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The Influence of Realistic Mathematics Education (RME) Model Based on Ethnomathematics of Engklek Game on Students' Mathematical Problem-Solving Abilities

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Abstract

This research aimed to examine the influence of applying the realistic mathematics education (RME) model based on the ethnomathematics of the Engklek game on students' mathematical problem-solving abilities. The study employed an experimental research design using quantitative methods. The chosen design was a Randomized Two Group Design Posttest Only. Samples were selected using cluster random sampling techniques, resulting in the control class (VII-3) and the experimental class (VII-4). The research utilized lesson plans (RPP), worksheets (LKPD), and a Posttest as the instruments. The data were analyzed using inferential statistical analysis techniques, specifically the Independent Sample T-test with SPSS 25 software. The results of the study indicated that the mean posttest score in the experimental class was 84.76, while the mean posttest score in the control class was 60.90. The hypothesis test at a significance level of 5% yielded a sig.2 tailed value of 0.000. This indicates that the Sig. (2 Tailed) < 0.05, demonstrating a significant effect of applying the realistic mathematics education (RME) model based on the ethnomathematics of the Engklek game on students' mathematical problem-solving abilities. Further research is needed to deepen the understanding of the influence of the RME model based on the ethnomathematics of the Engklek game on students' mathematical problem-solving abilities. Additionally, it is hoped that future researchers can conduct further research using other learning models that are tailored to the subject matter, allowing for a comparison of the obtained mathematical problem-solving abilities. This would enable teachers to select an effective learning model based on the specific needs of their students.

Keywords: RME; Ethnomathematics; Engklek Game; Mathematical Problem-Solving Abilities

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INTRODUCTION

Education is a deliberate and conscious process aimed at creating a learning environment and promoting the development of learners' inherent abilities. The significance of education in Indonesia is evident through the implementation of a mandatory 12-year schooling system (Ramadhani & Wahyuni, 2023). Every subject studied at the school level holds value and has a profound impact on individuals' lives, including Mathematics. Mathematics is incorporated into all levels of formal education due to its pivotal role in nurturing critical thinking and problem-solving skills, which are essential for students' success in various aspects of life. However, there is a consistent underperformance of students in this discipline (Nahdi, 2019).

In Indonesia, the achievement in mathematics is still considered low. According to the PISA 2018 survey results, Indonesia ranked 72nd out of 78 countries in mathematics, with a score of 379 (Schleicher, 2019). Moreover, the TIMSS 1999 study revealed that Indonesian students' average scores in mathematics were significantly lower than the international average, positioning Indonesia at 34th out of 38 countries (Umar et al., 2020). These findings indicate that the level of students' mathematics achievement in Indonesia is unsatisfactory, both nationally and internationally. The low achievement in mathematics can be attributed to the ineffective optimization of mathematics learning, resulting in a weaker grasp of the subject matter. This ineffectiveness stems from the fact that many teachers in Indonesia still employ teaching methods that primarily focus on the teacher, leaving students as passive recipients of knowledge. These teaching methods fail to adequately involve students, hindering their engagement and attentiveness, ultimately impeding the effective delivery of mathematical concepts. Consequently, students continue to struggle with the math problems presented to them (Risma et al., 2019).Based on the analysis conducted by the author during the implementation of PPL 3 activities and interviews with Mrs. Rusni Br Tarigan, S.Pd, the mathematics teacher at Istiqlal Delitua Private Junior High School, it was determined that the students' mathematics learning achievement is still considered low. This is primarily due to the students perceiving mathematics as difficult, which poses challenges in solving math problems. Furthermore, the learning process remains teacher-centered with limited student participation and lacks connection to real-life situations. As a result, the quality of mathematics learning achievement is also low, leading to a lack of mathematical problem-solving abilities among students (Endriani & Rakhmawati, 2019). This can be attributed to the continued use of conventional teaching methods that do not engage students effectively (Siregar, 2021). A study conducted by Jayanti et al. (2020) revealed that students find mathematics difficult, uninteresting, and confusing. Consequently, teachers are required to possess the skills to design more contextual mathematics learning experiences that are closely aligned with human activities.

