to elementary school students. One such game widely played during recess is "bitingan." Also known as lurah-lurahan or chutikan, this traditional game from Java uses sticks as the main tools (Cholimah, 2023).

The game of bitingan involves preparing several items: 1) a playing area of at least 1 to 4 square meters depending on the number of players; 2) forming groups of 2 to 4 players; 3) creating a playing field measuring 30 x 30 cm, which can be on tile or chalk-lined floors; 4) determining the order of play through "hompimpah" or "sut"; and 5) preparing sticks, typically one 12 cm stick and several 10 cm sticks, with the longer stick bent at the tip to serve as a "lurah" or grabbing tool (nyuthik). The 12 cm stick must be bent at the end, roughly between 10 and 2 cm in length.

The sequence of play is usually determined through hompimpah. The first player gathers all the sticks in one hand and releases them, causing them to scatter. The more scattered the sticks, the easier it is to pick them up individually, provided no other sticks are moved. Players must be careful to avoid disturbing other sticks, as doing so results in failure, and the turn passes to the next player. Players earn points by collecting sticks—each regular stick worth 5 points, and the "lurah" stick worth 15 points. Scores are recorded in a table listing players' names and points, with the highest scorer declared the winner (Choiro, 2022).

Considering the rules and gameplay of bitingan, it is evident that many mathematical elements and activities are involved. However, many students and teachers remain unaware that traditional games such as bitingan contain mathematical concepts that can be applied to various

educational contexts (Marlissa et al., 2024). This lack of awareness is partly due to the limited number of studies examining *bitingan* compared to other traditional games such as *engklek*, *congklak*, and *snakes and ladders*. Consequently, further exploration of *bitingan* as an educational medium is necessary. Studies by Devianti & Jamaludin (2023) and Masah et al. (2025) have highlighted the potential of incorporating games into learning. In the case of bitingan, students are required to be precise, patient, and capable of understanding symbols, performing quick calculations, presenting and analysing data from tables, and making strategic decisions to win. Therefore, bitingan can be regarded as a form of ethnomathematics.

According to D'Ambrosio, as cited in Rosa et al. (2016), ethnomathematics is a student-centred approach to teaching mathematics that recognises the unique knowledge, experiences, and cultural backgrounds of each learner. Consequently, mathematics education should be adapted to these diverse contexts. Ethnomathematics can serve as an alternative teaching approach (Turmudi, 2018), with the aim of enhancing numeracy literacy. This is supported by previous research demonstrating how local wisdom can improve educational quality (Subai et al., 2023). Preliminarily, it has been found that students at SDI Tahfidz Preneur Daarul Ahsan have an average numeracy literacy score of 47.62%, categorised as moderate at the district level and lower-middle nationally (SDI Tahfidz Preneur Daarul Ahsan Education Report, 2024). Therefore, it is hoped that applying ethnomathematics through the game of bitingan can optimise students' numeracy skills.

This study aims to compare the numeracy literacy skills of students who are taught using ethnomathematics-based methods through the game of bitingan with those who are not. Additionally, it seeks to examine the improvements in students' skills following the implementation of ethnomathematics in mathematics lessons.

2. METHOD

This research employs a quantitative method with a quasi-experimental design. The study design is a Control Group Pretest-Post test, involving two sample groups: an experimental group and a control group (Arifin, 2014). Each group consists of 17 students. The sampling technique used is probability sampling**,** specifically cluster random sampling. The experimental group receives instruction in mathematics through the application of ethnomathematics via the game of *bitingan*, while the control group is taught using discovery learning. Data collected include pretest and posttest scores from both groups. The instrument used to collect data was an essay test consisting of six questions containing material, data presentation in tabular form. The research instrument used to collect data was an essay test consisting of six questions covering the topic of data presentation in tables**.** The instrument was developed based on the numeracy literacy skill indicators formulated by the National Literacy Movement Team of the Indonesian Ministry of Education and Culture (2017). These indicators include (1) The ability to employ various types of numbers and mathematical symbols associated with fundamental mathematical concepts to solve practical problems across diverse real-life contexts. This competency reflects students' capacity to interpret, organize, and compare numerical information meaningfully (2) The ability to analyse information presented in multiple representational forms (e.g., graphs, tables, charts) and to interpret these data accurately in order to make reasoned predictions and informed decisions. This indicator demonstrates students' analytical and interpretive proficiency in numerical contexts. Here is the instrument grid.

