



The Effectiveness of Problem-Based Learning (PBL) Model Assisted by Treasure Hunt Game on Students' Conceptual Understanding and Learning Interest in Grade II

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Abstract: This study aims to determine the effectiveness of the Problem-Based Learning (PBL) model assisted by a treasure hunt game on conceptual understanding and interest in learning mathematics in Grade II elementary school students. This study used a quasi-experimental method with a non-equivalent control group design involving 21 students in the experimental class and 19 students in the control class. Data were collected using a pretest-posttest instrument for conceptual understanding and a questionnaire for learning interest. Data analysis included normality and homogeneity tests, followed by dependent and independent sample t-tests, and N-gain score tests using SPSS version 16.00. The results showed that the implementation of PBL assisted by a treasure hunt game had a positive and significant effect on conceptual understanding and interest in learning mathematics in Grade II elementary school students. Students in the experimental class obtained higher posttest scores and N-gain scores compared to students in the control class who received conventional learning. Thus, PBL integrated with treasure hunt game activities can be considered an effective learning approach to improve conceptual understanding and interest in learning mathematics in early-grade elementary students.

Keywords: Interest in Learning Mathematics; Mathematics Concepts; Problem Based Learning (PBL)

Introduction

Mathematics is a fundamental discipline essential for developing students' problem-solving, analytical, and reasoning skills. A strong conceptual understanding of mathematics plays a crucial role in supporting students' academic progress and future competencies in STEM fields (Panjaitan et al., 2023). However, international and national assessment results consistently show low student achievement in mathematics. PISA data show that Indonesian students struggle to apply mathematical concepts in real-world contexts, reflecting difficulties with higher order

thinking and conceptual understanding. Similar findings emerge in national assessments, where many students score below the proficiency standard.

These learning challenges are generally associated with conventional learning approaches that emphasize lectures, rote procedures, and formula memorization without building in-depth understanding (Jafar, 2021; Marsigit, 2016). As a result, students become passive, less engaged, and less interested in learning mathematics, especially in the early grades where enjoyment and motivation are crucial for developing positive mathematics attitudes (Sari, 2019).

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To address this issue, innovative approaches that encourage active engagement and contextual learning are needed. Problem-Based Learning (PBL) is recognized as an effective learning model for enhancing students' conceptual understanding through the exploration of real-life problems (Musa et al., 2023; Rahmadani et al., 2023). However, the implementation of PBL in lower grades still faces limitations because early childhood students tend to require concrete, enjoyable, and engaging learning experiences (Sumardjan, 2017). Therefore, integrating game-based activities into a PBL framework is considered a potential strategy to maximize its impact.

One promising alternative is the treasure hunt game, which combines group collaboration, movement, and problem-solving in authentic learning situations (Suryanti et al., 2022; Puspita et al., 2023). This game encourages students to actively search for mathematical clues and apply concepts to solve learning tasks. Despite growing recognition, empirical studies focusing on the integration of treasure hunt games into PBL, particularly in early-grade mathematics, remain very limited, highlighting a clear research gap.

The novelty of this research lies in the combination of the PBL model with a treasure hunt game activity specifically designed to strengthen conceptual understanding and increase the learning interest of second grade elementary school students. This combination is expected to create a meaningful learning experience, which not only increases understanding but also fosters motivation and a sense of enjoyment in learning mathematics.

Therefore, this research is important to conduct because it provides an evidence-based alternative solution to improve the quality of early grade mathematics learning, which is crucial for building students' basic competencies and long-term success in mathematics.

Method

This study used a quantitative approach with a quasi-experimental design with a pre-test-post-test non-equivalent control group design. The quasi-experimental design was chosen because it allows researchers to test causal relationships in a natural classroom setting where random assignment is not entirely feasible (Creswell & Creswell, 2021; Sugiyono, 2020).

This research was conducted in the second grade of SDN 02, Ampek Nagari District, Agam Regency. The sample was determined using a cluster random sampling technique, resulting in Class A (21 students) as the experimental group and Class B (19 students) as the

control group. The experimental group received the Problem-Based Learning (PBL) learning model assisted by a treasure hunt game, while the control group received conventional learning.

