Kognitif
Jurnal Riset HOTS Pendidikan Matematika
Volume- 5 No- 3 Halaman 1398 – 1408
ISSN 2776-9704 P-ISSN 2776-9984
https://doi.org/10.51574/kognitif.v5i3.3854

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How to cite : Ananda, S., Pardi, M. H. H., & Kusaeri, A. (2025). Enhancing Mathematical Representation Skills through the Traditional Game Ceprek Lombok. *Kognitif: Jurnal Riset HOTS Pendidikan Matematika*, *5*(3), 1398–1408. https://doi.org/10.51574/kognitif.v5i3.3854

To link to this artcle : https://doi.org/10.51574/kognitif.v5i3.3854

Opened Access Article

Published Online on 28 September 2025

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Kognitif: Jurnal Riset HOTS Pendidikan Matematika
https://doi.org/10.51574/kognitif.v5i3.3854 Volume 5, No 3, Juli - September 2025, pp. 1398– 1408

Enhancing Mathematical Representation Skills through the Traditional Game *Ceprek* Lombok

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Article Info

Article history:

Received Aug 30, 2025
Accepted Sep 25, 2025
Published Online Sep 28, 2025

Keywords:

Mathematical Representation Skills
Ethnomathematics
Traditional Games

ABSTRACT

Mathematical representation skills play a crucial role in learning mathematics, particularly in connecting mathematical concepts into symbols and diagrams, especially in the context of plane geometry. This study investigates the improvement of students' mathematical representation skills through the use of the traditional game *Ceprak Lombok*. A quantitative approach with a quasi-experimental design was employed. The population consisted of all seventh-grade students (N = 158), with a sample of 35 students from class VII B. Data were collected using pretest and posttest instruments to measure students' mathematical representation skills, supported by observation sheets to monitor the intervention process. Data analysis was performed using SPSS, including normality and homogeneity tests as prerequisites, followed by hypothesis testing. The results showed that the data were normally distributed ($p > 0.05$) and homogeneous ($p > 0.05$). Hypothesis testing further revealed a significant improvement in students' learning outcomes after the treatment ($p < 0.05$). These findings suggest that the *Ceprak Lombok* traditional game is effective in enhancing mathematical representation skills and provide practical implications for teachers to utilize traditional games as engaging and effective strategies for developing students' mathematical competencies.

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Introduction

Mathematics is often perceived as a difficult, intimidating, and less enjoyable subject by many students. Such negative perceptions generally arise from various factors, including difficulties in understanding abstract concepts, complex formulas, and the use of unengaging teaching approaches (Dwijayanti et al., 2024). As a result, many students show low interest and tend to avoid mathematics lessons. To address these challenges, a contextual learning approach is needed, one that connects mathematics content with students' everyday realities. An essential aspect of improving students' understanding and engagement in mathematics learning is the development of mathematical representation skills (Atikasuri & Kusaeri, 2024). According to Riyanto et al. (2024), representation is regarded as a mathematical communication tool that enables students to express their thinking through models or forms appropriate to a given situation. There are three indicators of mathematical representation skills: visual, symbolic, and verbal (Putri et al., 2020). These skills involve the ability to comprehend, illustrate, and communicate mathematical ideas in multiple forms, such as symbols, graphs, diagrams, or verbal explanations (Kusgiarohmah et al., 2022). Moreover, mathematical representation plays a significant role in fostering critical and analytical thinking, which is essential in both everyday life and education (Dinarti & Qomariyah, 2023).

International data indicate that Indonesian students' mathematical representation skills remain relatively low. Based on the 2022 PISA results, the average mathematics score of Indonesian students was 502, which falls below the OECD average (OECD, 2023). This condition highlights the importance of strengthening students' mathematical representation skills so that they can better understand and communicate mathematical concepts effectively. To enhance these skills, learning approaches should not be limited to theoretical aspects but also provide concrete and enjoyable experiences. One relevant approach is the integration of ethnomathematics, which connects mathematics learning with local cultural values (Pulungan & Adinda, 2023). Ethnomathematics emphasizes the importance of cultural aspects in mathematics education and enables students to contextualize mathematical concepts through familiar settings (Tambunan & Simanjuntak, 2021).

