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THE EFFECT OF USING PIZZA-SHAPED GAME MEDIA IN LEARNING FRACTIONS ON THE MATHEMATICS LEARNING OUTCOMES OF FIFTH-GRADE STUDENTS AT SDN SUSUKAN 09 PAGI, EAST JAKARTA

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ABSTRACT
Mathematics learning outcomes on fraction topics are still relatively low because students experience difficulties in understanding abstract concepts and the instructional media used is less engaging. This study aimed to determine the effect of using pizza-shaped game media on the mathematics learning outcomes of fifth-grade students at SDN Susukan 09 Pagi, East Jakarta. This research employed a quantitative approach using a quasi-experimental method with a Nonequivalent Control Group Design. A saturated sampling technique was used, involving all 50 fifth-grade students from classes VA and VB, divided into an experimental class and a control class, each comprising 25 students. Data were collected using a mathematics achievement test. Initially, the instrument consisted of 25 multiple-choice items. After validity testing using Pearson Product-Moment correlation, 19 items were declared valid, while six items were excluded from the study. The reliability test yielded a Cronbach's Alpha coefficient of 0.868, indicating high internal consistency. Data were analyzed using descriptive statistics, normality and homogeneity tests, followed by an independent-samples t-test with the assistance of SPSS version 29. The results showed a significant difference in learning outcomes, where the post-test average score of the experimental group (84.56) was higher than that of the control group (73.04). The independent-samples t-test score showed a significance value of less than 0.001, meaning that H_O was rejected and H_a was accepted. In conclusion, the use of pizza-shaped game media has a significant and positive effect on students' mathematics learning outcomes on fraction topics, creates a more active learning environment, and makes it easier for students to understand concepts.

Keywords: Elementary Mathematics, Fraction Learning, Learning Media, Mathematics Learning Outcomes, Pizza Game.

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PRELIMINARY

Education is a fundamental pillar of national development because it plays a crucial role in improving human resource quality. In the twenty-first century, education is expected to equip students not only with literacy skills but also with numeracy competencies, including logical reasoning, mathematical thinking, and problem-solving. Mathematics, as a core subject in elementary education, contributes to developing these competencies and preparing students to solve everyday problems. In line with the Indonesian Merdeka Curriculum, mathematics learning is expected to develop not only computational skills but

also conceptual understanding and the ability to apply mathematical concepts in authentic contexts. Therefore, mathematics instruction should provide meaningful, contextual, and student-centered learning experiences.

Fractions are among the mathematical topics that elementary students often find difficult because they require understanding part-whole relationships, equivalent fractions, fraction comparison, and arithmetic operations. These concepts are abstract and require students to visualize proportional relationships that cannot always be directly observed. Consequently, students often experience misconceptions in identifying part-whole relationships, comparing fractions with different denominators, recognizing equivalent fractions, and interpreting fractions as numerical quantities (Ardiansari et al., 2026). A systematic literature review by (History, 2025) also found that these difficulties are largely caused by the abstract nature of fractions and the dominance of procedural instruction, which limits opportunities for conceptual understanding through concrete experiences. Therefore, instructional media that allow students to visualize and manipulate fractions are needed. Research shows that manipulatives such as fraction circles, bars, and area models can improve fraction understanding by connecting concrete experiences with abstract mathematical representations (Wilkie & Roche, 2023)

The importance of improving students' understanding of mathematics is also reflected in Indonesia's performance in the Programme for International Student Assessment (PISA) 2022. Indonesian students obtained an average mathematics score of 379, which remains considerably below the OECD average of 472 (OECD, 2023; *PISA 2022 Assessment and Analytical Framework*, 2022) This result indicates that strengthening students' conceptual understanding and mathematical reasoning, particularly in fraction learning, remains an important priority in elementary education.