Linking mathematics learning to real-life situations is an approach aimed at helping students apply the mathematics concepts they have learned in their everyday lives (Lutfiah et al., 2023). By doing so, students are likely to become more interested in exploring mathematics lessons and less likely to forget the material they have learned. Umar et al. (2020) suggest that in order to address global challenges, it is important to utilize innovative learning models. Traditional teaching methods have resulted in passive learners, limiting their ability to engage in creative thinking; hence the significance of educational innovation. Learning approaches should be updated to facilitate the development of 21st-century skills (Nahdi, 2019).

One learning model that effectively connects mathematical concepts with students' personal experiences is the Realistic Mathematics Education (RME) model (Wulansari & Wiryanto, 2023). Originally developed by Dutch scientist Hans Freudenthal, RME is based on the belief that mathematics is a "human activity" (Lubis & Siregar, 2022). The primary objective of this model is to provide students with the opportunity and freedom to independently explore mathematical concepts without relying heavily on direct guidance from the teacher. The realistic mathematics education model is also grounded in students' everyday activities, such as their culture, which is referred to as ethnomathematics in the context of mathematics (Prahmana et al., 2023).The concept of ethnomathematics was first introduced by D'Ambrosio in 1977, originating from Brazil (Sagala & Hasanah, 2023). Ethnomathematics is widely recognized as a teaching method in mathematics education that aims to motivate students by integrating mathematical concepts with relevant cultural elements, such as local customs or cultural practices (Zaenuri et al., 2018). One specific Indonesian cultural practice that can be applied in the Realistic Mathematics Education (RME) framework based on ethnomathematics is the traditional game known as "Engklek" (Irawan, 2018). Engklek is a game in which players hop along a pattern depicted on the ground or floor, and it inherently incorporates mathematical elements (Nuryanti et al., 2021). By utilizing Engklek, students can explore and create various combinations of two-dimensional shapes, including rectangles with triangles, squares with circles, triangles with squares, and so on (Wulansari & Wiryanto, 2023).

Several previous studieshave demonstrated the positive impact of integrating the traditional game Engklek with the RME model on students' learning outcomes in the area of two-dimensional shapes' area (Wulansari & Wiryanto, 2023). Another study focusing on the topic of cube nets suggests that the utilization of traditional games like Engklek can have a beneficial effect on learning achievements in mathematics (Nuryanti et al., 2021). Research conducted by A. Naashir. M. Lubis (2022) indicates that an RME model centered around ethnomathematics positively influences students' ability to prove mathematical principles. Additionally, Mulyasari et al. (2021) found that implementing ethnomathematics with the Engklek game significantly enhances students' understanding of geometric concepts. Moreover, Wijayanti and Trisiana (2018) highlight that the ethnomathematics-based traditional game Engklek can improve students' critical thinking abilities in the context of two-dimensional shapes. Lastly, Fatonah and Naemah (2022) state that the Engklek game can positively influence students' motivation to learn about the perimeter of two-dimensional shapes.Several previous studies have shown that integrating real-life situations into the mathematics learning process has a positive impact. This includes improvements in learning outcomes, the ability to prove mathematical principles, understanding of geometric concepts, and critical thinking abilities. It also influences students' motivation to learn mathematics.

However, none of the previous studies have focused specifically on students' mathematical problem-solving abilities. The use of Realistic Mathematics Education (RME) based on ethnomathematics in the game of Engklek is an innovative approach that has not been extensively researched before. Therefore, the main difference between this study and previous research is the dependent variable, which focuses on students' mathematical problem-solving abilities in the context of the area and perimeter of quadrilaterals and triangles using the RME model based on ethnomathematics and the Engklek game. This study introduces the concept of mathematics instruction rooted in local culture, integrating cultural aspects with mathematics learning to enhance students' mathematical problem-solving abilities.

Based on the above, the aim of this study is to determine the impact of the RME model based on ethnomathematics and the Engklek game on students' mathematical problem-solving abilities, specifically in the context of the area and perimeter of quadrilaterals and triangles. It is hoped that through this research, the application of an ethnomathematics-based RME model using the Engklek game can have a positive influence on students' mathematical problem-solving abilities.