Topic		Presentation of Data in Tabular Form • Arranging and Comparing Data • Presenting Data in Tables		
No	**Indicators of Numeracy Literacy Skills**	**Item Indicators**	**Item Numbers**	**Maximum Score**
1	The ability to employ various types of numbers and mathematical symbols associated with fundamental mathematical concepts to solve practical problems across diverse real-life contexts. This competency reflects students' capacity to interpret, organize, and compare numerical information meaningfully.	1. Arrange (C3) a given set of data in a specified order. 2. Identify (C3) the smallest and largest data values. 3. Compare (C5) numerical data based on specified criteria.	1, 3, & 5	18
2	The ability to analyse information presented in multiple representational forms (e.g., graphs, tables, charts) and to interpret these data accurately in order to make reasoned predictions and informed decisions. This indicator demonstrates students' analytical and interpretive proficiency in numerical contexts.	1. Construct (C6) a table to represent given data accurately. 2. Record (C1) data systematically using tally marks. 3. Identify (C3) the most frequent and least frequent data values.	2, 4, & 6	18

The instrument that have been validated both theoretically and empirically. The theoretical validity of the instrument was confirmed by lecturers from the FKIP Universitas Sultan Ageng Tirtayasa and experienced teachers with over two years of teaching practice. Empirical validation involved testing for validity, reliability, difficulty index, and discriminatory index with α 5%.

Table 1. Result of Empirical Instrument Testing

No. of Question	Validity		Reliability		Difficulty Index		Discriminatory Index		Remark
1	0,68	Valid	0,79	Highly Reliable	0,68	Moderate	0,45	Very Good	Used
2	0,71	Valid			0,66	Moderate	0,58	Good	Used
3	0,51	Valid			0,52	Moderate	0,30	Very Good	Used
4	0,75	Valid			0,30	Moderate	0,54	Very Good	Used
5	0,72	Valid			0,66	Moderate	0,45	Very Good	Used
6	0,79	Valid			0,27	Difficult	0,71	Very Good	Used

The data obtained were further analyzed using descriptive statistical analysis to determine the minimum value, maximum value, mean, standard deviation, and variance. This descriptive analysis helps briefly to characterize the data collected (Khudriyah, 2021). The analysis was conducted using Microsoft Excel. In addition to descriptive statistics, the N-gain score was also calculated to measure the effectiveness of a learning intervention in improving students' learning outcomes (Sukarelawa et al., 2024).

After calculating the N-gain scores, inferential statistical analysis was conducted to determine whether there was a significant difference between the experimental group, which received ethnomathematics treatment through the game of bitingan, and the control group, which did not receive ethnomathematics instruction.

To determine the appropriate statistical test, the pretest and posttest data from both groups were first subjected to a normality test as a prerequisite, using a significance level of $\alpha = 0.05$

(5%). If the data were found to be normally distributed, a homogeneity test was subsequently conducted. When the data met both the assumptions of normality and homogeneity, they were analysed using a paired t-test with the pooled variance formula. However, if the data were normally distributed but not homogeneous, the analysis employed a paired t-test with the separated variance formula. Conversely, if the data were not normally distributed, a non-parametric test, specifically the Mann–Whitney test, was used to analyse the data.

3. RESULT AND DISCUSSION

Result

The data collection process began with administering a pretest to both the experimental and control groups. Following the pretest, the study continued by implementing an ethnomathematics treatment through the game of bitingan in the experimental group. The treatment was conducted over three sessions of mathematics lessons. The implementation of the treatment was carried out by the homeroom teacher, guided by the instructional module provided by the researcher. In the control group, instruction was carried out by the homeroom teacher using the discovery learning.

After three sessions of mathematics lessons in both the experimental and control groups, the study proceeded with the posttest data collection in both groups. The results of the data and the descriptive statistical analysis obtained are presented below.

Table 2. Pretest Data for the Experimental and Control Groups

Student	Experiment Group	Control Group
1	17	19
2	17	14
3	12	13
4	9	18
5	23	7
6	25	11
7	17	11
8	13	15
9	11	10
10	14	11
11	12	8
12	11	0
13	15	12
14	16	11
15	15	10
16	18	18
17	18	11

The tabulated data above will then be analyzed using descriptive statistics as follows.

