THE INFLUENCE OF THE APPLICATION OF ETHNOMATHEMATICS IN THE CONTEXT OF THE TRADITIONAL ENGKLEK GAME ON THE MATHEMATICS LEARNING OUTCOMES OF CLASS IV STUDENTS AT PADEMONEGORO SUKODONO ELEMENTARY SCHOOL

Sri Nur Leni[1], Mohammad Faizal Amir[2]
Program Studi Pendidikan Guru Sekolah Dasar[1], Program Studi Pendidikan Profesi Guru[2], Universitas Muhammadiyah Sidoarjo[1,2]
srinurleny02@gmail.com[1], faizal.amir@umsida.ac.id[2]

Abstract

The process of learning mathematics at the elementary school level still faces challenges, especially in understanding abstract concepts, which results in poor learning outcomes for students. Several ways to address this problem include implementing an ethnomathematics approach to connect mathematical ideas with local cultural wisdom, such as playing the traditional game of engklek. This study aims to measure the impact of applying ethnomathematics related to the traditional game of engklek on the mathematics learning targets of fourth-grade students at SDN Pademonegoro Sukodono. This study adopts a quantitative method with a pre-experimental design of the one-group pretest-posttest type. The number of research samples was 23 students obtained using purposive sampling. Data collection was carried out using pretest and posttest tests. Data analysis included normality testing, hypothesis testing using the Wilcoxon test, and N-Gain calculations to determine the level of improvement in learning outcomes. The research findings showed that the average pretest score, which was initially 45.22, increased to 86.52 at the posttest. Hypothesis testing showed a Sig. (2-tailed) value of 0.000 < 0.05, indicating a significant difference between before and after the treatment. The average N-Gain value reached 0.6558, which is in the moderate category. Therefore, the application of ethnomathematics through the engklek game.
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Keywords: Ethnomathematics, traditional engklek game, mathematics learning outcomes.

A. Introduction

Mathematics education is one of the main fields of study for improving students' ability to make decisions through analytical, creative, and logical thinking. In the elementary school curriculum, the goal of mathematics education is not only focused on technical mastery and arithmetic operations, but also aims to improve students' skills in solving everyday challenges. However, many fourth-grade

elementary school students still face challenges in understanding mathematical concepts, especially conceptual ones such as measurement, two-dimensional and three-dimensional shapes, and arithmetic operations, which causes students to lose motivation and prevents them from achieving their full potential in mathematics. Mathematics learning is an activity that seeks to maximize knowledge, improve students' understanding of mastery, and develop mathematics so that they can overcome problems that arise in their daily experiences (Yulianasari et al., 2023). Mathematics education is a very important area and is a focus in many countries around the world. Although many people recognize the importance of mathematics, some students experience difficulties in learning the mathematical concepts introduced in school. One of the main reasons for this challenge is that the mathematical concepts studied are often difficult and hard to relate to the daily lives of students. These difficulties often result in unsatisfactory mathematics learning outcomes and have an impact on student motivation in learning.

The effort to resolve this issue is to apply an ethnomathematics approach. This approach connects mathematical concepts with the culture or traditions inherent in the daily habits of the (Taskiyah & Widyastuti, 2021). can be viewed as a method adopted by certain cultures in the application of mathematics. Mathematical activities are procedures for organizing real knowledge obtained through activities into mathematical forms, such as grouping, counting, measuring, designing buildings or tools, creating patterns, calculating, determining positions, and conducting research. The Ethnomathematics Approach (Ilmiyah et al., 2021). This way, students can learn mathematics in a more realistic, clear, and meaningful context. The relationship between culture and mathematics is called ethnomathematics, which is the teaching of mathematics in relation to the local culture and traditions of the community surrounding the students. With ethnomathematics, students learn mathematics in a more interesting way because the material taught is related to the culture they are familiar with.