The conditions described above are consistent with the results of preliminary observations conducted at SDN Susukan 09 Pagi, East Jakarta. Based on classroom observations and interviews with the fifth-grade mathematics teacher, mathematics instruction on fraction topics was predominantly conducted through lectures and textbook exercises, while concrete instructional media were rarely utilized. As a result, many students experienced difficulties in comparing fractions and performing simple fraction operations. Classroom instruction tended to emphasize procedural calculations rather than conceptual understanding, resulting in passive student participation and relatively low mathematics learning outcomes.

According to Piaget's theory of cognitive development, elementary school students are generally in the concrete operational stage, in which learning becomes more meaningful when students manipulate concrete objects (Juardi & Komariah, 2023). Likewise, Bruner's theory explains that conceptual understanding develops progressively through enactive, iconic, and symbolic representations. Therefore, manipulative instructional media are considered appropriate for facilitating students' understanding of abstract mathematical concepts, particularly fractions.

One instructional medium that has considerable potential to support fraction learning is pizza-shaped game media. Pizza slices naturally represent part-whole relationships, enabling students to manipulate, compare, combine, and separate fractions through meaningful learning activities. Such concrete representations help students connect mathematical symbols with everyday experiences, thereby reducing misconceptions and strengthening conceptual understanding.

Previous studies have consistently demonstrated the positive contribution of pizza-based instructional media to mathematics learning. (Nugroho & MUrhayati, 2020) reported that integrating pizza media with the *Realistic Mathematics Education* (RME) approach improved students' understanding of part-whole relationships. Similarly, (Maghfiroh et al., 2024b) found that pizza media integrated with the *Pendidikan Matematika Realistik Indonesia* (PMRI) approach significantly enhanced students' conceptual understanding of fractions. (Hidayati et al., 2024) further developed *Pizza Slice Math* learning media and reported highly positive student responses regarding its practicality, attractiveness, and usability in mathematics instruction. Likewise, (Citra Septiyani et al., 2024) concluded that pizza game-based learning media increased students' engagement and participation during fraction learning. Collectively, these studies demonstrate that pizza-based instructional media effectively facilitate meaningful learning experiences and improve students' understanding of fraction concepts.

Although previous studies have shown the potential of pizza-based media in fraction learning, their approaches remain limited. (Hidayati et al., 2024) examined students' responses to Android-based *Pizza Slice Math* using a qualitative questionnaire, while (Maghfiroh et al., 2024a) investigated pizza media through PMRI using a descriptive qualitative approach. Neither study examined its effect on mathematics learning outcomes using a quasi-experimental design. Moreover, evidence involving fifth-grade students in public elementary schools within the Merdeka Curriculum remains limited. Therefore, this study addresses the gap by quantitatively examining the effect of pizza-shaped game media

on fifth-grade students' mathematics learning outcomes through a quasi-experimental design.

Based on the research background and the identified research gap, the objectives of this study are: (1) to examine the effect of pizza-shaped game media on the mathematics learning outcomes of fifth-grade students at SDN Susukan 09 Pagi, East Jakarta, in fraction learning; and (2) to provide empirical evidence regarding the effectiveness of contextual manipulative media in improving elementary school students' mathematics learning outcomes. The novelty of this study lies in its use of a quasi-experimental design to examine the effect of pizza-shaped game media on students' mathematics learning outcomes, rather than merely assessing students' responses. This study also focuses on fifth-grade students in a public elementary school within the Merdeka Curriculum and applies comprehensive statistical analyses, including validity, reliability, normality, homogeneity, t-test, and effect size. Thus, this study provides empirical evidence on the effectiveness of pizza-shaped game media for improving elementary students' mathematics learning outcomes.

METHODS

This study employed a quantitative research approach using a quasi-experimental method with a Nonequivalent Control Group Design. According to (Sugiyono, 2020), a quasi-experimental design is used to examine the effect of a treatment on a dependent variable when researchers cannot fully control external variables affecting the research. The study was conducted at SDN Susukan 09 Pagi, East Jakarta, Indonesia, during the second semester of the 2025/2026 academic year. The research design is presented in Table 1.

