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The Effectiveness of Monopoly Mathematics Games in Improving Fifth-Grade Students' Learning Outcomes: A Quasi-Experimental Study

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ABSTRACT

Purpose of the study: This study aimed to investigate the effectiveness of Monopoly Mathematics Games in improving fifth-grade students' mathematics learning outcomes. It also sought to determine whether students taught using the game achieved better performance than those receiving conventional instruction.

Methodology: This study employed a quasi-experimental design involving experimental and control groups at SD Islam Darul Mu'minin. The sample consisted of 50 fifth-grade students selected through simple random sampling. Data were collected using essay tests, while instrument validity and reliability were examined. Statistical analyses, including normality, homogeneity, and independent samples t-tests, were conducted using IBM SPSS Statistics version 22.0.

Main Findings: The findings indicated that students taught through Monopoly Mathematics Games achieved higher mathematics learning outcomes than those receiving conventional instruction. The experimental group obtained a mean score of 75.64, whereas the control group achieved 67.00. Statistical testing revealed a significant difference between the two groups with a significance value of 0.008. Cognitive achievement in the experimental group was also higher across Bloom's taxonomy levels.

Novelty/Originality of this study: The originality of this study lies in the development of a modified Monopoly Mathematics Game designed specifically for elementary mathematics learning. The game integrates knowledge cards, opportunity cards, help cards, and mathematical problem-solving activities. Additionally, this study evaluates students' cognitive achievement based on Bloom's taxonomy, thereby providing broader evidence regarding the effectiveness of game-based learning in mathematics education.

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1. INTRODUCTION

Mathematics learning in elementary schools plays a strategic role in developing students' logical, analytical, and problem-solving abilities. Effective mathematics instruction is expected to facilitate students in understanding concepts and applying them in daily life [1], [2]. Therefore, the selection of appropriate learning strategies and media becomes an essential factor in achieving learning objectives. In recent years, student-centered

learning approaches have increasingly received attention because they encourage active participation during the learning process [3], [4]. Consequently, innovative learning media are needed to create meaningful and enjoyable learning experiences for elementary school students.

Despite its importance, mathematics is still often perceived as a difficult and less interesting subject by many elementary school students. Conventional learning practices that rely heavily on teacher explanations tend to make students passive and reduce their motivation to learn [5]. Limited use of interactive learning media also contributes to students' difficulties in understanding mathematical concepts. As a result, students' learning outcomes frequently remain below the expected standards [6], [7]. These conditions indicate the need for more engaging instructional approaches that can increase students' participation and achievement in mathematics learning.

Several previous studies have reported that game-based learning has a positive contribution to improving students' motivation and academic achievement. Educational games are considered capable of creating enjoyable learning environments and encouraging active interaction among students [8]. Previous studies have also shown that monopoly-based learning media can enhance students' interest and participation during classroom activities. However, most studies have focused on students at different educational levels or have emphasized motivation and learning interest rather than learning outcomes [9]. In addition, empirical evidence regarding the effectiveness of Monopoly Mathematics Games among fifth-grade elementary students remains relatively limited.

Although previous research has demonstrated the potential benefits of educational games, there are still inconsistencies regarding their implementation in mathematics learning. Many studies have employed descriptive or classroom action research designs, which provide limited evidence concerning causal relationships [10], [11]. Furthermore, only a few studies have used a quasi-experimental approach to compare the effectiveness of Monopoly Mathematics Games with conventional teaching methods. The limited number of studies conducted in Islamic elementary schools also leaves an important contextual gap [12], [13]. Therefore, further investigation is required to provide stronger empirical evidence regarding the effectiveness of game-based mathematics learning.

Examining the effectiveness of Monopoly Mathematics Games is important because elementary school students generally prefer learning activities that involve play and interaction. Integrating game elements into mathematics instruction can help reduce students' anxiety and negative perceptions toward the subject. Interactive learning experiences are also expected to increase students' engagement and facilitate conceptual understanding [14], [15]. Moreover, improving mathematics learning outcomes at the elementary level is essential because these competencies serve as the foundation for higher-level mathematical learning [16]. Hence, exploring innovative instructional media is highly relevant to current educational demands and students' developmental characteristics.