This method makes the learning process more meaningful, encourages students to be more enthusiastic about learning, and supports them in understanding mathematical concepts in a more tangible way. Ethnomathematics connects local cultural wisdom with the context of mathematics education. Culture-based learning

is a way to build a learning atmosphere and design learning knowledge that incorporates culture into educational steps. This learning is based on the understanding that culture is a fundamental and important element in education as a means of conveying concepts and developing knowledge. Through this approach, culture-focused learning is able to introduce local cultures that are often not included in school curricula, including in the teaching of various subjects (Chrissanti, 2019). Six basic activities, namely counting, measuring, designing, explaining, locating, and playing. Examples of ethnomathematics can be seen in traditional games. Traditional games contain many mathematical elements. For example, the game of hopscotch can be used as an educational tool. One example of ethnomathematics can be found in cultural games. Cultural games contain many mathematical elements. In hopscotch, we can use it as a means to (Annisa et al., 2020). Several traditional games that have mathematical learning components can be used as context in ethnomathematics learning, namely the traditional game of engklek. Engklek is a traditional game that can be played in several ways, either in groups or individually (Indriyani et al., 2021). Engklek is a traditional game commonly played by children by jumping with one foot from one box to another using.

Engklek can be described as a game usually played by children by jumping from one box to the next. This game is very familiar to Indonesian children and is often played at school and (Maulida, 2020). Having social and cultural value, the game of engklek also contains various mathematical elements that can be linked to classroom learning. In this game, there are various shapes such as triangles and squares on the engklek board, the concept of number patterns in the sequence of game steps, and the coordination of foot positions, with one foot jumping to the next square. Thus, integrating the game of engklek into mathematics education can facilitate students' learning while playing, making learning more interesting, and making it easier for them to understand mathematical concepts directly through real experiences from traditional games. The cultural game of engklek is legendary among the community, but gradually, with the passage of time and the development of modern technology, the existence of and interest in traditional games such as engklek are increasingly (Prihastari, 2015) Traditional games have educational

value, especially mathematical elements that can be studied and used as learning tools. Engklek can be used as a medium for learning mathematics because it contains concepts of flat shapes that are relevant to elementary school material. The use of this game can help educators convey material in a more concrete, interesting, and easy-to-understand way (Taskiyah & Widyastuti, 2021).

Observations conducted in the field show that the mathematics learning process in elementary schools continues to encounter many obstacles. Students rarely participate in classroom activities, especially when learning is conducted using traditional teacher-centered methods. This situation has a negative impact on student learning outcomes because they are unable to understand mathematical concepts (Hidayat, M., & Salim, 2022). Teachers apply contextual and pedagogical approaches based on students' lives. Contextual learning refers to learning that takes place in close connection with reality. Learning occurs when students receive new information or knowledge in a way that is consistent with their existing knowledge (Tilaar, n.d.). This study prioritizes the application of ethnomathematics in the context of traditional hopscotch games to improve mathematics learning outcomes for elementary school students. The scope of the research is on flat shapes as a learning topic related to mathematical elements in the game of engklek. Previously, research focused more on ethnomathematics in everyday contexts such as batik, weaving, and traditional learning in a descriptive manner without affecting student learning outcomes. This is related to the mathematical elements in the game of engklek. Previously, research on ethnomathematics focused more on everyday contexts such as batik, weaving, and customs in a descriptive manner without affecting learning outcomes (Ike Safitri & Ahyansyah, 2025)

This is expected to contribute to various parties involved in education. For students, the application of ethnomathematics in the context of the traditional game of engklek is designed to increase learning motivation because students are directly involved in fun and meaningful activities. Through this game, students can understand mathematical concepts more clearly and have a positive impact on learning achievement (Wahyuningsih & Astuti, 2023). Teachers, the findings of this study are expected to provide creative and contextually appropriate learning process options. Teachers can utilize elements of local culture to convey

mathematical concepts. In this way, learning becomes more contextual and relevant to the daily lives of students. In addition, for schools, this study is expected to encourage the implementation of learning rooted in local culture as part of efforts to preserve traditional values in education. Schools can apply the ethnomathematics approach as a learning strategy that supports character building and cultural understanding (Siregar et al., 2024). Other researchers can use the results of this study as a basis for further research on the application of ethnomathematics, both through different traditional game contexts and at other levels of education. Therefore, this study makes a real contribution to enriching innovation in mathematics learning based on local culture and improving learning outcomes.