Table 1. Nonequivalent Control Group Design

Group	Pre-test	Treatment	Post-test
Experimental	O_1	X	O_2
Control	O_3	–	O_4

The population of this study consisted of all fifth-grade students at SDN Susukan 09 Pagi, totaling 50 students. Saturated sampling was employed. Twenty-five students from Class VA were assigned as the experimental group and received mathematics instruction using pizza-shaped game media, while twenty-five students from Class VB served as the control group and received conventional mathematics instruction.

The research procedure consisted of four stages. The first stage involved preparation activities, including identifying research problems, preparing lesson plans, developing the pizza-shaped game media, and validating the research instrument. The second stage involved

administering a pre-test to both groups to measure students' initial understanding of fraction concepts. The third stage consisted of implementing the learning intervention. The experimental group learned fraction concepts using pizza-shaped game media, whereas the control group received conventional instruction without the instructional media. Finally, a post-test was administered to both groups to measure students' mathematics learning outcomes after the intervention.

The research instrument was a multiple-choice achievement test on fraction material. Initially, the instrument consisted of 25 items. Before data collection, the instrument was subjected to validity and reliability testing. The validity test indicated that 19 items met the validity criteria, whereas six items were declared invalid and excluded from the final instrument. The reliability analysis showed that the instrument had satisfactory internal consistency, indicating that it was appropriate for measuring students' mathematics learning outcomes.

Data were analyzed using IBM SPSS Statistics version 29. Descriptive statistics were first employed to summarize students' pre-test and post-test scores. Before testing the research hypothesis, prerequisite analyses were conducted. The normality test was performed on both the pre-test and post-test scores using the Shapiro–Wilk test to determine whether the data were normally distributed. The homogeneity test was conducted using Levene's Test on the pre-test scores to verify that the experimental and control groups had homogeneous variances before the treatment. Subsequently, the independent-samples *t*-test was employed at a significance level of 0.05 to examine differences in mathematics learning outcomes between the two groups. In addition, *Cohen's effect size* was calculated to determine the magnitude of the effect of pizza-shaped game media on students' mathematics learning outcomes.

RESULT AND DISCUSSION

The implementation of pizza game media was carried out in the experimental class during fraction learning. Before the learning activities began, the teacher introduced the pizza game media and explained the objectives of the lesson. The students were then divided into several small groups to encourage collaborative learning. Each group received a set of pizza fraction media consisting of circular pizza models divided into equal fractional parts, such as one-half, one-third, one-fourth, one-sixth, and one-eighth.

Figure 1. Pizza-Shaped Game Media for Fraction Learning

During the learning process, students were encouraged to manipulate the pizza pieces to identify fractions, compare equivalent fractions, arrange fractions according to their values, and solve contextual fraction problems. The teacher acted as a facilitator by providing guidance, asking probing questions, and encouraging students to discuss their answers with peers. Learning activities emphasized student participation, exploration, and collaboration rather than teacher-centered instruction.

Compared with the control class, students in the experimental class showed higher. Most students were actively involved in discussions, confidently presented their ideas, and demonstrated better understanding when explaining fraction concepts using the pizza models. These observations indicate that the pizza game media successfully created an interactive learning environment and encouraged students to construct mathematical concepts through direct experiences.

Descriptive Statistics

A descriptive statistical analysis was conducted to describe students' mathematics learning outcomes before and after the implementation of pizza-shaped game media in the experimental and control classes. The analysis included the number of participants, minimum score, maximum score, mean, median and mode. The descriptive statistics are presented in Table 2.

Table 2. Descriptive Statistics of Students' Mathematics Learning Outcomes

Group	N	Minimum	Maximum	Mean	Median	Mode
Experimental Class Pre-test	25	42	84	62.92	63.00	63
Experimental Class Post-test	25	63	100	84.56	84.00	79

Group	N	Minimum	Maximum	Mean	Median	Mode
Control Class Pre-test	25	47	89	67.52	68.00	63
Control Class Post-test	25	53	95	73.04	74.00	68

Table 2 shows that the experimental group obtained a mean pre-test score of 62.92, which increased substantially to 84.56 after learning using pizza-shaped game media. This represents an improvement of 21.64 points. In comparison, the control group achieved a mean pre-test score of 67.52, which increased to 73.04 after conventional instruction, representing an improvement of only 5.52 points.