METHOD

This study employed a quantitative research design, specifically an experimental approach. The research utilized a randomized two-group posttest-only control design, in which two classes were randomly selected. One class served as the experimental group, receiving instruction based on the Realistic Mathematics Education (RME) model using the ethnomathematics of the crank game. The other class served as the control group, receiving conventional instruction. Data was collected through a posttest administered to both groups under the same conditions. The average scores of the posttest results for mathematical problem-solving abilities were then compared between the two classes.

The research was conducted at Istiqlal Delitua Private Junior High School, located in Deli Serdang Regency, North Sumatra. The study took place during the second semester of the 2023/2024 academic year, specifically from May 20 to May 25, 2024.

The population of this study consisted of all seventh-grade students at Istiqlal Delitua Private Junior High School for the 2023/2024 academic year, totaling 104 students. The sample was selected using the Cluster Random Sampling method, randomly selecting two classes from the seventh-grade group via lottery. The selected samples were class VII-3, consisting of 21 students, as the control group, and class VII-4, consisting of 21 students, as the experimental group. The control group received conventional instruction using lecture and discussion methods, while the experimental group received instruction using the Realistic Mathematics Education (RME) learning model based on ethnomathematics in the context of the Engklek game, specifically focusing on the topic of area and perimeter of quadrilaterals and triangles.

The instruments used in this study included Lesson Plans (RPP), Worksheets (LKPD), and a posttest comprising essay questions. Prior to use, the validity and reliability of the posttest instrument were assessed to ensure its appropriateness. Content validation was conducted by two validators, namely lecturers from the Uinsu Mathematics Education Department and mathematics teachers from Istiqlal Delitua Private Junior High School. The content validity test aimed to determine if the questions adequately represented the overall indicators of the ability being measured, namely students' mathematical problem-solving abilities, as well as if the questions covered the learning materials provided. Empirical validation was achieved by conducting a posttest trial with Class VIII-1 at SMP Swasta Istiqlal Delitua, which included 22 students. Furthermore, the reliability test utilized Cronbach's Alpha with the SPSS application. The posttest was deemed reliable if the value of r count > r table (0.423). In this research, the calculated r value was 0.546, which exceeded 0.423, indicating that the posttest was reliable. Following the validity and reliability tests, the posttest instrument was deemed valid and reliable.

The indicators used to measure students' mathematical problem-solving abilities were based on Polya's problem-solving indicators, which included: 1) Understanding the problem, 2) Planning problem-solving strategies, 3) Implementing the plan, and 4) Reviewing/checking the solution/making conclusions. The scoring categories used in this study were derived from Risma et al. (2019) and are presented in Table 1.

Table 1. Categories of Mathematical Problem-Solving Ability Score Ranges for Students

No.	Score Interval	Category
1.	$0 \leq$ Score < 45	Very Less
2.	$45 \leq$ Score < 65	Insufficient
3.	$65 \leq$ Score < 75	Sufficient
4.	$75 \leq$ Score < 90	Good
5.	$90 \leq$ Score ≤ 100	Excellent

The data was analyzed using inferential statistical analysis through SPSS 25 software. Normality tests were conducted using the Shapiro-Wilk test, and homogeneity tests were carried out using the Levene Test, both with a significance level set at 5% ($\alpha = 0.05$). If the results of these prerequisite tests indicated that the experimental and control groups were drawn from populations with normal distribution and had homogeneous variances, the hypothesis test utilized the Independent Samples T-test ($\alpha = 0.05$) with the assistance of SPSS 25 software.

RESULTS AND DISCUSSION

Results of Data Analysis

The data analysis revealed that the experimental class achieved a higher mean score (84.76) compared to the control class (60.90), indicating a significant difference in their mathematical problem-solving abilities. Table 2 presents the SPSS output for the experimental class, displaying descriptive statistics such as the average, median, standard deviation, minimum, and maximum values in tabular format.

Table 2. Description of Experimental Class Data

		Statistic
Experimental group Posttest score	Mean	84.76
	Median	85.00
	Variance	50.190
	Std. Deviation	7.085
	Minimum	70
	Maximum	**100**

Table 3 presented the ranges of scores for students' mathematical problem-solving ability in the experimental class. The scores were assessed in the past.