B. Research Method

This study uses a quantitative approach with a pre-experimental design. The purpose of this experiment is to determine the extent of the influence of variable X on variable Y in an objective and measurable manner. The research design applied is a one-group pretest-posttest design, which involves a single group of research subjects. In this design, the researcher administers a pretest before the treatment (intervention) to determine the initial abilities of the students, then administers the treatment, and subsequently conducts a posttest to determine the changes or improvements in learning outcomes after the intervention. Through this series of tests, the researcher can compare the results before and after the treatment to obtain accurate data on the effect of variable X on variable Y. The researcher's objective in conducting this study is to obtain accurate results through a series of tests, namely by conducting a pretest (before the intervention) and a posttest (after the intervention). This is a type of research that involves one group (Safitri et al., 2024).

Tabel 1. One-group Pretest-Postest research method

Pre tes	Treatment	Post-test
0_1	X	0_2

Explanation:

O_1 : Pretest administered before the treatment is applied.

X: Treatment given to research subjects.

O_2: Posttest administered after the treatment is applied.

Fokus This study used a quantitative approach with a sample of 23 fourth-grade students at SDN Pademonegoro in the 2025/2026 academic year, selected through purposive sampling. Data were collected through pretest, posttest, and documentation.

1. validity test & reliability test

The validity of the instruments was tested through expert assessment (two PGSD UMSIDA lecturers) and analyzed using Aiken's V formula to determine the content validity of each item. Furthermore, the level of difficulty and discrimination power analysis as well as the reliability test were conducted using SPSS Statistics 25 with Cronbach's Alpha coefficient ($\alpha \geq 0.70$). (Pembelajaran et al., 2021).

2. Normality test

Before testing the hypothesis, a normality test was conducted as a prerequisite test. If the data was normally distributed, a paired sample t-test was used, whereas if it was not normally distributed, a Wilcoxon test was used. The improvement in learning outcomes was analyzed using the N-gain score calculation to determine the effect of applying the traditional engklek game based on ethnomathematics on student learning outcomes (Yulianasari et al., 2023)

C. Results and Discussion

The questionnaire validity test was conducted to assess the validity level of each statement item using the Product Moment correlation formula. The correlation technique used was Pearson Correlation, which was calculated using the SPSS program. An item statement is declared valid if the calculated r value is greater than the table r at a significance level of 0.05. Conversely, if the calculated r value is smaller than the table r, then the item is declared invalid and needs to be revised or deleted (Nikola Tolentini, Maria A.U. Leba, 2025). The validity test of the instrument can be seen in the table.

Table 2. Validity Test Results Table

Item	Calculated R	Table R	Description
P1	0.735	0.291	Valid
P2	0.715	0.291	Valid
P3	0.799	0.291	Valid
P4	0.532	0.291	Valid
P5	0.491	0.291	Valid
P6	0.542	0.291	Valid
P7	0.650	0.291	Valid
P8	0.529	0.291	Valid
P9	0.527	0.291	Valid
P10	0.618	0.291	Valid

Based on the information in the table, the r values calculated for all questions exceed the table r of 0.291. It can be concluded that all questions are valid.