Table 3. Descriptive Statistical Analysis of Pretest Data

	Experiment Group	Control Group
n (student)	17	17
Min	9	0
Max	25	19
Average	15,47	11,70

Standard Deviation	4,19	4,55
Varians	17,63	20,72

Based on Table 3, it can be concluded that the number of students in each group, both experimental and control, was the same, totaling 17 students. The variance for the experimental group was 17.63, while the control group had a variance of 20.57. These variance values indicate the level of dispersion in the scores obtained by the students in each group. A higher variance suggests greater variability, meaning the scores are more widely spread out. In this pretest, the variance in the control group was higher than in the experimental group, indicating that the scores in the control group were more varied.

Regarding the mean scores, the experimental group achieved an average of 15.47, with the lowest score being 9 and the highest 25 out of an ideal score of 36. Conversely, the control group had an average score of 11.70, with the lowest score at 0 and the highest at 19. This suggests that the scores in the experimental group were more concentrated around the mean, whereas the control group exhibited a wider distribution of scores despite the lower average.

Furthermore, the standard deviation for the experimental group was 4.19, while for the control group it was 4.55. This indicates that the range of scores in the control group was more dispersed around the mean compared to the experimental group. Overall, the pretest data demonstrate that the scores in the control group displayed greater variability, whereas the experimental group's scores were more centralized around the average.

Table 4. Posttest Data for the Experimental and Control Groups

Student	Experiment Group	Control Group
1	18	27
2	35	20
3	20	22
4	31	24
5	30	16
6	35	23
7	34	20
8	24	12
9	14	15
10	18	19
11	33	7
12	13	7
13	28	13
14	30	20
15	26	17
16	22	32
17	30	25

The tabulated data above will then be analyzed using descriptive statistics as follows.

Table 5. Descriptive Statistical Analysis of Posttest Data

	Experiment Group	Control Group
n (student)	17	17
Min	13	7
Max	35	32
Average	25,94	18,76
Standard Deviation	7,28	6,72
Varians	53,05	45,19

Based on Table 5, it is evident that the number of students in each group—both experimental and control—was equal, with 17 participants in each group during the post-test. Unlike the pre-test data, the post-test results show that the variance for the experimental group was 53.05, while the control group had a variance of 45.19. These figures reflect the degree of variability in the scores obtained by the students in each group. A higher variance indicates a wider spread of scores, meaning that individual results are more dispersed. In this case, the experimental group exhibited a greater variance than the control group, suggesting that post-test scores in the experimental group were more varied.

This is further supported by the average scores. The experimental group achieved a mean post-test score of 25.94, with the lowest score being 13 and the highest 35 out of a possible 36. The control group, on the other hand, had a mean score of 18.76, with scores ranging from 7 to 32. These figures imply that most students in the control group scored around the mean of 18.76, whereas the scores in the experimental group were more widely distributed.

Moreover, the standard deviations reinforce this observation: 7.28 for the experimental group and 6.72 for the control group. The larger standard deviation in the experimental group indicates that the scores were more spread out around the mean compared to the control group. Overall, these findings suggest that although the experimental group achieved higher average scores, there was also greater variability in student performance within that group.

To assess the improvement in numeracy literacy skills and to achieve the research objectives, it is necessary to obtain data on the enhancement of each student's numeracy literacy ability in the experimental group after being exposed to ethnomathematics treatment through the use of Bitingan games. Therefore, the post-test n-gain scores for the experimental group are required. The calculation results of the n-gain scores are as follows.

Table 6. Results of the n-gain score calculations

Student	N-gain Score	Interpretation
1	0,05	Low
2	0,94	High
3	0,33	Moderate
4	0,81	High
5	0,53	Moderate
6	0,90	High
7	0,89	High
8	0,47	Moderate
9	0,12	Low
10	0,18	Low
11	0,87	High
12	0,08	Low
13	0,61	Moderate
14	0,70	High
15	0,52	Moderate
16	0,22	Low
17	0,66	Moderate

The data were then analyzed using descriptive statistics. The specific descriptive statistical measures examined are as follows.

Table 7. Descriptive Statistical Analysis of N-gain Scores

n (student)	17
Min	0,05
Max	0,94

Avarege	0,52
Standard Deviation	0,31
Varians	0,09

Based on Table 7, the students in the group receiving ethnomathematics treatment through the Bitingan game numbered 17 participants. The variance of their N-gain scores was 0.09, indicating some variability in the scores. The standard deviation was 0.31, reflecting the dispersion of N-gain values around the mean.