To provide a clearer visualization of the implementation procedure, the detailed flow of this research process is illustrated in Figure 1.

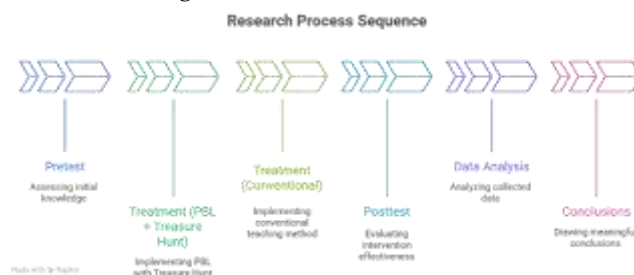


Figure 1. Research Procedure Flowchart

The data collection instruments consisted of (1) a conceptual understanding test administered before and after treatment and (2) a learning interest questionnaire. The validity and reliability of the instruments were tested before data use. Data analysis included normality and homogeneity tests, followed by independent and paired sample t-tests, and N-Gain analysis to determine the effectiveness of the intervention (Pallant, 2020).

Results and Discussion

Based on the research that has been done, the pretest results of students' conceptual understanding in the experimental and control classes were below average. The average pretest result for the experimental class was 45.71, categorized as lacking, while the average pretest for the control class was 40.00, categorized as lacking. The same thing also happened to the average learning interest of the experimental and control classes, where the average interest in learning mathematics in the experimental class was 52.52, categorized as sufficient. The following step involved a different treatment. The experimental class was given a learning treatment using the Problem-Based Learning (PBL) model assisted by a treasure hunt game, and the control group was given a conventional learning model without special treatment. After the treatment, a posttest was carried out, which yielded the following results: the average understanding of mathematical concepts in the experimental class increased to 88.49, categorized as very good, while the average conceptual understanding in the control class also increased but not as much as that of the experimental class, reaching 61.67, categorized as sufficient. Similarly, regarding students' learning interest, in the experimental class, the average interest was 91.28, categorized as very high. In contrast, the average interest in learning of students in the control

group increased slightly, namely 53.74, categorized as sufficient. Based on the explanation above, there was an increase in conceptual understanding and interest in learning mathematics in the experimental group after being given the Problem-Based Learning (PBL) model assisted by a treasure hunt game. Thus, implementing

the Problem-Based Learning (PBL) model assisted by a treasure hunt game was more effective than the conventional learning model or learning without special treatment. To see whether there is a significant difference, a t-test was carried out to test the hypothesis as follows:

Hypothesis 1

Table 1. T-test of Understanding of Mathematical Concepts

		Leven's Test for Equallity of Variance		t-test for Equallity							
		F	Sif	t	df	Sig. (2- tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
										Lower	Upper
Student Learning Outcomes	Equal variances assumed	.997	.324	9.599	38	.000	26.779	2.790	21.132	32.427	
	Equal variances not assumed			9.485	34.186	.000	26.779	2.823	2.043	32.516	

Based on Table 1, which presents the t-test results on students' understanding of mathematical concepts, the probability value of Asymp can be seen. Sig. (2-tailed) between the experimental group and the control group was recorded at 0.000. This value indicates that the probability is below the set threshold of 0.05 (in this case, 0.000 <0.050). The results of this analysis indicate a significant difference between the two groups tested. Thus, the decision to reject the null hypothesis (Ho) and accept the alternative hypothesis (HI) becomes apparent.

Therefore, the third hypothesis tested in this study can be accepted: "There is a difference in students' understanding of mathematical concepts between the

experimental group and the control group." The experimental group consisted of students who took part in learning using the Problem-Based Learning (PBL) learning model assisted by a treasure hunt game, while the control group consisted of students who did not use the model. These findings indicate that applying a problem-based learning model with an interactive and fun approach contributes positively to improving students' understanding of mathematical concepts, thus providing evidence that innovative teaching methods can significantly impact the learning process in the classroom.