Although the experimental group demonstrated a lower initial performance than the control group, its post-test achievement was considerably higher following the instructional treatment. Furthermore, the minimum score in the experimental group increased from 42 to 63, while the maximum score increased from 84 to 100. In contrast, the control group showed only a modest improvement, with the minimum score increasing from 47 to 53 and the maximum score from 89 to 95.

These descriptive findings suggest that students who learned fractions through pizza-shaped game media demonstrated greater improvement in mathematics learning outcomes than those who received conventional instruction. The improvement indicates that the instructional media helped students understand fraction concepts more effectively by providing concrete and contextual learning experiences.

Instrument Validity Test

Before conducting the empirical validity test, the research instrument underwent content validation by a mathematics education lecturer to ensure that the test items were appropriate in terms of content, language, construction, and their alignment with the learning objectives and indicators of fraction material. The validator also provided suggestions for improving the clarity and appropriateness of several test items. Revisions were made based on the validator's recommendations before the instrument was administered for the pilot test.

Before data collection, the revised research instrument was subjected to an empirical validity test using Pearson's Product-Moment correlation analysis. The pilot test was conducted on 25 fifth-grade students at SDN Cipinang Cempedak 09 Pagi, East Jakarta, who were not included in the research sample. The validity test was conducted to determine whether each test item was capable of measuring students' mathematics learning outcomes

on fraction materials. An item was considered valid if the Pearson correlation coefficient (*r*-count) was greater than the *r*-table value (0.396) at a significance level of 5%, and the significance value was below 0.05. The results showed that 19 of the 25 items met the validity criterion, whereas six items were declared invalid and excluded from the final instrument. Consequently, only the 19 valid items were administered in the pre-test and post-test conducted at SDN Susukan 09 Pagi, East Jakarta. The results of the instrument validity test are presented in Table 2.

Table 3. Instrument Validity Test

No.	Pearson Correlation	Sig. Value	Conclusion
1	0.772	<0.001	Valid
2	0.890	<0.001	Valid
3	0.977	<0.001	Valid
4	0.787	<0.001	Valid
5	0.923	<0.001	Valid
6	0.977	<0.001	Valid
7	0.932	<0.001	Valid
8	0.923	<0.001	Valid
9	0.328	0.109	Invalid
10	0.350	0.086	Invalid
11	0.346	0.090	Invalid
12	0.977	<0.001	Valid
13	0.257	0.216	Invalid
14	-0.031	0.881	Invalid
15	0.977	<0.001	Valid
16	0.702	<0.001	Valid
17	0.885	<0.001	Valid
18	0.899	<0.001	Valid
19	0.923	<0.001	Valid
20	0.785	<0.001	Valid
21	0.923	<0.001	Valid
22	0.881	<0.001	Valid
23	0.923	<0.001	Valid
24	0.881	<0.001	Valid
25	-0.105	0.618	Invalid

As shown in Table 2, the empirical validity analysis indicated that 19 of the 25 multiple-choice items met the validity criteria, whereas six items (Items 9, 10, 11, 13, 14, and 25) were declared invalid because their *r*-count values were lower than the *r*-table value and their significance values exceeded 0.05. These invalid items were removed before the implementation of the main study. Consequently, only the 19 valid items were used as the final research instrument and were administered in both the pretest and the posttest to students at SDN Susukan 09 Pagi, East Jakarta. The pretest and posttest employed the same

set of 19 validated items, with the difference lying in the time of administration rather than the content of the instrument, thereby enabling consistent measurement of students' learning outcomes before and after the instructional intervention.

The 19 valid items represented all learning indicators of fraction material specified in the instrument blueprint (*kisi-kisi*), including understanding part-whole relationships, identifying equivalent fractions, comparing fractions, and performing simple fraction operations. Therefore, the final instrument adequately represented the intended learning objectives and was considered appropriate for measuring students' mathematics learning outcomes.