This variability was categorized into three levels: low, moderate, and high improvement. All students in the experimental group experienced an increase in their scores, with the lowest gain being 0.05 and the highest 0.94, within a range from 0 to 1. Of these, 16 students fell into the moderate and high improvement categories, while 5 students were classified as experiencing low improvement.

However, not all students in the low improvement category had gains just above 0.05; three of these five students demonstrated gains exceeding 0.10. These findings suggest that the majority of students showed a significant increase in their N-gain scores following the ethnomathematics treatment through the Bitingan game.

Based on the posttest data from the experimental and control groups obtained, these two datasets were subsequently compared to determine if there was a significant difference. To achieve this, a prerequisite test was conducted, namely the normality test using the Lilliefors test. The normality test is essential to decide whether to use parametric or non-parametric statistical tests in the subsequent analysis. The results of the normality tests for the posttest scores of both the experimental and control groups are as follows.

Table 8. Results of Posttest Normality Tests

Experiment Group			**Control Group**		
L (Value)		**L (Table)**	**L (Value)**		**L (Table)**
0,106	<	0,206	0,077	<	0,206
normally distributed			normally distributed		

Based on the results of the tests, it was concluded that the data for both the experimental and control groups are normally distributed. Therefore, the hypothesis testing will employ parametric statistical tests. To determine which parametric test to use, the homogeneity of the posttest data for both groups was first assessed using the F-test. According to the F-test with an alpha level of 0.05, and degrees of freedom of 1 and 16 respectively, the critical F-value is 4.5. The calculated variances for the two groups were 53.05 and 45.19. Based on these figures, the F-hitung value was found to be 1.174. The following section presents the homogeneity test conducted.

Table 9. Results of Homogeneity Test for Posttest Data in Experimental and Control Groups

L (Value)		**L (Table)**
0,106	<	0,206
Data is homogeneous		

Based on the homogeneity test, it was concluded that the F-value was lower than the F-tabel, indicating that the experimental and control groups are homogeneous and have equal variances. Consequently, the hypothesis test employed was a t-test using the pooled variance formula. After conducting the prerequisite tests, it was confirmed that the posttest data for both

groups followed a normal distribution and exhibited homogeneous variances. The next step involved performing a two-tailed t-test at a significance level of $\alpha = 0.05$ to determine whether there was a significant difference between the two groups. The results of this hypothesis test are presented below.

Table 10. Results of Hypothesis Testing

Test Type	Result	Interpretation
Paired t-test	T-Value = 2,985 T-Table = 2,036	There is a significant difference

Based on the conducted t-test, the calculated t-value was 2.985, while the critical t-value was 2.036. This indicates that t-hitung is greater than t-tabel. As a result, the hypothesis H_0 is rejected, and H_1 is accepted, meaning there is a significant difference in the application of ethnomathematics through the *bitingan* game on the numeracy literacy skills of third-grade students at SDI Tahfidz Preneur Daarul Ahsan.

Discussion

Based on the results obtained, there is a significant difference in numeracy literacy skills between the class that received instruction incorporating ethnomathematics through the *bitingan* game, and the class that did not receive such treatment. This significant difference is evident from the *t*-test results, where the calculated *t*-value (2.985) is greater than the table *t*-value (2.036), indicating a statistically significant difference between the class taught using ethnomathematics through the *bitingan* game, and the class that was not exposed to the application of ethnomathematics through the *bitingan* game.

This significant difference cannot be separated from the role of learning effectiveness achieved through the implementation of ethnomathematics. In learning that applies ethnomathematics, students are stimulated with concrete and contextual elements, while still maintaining alignment with the school's academic climate. This finding is in line with Hidayat (2013), who stated that one of the stages to achieve effective learning is by applying effective interaction within the learning process. The effectiveness of interaction in ethnomathematics is realized through the harmonization of the academic climate with the school culture. According to Jamaludin (2020), school culture plays an important role in the educational process. Moreover, other studies have also identified a significant relationship between teachers' teaching experience and the nature of educational institutions with their understanding of ethnomathematics (Pradhan, 2023).