A practical form of ethnomathematics integration is through traditional games, which represent cultural heritage rich in mathematical values such as patterns, geometric shapes, counting, measurement of time and distance, and strategies (Munifah, 2017). Games such as *congkak*, *egrang*, *selodor*, *engklek*, and *karapan sapi* provide students with opportunities to directly apply mathematical concepts (Sufia et al., 2023). One traditional game that is particularly relevant in Lombok is *Ceprak*. This game involves activities such as counting steps, strategizing, and identifying patterns, thereby offering students opportunities to develop visual, symbolic, and verbal mathematical representations in a meaningful and enjoyable way. Consequently, *Ceprak* can serve as an effective medium to enhance mathematical representation skills through concrete learning experiences (Munifah, 2017). Thus, traditional games as part of an ethnomathematical approach may provide an effective medium for improving students' mathematical representation skills.

Several studies have highlighted the role of ethnomathematics in enhancing students' mathematical representation skills. Ulya & Rahayu (2020) and Syakira Nurisma et al. (2024) reported that students demonstrated good levels of representation when solving ethnomathematics-based problems. Similarly, Abung (2023) found that ethnomathematics-based worksheets (LKPD) were effective in improving students' representation skills. Further studies by Fauzana (2022) and Kurnia & Sari (2023) revealed that ethnomathematics-based RME approaches had a positive impact on students' achievement in mathematical representation. In addition, Pambudi et al. (2021) showed that ethnomathematics-based learning effectively enhanced students' reasoning and representation skills. Nevertheless, field evidence shows that many students still possess relatively low levels of mathematical representation skills (Ristiani & Maryati, 2022). Nasution et al. (2023) found that students' representation abilities were at a moderate level, while Amieny and Firmansyah (2021) reported that only 26% of students demonstrated adequate representation skills in mathematics learning. These findings suggest that students' mathematical representation skills remain insufficient.

Kognitif: Jurnal Riset HOTS Pendidikan Matematika
https://doi.org/10.51574/kognitif.v5i3.3854 Volume 5, No 3, Juli - September 2025, pp. 1398– 1408

This situation is also supported by observations conducted at SMPN 7 Pujut, which revealed that ethnomathematics (particularly traditional games) has not yet been integrated into mathematics learning. Many students failed to reach the minimum mastery criterion in representation skills, largely due to teacher-centered methods that were passive and insufficiently connected to cultural or real-life contexts. The application of the *Ceprak Lombok* traditional game is therefore expected to provide concrete learning experiences, link mathematical concepts with local cultural activities, and support the improvement of students' mathematical representation skills. Although previous research has demonstrated the effectiveness of ethnomathematics in improving mathematical representation, few studies have specifically examined the use of traditional games as a learning medium within this approach. This study applies the traditional game *Ceprak Lombok* in mathematics learning to make it more culturally contextual and to offer students an engaging instructional strategy. Accordingly, the purpose of this study is to examine whether the use of *Ceprak Lombok* improves students' mathematical representation skills.

Method

Research Design

This study employed a quantitative approach with a quasi-experimental design, specifically a one-group pretest–posttest model. Quantitative research is characterized by the use of numerical data to analyze population conditions or trends (Syahrizal & Jailani, 2023). Rationale for adopting this approach is that it enables data to be measured and analyzed objectively in numerical form. Furthermore, this design allows the researcher to examine the relationship between the treatment administered and students' performance before and after the intervention.

Population and Sample

Population in this study refers to all objects or individuals sharing specific characteristics determined by the researcher as the source of data from which conclusions can be drawn (Mukhid, 2019). Population consisted of seventh-grade students at SMPN 7 Pujut, Central Lombok, comprising five classes with a total of 158 students. Sampling technique applied was Cluster Random Sampling, in which the population was divided into class clusters, and one class was randomly selected as the sample (Subhaktiyasa, 2024). Selected sample was class VII B, consisting of 35 students. The random selection from the five available classes was carried out to ensure the representativeness of the sample.

Instruments

Instruments used in this study consisted of a test (pretest and posttest) and an observation sheet. Pretest–posttest items were validated by two experts in mathematics education, namely a mathematics teacher at SMPN 7 Pujut and a university mathematics lecturer, and were declared suitable for use. Observation sheet was employed to record students' learning activities during the instructional process.