The novelty of this study lies in the application of Monopoly Mathematics Games as a gamification-based learning medium to improve fifth-grade students' learning outcomes through a quasi-experimental design. Unlike previous studies that primarily emphasized motivation or learning interest, this study focuses specifically on measuring students' mathematics achievement [17]. In addition, this study compares the effectiveness of Monopoly Mathematics Games with conventional instruction to provide more robust evidence. The research is conducted within the context of an Islamic elementary school, which has received limited attention in previous studies. Therefore, this study is expected to contribute to the development of innovative mathematics learning practices and enrich the literature on game-based learning in elementary education.

2. RESEARCH METHOD

2.1 Research Design

This study employed a quantitative approach using a quasi-experimental design to examine the effectiveness of Monopoly Mathematics Games in improving students' mathematics learning outcomes. The study involved two groups consisting of an experimental class and a control class [18], [19]. The experimental group received mathematics instruction through Monopoly Mathematics Games, whereas the control group was taught using conventional learning methods. A posttest-only control group design was applied to compare the learning outcomes of both groups after the treatment. This design was selected because it allowed the researcher to investigate the effect of the treatment under natural classroom conditions without full control over all variables.

Table 1. Research Design

Group	Treatment	Posttest
Experimental Group	X1	Y
Control Group	X2	Y

Note:

X1 = Mathematics learning using Monopoly Mathematics Games

X2 = Conventional learning
Y = Posttest

2.2 Participants and Research Setting

This research was conducted at SD Islam Darul Mu'minin, Indonesia. The population of the study consisted of fifth-grade students enrolled in the school. The samples were selected using a simple random sampling technique, resulting in two classes being assigned as the experimental and control groups. Class V-Ba served as the experimental class, while Class V-Ja served as the control class. The selection of these classes aimed to ensure that both groups represented similar characteristics and learning conditions.

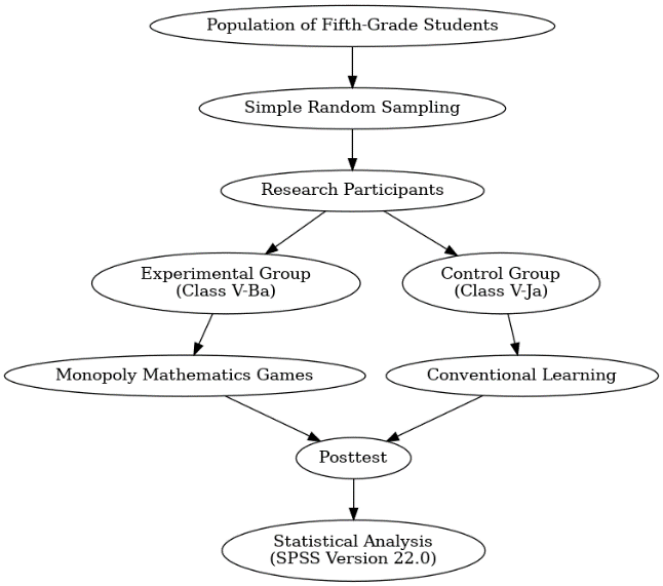

Figure 1. Research Procedure

2.3 Research Instrument and Data Collection

Data were collected using an essay test designed to measure students' mathematics learning outcomes. Initially, fourteen test items were developed based on indicators of arithmetic operations and number estimation. The instrument was subjected to validity and reliability testing before being administered to the participants. The results of the item analysis indicated that eleven items met the validity criteria and were therefore used in the final test. The validated instrument was subsequently administered to both groups after the implementation of the learning treatments.

Table 2. Distribution of Mathematics Learning Outcome Indicators

Indicators	Cognitive Domain	Number of Items
Identifying the commutative property	C1	2
Identifying the associative property	C2	1
Applying the distributive property	C3	2
Solving mixed arithmetic operations	C3	2
Rounding numbers to the nearest place value	C2	2
Estimating arithmetic operation results	C3	1
Total		10

2.4 Data Analysis

The collected data were analyzed using Statistical Package for the Social Sciences (SPSS) version 22.0. Prior to hypothesis testing, normality analysis was conducted to determine whether the data were normally distributed. If the data fulfilled the assumption of normality, an independent samples t-test was employed to examine differences between the experimental and control groups. However, non-parametric analysis would be used when the data violated the normality assumption. The level of significance adopted in this study was 0.05, with a p-value below 0.05 indicating a statistically significant effect of Monopoly Mathematics Games on students' mathematics learning outcomes.