Metode The method used for internal evaluation in this study was Cronbach's alpha. The questionnaire as a measuring instrument was considered reliable if the Cronbach's Coefficient Alpha value exceeded 0.6. If the Cronbach's Coefficient Alpha value was less than 0.6, the questionnaire as a measuring instrument was considered unreliable. (Nikola Tolentini, Maria A.U. Leba, 2025). Rom the reliability test can be seen in the table:

Table 3. Reliability Test Results Table

Cronbach's Alpha	Limit	Description
0.816	> 0.6	Reliabel

Based on the summary of the reliability test results presented in the table above, it can be concluded that the Cronbach Alpha coefficient values for all research variables are greater than 0.6, so all items in the research variables can be considered reliable.

Table 4. Aiken'v Test Result

Item	Validator 1	Validator 2	s1	s2	∑s	N (c-1)	v	Description
1	4	4	3	3	6	8	0.75	valid
2	4	3	3	2	5	8	0.625	quite valid
3	4	4	3	3	6	8	0.75	valid
4	4	4	3	3	6	8	0.75	valid
5	4	4	3	3	6	8	0.75	valid
Skor	20	19	15	14	29	40	0.725	valid

It will be held from February 5 to 7, 2026, at SDN Pademonegoro during the even semester of the 2025/2026 academic year. Initial information about the mathematical learning abilities of fourth-grade students was obtained through a pretest, which was an exam conducted before the implementation of the engklek cultural game using the ethnomathematics method in the learning process, specifically about flat shapes and the introduction of flat shapes through the game. The validity test of the pretest and posttest in this study has been carried out and shows valid results. This pretest was conducted for 23 fourth-grade students at SDN PADEMONEGORO, consisting of 8 male students and 15 female students. The assessment scale used ranged from 1 to 100. Students were declared to have passed if they achieved a minimum passing score (KKM) of 70. The pretest instrument in this study consisted of 10 multiple-choice questions and 5 essay questions designed in accordance with the competencies to be measured, reviewing flat shapes in everyday mathematics and methods of solving them. Through this pretest activity, the average learning outcomes of fourth-grade students were obtained as follows.

Table 2. Analysis of Students' Pretest Learning Outcomes

Gender	Number of Students	Average Score	High Score	Low Score
Man	8	47,5	40	30
Woman	15	37,3	50	30

The table above shows that the average score of the 8 male students was 47.5, with the highest score being 40 and the lowest score being 30. After the pretest was conducted, the next step was to use the traditional game of Engklek by applying the ethnomathematics method in the learning process. This game activity was carried out in two sessions, namely on Friday, February 6, 2026, and Saturday, February 7, 2026, during the first lesson. The learning activities in each meeting lasted for 2×35 minutes in accordance with the allocated time (a total of 70 minutes). When the Traditional Engklek Game was applied using the Ethnomathematics method, the students showed enthusiasm during the learning process. This was reflected in the students' enthusiasm and confidence level when playing Engklek on a 2×1.5 meter banner in front of their friends. Each box on the banner contained various types of flat shapes so that students could recognize various shapes.

Figure 1. Playing Engklek Mathematics Learning

Next is conducting a posttest. The posttest is conducted to assess the students' understanding after the learning process is carried out by applying the traditional game of engklek through an ethnomathematics approach. The posttest results show that the instruments used have met the validity criteria so that the data obtained can be declared valid. Based on these results, there was an increase in the average learning outcomes of the students. The students' scores after the application of this method showed better progress compared to before the treatment was given. The traditional game of engklek with an ethnomathematics approach was better than before the game was played. The average posttest scores of the students can be seen.

Table 3. Analysis Of Student Post-Test Learning Outcomes.

Gender	Number of Students	Average Score	High Score	Low Score
Man	8	82,5	90	70
Woman	15	80	100	70

In the table, the average score of 8 male students, which was originally 47.5, has now increased to 82.5, with a high score of 90 and a low score of 70. Meanwhile, the average score of 15 students, which was previously 37.5, has now increased to 80, based on a highest score of 100 and a lowest score of 70. The pre-test and post-test results show a significant improvement in learning outcomes for students of both genders. After obtaining the pre-test and post-test data, the next step is to test normality using the Kolmogorov-Smirnov method, which shows a significance value of 0.017 for the pre-test and 0.027 for the post-test. The pretest significance

value of $0.017 < 0.05$ indicates that the data is not normally distributed. The posttest sig value of $0.027 < 0.05$ indicates that the data is not normally distributed (Yulianasari et al., 2023).