Instrument Reliability Test

The reliability analysis was conducted to determine the consistency of the research instrument. The reliability test used Cronbach's Alpha coefficient.

Table 4. Instrument Reliability Test

Cronbach's Alpha	Number of Items	Interpretation
0.868	19	Reliable

Based on Table 3, the instrument obtained a Cronbach's Alpha value of 0.868. Since the coefficient exceeded the minimum reliability standard of 0.70, the instrument was categorized as highly reliable. This indicates that the instrument had strong internal consistency and was appropriate for measuring students' mathematics learning outcomes.

Normality Test

The normality test was conducted to determine whether the data distribution satisfied the assumption of normality required for parametric statistical analysis. The Shapiro–Wilk test was selected because each group consisted of fewer than 50 participants. The test was performed separately for the pretest and posttest scores of both the experimental and control groups.

Table 5. Shapiro–Wilk Normality Test

Group	Statistic	Sig.	Conclusion
Experimental Pre-test	0.979	0.856	Normal
Experimental Post-test	0.949	0.238	Normal
Control Pre-test	0.970	0.650	Normal
Control Post-test	0.962	0.455	Normal

The results show that all significance values exceeded 0.05. Therefore, all data were normally distributed. These results indicate that the data fulfilled the assumption of normality and could be analyzed using parametric statistical procedures.

Homogeneity Test

The homogeneity test was performed using Levene's Test to determine whether the variances of the research data were homogeneous before conducting the hypothesis test. Homogeneity of variance is one of the assumptions required for applying the Independent Samples *t*-test.

Table 6. Result of the Homogeneity Test

Variabel	Levene Statistic	df1	df2	Sig.	Conclusion
Based on Mean	0.312	3	96	0.816	Homogeneous
Based on Median	0.280	3	96	0.840	Homogeneous
Based on Median (Adjusted df)	0.280	3	95.557	0.840	Homogeneous
Based on Trimmed Mean	0.318	3	96	0.813	Homogeneous

As presented in Table 6, Levene's Test based on the mean produced a significance value of 0.816, which was greater than the significance level of 0.05. Likewise, the significance values obtained from the median, adjusted median, and trimmed mean methods were 0.840, 0.840, and 0.813, respectively, all exceeding 0.05. These results indicate that the variances of the data were homogeneous. Therefore, the assumption of homogeneity of variance was satisfied, and the data were considered appropriate for further analysis using the Independent Samples *t*-test. Independent Samples t-test

An Independent Samples *t*-test was conducted to determine whether there was a statistically significant difference in mathematics learning outcomes between the experimental group, which received instruction using pizza-shaped game media, and the control group, which received conventional instruction. Since the homogeneity test indicated that the assumption of equal variances was satisfied ($p = 0.498 > 0.05$), the results under the Equal variances assumed condition were used for hypothesis testing.Table 6. Independent Samples t-test Results.

Table 7. Independent Samples t-test

Variabel	Asumsi Varians	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Value	Equal variances assumed	0.466	0.498	-7.341	48	<0.001	-21.640
	Equal variances not assumed	-	-	-7.341	47.645	<0.001	-21.640

As presented in Table 6, the Independent Samples *t*-test under the Equal variances assumed condition yielded a *t*-value of −7.341 with 48 degrees of freedom and a significance value (Sig. (2-tailed)) of < 0.001. Since the significance value was lower than the

predetermined significance level of 0.05, the null hypothesis (H_0) was rejected, and the alternative hypothesis (H_1) was accepted.

These findings demonstrate that there was a statistically significant difference in mathematics learning outcomes between the experimental and control groups. The mean difference of −21.640 indicates that the students who learned using pizza-shaped game media achieved higher mathematics learning outcomes than those who received conventional instruction. Therefore, it can be concluded that the use of pizza-shaped game media had a significant positive effect on fifth-grade students' mathematics learning outcomes in learning fractions.

