

THE EFFECT OF PEER TUTORING LEARNING ON THE MATHEMATICS LEARNING OUTCOMES OF GRADE V STUDENTS AT ELEMENTARY SCHOOL TUGU 1 CIMANGGIS DEPOK

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ABSTRACT

The low achievement of students' mathematics learning outcomes and the suboptimal participation of students during the learning process are the basis for implementing this research. The purpose of this research is to analyze the effect of peer tutoring learning on the mathematics learning outcomes of fifth-grade students of SDN Tugu 1 Cimanggis Depok. The quantitative approach was implemented using a posttest-only control design. The research population included all fifth-grade students of SDN Tugu 1 Cimanggis Depok, while the sample used was 53 students divided into 27 students in the experimental class and 26 students in the control class. Data collection was based on mathematics learning outcome tests that had undergone validity and reliability testing. A series of data analysis included normality tests, homogeneity tests, and hypothesis testing using independent sample t-tests. The results of data processing showed that the distribution met the assumptions of normality and equal variance between groups. Hypothesis testing produced a significance value (Sig. 2-tailed) of 0.000 which was below the threshold of 0.05 so that H_0 was not accepted and H_1 was declared valid. The average learning outcome in the experimental class was recorded at 70.67, while the control class was 54.31 with a difference indicating an advantage in the experimental class. The calculation of the effect size (Cohen's d) of 1.048 leads to a large category. These findings indicate that peer tutoring learning has a significant and strong influence on the mathematics learning outcomes of fifth-grade students at SDN Tugu 1 Cimanggis Depok, so this method can be considered as an alternative learning strategy to improve mathematics learning outcomes in elementary schools.

Keywords: mathematics learning outcomes, mathematics learning, peer tutoring

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BACKGROUND

Education plays a crucial role in improving the quality of human resources and driving national progress. At the elementary school level, learning is positioned as the primary foundation for developing students' academic abilities, skills, and character, preparing them for the next stage of their education. Therefore, effective learning design is required to maximize educational goals. Structured interactions between students, teachers, and learning resources aimed at optimally achieving learning objectives are referred to as learning.(Hasbiyallah & Fikri Al-Ghifary, 2023).

The strong role of mathematics learning is reflected in students' critical, logical, and systematic thinking skills. Therefore, students acquire skills that can be used to understand and solve problems in their daily lives. However, learning in elementary schools still focuses on formulas and solving periodic problems. The challenges faced by many students lie in their suboptimal understanding of mathematical concepts, influenced by the abstract nature of the material and teacher dominance in learning activities. This condition impacts students' motivation to learn and their achievement in mathematics.(Aisyah et al., 2024).

Similar findings were obtained from observations during the PLP activities at SDN Tugu 1 Cimanggis Depok. Based on these results, the majority of fifth-grade students had not yet met the Minimum Competency (KKM) in mathematics. Low student engagement was also evident because the learning process was still dominated by the teacher. This situation resulted in minimal student participation and created obstacles in fully understanding

mathematical concepts.(Wiryana & Alim, 2023).

Orientation to calculation skills alone is not enough in mathematics learning; emphasis also needs to be directed toward conceptual mastery and problem-solving skills. Active student participation during learning activities requires the implementation of learning strategies that can stimulate such engagement. In this study,Alif Hazira et al. (2024)showed significant results on mathematical skills with a student-centered approach during the learning process, with students' real participation in constructing understanding throughout the learning process. One relevant alternative to use is peer tutoring. This method facilitates the involvement of students with higher academic achievement to accompany their peers in understanding the learning material. The occurrence of a more communicative and collaborative learning atmosphere is influenced by interaction and discussion between students, so that students' understanding of the material can be obtained through the use of easy-to-understand and simple language.(Sudjadmiko, 2021).

Mathematics learning outcomes show positive impacts when students are actively involved. This can be achieved through cooperative learning.(Juhaeroh 2021).The suitability of the findings was also stated byLase & Subekti (2024)The mathematics learning model with peer tutors shows positive results and an increase in the active attitudes of elementary school students.(Mashari et al., 2022). Furthermore, the improvement of student learning outcomes at the secondary school level through the implementation of peer tutoring was also revealed.(Mazlahidar, 2022). In

addition, improving students' English learning outcomes through the use of peer tutors is implemented by Arsyad et al. (2023). Overall, the findings confirm that peer tutoring has potential as an option for effectiveness in improving student learning outcomes.