Hypothesis testing in this study indicates that the Sig. (2-tailed) value is 0.000. With this number, it can be concluded that the significance value (2-tailed) < 0.05, which means that there is a significant difference in the level of learning comprehension of fourth-grade students at SDN PADEMONEGORO before and after the implementation of the traditional game of Engklek using the ethnomathematics method. These findings support the research hypothesis, which states that there is a difference in the level of understanding of fourth-grade students at SDN PADEMONEGORO before and after implementing the traditional game of Engklek using the Ethnomathematics method.

Descriptive statistics show that this study involved 23 students as research samples. The pretest scores ranged from a low of 30 to a high of 60, with a mean of 45.22 and a standard deviation of 11.229. On the posttest, the lowest score obtained was 70 and the highest was 100, with a mean of 86.52 and a standard deviation of 10.706. These data show an increase in the average learning achievement of students after receiving treatment. Furthermore, after calculating the N-Gain from the pretest and posttest data for each student, it was found that the minimum N-Gain value was 0.30 and the maximum value was 1.00. The mean N-Gain value was 0.6558 with a standard deviation of 0.19953. This average value indicates that the improvement in student learning outcomes is classified as moderate, because it is in the range of $0.30 \leq g < 0.70$ (Safitri et al., 2024)Thus, the learning method applied in this study succeeded in improving the learning outcomes of students at SDN PADEMONEGORO after applying the local cultural game of engklek with the Ethnomathematics method, and the results are classified as moderate.

D. Conclusion

Based on the scores obtained, it can be concluded that the application of the traditional Engklek game using the ethnomathematics method has a positive impact on the learning of fourth-grade students at SDN Pademonegoro. Thus, there was an increase in the average scores of fourth-grade students at SDN Pademonegoro

before and after the application of the traditional Engklek game using the ethnomathematics method in the learning process. The learning improvement of 8 male students, whose initial score was 47.5, increased to 82.5 with a maximum score of 90 and a minimum score of 70. Meanwhile, the average score of 15 female students, which was originally 37.5, increased to 80, with a maximum score of 100 and a minimum score of 70. A comparison between the pre-test and post-test improvements shows a significant difference in learning outcomes between male and female students.

Bibliography

Annisa, C., Fauziah, A., & Erawati, E. (2020). ENGKLEK GEN 4.0 (Studi Etnomatematika : Permainan Tradisional Engklek sebagai Media Pembelajaran Matematika). *Factor M*, *3*(1), 33–48. https://doi.org/10.30762/f_m.v3i1.2499

Chrissanti, M. I. (2019). Etnomatematika sebagai salah satu upaya penguatan kearifan lokal dalam pembelajaran matematika. *Math Didactic: Jurnal Pendidikan Matematika*, *4*(2018), 243–252. https://doi.org/10.33654/math.v4i0.191

Hidayat, M., & Salim, A. (2022). Pengembangan Media Pembelajaran Berbasis Game Edukatif Untuk Mata Pelajaran Akidah Akhlak. *ACADEMIA: Jurnal Inovasi Riset Akademik*, *5*(3), 67–75.

Ike Safitri, A. H., & Ahyansyah, A. (2025). Etnomatematika Pada Permainan Tradisional di Indonesia: Systematics Literature Review. *DIKSI: Jurnal Kajian Pendidikan Dan Sosial*, *6*(3), 399–406. https://doi.org/10.53299/diksi.v6i3.2421

Ilmiyah, N., Handayani, N., Hanifah, & Pramesti, S. L. D. (2021). Studi Praktik Pendekatan Etnomatematika dalam Pembelajaran Matematika Kurikulum 2013. *SANTIKA: Seminar Nasional Tadris Matematika*, *1*, 187–188.