The research conducted by Supriyadi et al. (2024), which investigated the integration of West Javanese ethnomathematics into the mathematics curriculum, aimed to examine its effect on students' engagement and mathematical reasoning. The results revealed that this pedagogical innovation, which combines elements of traditional culture with mathematics education, can enhance students' interest and cognitive skills. Another study also highlighted the benefits of utilizing local wisdom activities in developing students' critical thinking abilities (Rakhman, 2023). This finding cannot be separated from the role of traditional cultural games, which make learning more contextual and meaningful. This approach also enables the appreciation of local culture**,** the integration of everyday life elements, the incorporation of educational playfulness, and the promotion of collaborative learning (Da Silva & Raabe, 2025).

According to Lipiah et al. (2022), contextual learning emphasizes the importance of helping students understand learning materials within the context of everyday life, whether in personal,

social, or cultural aspects. Ethnomathematics offers a more contextual learning approach by integrating cultural elements that exist within the students' surroundings, which may take the form of objects, songs, games, and other local traditions. In this study, the cultural form utilized was the traditional *bitingan* game. This is consistent with Hayati et al. (2021), who stated that the environment and conditions in primary schools are inseparable from a culture of play, as one of the essential needs of elementary school students is the desire to play and engage in physical activities. Learning activities developed through local game-based approaches not only make learning experiences more accessible, enjoyable, and engaging, but are also pedagogically effective for the intended learners (Mtebe & Christina, 2024). Previous research also revealed an improvement in numeracy literacy through the application of ethnomathematics in the architectural context of Naga Village, particularly from a geometrical perspective (Arini et al., 2023).

One of the games frequently played at SDI Tahfidz Preneur Daarul Ahsan is the *bitingan* game, which supported the implementation of this study. During the ethnomathematics treatment involving the *bitingan* game in the experimental class, most students were already familiar with how to play, allowing the learning process to proceed efficiently without consuming much instructional time. The *bitingan* game is a traditional game that has been passed down from generation to generation as part of local culture. According to Saputra and Ekawati (2017), one of the key functions of traditional games is to develop children's fundamental abilities, including numeracy skills and the capacity to maintain focus when solving problems.

Based on these perspectives and supported by the findings of this study, there is a substantial difference in the descriptive statistical analysis results. The class that received ethnomathematics-based instruction through the *bitingan* game achieved an average score of 25.9, while the class that did not receive such treatment obtained an average score of 18.7, out of an ideal score of 36. Moreover, differences were also observed in the minimum and maximum values between the experimental and control classes. The experimental class recorded a higher minimum score (13) compared to the control class (7). Similarly, the maximum score in the experimental class was 35, while the control class reached only 32. These descriptive statistics clearly indicate that the class receiving ethnomathematics instruction through the *bitingan* game achieved higher results than the class that did not.

This outcome cannot be separated from the learning activities embedded in the ethnomathematics approach through the *bitingan* game. Sasmito (2023) reported that incorporating games into classroom learning can help students absorb and retain information more effectively. The study found a significant increase in student achievement, from scores below the minimum mastery criterion (70) to an average score of 87. Out of 20 students who were given the traditional game treatment, only one failed to reach mastery. Another study revealed that the traditional game *Ular Tangga* (snake and ladder) can improve elementary students' numeracy literacy skills. The findings showed an improvement of 27%, with a *t*-value of −4.029 and a *Sig.* (2-tailed) value of $0.000 < \alpha$ (0.05), indicating a significant difference between pre-test and post-test results. Collectively, these studies demonstrate the significant role of traditional games in enhancing students' numeracy literacy skills.

The *bitingan* game, as one form of traditional play, represents a contextualized model of learning. During the treatment process, students were required to measure the playing area of the *bitingan* game, determine the best position to release the sticks without crossing boundaries, count the number of sticks and points earned using multiples of five, record scores using tally marks,

create tables, interpret information from those tables, design effective strategies to win, and make decisions based on the total points obtained.

According to Bishop, as cited in Dominikus (2021), there are six characteristics of ethnomathematics. When a particular culture embodies one or more of these characteristics, it can be explored for the application of ethnomathematics. The six characteristics are counting, locating, measuring, designing, playing, and explaining. All of these aspects are embodied in the *bitingan* game, as discussed in the previous chapter. Therefore, the application of ethnomathematics through the *bitingan* game can lead to differences in students' numeracy literacy abilities.

Differences in numeracy literacy skills can be observed from the *n*-gain results of the experimental class. The experimental class achieved an *n*-gain score of 0.52, which falls within the medium category. However, this score does not mean that all students' improvements were in the medium range. There were five students in the low improvement category, six students in the medium category, and six students in the high category.