However, studies specifically examining the impact of peer tutoring on fifth-grade students' mathematics learning outcomes are still relatively limited. Previous research has predominantly focused on other subjects and at different educational levels. Therefore, further testing of the effectiveness of peer tutoring in elementary school mathematics learning is still needed. Using a posttest-only control design, testing the effect of peer tutoring on fifth-grade students' mathematics learning outcomes marks the novelty of this research, given that the application of this design is still relatively rare in elementary school mathematics learning.

Previous studies have shown that peer tutoring influences fifth-grade elementary school students. The aim of this study was to examine the influence of peer tutoring on fifth-grade mathematics learning outcomes. The study's outcomes are expected to contribute empirical evidence for the development of more active, collaborative, and useful mathematics learning strategies in elementary schools.

RESEARCH METHODS

A quantitative approach was chosen in this study by applying the quasi-experimental method and a posttest-only control design (Sugiyono, 2023). The research was conducted at SDN Tugu 1 Cimanggis Depok in the 2025/2026 academic year. The research design divided the students into two groups: experimental

(receiving peer tutoring treatment) and control (conventional learning).

The research population consisted of 58 fifth-grade students of SDN Tugu 1 Cimanggis Depok, all of whom were selected as research subjects. A saturated sampling technique was used in the sample selection process, so that all members of the population were included as research samples without exception. However, during the research, five students did not fully participate in all the activities, so their data did not meet the criteria for analysis. A total of 53 students were selected as the analysis sample, with a composition of 27 students from grade VD (experimental) and 26 students from grade VC (control).

Over approximately three weeks, the research encompassed a series of planning, preparation, treatment, observation, and evaluation stages. In the first week, the researcher developed learning materials, including teaching modules, worksheets (LKPD), teaching materials, and instructional videos utilized throughout the study. In the second week, instrument testing was conducted to assess the validity and reliability of the mathematics learning outcome test to be used. The determination of students who would act as tutors and tutees in the same phase was carried out collaboratively with the class teacher, taking into account the students' abilities and grades in learning. The research spanned approximately three weeks, encompassing a series of planning, preparation, treatment implementation, observation, and evaluation. In the first week, the researcher designed learning materials, including teaching modules, worksheets, teaching materials, and instructional videos utilized throughout the research process. In the following week, instrument testing was conducted to assess the validity and reliability of the mathematics learning outcome test to be used. Concurrently, the determination of students as tutors and tutees was determined collaboratively with the class teacher, taking into account their

mathematics learning abilities and previous mathematics learning achievement levels.

The research data source comes from the results of students' mathematics learning tests. Multiple-choice tests serve as instruments designed based on cognitive ability indicators, including the ability to apply (C3), analyze (C4), and evaluate (C5). (Syaeful Rohman et al., 2021). Before use, the instrument underwent validity and reliability testing to ensure its suitability in measuring students' mathematics learning outcomes.

The presentation of data processing results is compiled through the application of descriptive statistics and inferential statistics. The description of student learning outcomes is explained using descriptive statistics that include minimum values, average values, standard deviations, and maximum values. Validity tests, reliability tests, and normality tests were conducted using Microsoft Excel. Furthermore, homogeneity tests using Levene's test and hypothesis testing using Independent Samples t-Test were conducted using IBM SPSS Statistics 27 at a significance level of 0.05. Effect size analysis using Cohen's d was used to analyze the impact of peer tutoring on students' mathematics learning outcomes.

RESULTS AND DISCUSSION

Prior to the study's implementation, the initial stage was to test the instrument's suitability through validity and reliability checks to ensure its accuracy in assessing mathematics learning outcomes. The validity test, applied to 40 questions, found that 28 met the criteria and were therefore suitable for use in the study. Of these valid items, 25 were selected because they comprehensively represented all measured learning indicators. The instrument's validity criteria were determined based on the interpretation of the point-biserial

correlation. (Abigail Soesana et al., 2023). The following are the test results in table 1.