Indriyani, D., Muslihin, H. Y., & Mulyadi, S. (2021). Manfaat Permainan Tradisional Engklek dalam Aspek Motorik Kasar Anak. *Jurnal Pendidikan Anak Usia Dini Undiksha*, *9*(3), 349. https://doi.org/10.23887/paud.v9i3.34164

Maulida, S. H. (2020). Pembelajaran Matematika Berbasis Etnomatematika Melalui Permainan Tradisional Engklek. *LEMMA : Letters of Mathematics Education*, *7*(01), 35–44. http://ojs.semdikjar.fkip.unpkediri.ac.id/index.php/SEMDIKJAR/article/view/67%0Ahttp://ojs.unpkediri.ac.id/index.php/matematika/article/view/12810

Nikola Tolentini, Maria A.U. Leba, A. B. B. (2025). Jurnal Dinamika Pendidikan. *Jurnal Dinamika Pendidikan Nusantara*, *6*(1), 46.

Pembelajaran, E., Pendidikan, S., Uji, M., & Wahab, A. (2021). *Jurnal basicedu*. *5*(2), 1039–1045.

Prihastari, E. B. (2015). Pemanfaatan Etnomatematik Melalui Permainan Engklek Sebagai Sumber Belajar. *MENDIDIK: Jurnal Kajian Pendidikan Dan Pengajaran*, *1*(2), 155–162.

Safitri, S. L., Santoso, D. A., & Kuryanto, M. S. (2024). Pengaruh Permainan Tradisional Engklek Melalui Pendekatan Etnomatematika Terhadap Hasil Belajar Siswa Kelas V. *Absis: Mathematics Education Journal*, *6*(2), 106–111.

Siregar, A. R., Fitri, A., Pakpahan, H., Siregar, E. B., Giawa, F., Siregar, J. M., Ramadhani, N., Matondang, N. H., Hidayah, N., Karo, B., Sonia, P., Simarmata, B., & Hasibuan, R. P. (2024). Prosiding MAHASENDIKA III Tahun 2024 ETNOMATEMATIKA SEBAGAI SARANA PENGUATAN BUDAYA LOKAL MELALUI KURIKULUM MERDEKA BELAJAR. *Prosiding MAHASENDIKA III*, 44–57.

Taskiyah, A. N., & Widyastuti, W. (2021). Etnomatematika dan Menumbuhkan Karakter Cinta Tanah Air pada Permainan Engklek. *Jurnal Pendidikan Matematika (Kudus)*, *4*(1), 81. https://doi.org/10.21043/jmtk.v4i1.10342

Tilaar, A. L. (n.d.). The Effectiveness of Contextual Learning in Teaching Mathematics. *Jurnal Informatif*, *1*(3), 186–191.

Wahyuningsih, A., & Astuti, H. P. (2023). *Etnomatematika : Analisis Konsep Matematika Pada Permainan Tradisional Engklek Ethnomathematics : Analysis of Mathematics Concepts in Traditional Engklek Games*. *9*(1), 239–248.

Wijayanti, R., & Trisiana, A. (2018). Pengaruh Permainan Engklek Berbasis Etnomatematika Terhadap Kemampuan Berpikir Kritis Peserta Didik Kelas Iii. *Jurnal Sinektik*, *1*(2), 178. https://doi.org/10.33061/js.v1i2.2802

Yulianasari, N., Salsabila, L., Maulidina, N., & Maula, L. H. (2023). Implementasi Etnomatematika sebagai Cara untuk Menghubungkan Matematika dengan Kehidupan Sehari-hari. *SANTIKA : Seminar Nasional Tadris Matematika*, *3*, 642–652.