Effect Size Analysis

To determine the practical significance of the treatment effect, an effect size analysis was conducted using Cohen's d. Effect size analysis provides information regarding the magnitude of the difference between the experimental and control groups beyond statistical significance.

The calculation of Cohen's d was based on the difference between the post-test mean scores of the experimental and control groups.

Table 8. Effect Size Analysis

Value	Standardizer	Point Estimate	95% Confidence Interval	
			Lower	Upper
Cohen's *d*	11.180	1.934	1.242	2.611

The obtained Cohen's d value of 1.934 indicates a large effect size. This finding demonstrates that the implementation of pizza-shaped game media had a substantial practical effect on improving students' mathematics learning outcomes in fraction materials. Therefore, the difference between students who learned using pizza-shaped game media and those who received conventional instruction was not only statistically significant but also educationally meaningful.

DISCUSSION

The findings indicate that pizza-shaped game media significantly improved students' mathematics learning outcomes in fraction learning. The experimental group achieved higher post-test scores than the control group, suggesting that manipulative media provide meaningful hands-on experiences that support conceptual understanding. This finding is consistent with (Stefan & Sagheer, 2024), who found that concrete and virtual manipulatives

significantly improved elementary students' mathematics achievement by connecting concrete experiences with abstract mathematical concepts.

The effectiveness of pizza-shaped game media can be explained by its ability to transform abstract mathematical concepts into concrete representations. Fraction concepts require students to understand part-whole relationships, compare fractions with different denominators, recognize equivalent fractions, and perform fraction operations. These concepts are often difficult because students tend to perceive numerators and denominators as separate whole numbers rather than as components of a single quantity. By manipulating pizza slices directly, students could visualize and compare fractions more accurately, thereby reducing misconceptions and strengthening conceptual understanding. This finding is consistent with previous studies indicating that manipulative media facilitate students' conceptual understanding by transforming abstract fraction concepts into concrete representations. The use of pizza-shaped game media enabled students to visualize abstract fraction concepts through concrete representations, thereby facilitating conceptual understanding and reducing misconceptions (Björkhammer et al., 2024; Maghfiroh et al., 2024b; Nugroho & MUrhayati, 2020; Stefan & Sagheer, 2024; Wilkie & Roche, 2023).

These findings are also supported by (Hidayati et al., 2024), who developed Pizza Slice Math learning media and reported highly positive responses from elementary school students regarding its usability, attractiveness, and learning quality. Although their research focused primarily on media feasibility, the positive student responses indicate that pizza-based instructional media create engaging learning environments that facilitate students' understanding of fraction concepts. The present study extends these findings by demonstrating that pizza-shaped game media not only receive positive responses but also significantly improve measurable mathematics learning outcomes through a quasi-experimental design.

The present findings are also consistent with Piaget's theory of cognitive development. According to Piaget (1972), elementary school students are generally in the concrete operational stage, during which they understand concepts more effectively through direct manipulation of tangible objects. Fraction concepts are often difficult because they involve abstract proportional reasoning (Juardi & Komariah, 2023; Sampel Korompis, 2023). Therefore, presenting fractions through concrete objects such as pizza slices allows students to connect abstract mathematical symbols with observable representations. Similarly, Bruner's (1966) theory suggests that learning develops progressively through enactive, iconic, and symbolic representations. Pizza-shaped game media supports these

three stages by allowing students to manipulate concrete pizza models (enactive), observe visual fraction representations (iconic), and finally express fractions using mathematical notation (symbolic). This progression facilitates meaningful conceptual learning and reduces cognitive difficulties (*A Brunerian Theoretical Framework for ECE : A Review of Jerome Bruner's Theoretical Contributions to Early Childhood Education*, 2026).