Table1. Instrument Validity Test Results

Testing Phase	Number of Questions	Information
Stage 1	18 questions	Valid
Stage 2	10 questions	Valid
Total	28 questions	Valid
Questions used	25 questions	Research Instruments

Reliability testing was carried out using the KR-20 formula because the research instrument used was in the form of a questionnaire. (Slamet Widodo et al., 2023) The results of the first stage of testing showed a reliability coefficient of 0.85, while the second stage obtained a value of 0.79. The instrument was declared suitable for the study, as the values achieved were in the high-very high category. These are then presented in Table 2.

Table2. Instrument Reliability Test Results

Testing Phase	KR-20	Information
Stage 1	0.85	Very high
Stage 2	0.79	Tall

After the learning process, students' mathematics learning outcomes were measured by administering a posttest to both groups. Table 3 provides a description of this.

Table 3 Description of Student Learning Outcomes

Class	N	Mean	Maximum	Minimum	Standard Deviation
Experiment	27	70.67	92	44	13,901
Control	26	54.31	88	32	17,202

The mean result of the experimental class students' learning score was 70.67 in Table 3 compared to the control class. The score range in the experimental class was recorded with a maximum score of 92 and a minimum of 44, while in the control class the highest score was 88 and the lowest was 32. There was a difference in student learning outcomes with the peer tutoring method and conventional from the results.

Data analysis requirements are met by carrying out normality tests and homogeneity tests before hypothesis testing is carried out.

The use of the Liliefors method for normality testing produces the output presented in Table 4.

Table 4. Normality Test Results

Class	Count	Table	Information
Experiment	0.0966	0.1705	Normal
Control	0.1431	0.1737	Normal

Shows that there is a difference in the calculated L value in the control and

experimental classes which is lower than the L table at a significance level of 0.05. This condition indicates that the distribution of learning outcomes from both groups follows a normal pattern.

IBM SPSS 27 is a tool for processing Levene's test, which produces a homogeneity test. The following is Table 5.

Table 5. Homogeneity Test Results

Variables	Levene Statistics	Sig.	Information
Mathematics Posttest	2,2034	0.144	Homogeneous

In Table 5, the significance value of 0.144 is recorded as exceeding the threshold of 0.05 so that the uniformity of the variance of learning outcomes between the experimental class and the control class with appropriate conditions.

Hypothesis testing was then carried out using an independent sample t-test, Table 6 is a test presentation.

Class	N	Mean	t	Sig. (2-tailed)
Experiment	27	70.67	3,815	0,000
Control	26	54.31		

Table 6. Effect Size Calculation Results

Variables	Cohen's d	Category
Learning outcomes	1,048	Big

Referring to Table 7, the large category is shown at 1.048. Improvement in students' mathematics learning outcomes is strongly influenced by peer tutoring, indicating a static difference.

The results show a 2-tailed Sig. value of 0.000 (<0.05) so that a difference can be found indicating that there is an impact in peer tutoring learning on the mathematics scores of fifth grade elementary school students. The average comparison shows that the experimental class obtained a score of 70.67, while the control class was at 54.31. This difference indicates that the learning outcomes of students who participated in peer tutoring learning were higher than those who received conventional learning.(Nuryadi et al., 2017).

Cohen's d value of 1.048, obtained through the effect size calculation, indicates a large category, thus clearly identifying the impact of peer tutoring. The improvement in student mathematics learning outcomes obtained through peer tutoring not only presents a statistical difference but also makes a strong contribution to those achievements. Therefore, peer tutoring should be considered an effective learning alternative to support elementary school students' understanding of mathematical concepts.

Peer tutoring provides opportunities for students to learn actively through discussion, collaboration, and peer interaction, thus improving learning outcomes. During the learning process, students' roles as tutors are realized through assisted explanations of material using simpler language, making it easier for group members to understand. Students' courage to ask questions, express ideas, and actively

participate during learning increases as a result of these conditions. Furthermore, students' understanding of mathematical concepts develops gradually according to their individual capacity, supported by a more relaxed and communicative learning environment.