Table 3. Score Ranges for Students in the Experimental Class

No.	Score Interval	Frequency	Persentage (%)	Category
1.	0 ≤ Score < 45	0	0	Very Less
2.	45 ≤ Score < 65	0	0	Insufficient
3.	65 ≤ Score < 75	3	14	Sufficient
4.	75 ≤ Score < 90	11	52	Good
5.	90 ≤ Score ≤ 100	7	34	Excellent
	Total	**21**	**100**	

Table 3 presented a breakdown of the students' mathematical problem-solving abilities in the experimental class. It indicated that there were 7 students with excellent abilities, 11 students with good abilities, and 3 students with sufficient abilities. Additionally, Table 4 provided descriptive statistics of the control class in a tabular format.

Table 4. Description of Control Class Data

		Statistic
Control group Posttest score	Mean	60.90
	Median	62.00
	Variance	58.790
	Std. Deviation	7.667
	Minimum	40
	Maximum	72

Table 5 presented the ranges of mathematical problem-solving ability scores for the students in the control class. The purpose of this table was to provide an overview of the scores achieved by the students in terms of their mathematical problem-solving abilities. By presenting this data, it aimed to offer a clearer understanding of the range of abilities demonstrated by the students in the control class.

Table 5. Score Ranges for Students in the Control Class

No.	Score Interval	Frequency	Persentage (%)	Category
1.	0 ≤ Score < 45	1	5	Very Less
2.	45 ≤ Score < 65	11	52	Insufficient
3.	65 ≤ Score < 75	9	43	Sufficient
4.	75 ≤ Score < 90	0	0	Good
5.	90 ≤ Score ≤ 100	0	0	Excellent
	Total	**21**	**100**	

Table 5 presents the distribution of students' mathematical problem-solving abilities in the control class. It reveals that there is one student with significantly low ability, eleven students with insufficient abilities, and nine students with sufficient abilities.

The normality test conducted on the control class data yielded a significance value of 0.153. Since this value is greater than the predetermined significance level of 0.05, the null hypothesis is accepted. Therefore, it can be concluded that the data in the control class is normally distributed. Similarly, the normality test conducted on the experimental class data resulted in a significance value of 0.342, which is also greater than 0.05. Hence, the null hypothesis is accepted, indicating that the data in the experimental class is normally distributed.

Furthermore, the homogeneity test yielded a significance value of 0.609, which is greater than the significance level. Consequently, the null hypothesis is accepted, indicating that the data from both classes are homogeneous. Additional information on the normality and homogeneity tests can be found in Table 6 and Table 7, respectively.

Table 6. Normality Test Results

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Experimental group Posttest score	.167	21	.128	.932	21	.153
Control group posttest score	.158	21	.185	.950	21	.342

Table 7. Homogeneity Test Results

		Levene Statistic	df1	df2	Sig.
Posttest score	Based on Mean	.265	1	40	.609

Based on the results of the independent samples t-test, the value of Sig. (2 Tailed) was found to be 0.000. This result suggests that Sig. (2 Tailed) < 0.05, leading to the rejection of and acceptance of . Consequently, it can be inferred that the RME model, which is based on the ethnomathematics of the "Engklek" game, exerts a significant influence on the mathematical problem-solving abilities of students. The outcome of the independent samples t-test is presented in Table 8.

Table 8. Hypothesis Test Results

		Posttest score	
		Equal variances assumed	**Equal variances not assumed**
t-test for Equality of Means	t	-10.473	-10.473
	df	40	39.752
	Sig. (2-tailed)	.000	.000