Validity of the Pretest–Posttest Instrument

Pretest–posttest instrument was designed to measure students' mathematical representation skills, ensuring that each item aligned with the specified indicators. Content validity was examined through expert judgment using a validation sheet. The criteria for validity assessment are presented in Table 1.

Table 1. Criteria for Test Item Validity

Percentage (%)	Description
85–100%	Very valid
70–84%	Valid
50–69%	Less valid
≤ 50%	Not valid

Validity score was calculated using the following formula:

$$P = \frac{\sum x}{\sum x_i} \times 100\%$$

where P = validity percentage, $\sum x$ = total score, and $\sum xi$ = ideal maximum score.

Pretest and Posttest Items

Test was administered twice: a pretest before the intervention (conventional learning) and a posttest after the ethnomathematics-based intervention (traditional game *Ceprak*). The aim of the test was to examine improvements in students' mathematical representation skills. Indicators and sample items are summarized in Table 2 and Table 3.

Table 2. Indicators and Pretest Items

Indicator	Pretest Item
Visual representation (presenting data/information in tables, figures, or graphs)	A traditional *Ceprak* game consists of eight geometric shapes. Identify the names and types of these shapes.
Symbolic representation (constructing equations or mathematical models from given representations)	Each square on the game board has a side length of 20 cm. Calculate the total area of the seven squares.
Verbal representation (explaining problem-solving steps in words)	One of the boxes in the *Ceprak* game is a circle with a diameter of 10 cm. Explain how you would calculate its area.

Table 3. Indicators and Posttest Items

Indicator	Posttest Item
Visual representation	Illustrate the complete layout of the *Ceprak* game consisting of eight shapes. State the number of each shape.
Symbolic representation	Each square has a side length of 20 cm and the semicircle has a diameter of 20 cm. Calculate the total area of all shapes in the game.
Verbal representation	One of the boxes in the *Ceprak* game is a square with a side length of 5 cm. Explain how you would calculate its area.

Validation results indicated that the items were aligned with the indicators of mathematical representation skills and were therefore appropriate for use as research instruments. This validation ensured that the test was relevant, measurable, and reliable in representing students' abilities.

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Observation Sheet

Observation sheet was used as the primary tool for systematically documenting learning activities during the intervention. It allowed the researcher to record behaviors, interactions, and important phenomena objectively and in detail. Observations focused on three main categories: teacher support, student engagement, and collaborative problem-solving. The indicators of observation and their criteria are presented in Table 4.

Table 4. Observation Sheet

No.	Indicator	Success Criteria
1	Teacher provides motivation, guidance, and support to facilitate understanding of mathematical concepts	Very good
2	Teacher uses relevant stories or phenomena to build problem contexts	Good
3	Teacher presents problems and explains problem-solving steps systematically	Very good
4	Students actively follow the lesson, listen, and take notes	Good
5	Students complete assigned tasks properly	Good
6	Students participate in discussions or answer teacher questions	Good
7	Students collaborate in groups to solve problems	Very good
8	Teacher refines students' conclusions; students present group work and provide feedback to peers	Very good
9	Students draw conclusions collaboratively	Good

Data Collection

Data were collected through pretest and posttest instruments administered to seventh-grade students in class VII B at SMPN 7 Pujut, Central Lombok. Process was conducted over four sessions. In the first session, students received conventional instruction on plane geometry and its connection to the Ceprak game. The second session involved administering the pretest, which was developed based on the indicators of mathematical representation skills. In the third session, students directly engaged in and practiced the Ceprak traditional game. Finally, the fourth session involved administering the posttest, also developed according to the same indicators. All data collection activities were carried out in the classroom under the researcher's supervision to ensure orderly administration and the authenticity of student responses.