The results of this study confirm the ideaKaro (2022)that increasing student motivation and self-confidence in learning can be achieved through the implementation of peer tutoring. Similar support was also expressed bySudjadmiko (2021)which emphasizes that a more active, collaborative, and conducive learning environment for student conceptual understanding can be created through peer tutoring. Interaction between students makes the learning process more communicative, thus broadening students' opportunities to construct an understanding of mathematical concepts.

This research also supports the findings of an international study by Thurston et al. (2020) on improving student learning outcomes in elementary school mathematics through peer tutoring. This improvement is explained as occurring due to the fostering of social interactions between tutors and tutees, which optimally develops understanding of mathematical concepts through discussions, feedback, and collaboration throughout the learning process.

In line with the studyFirdaus et al. (2024)AndPanjaitan et al. (2020)emphasizes the need for active student involvement for effective mathematics learning and optimal conceptual mastery. In the application of peer tutoring, information is not solely obtained from the teacher, but rather understanding is built through group

discussions and collaboration by the students themselves. This alignment of results is also evident in Abdul Rahman & Lee Abdullah (2024) which confirms that peer interaction during learning activities makes a significant contribution to improving students' mathematical understanding. This opportunity to deepen students' understanding of the material taught through communication and the exchange of ideas between individuals allows for a more focused understanding reinforcement process. These findings indicate that peer tutoring supports the implementation of student-centered learning, where students actively construct knowledge through activities. Therefore, peer tutoring can result in a more focused learning process for students and provide a more optimal learning experience.

The results of the study obtained were strengthened by research. Musyafa et al. (2020) Improved conceptual understanding and mathematics learning outcomes were achieved through the implementation of learning that positions students as active participants throughout the learning process. Broader opportunities for understanding mathematical concepts were achieved through direct student involvement in discussions, interactions, and independent knowledge construction. Space for information exchange and collaborative mathematical problem solving was provided through the implementation of peer tutoring in this study, thus optimizing the activeness and effectiveness of the learning process.

In line with the findings of Lase & Subekti (2024), Mashari et al. (2022), Arsyad et al. (2023), Mazlahidar (2022), as well as Alegre et al. (2020) Student learning outcomes are positively influenced by peer

tutoring across various educational levels and subjects, as confirmed by the findings of this study. This agreement confirms the effectiveness of peer tutoring as a learning strategy, as it can increase student engagement, strengthen interactions between students, and facilitate optimal understanding of learning materials.

The implications of this research's findings indicate that the use of peer tutoring is a viable alternative method for teaching mathematics in elementary schools to foster a more active, collaborative, and student-centered learning environment. Through peer tutoring, students have the opportunity to help each other, exchange ideas, and solve problems collaboratively, thereby increasing student engagement in the learning process. Therefore, peer tutoring serves as a supportive approach to improving elementary school students' mathematics learning outcomes. This study supports this. Oikarinen et al. (2022) which explains that collaboration and feedback between students in peer tutoring helps build active mathematical understanding. The success of peer tutoring is influenced not only by the way the material is delivered, but also by the quality of the interactions and collaborations that develop throughout the learning process.

CONCLUSION

The influence of d is significantly shown in peer tutoring learning in a study conducted at SDN Tugu 1 Cimanggis class V Depok. $0.000 (<0.05)$ is a significance value when testing the hypothesis so that there is a difference in the learning outcomes of conventional methods and peer tutoring. These results are supported by the mean learning outcomes, where the control class is

54.31 and the experimental class with a figure of 70.67. The calculation of 1.048 in the Cohen's d value in the effect size calculation (large category), produces a conclusion included in the high category of the influence of peer tutoring learning on mathematics results.

The study results demonstrate the creation of more lively learning activities, more intense collaboration between students, and a student-centered approach as a result of the implementation of peer tutoring. Broader opportunities for students to ask questions, exchange ideas, and master learning materials more optimally emerged through interaction and discussion with peers. Empirical evidence regarding the effectiveness of peer tutoring in mathematics learning in elementary schools is increasingly strengthened, especially in fifth-grade students who were studied using a posttest-only control design. Thus, an alternative learning strategy in the form of peer tutoring is worth considering to support the realization of mathematics studies that focus on elementary school students.

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