3. RESULTS AND DISCUSSION

3.1 Development of Monopoly Mathematics Games

The Monopoly Mathematics Games employed in this study were developed by modifying the traditional monopoly game into an interactive mathematics learning medium. The game incorporated mathematical concepts related to integer operations and arithmetic properties for fifth-grade students. Several components, including knowledge cards, opportunity cards, help cards, and property cards, were designed to facilitate students' understanding of mathematical concepts. Students were required to answer mathematical questions to obtain ownership of spaces on the game board. Therefore, the developed game was intended to create meaningful and enjoyable learning experiences during mathematics instruction.

Figure 2. Monopoly Mathematics Games Used in the Experimental Group

3.2 Students' Learning Outcomes and Hypothesis Testing

The descriptive analysis indicated differences in mathematics learning outcomes between the experimental and control groups. The experimental group obtained a higher mean score (75.64) than the control group (67.00), suggesting that students who learned through Monopoly Mathematics Games achieved better performance. The results of the normality test revealed significance values of 0.177 and 0.060 for the experimental and control groups, respectively, indicating that both datasets were normally distributed. Furthermore, the homogeneity test showed a significance value of 0.148, demonstrating that the variances of the two groups were homogeneous. The independent samples t-test yielded a significance value of 0.008, which was lower than 0.05, indicating that Monopoly Mathematics Games significantly affected students' mathematics learning outcomes.

Table 3. Descriptive Statistics of Posttest Scores

Statistics	Experimental Group	Control Group
Sample Size	25	25
Minimum Score	45	38
Maximum Score	90	85
Mean	75.64	67.00
Standard Deviation	9.394	12.533

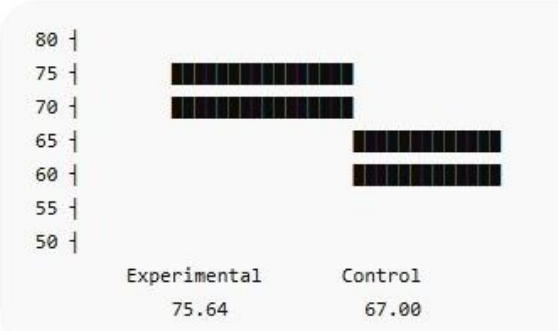

Figure 3. Comparison of Mean Posttest Scores Between Experimental and Control Groups

Table 4. Results of Assumption and Hypothesis Testing

Test	Statistical Value	Sig.	Decision
Normality Test (Experimental)	0.146	0.177	Normal
Normality Test (Control)	0.170	0.060	Normal
Homogeneity Test	2.163	0.148	Homogeneous
Independent Samples t-Test	2.305	0.008	Significant

3.3 Students' Cognitive Achievement Across Bloom's Taxonomy Levels

The analysis of students' cognitive achievement revealed that the experimental group outperformed the control group across all cognitive domains. In the remembering domain (C1), the experimental group achieved 80.00%, whereas the control group obtained 68.00%. Similarly, the experimental group demonstrated higher percentages in the understanding (C2) and applying (C3) domains, with scores of 76.50% and 73.67%, respectively. In contrast, the control group attained 71.00% in C2 and 64.80% in C3. These findings indicate that Monopoly Mathematics Games contributed positively to students' cognitive development at different levels of Bloom's taxonomy

Table 5. Percentage of Cognitive Achievement Based on Bloom's Taxonomy

Cognitive Domain	Experimental Group	Control Group
C1 (Remembering)	80.00%	68.00%
C2 (Understanding)	76.50%	71.00%
C3 (Applying)	73.67%	64.80%

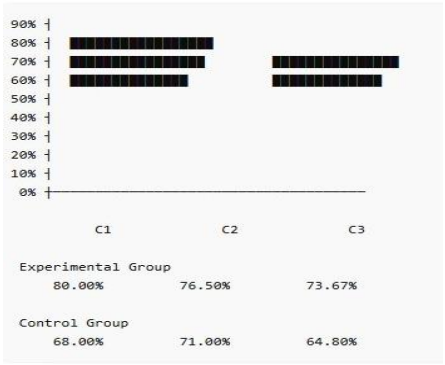

Figure 4. Comparison of Students' Cognitive Achievement Across Bloom's Taxonomy Levels

The findings of this study demonstrated that the use of Monopoly Mathematics Games positively influenced fifth-grade students' mathematics learning outcomes. Students in the experimental group achieved a higher mean posttest score than those in the control group, indicating better academic performance after receiving the treatment. The statistical analysis also confirmed a significant difference between the two groups, as evidenced by the significance value obtained from the independent samples t-test. In addition, both groups fulfilled the assumptions of normality and homogeneity, ensuring the appropriateness of the statistical procedures employed. These findings suggest that integrating game-based learning into mathematics instruction can improve students' understanding of mathematical concepts and enhance their overall learning outcomes.