Analysis

Data analysis consisted of prerequisite tests (normality and homogeneity) followed by hypothesis testing using a paired sample t-test. Normality testing was conducted using the Shapiro–Wilk method with SPSS software, where data were considered normally distributed if the significance value (Sig.) exceeded 0.05. Homogeneity testing was conducted using Levene's test to evaluate the equality of variances; data were considered homogeneous if the significance value was greater than 0.05. Once these assumptions were met, hypothesis testing proceeded with a paired sample t-test, as the study compared the performance of the same group under two conditions (pretest and posttest). A significance value (Sig. 2-tailed) below 0.05 indicated the acceptance of the alternative hypothesis, suggesting a statistically significant difference between pretest and posttest scores. This result demonstrated that the implementation of the Ceprak traditional game had a positive effect on improving students' mathematical representation skills.

Results

Data collection was carried out through pretest and posttest instruments administered to seventh-grade students in class VII B at SMPN 7 Pujut, Central Lombok. The results were compiled and presented in quantitative form to analyze the development of students' mathematical representation skills. The descriptive statistics of students' scores are summarized in Table 5.

Table 5. Descriptive Statistics of Pretest and Posttes

	Pretest	Posttest
Mean	46.11	59.14
Median	50	55
Mode	45	50
Maximum	79	95
Minimum	10	27
Standard Deviation	19.20	17.39
Variance	368.75	302.71

The results indicate noticeable differences between students' pretest and posttest performance. The mean score increased from 46.11 in the pretest to 59.14 in the posttest, reflecting an improvement of 13.03 points after the intervention with the *Ceprak* traditional game as a learning medium. Similarly, the median score rose from 50 to 55, while the mode increased from 45 to 50. These findings provide preliminary evidence of improvement in students' mathematical representation skills following the implementation of the intervention.

Data obtained were analyzed using SPSS to conduct prerequisite tests and hypothesis testing. The prerequisite tests included normality and homogeneity tests. The results of the normality test using the Shapiro–Wilk method are presented in Table 6.

Table 6. Normality Test Results (Shapiro–Wilk)

Class	df	Sig.	Criteria	Conclusion
Pretest	35	0.168	> 0.05	Normal
Posttest	35	0.504	> 0.05	Normal

Significance value (*p*-value) for the pretest data was 0.168, which is greater than the research significance level of 0.05 (0.168 > 0.05). Therefore, the pretest data can be considered normally distributed. Similarly, the posttest data showed a significance value of 0.504, which also exceeded the 0.05 threshold (0.504 > 0.05). This result confirms that the posttest data also met the normality assumption. Accordingly, both pretest and posttest scores were normally distributed, fulfilling the prerequisite for parametric analysis.

Homogeneity test was conducted using Levene's test, and the results are presented in Table 7.

Table 7. Test of Homogeneity of Variance

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.	Kriteria	Kesimpulan
Score	Based on Mean	.151	1	68	0,699	> 0,05	Homogen
	Based on Median	.180	1	68	0,673	> 0,05	Homogen
	Based on Median and with adjusted df	.180	1	67,00	0,673	> 0,05	Homogen
	Based on trimmed mean	.150	1	68	0,700	> 0,05	Homogen

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Significance value based on the mean was 0.699, which exceeded the threshold of 0.05. This result indicates that there was no significant variance difference between the pretest and posttest data. In other words, the two datasets were considered homogeneous. Hypothesis testing was then performed using a paired sample *t*-test to examine whether there was a statistically significant difference between the mean scores of the two conditions. The results are shown in Table 8.

Table 8. Paired Sample *t*-Test Results

Paired Samples Test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Score	Prettest – posttest	-13.029	12.287	2.077	-17.249	-8.808	-6.273	34	.000

The mean difference between pretest and posttest scores was -13.029, indicating that posttest scores were higher than pretest scores. The negative sign reflects an increase in performance after the intervention. The significance value (Sig. 2-tailed) was 0.000, which is far below the 0.05 threshold. This result confirms that the difference between pretest and posttest scores was not due to chance but was statistically significant. Therefore, the findings demonstrate a meaningful improvement in students' mathematical representation skills following the implementation of the *Ceprak* traditional game.

Discussion

This study demonstrated that the traditional *Ceprak Lombok* game effectively enhanced students' mathematical representation skills in plane geometry. The significant improvement in students' posttest scores indicates that integrating local cultural practices into mathematics instruction can provide meaningful and contextual learning experiences. The novelty of this study lies in the direct application of a traditional game as a learning medium, which differs from previous studies that primarily focused on ethnomathematics through worksheets (LKPD) or theoretical approaches without hands-on practice.