The five students who demonstrated low improvement were primarily affected by the learning process in the third meeting, which focused on creating tables and interpreting information from tables. During this session, the teacher formed heterogeneous groups—combining high-achieving students with those of average or below-average ability. Such grouping often led to difficulties for lower-ability students to keep up with their more capable peers. Consequently, the group worksheets were largely completed by the high-achieving students, leaving lower-ability students with limited opportunities to engage actively in problem-solving. This situation reflects one of the common weaknesses of cooperative or group learning, in which certain students tend to dominate while others become passive (Salamun et al., 2023). As a result, lower-ability students provided less accurate answers on the post-test, particularly for items related to constructing and interpreting tables. These five students with low improvement scores were considered outliers in the data.

In contrast, during the first and second sessions, the teacher formed homogeneous groups. High-achieving students were grouped together, as were students of average or lower ability. The teacher also provided additional support for the lower-ability groups by frequently checking their work and offering further explanations when confusion arose during worksheet completion.

Overall, the post-test results indicated an improvement in students' numeracy literacy abilities after the implementation of ethnomathematics through the *bitingan* game—whether at low, medium, or high levels of improvement. This improvement is closely linked to the process of developing numeracy literacy, which requires students to engage in concrete activities. This finding aligns with Piaget's theory of cognitive development, which posits that elementary school children aged 7 to 11 are in the concrete operational stage and therefore need tangible experiences to understand and internalize concepts effectively (Santrock, 2017). The use of sticks (*lidi*) as concrete objects proved particularly helpful for students in practicing counting.

The incorporation of concrete materials in ethnomathematics-based learning through the *bitingan* game also aided students in understanding and retaining the material. This is because students were actively involved and allowed to perform actions related to the learning content (Jamaludin et al., 2023). According to Edgar Dale's *Cone of Experience* theory, learning that engages students in direct action can result in up to 90% knowledge retention. The following figure illustrates Edgar Dale's Cone of Experience (Pagarra et al., 2022).

Figure 1. Cone of Experience by Edgar Dale

In addition to the use of concrete materials in learning, the improvement in numeracy literacy skills was also closely related to the implementation of ethnomathematics through the *bitingan* game, which provided a contextual learning experience aimed at enhancing students' numeracy literacy. This aligns with the statement from the Ministry of Education and Culture (Kemdikbud, 2017), which emphasizes that one of the fundamental principles of numeracy literacy learning is contextual learning. One of the main reasons contextual learning is considered a key principle in developing numeracy literacy is that it connects the learning process with students' immediate environment. The learning materials are linked to situations familiar to students and applied to their daily activities. Such learning conditions tend to encourage students to reason more effectively about the phenomena and problems surrounding them.

This is in line with the definition of numeracy literacy, which is understood as an individual's ability to use reasoning. Reasoning, in this sense, refers to the capacity to comprehend and analyze statements through activities involving the manipulation of mathematical language or symbols encountered in everyday life, and to express these understandings both in written and oral form. This definition implies that numeracy literacy is not merely associated with the ability to receive, process, and analyze information, but also involves the capacity to communicate that information—either verbally or in writing—based on one's surrounding context (Abidin et al., 2021).

Based on the findings and discussion above, it can be concluded that the application of ethnomathematics through the *bitingan* game is effective in improving students' numeracy literacy skills. This conclusion is supported by the descriptive statistical analysis previously presented. The results obtained are also consistent with Turmudi (2018), who stated that ethnomathematics can serve as an alternative approach to mathematics learning. Similarly, previous studies support these findings, highlighting the potential integration of ethnomathematical concepts into the school mathematics curriculum (Rafiepour & Moradalizadeh, 2022).

4. CONCLUSION

Based on the findings and discussion presented, it can be concluded that the application of ethnomathematics through the bitingan traditional game in mathematics learning for Grade III students led to an improvement in numeracy literacy skills by 0.52, which falls within the moderate category. The numeracy literacy abilities of students who received learning through the integration of ethnomathematics in bitingan games differed significantly from those of students

who were not exposed to such integration. This difference, supported by the results of descriptive statistical analysis, indicates that students who engaged in mathematics learning through bitingan-based ethnomathematics demonstrated higher numeracy literacy performance than those in the control group.