Furthermore, the results revealed that students who learned through Monopoly Mathematics Games demonstrated better cognitive achievement across Bloom's taxonomy levels. The experimental group outperformed the control group in the remembering (C1), understanding (C2), and applying (C3) domains. Such findings indicate that the learning activities embedded in the game not only supported memorization but also facilitated conceptual understanding and problem-solving abilities. The collaborative nature of the game encouraged students to actively participate and construct their own knowledge through interaction with peers. Consequently, the learning process became more meaningful and student-centered compared with conventional instruction.

The results of this study are consistent with previous studies reporting that game-based learning contributes positively to students' mathematical achievement and learning motivation. Previous research has shown that educational games provide engaging learning experiences that encourage active participation and reduce students' anxiety toward mathematics [20], [21]. Similarly, the present study found that students exposed to Monopoly Mathematics Games achieved higher learning outcomes than those taught through conventional methods. These findings strengthen the growing body of evidence supporting the effectiveness of game-based approaches in elementary mathematics education [22], [23]. Therefore, this study provides additional empirical support for the integration of instructional games into classroom practices.

The novelty of this study lies in the development and implementation of a modified Monopoly Mathematics Game specifically designed to accommodate integer operations and arithmetic properties for fifth-grade students. Unlike conventional monopoly games, the developed media required students to answer mathematical questions in order to obtain ownership of spaces and advance in the game [24], [25]. The game was also supported by several components, including knowledge cards, opportunity cards, help cards, and property cards, which enriched the learning process. In addition, this study examined students' cognitive achievement across different levels of Bloom's taxonomy, providing a more comprehensive evaluation of learning outcomes [26]. Hence, the study contributes to the advancement of innovative and interactive mathematics learning media in elementary education.

The findings of this study have several practical implications for mathematics instruction. Teachers may utilize Monopoly Mathematics Games as an alternative learning medium to create more engaging and enjoyable classroom environments. The use of game-based learning can promote students' active participation, collaboration, and confidence in solving mathematical problems [27]. Moreover, educational institutions are encouraged to support the development and implementation of innovative learning media that align with students' characteristics and learning needs [28], [29]. Therefore, the integration of interactive games into mathematics classrooms may contribute to improving the quality of teaching and learning processes in elementary schools.

Despite its contributions, this study has several limitations that should be considered. First, the study was conducted only among fifth-grade students in one elementary school, limiting the generalizability of the findings to broader contexts [30], [31]. Second, the research focused solely on integer operations and arithmetic properties, which may not represent other mathematical topics. Third, the duration of the intervention was relatively limited, restricting the observation of long-term effects of the learning media. Furthermore, some students required additional time to adapt to collaborative learning and game procedures during the initial meetings. Therefore, future studies are recommended to involve larger samples, different mathematical topics, and longer intervention periods to provide more comprehensive evidence regarding the effectiveness of Monopoly Mathematics Games.

4. CONCLUSION

This study demonstrated that the use of Monopoly Mathematics Games was effective in improving fifth-grade students' mathematics learning outcomes, thereby achieving the research objective formulated in the introduction. The findings revealed that students who participated in game-based learning obtained better learning outcomes and higher cognitive achievement across Bloom’s taxonomy levels than those who experienced conventional instruction. These results indicate that integrating interactive and enjoyable learning media into mathematics instruction can foster active participation and facilitate students’ understanding of mathematical concepts. In addition, the development of Monopoly Mathematics Games contributes to the enrichment of innovative instructional media that support student-centered learning in elementary education. The practical implications of this study suggest that teachers and educational institutions may adopt similar game-based approaches to create more engaging and meaningful mathematics learning experiences. Furthermore, future studies are recommended to involve larger samples, diverse mathematical topics, and longer intervention periods to provide broader evidence regarding the effectiveness and applicability of Monopoly Mathematics Games in different educational contexts.

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