Discussion

The results of this study demonstrate that the mean score of students in the experimental class, who were instructed using the RME model based on the ethnomathematics of the Engklek game, surpasses that of students in the control class, who received instruction through conventional methods. In the experimental class, the mean score is recorded as 84.76, with a minimum score of 70 and a maximum score of 100. The median score is 85, with a variance of 50.19 and a standard deviation of 7.085. Further analysis reveals that 34% of students possess excellent mathematical problem-solving abilities, 52% display good abilities, and 14% exhibit sufficient abilities. On the other hand, the control class yields a mean score of 60.90, ranging from a minimum of 40 to a maximum of 72. The median score is 62, accompanied by a variance of 58.79 and a standard deviation of 7.667. The breakdown of results indicates that 5% of students possess very poor mathematical problem-solving abilities, 52% display poor abilities, and 43% exhibit sufficient abilities.The mathematical problem-solving ability of students in the experimental class was found to be superior to that of students in the control class. This difference can be attributed to the use of a learning model that promotes active participation and connects mathematics to everyday life. Specifically, the learning model incorporates the use of the Engklek game, which enables students to visualize geometric shapes and apply problem-solving strategies in a practical context, specifically in relation to the area and perimeter of quadrilaterals and triangles.

The Engklek game serves as a useful tool for enhancing understanding by allowing students to directly observe how the concepts of area and perimeter are applied in game patterns. Consequently, students not only memorize mathematical formulas, but also gain an understanding of the underlying principles and learn how to apply them in real-life situations. This interactive and contextual learning process fosters enthusiasm and interest among students, subsequently boosting their ability to solve mathematical problems. These findings are consistent with previous research by Apsari et al. (2022), who observed an increase in student engagement through the use of the Engklek game within a Realistic Mathematics Education (RME) framework.

The positive impact of the Engklek game on learning activities is further supported by the study conducted by Nuryanti et al. (2021). Their research suggests that the game promotes active learning and stimulates a comprehensive understanding of mathematical concepts. This aligns with the theories of Jerome Bruner and David Ausubel. Bruner's theory of discovery learning emphasizes hands-on activities, such as the Engklek game, as means to facilitate active learning and deeper comprehension. Similarly, Ausubel's theory of meaningful learning highlights the importance of connecting new knowledge to students' existing knowledge. Therefore, the use of the Engklek game in learning enhances problem-solving skills and encourages more profound and significant learning experiences.The implementation of the ethnomathematics element of the engklek game served as a means to enhance students' motivation to actively engage in learning and gain a better understanding of mathematical problem-solving. The learning process in the experimental class was aligned with the ethnomathematics elements of the engklek game, and it adhered to the steps outlined in the Realistic Mathematics Education (RME) learning model. According to Shoimin (2018), these steps involve: 1) Understanding contextual problems, 2) Solving contextual problems, 3) Discussing and comparing answers, and 4) Drawing conclusions. In this research, the learning activities were organized by dividing students into groups of four to five participants. Through this method, students were encouraged to actively participate in learning by creating patterns using rectangular and triangular shapes in the engklek game, showcasing their creativity and comprehension. Following the game, students were then tasked with completing worksheets that entailed problems related to the engklek game, specifically focusing on the area and perimeter of quadrilaterals and triangles present in the game's patterns. By incorporating these activities, students' diligence and engagement in the learning process were further enhanced. The following section documents students' involvement in playing the engklek game and their work on the associated worksheets (LKPD).

Figure 1. Students Play Engklek Games and Work on LKPD

Figure 1 displays students actively participating in the Engklek game and working on LKPD under the guidance of the teacher. This visual representation exemplifies the dynamic learning environment within the experimental class. The students exhibited a high level of enthusiasm and engaged in collaborative discussions as they tackled the assigned problems. Furthermore, the utilization of Worksheets (LKPD) as a learning tool enabled the students to document, observe, and reflect upon their learning process. Consequently, this enhanced their comprehension and problem-solving abilities acquired through the Engklek game.

Subsequently, the posttest results of the students in the experimental class are attached below, wherein one student achieved the maximum score and was categorized as excellent.