The scope of this study is limited to the implementation of ethnomathematics through the traditional bitingan game. The findings suggest that integrating ethnomathematics-based activities, such as bitingan, into mathematics learning is an effective approach to enhancing students' numeracy literacy skills. The game's various activities train students to interpret numbers and data, think rationally and systematically, and develop critical problem-solving and decision-making skills in diverse contexts. Therefore, it is recommended that future research explore the application of ethnomathematics across different educational levels and subject areas, as well as through a wider variety of traditional games, to further optimize students' numeracy literacy development.

REFERENCE

Abidin, Y., Tita, M., & Hana, Y. (2021). *Pembelajaran Literasi: Strategi Meningkatkan Kemampuan Literasi Matematika, Sains, Membaca, dan Menulis*. Bumi Aksara.

Arifin, Z. (2014). *Penelitian Pendidikan: Metode dan Paradigma Baru*. PT. Remaja Rosdakarya.

Arini, R., Ulinuha, W., & Jamaludin, U. (2023). Etnomatematika Bangunan Kampung Naga Dalam Meningkatkan Literasi Numerasi Ditinjau Dari Aspek Geometri. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, *8*(3), 4918-4929.

Choiro, U. D. (2022). *Alzam-Jurnal Pendidikan Islam Anak Usia Dini Peran Permainan Tradisional Terhadap Perkembangan Motorik Halus Anak*.

Cholimah, N. (2023). Menggali nilai-nilai permainan tradisional (Cublak-cublak suweng, Kucing-kucingan, Boi-boi an dan Lurah-lurahan) Di Taman Kanak-kanak Al-I'dad An-Nuur Sleman Yogyakarta Article history. *Jurnal Pendidikan Anak*, *12*(1), 1–10.

Da Silva, C. V. R., & Raabe, A. L. A. (2025). Synergy between theoretical knowledge and associated practices for ethnomathematics and creative learning. *Acta Scientiarum - Education*, *47*(1). https://doi.org/10.4025/actascieduc.v47i1.72082

Darwanto, D., Khasanah, M., & Putri, A. M. (2021). Penguatan Literasi, Numerasi, dan Adaptasi Teknologi pada Pembelajaran di Sekolah (Sebuah Upaya Menghadapi Era Digital dan Disrupsi). *Jurnal Eksponen*, *11*(2), 25–35.

Devianti, A. I., & Jamaludin, U. (2023). Nilai Karakter Siswa dalam Kompetisi Inovasi Permainan Tradisional Engkle. *Jurnal Ilmiah Universitas Batanghari Jambi*, *23*(1), 757-760.

Dierkx, V., van de Rijt, B., Hessen, D., van Luit, H., & van Viersen, S. (2025). Early numeracy development as a foundation of mathematics achievement in primary education. *Learning and Individual Differences*, *121*. https://doi.org/10.1016/j.lindif.2025.102706

Dominikus, W. S. (2021). *Hubungan Etnomatematika Adonara dan Matematika Sekolah*. MNC Publishing.

Gazanofa, F. S., & Wahidin, W. (2023). Eksplorasi Etnomatematika pada Gerak Tari Piring. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *7*(3), 3162–3173. https://doi.org/10.31004/cendekia.v7i3.2679

Harahap, N. S., & Jaelani, A. (2022). *Etnomatematika pada Permainan Tradisional Engklek*.

Hayati, F., Neviyarni, & Irdamurni. (2021). Karakteristik Perkembangan Siswa Sekolah Dasar : Sebuah Kajian Literatur. *Jurnal Pendidikan Tambusai*, *5*(1), 1809–1815.

Hidayat, S. (2013). *Pengembangan Kurikulum Baru*. PT. Remaja Rosdakarya.

Jamaludin, U. (2020). *Pembudayaan Nilai Budaya Sekolah Berbasis Islam pada Pembelajaran Ilmu Pengetahuan Sosial (Suatu Penelitian Etnografi di Kelas Tinggi Sekolah Dasar Islam Terpadu Allzzah Kota Serang Provinsi Banten)* (Doctoral dissertation, Universitas Negeri Jakarta).

Jamaludin, U., Pribadi, R. A., & Zahara, G. (2023). Pengembangan Media Pembelajaran Berbasis Alur Merdeka. *Jurnal Ilmiah Wahana Pendidikan*, *9*(14), 710-716.

Kemdikbud. (2017). *Materi Pendukung Literasi Numerasi*.