The findings align with prior research emphasizing the potential of ethnomathematics in strengthening mathematical understanding. For example, Andriyani et al. (2024) found that traditional games rooted in ethnomathematics improved both students' conceptual mastery and self-efficacy. Similarly, Rahayu et al. (2018) demonstrated that geometry-based problem-solving significantly increased students' mathematical representation skills. In this study, *Ceprak* functioned as a contextual problem-solving tool that embedded plane geometry elements, thereby engaging students in visual, symbolic, and verbal forms of representation. These results are also consistent with Abung (2023), Pambudi et al. (2021), and Ulya & Rahayu (2020), who confirmed the effectiveness of ethnomathematics-based learning in developing students' mathematical representation skills.

Beyond confirming earlier findings, this study contributes to the literature by highlighting the role of direct practice with traditional games. Unlike Fernández-Oliveras et al. (2021), who noted that many studies remain limited to theoretical discussions of ethnomathematical media, this research shows that active engagement in a traditional game can mobilize mathematical content and promote deeper learning. Thus, the use of *Ceprak* not only improved students' representation skills but also bridged mathematics learning with cultural contexts and everyday experiences. This dual contribution (pedagogical effectiveness and cultural revitalization) underscores the significance of integrating ethnomathematics into mathematics education.

The study's practical implication is that teachers can adopt traditional games as engaging and culturally relevant strategies to make abstract mathematical concepts more accessible. At the theoretical level, the findings reinforce the role of ethnomathematics in expanding the scope of representation theory by demonstrating how cultural practices can support the development of visual, symbolic, and verbal representations. This study, however, has limitations, as it was conducted with a single class and a relatively small sample size, which restricts the generalizability of the findings. Future studies should involve larger samples, multiple educational levels, and diverse traditional games to provide a more comprehensive understanding of how ethnomathematics can be effectively integrated into mathematics education.

Conclusion

Based on the results, it can be concluded that the use of the *Ceprak* traditional game in mathematics instruction proved effective in improving students' mathematical representation skills in plane geometry, as evidenced by the increase in pretest and posttest scores. Although this study involved only one class of 35 students and focused on a single type of game, the findings highlight that integrating local culture into mathematics learning can serve as a contextual approach that enhances both motivation and understanding. Moreover, this study contributes to the broader development of culturally responsive instructional models in schools. Overall, the findings indicate that learning through the *Ceprak* traditional game has a positive impact on students' learning outcomes, supporting the notion that integrating local culture into instruction not only strengthens students' cultural identity but also serves as an effective pedagogical strategy to improve the quality of mathematics education.

Acknowledgments

The authors would like to express their sincere gratitude to all parties who have provided support, assistance, and encouragement for this study entitled *"Enhancing Mathematical Representation Skills through the Traditional Game Ceprak among Junior High School Students."* Special thanks are extended to Dr. H. M. Habib Husnial Pardi, M.A., and Dr. H. Al Kusaeri, S.Pd.I., M.Pd., for their valuable guidance and supervision. Appreciation is also addressed to the mathematics teacher and the seventh-grade students of class VII B at SMPN 7 Pujut, Central Lombok, for their active participation in providing the data necessary to complete this research. All contributions and support have been highly meaningful in the successful completion of this study.

Conflict of Interest

The authors declare that there is no conflict of interest.

Authors' Contributions

S.A. contributed to instrument development, study design, theoretical framework, data collection, data processing, data analysis, presentation of results and discussion, manuscript revision, and final integration of the article. M.H.H.P. contributed to theoretical development

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and approved the final version of the manuscript. A.K. contributed to theoretical development and approved the final version of the manuscript. The overall percentage contributions for conceptualization, preparation, and revision of this article are as follows: S.A.: 40%, M.H.H.P.: 30%, and A.K.: 30%.

Data Availability Statement

The authors declare that the data supporting the findings of this study will be made available by the corresponding author, [S.A.], upon reasonable request.

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Kognitif: Jurnal Riset HOTS Pendidikan Matematika
https://doi.org/10.51574/kognitif.v5i3.3854 Volume 5, No 3, Juli - September 2025, pp. 1398– 1408

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