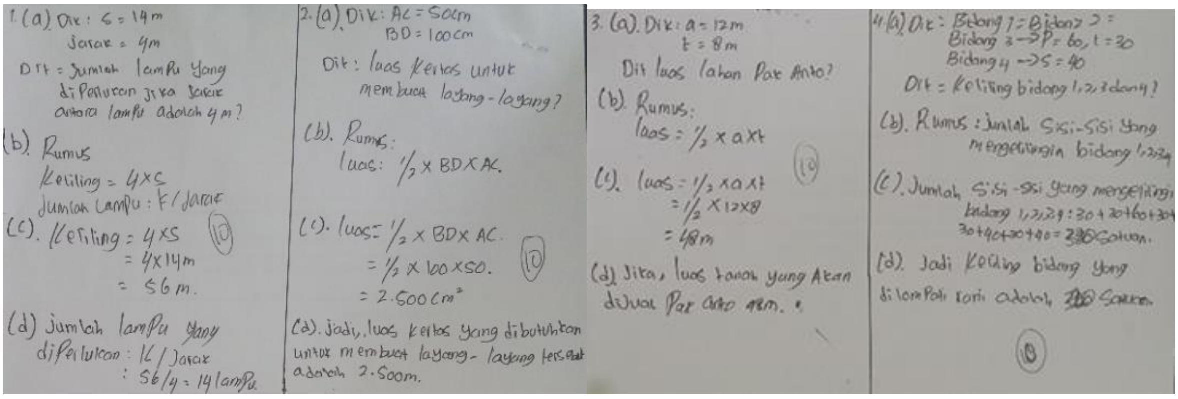

Figure 2. Examples of Maximum Score Posttest Answers From the Experimental Class, Demonstrating Students' Problem-Solving Abilities in Line with Polya's Indicators.

Figure 2 illustrates the student's ability to solve mathematical problems based on Polya's four problem-solving indicators (Risma et al., 2019). These indicators include: 1) Understanding the problem, where the student records the known information and the question presented in the problem, 2) Planning a problem-solving strategy, where the student identifies the relevant formula to be utilized, 3) Executing the plan, where the student solves the problem using the determined formula, and 4) Reflecting on the solution, where the student formulates a conclusion.

Furthermore, the subsequent section presents the posttest results of the control group students who achieved the lowest scores falling within the "very low" category.

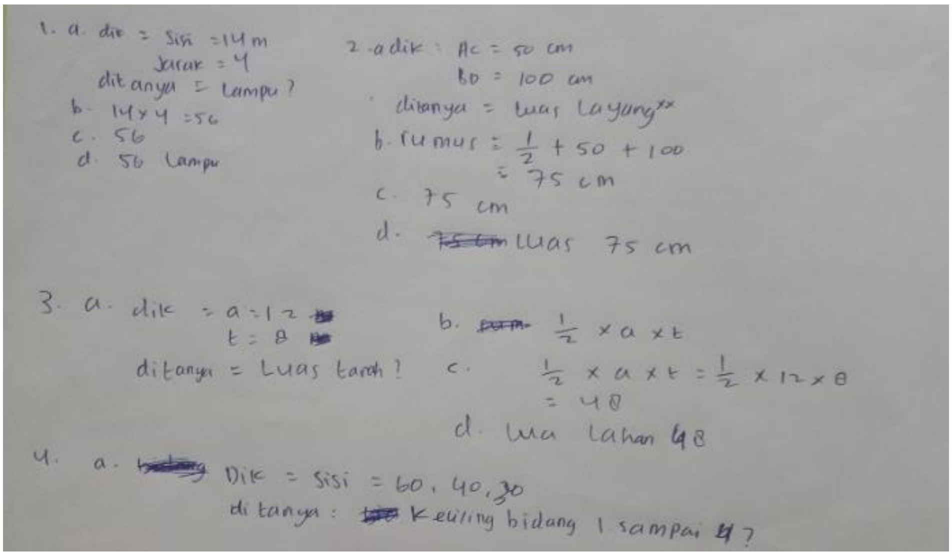

Figure 3. Examples of Minimum Score Posttest Answers From the Control Class

Figure 3 illustrates the posttest responses of students in the control class who obtained the lowest score. It is evident that the student was proficient in addressing indicator 1, which involves stating the given information and the problem task. However, the student struggled with indicator 2, as they recorded an incorrect formula. Additionally, difficulties were encountered with indicator 3, as there were calculation errors leading to incorrect answers. In relation to indicator 4, the student encountered challenges in drawing conclusions, as the responses to questions 1 and 2 were incorrect, and no conclusion was provided for question 4.