Khudriyah. (2021). *Metodologi Penelitian dan Statistika Pendidikan*. Madani.

Lipiah, D., Septianti, N., Yuwono, R., & Atika, R. (2022). Implementasi Model Pembelajaran Kontekstual di Sekolah Dasar. *TSAQOFAH: Jurnal Penelitian Guru Indonesia*, *2*(1), 31–40. https://ejournal.yasin-alsys.org/index.php/tsaqofah

Marlissa, I., Juandi, D., & Turmudi, T. (2024a). Persepsi Etnomatematika dalam Pembelajaran Matematika. *Indiktika : Jurnal Inovasi Pendidikan Matematika*, *7*(1), 148–159. https://doi.org/10.31851/indiktika.v7i1.16993

Masah, M., Maryam, M., & Rakhman, P. A. (2025). Analisis Penggunaan Model Game Based Learning Pada Materi Operasi Hitung Pecahan Di Sekolah Dasar Kelas V. *PAIDAGOGIA: Jurnal Pengajaran dan Pendidikan*, *1*(2), 29-42.

Mtebe and Christina. (2024). Developing Local Games for Enhancing Numeracy Skills in Primary Schools in Tanzania: A Participatory Approach.East African Journal of Science, Technology and Innovation 5(2).

Pagarra, H., Syawaluddin, A., Krismanto, W., Sayidiman. (2022) Media Pembelajaran. Badan Penerbit UNM.

Pradhan, J. B. (2023). Integrating Ethnomathematics Approach in Teaching School Mathematics In-Service Teachers' Perception. *Prometeica*, *27*, 400–409. https://doi.org/10.34024/prometeica.2023.27.15321

Rafiepour, A., & Moradalizadeh, A. (2022). Using mathematical ideas from carpet and carpet-weavers as a context for designing mathematics tasks. *Journal on Mathematics Education*, *13*(3), 383–392. https://doi.org/10.22342/jme.v13i3.pp383-392

Rakhman, P. A., Suryadi, D., & Prabawanto, S. (2019, February). Mathematical communication of junior high student based on the conceptual understanding of triangle. In *Journal of Physics: Conference Series* (Vol. 1157, No. 4, p. 042115). IOP Publishing.

Rosa, M., Ubiratan D', ·, Daniel, A., Orey, C., Shirley, L., Alangui, W. V, Palhares, P., & Gavarrete, M. E. (2016). *Current and Future Perspectives of Ethnomathematics as a Program ICME-13 Topical Surveys*. http://www.springer.com/series/14352

Salamun, Widyastuti, Ana., Syawaluddin., Iwan, R. N. A., Simarmata, J., Simarmata, E. J., Suleman, Y. N., Lotulung, C., Arief, M. H. (2023). Model-model Pembelajaran Inovatif. Yayasan Kita Menulis.

Santrock, John W. (2017). Psikologi Pendidikan. Salemba Humanika.

Saputra, N. E., & Ekawati, Y. N. (2017). Permainan Tradisional sebagai Upaya Meningkatkan Kemampuan Dasar Anak. *Jurnal Psikologi Jambi*, *2*(2).

Sasmito, L. F. (2023). Peningkatan Kemampuan Literasi dan Numerasi Peserta Didik Menggunakan Permainan Tradisional. Dalam *Jurnal Ilmiah Penjas* (Vol. 9, Nomor 2).

Subai, S., Hidayat, S., Jamaludin, U., & Leksono, S. M. (2023). Menggali Kearifan Lokal Untuk Meningkatkan Kualitas Pendidikan: Studi Etno-Pedagogi di Suku Baduy. *Al Qalam: Jurnal Ilmiah Keagamaan dan Kemasyarakatan*, *17*(4), 2886-2906.

Sukarelawa, Moh. I., Indratno, T. K., & Ayu, S. M. (2024). *N-Gain vs Stacking*. SuryaCahya.

Supriyadi, E., Turmudi, T., Afgani Dahlan, J., & Juandi, D. (2024). Ethnomathematics Integration in Mathematics Classroom: Impacts and Insight Assisted by ATLAS.TI 23. Dalam *Journal of Engineering Science and Technology* (Vol. 20).

Turmudi, T. (2018). Kajian Etnomatematika: Belajar matematika dengan Melibatkan Unsur Budaya. *Prosiding Seminar Nasional Etnomatnesia*, 38–53.