The findings of this study are in line with several previous studies. (Nugroho & MUrhayati, 2020) found that integrating pizza media with the Realistic Mathematics Education (RME) approach improved elementary students' understanding of part-whole relationships in fractions. Likewise, (Maghfiroh et al., 2024b) reported that pizza media combined with the Indonesian Realistic Mathematics Education (PMRI) approach significantly enhanced students' conceptual understanding of fractions. (Hidayati et al., 2024) also developed Pizza Slice Math learning media and reported highly positive evaluations regarding its practicality, attractiveness, and usability in elementary mathematics instruction. Furthermore, (Citra Septiyani et al., 2024) concluded that pizza-based game media increased students' learning motivation, classroom participation, and engagement during mathematics learning. Similarly, (Putri & Andaryani, 2025) developed a snake-and-ladder board game for teaching fractions and found that game-based instructional media significantly improved elementary students' mathematics learning outcomes while increasing learning motivation and classroom interaction. Although the instructional media differed from the pizza-shaped game used in the present study, both studies demonstrate that game-based learning provides meaningful learning experiences that facilitate students' conceptual understanding of fractions. The consistency between the present findings and previous studies strengthens the evidence that contextual manipulative media are effective in supporting mathematics learning at the elementary school level.

However, this study extends previous research in several important aspects. The present findings also complement recent developments in game-based mathematics learning. Furthermore, the effectiveness of pizza-shaped game media was examined through comprehensive statistical procedures, including instrument validation, reliability testing, normality and homogeneity testing, and hypothesis testing using the Independent Samples *t*-test. These methodological procedures provide stronger empirical evidence regarding the causal effect of pizza-shaped game media on students' mathematics learning outcomes.

Another important finding observed during the learning process was the increased level of student participation in the experimental classroom. Students appeared more enthusiastic when manipulating pizza models, discussing fraction problems, and completing

collaborative learning activities. Similar findings have been reported in previous studies showing that game-based learning increases students' engagement, motivation, collaboration, and participation during mathematics instruction (Akbar et al., 2021; Citra Septiyani et al., 2024; Debrenti, 2023; Hidayati et al., 2024; Putri & Andaryani, 2025). Compared with conventional instruction, which mainly relied on teacher explanations and textbook exercises, pizza-shaped game media created a more interactive learning environment. This increased engagement likely contributed to students' improved conceptual understanding and higher post-test scores. Active participation has been widely recognized as one of the key factors influencing meaningful mathematics learning because students learn more effectively when they are actively involved in constructing knowledge.

From a practical perspective, teachers can integrate contextual manipulative media into fraction instruction. Pizza-shaped game media can be made from inexpensive materials and provide meaningful opportunities for students to explore mathematical concepts through direct experience. This approach aligns with the Merdeka Curriculum, which emphasizes active, student-centered, contextual, and higher-order learning. Similar findings were reported by (Firyani & Ninawati, 2024) who found that simple and low-cost visual media can effectively support fraction learning in elementary schools.

This study has several limitations. It involved only 50 fifth-grade students from one public elementary school, which may limit the generalizability of the findings. In addition, the intervention focused only on fractions and measured cognitive learning outcomes without examining long-term retention, mathematical communication, or students' attitudes toward mathematics. Future research should therefore involve larger and more diverse samples, explore other mathematical topics, and examine additional outcomes such as retention, mathematical reasoning, problem-solving, motivation, and attitudes.

Overall, the findings provide empirical evidence that pizza-shaped game media can improve elementary students' mathematics learning outcomes in fraction learning. By providing concrete, contextual, and interactive experiences, the media can support conceptual understanding, reduce misconceptions, and encourage active participation in mathematics learning (Supratman, 2025)

CONCLUSION

This study concluded that the use of pizza-shaped game media had a significant positive effect on the mathematics learning outcomes of fifth-grade students at SDN Susukan 09 Pagi, East Jakarta, on fraction materials.

Pizza-shaped game media provided a more engaging and meaningful learning experience by helping students understand abstract fraction concepts through concrete and interactive activities. Therefore, this media can be considered an effective alternative for teaching fractions in elementary schools.

This study was limited to one school and focused only on fraction materials. Future research is recommended to investigate the effectiveness of pizza-shaped game media in other mathematics topics, different educational levels, and broader learning contexts.

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