Hypothesis 2

Table 2. t-test of interest in learning mathematics

		Leven's Test for Equallity of Variance			t-test for Equallity						
		F	Sif	t	df	Sig. (2- tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
										Lower	Upper
Result of Posttest	Equal variances assumed	3.867	.057	42.931	38	.000	37.549	.875	35.778	39.319	
	Equal variances not assumed			43.612	36.416	.000	37.549	.861	35.861	39.294	

Based on Table 2, which shows the t-test results on interest in learning mathematics, the probability value of Asymp. Sig. (2-tailed) For the comparison between the experimental group and the control group was 0.000. This figure shows that the probability is below the set significance threshold of 0.05 (0.000 <0.050). The results of this analysis provide a strong indication of a

significant difference in interest in learning mathematics between the two groups of students involved in the study. Thus, the decision to reject the null hypothesis (Ho) and accept the alternative hypothesis (HI) becomes apparent and verified.

Therefore, the third hypothesis tested in this study can be accepted as valid: "There is a difference in

students' interest in learning mathematics between the experimental and control classes." The experimental group consisted of students involved in the learning process that applied the Problem-Based Learning (PBL) learning model assisted by a treasure hunt game. In contrast, the control group was students who took part in learning without applying the model. These findings indicate that innovative and engaging learning approaches can significantly increase students' interest in mathematics. Thus, the results of this study have important implications for the development of more effective and engaging teaching strategies, as well as encouraging students to be more involved in mathematics learning.

The hypothesis test results showed a significant difference in students' understanding of mathematical concepts between the experimental group and the control group. With a probability value of Sig. (2-tailed) of 0.000, which is below the threshold of 0.05, the hypothesis stating "There is a difference in students' understanding of mathematical concepts between the experimental group and the control group" can be accepted. This shows that applying the Problem-Based Learning (PBL) learning model assisted by a treasure hunt game significantly improves students' understanding of mathematical concepts, compared to the conventional learning method applied to the control group.

In this study, both groups were given the same learning materials, but the difference lay in the method used. The experimental group implemented PBL with the assistance of a treasure hunt game designed to increase student engagement and motivation. This learning model encourages students to learn more interactively and to develop their problem-solving skills. This approach enables students to think critically and creatively, thereby improving their understanding of the mathematical concepts taught.

The effectiveness of the PBL learning model assisted by the treasure hunt game is also seen from the posttest results, which show an increased understanding of mathematical concepts in the experimental group compared to the control group. The average difference in posttest scores of 26.778, which was measured from the variance analysis, shows that this innovative learning approach can produce better achievements. This study emphasizes the importance of a relevant and engaging learning approach to foster interest and improve students' academic achievement in mathematics. This is in line with the primary goal of education, namely, to create students who not only understand concepts theoretically but are also able to apply the concepts that have been learned in real situations.

Conclusion

Based on the research findings, it can be concluded that the implementation of the Problem-Based Learning (PBL) model assisted by a treasure hunt game is effective in improving students' understanding of mathematical concepts and learning interest. Students in the experimental group showed significantly higher posttest scores compared to the control group, indicating a stronger mastery of mathematical concepts after receiving the PBL-based intervention. Students' learning interest also increased significantly, supported by the active, interactive, and collaborative learning atmosphere created through group problem-solving activities and games.

These results indicate that integrating real-life problem-solving and game elements into mathematics learning not only improves cognitive skills but also motivates students to be more enthusiastic in the learning process. Thus, this learning model can be generalized as an alternative learning approach suitable for elementary mathematics education, especially to address low student participation and conceptual misconceptions.

Practically, the implementation of the PBL model supported by a treasure hunt game can be recommended to teachers as an innovative strategy for creating meaningful and enjoyable mathematics learning experiences. Further implementation of this approach can contribute to the development of students who are more confident, collaborative, and motivated to learn mathematics.

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Author Contributions

Conceptualization, Dina Aryanti, Firman, Syafri Ahmad, Melva Zainil; Data curation, Dina Aryanti; Formal analysis, Dina Aryanti; Investigation, Dina Aryanti; Writing original draft, Dina Aryanti; Writing review and editing, Dina Aryanti, Firman, Syafri Ahmad, Melva Zainil. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest in this research

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