The average score of the control class students was lower compared to that of the experimental class students. This discrepancy can be attributed to the teaching model employed in the control class, which primarily relied on teacher-centered instruction and lacked active student engagement. Consequently, students encountered difficulties in solving the given mathematical problems. This finding aligns with the research conducted by Jayanti et al. (2020)

on the factors influencing mathematics learning difficulties, which identified teaching methodology as a contributing factor. Despite the teacher's proficient delivery and clarity of the instructional content, the absence of interactive teaching methods hindered student interest and participation during learning activities. In the control class, the instructional approach involved the teacher presenting the concepts of area and perimeter of quadrilaterals and triangles by writing on the blackboard, followed by opportunities for students to ask questions regarding any unclear concepts.

However, most students exhibited limited engagement and attentiveness during these sessions, resulting in less effective content delivery and subsequently impacting students' mathematical problem-solving abilities. It can therefore be concluded that the teaching method employed in the control class was inadequate. This finding is corroborated by the study conducted by Sriwahyuni and Maryati (2022), which emphasizes the role of inappropriate teaching methods in hindering students' mathematical problem-solving capabilities.The results of the hypothesis test indicate that the RME model, incorporating the ethnomathematics of the "engklek" game, has a positive impact on the mathematical problem-solving abilities of students in the experimental class. The RME model, based on the ethnomathematics of the engklek game, fosters active student participation during the learning process, thereby influencing their mathematical problem-solving abilities. This finding is in line with a study conducted by Wulansari and Wiryanto (2023), which suggests that the integration of the traditional Engklek game with the RME model positively influences the learning of mathematics. This approach connects the learning material with real-life activities of the students, reflecting Hans Freudenthal's perspective on RME as a "human activity".

Additionally, Ma'wa et al. (2022) assert that the implementation of RME, incorporating ethnomathematics, enhances students' perception and knowledge formation, making the learning experience more captivating and meaningful. Moreover, the incorporation of the Engklek game into mathematics learning activities sparks students' interest in learning the subject matter, leading to better absorption of lessons. Fatonah and Naemah (2022) support this statement by emphasizing that the use of the Engklek game as a motivating tool in learning stimulates students, resulting in more effective learning outcomes.

Based on the aforementioned explanations, it can be deduced that the choice of a learning model is a significant factor that can influence the success of the learning process. The use of the RME model, integrating the ethnomathematics of the engklek game, is appropriate and aligns with the indicators of students' mathematical problem-solving abilities, ultimately leading to enhanced performance compared to students instructed using a conventional, teacher-centered learning model.

CONCLUSION

Based on the research findings, it is evident that the implementation of the Realistic Mathematics Education (RME) model, specifically using the ethnomathematics game of engklek, significantly impacts students' mathematical problem-solving abilities. The average score for the experimental group students' mathematical problem-solving ability (84.76) surpasses that of the control group students (60.90).

Utilizing the engklek game in mathematics instruction not only enhances students' problem-solving skills but also cultivates a positive attitude towards mathematics. Students become more enthusiastic and motivated to learn, leading to improved academic performance. Engklek serves as an educational tool that provides a real-world context, enabling students to establish connections between mathematical concepts and daily activities. Consequently, this facilitates more meaningful and effective learning experiences. Therefore, the Realistic Mathematics Education (RME) model, incorporating the ethnomathematics of the engklek game, can be recognized as an innovative and effective approach in mathematics education. By integrating cultural and contextual elements, this model promotes deeper comprehension and enhances students' problem-solving abilities. The empirical evidence from this study supports the widespread application of this method to enhance the quality of mathematics education across different educational levels.

RECOMMENDATION

Upon reviewing the findings of this study, which focused solely on examining the impact of the RME model based on the ethnomathematics of the engklek game on students' mathematical problem-solving skills, it is anticipated that future researchers will delve more deeply into the influence of the RME model in order to encourage further discussion and investigation in this area. Furthermore, it is recommended that future researchers conduct additional studies employing alternative learning models that are tailored to the subject matter, with the aim of identifying variations in mathematical problem-solving abilities. These findings can then serve as a guide for educators in selecting an effective instructional approach.

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