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The Effect of Applying the Peer Tutoring Model on Fifth-Grade Students' Ability to Solve Mathematical Word Problems

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Abstract: Mathematics is one of the sciences that plays an important role in human life. Through learning mathematics, students are trained to think critically, logically, and systematically, as well as to solve the problems they encounter in daily life—many of which are presented in the form of mathematical word problems. Based on initial observations, students' ability to solve mathematical word problems is still relatively low. Therefore, efforts are needed to improve this ability, one of which is through the implementation of the peer tutoring learning model. This research used a quasi-experimental method with a pretest–posttest control group design. The population in this study consisted of fifth-grade students from public elementary schools in the Darussalam sub-district. The sample included 25 students from Ujong Kuta Public Elementary School and 7 students from Tanjung Selamat Public Elementary School. Data were collected using a mathematical word problem-solving ability test. Data analysis was conducted using the Independent Samples t-test via the SPSS application. Based on the analysis of the posttest scores, the Sig. (2-tailed) value was 0.003, which is less than 0.05. These results indicate that the peer tutoring model had a significant effect on the ability of fifth-grade students to solve mathematical word problems.

Keywords: peer tutor; ability; questions story

A. Introduction

Raharjo, in the journal *The Great*, states:

> *"Mathematical word problems are questions that contain and reflect real-life situations, which can be solved using mathematical language."*

The term *mathematical language* here refers to supporting sentences that contain mathematical understanding—such as numbers, arithmetic operations, and relationships. However, the ability of fifth-grade students to solve mathematical word problems is still considered low. This is supported by empirical data, where the average score of Grade V students was 29.76, with the following percentage of achievement across five indicators: 19% on the ability to read the question, 7% on the ability to understand the question, 11% on the ability to transform the problem, 8% on process skills, and 3% on the ability to present the answer. Based on the test results, the researcher concluded that out of the five indicators, only one met the minimum standard.

The ability to solve mathematical word problems refers to the skills involved in analyzing, solving, and answering questions in accordance with learning objectives and the intended meaning of the problem. Word problem solving is a crucial aspect of mathematics, as it involves real-life application and requires students to interpret and process information presented in textual form.

According to Newman's procedure, the steps for solving mathematical word problems include: Reading – accurately reading the problem, Comprehension – understanding what the problem is asking, Transformation – translating the problem into a mathematical form, Process Skills – performing the necessary calculations, Encoding – writing the correct answer in the required format (Afwika, Aprilia, et al., 2023).

According to Haryati,

> *"The competencies that students must possess in solving mathematical word problems include meaningful verbal ability, the ability to understand and interpret questions, and the ability to translate them into mathematical models. In addition, algorithmic ability is also essential—that is, the student's ability to determine the correct algorithm to solve the problem, perform accurate calculations, and draw appropriate conclusions from the results, which should be connected back to the original question." (Afwika, Aprilia, et al., 2023)*

Peer tutoring is a learning strategy in which students are appointed or assigned to assist their classmates who are experiencing learning difficulties. This approach is effective because relationships among peers are generally closer and more relaxed than the relationships between teachers and students. In peer tutoring, both the tutor and the tutee are students of the same age or academic level. The tutor acts as a teacher, while the tutee is the learner, both being peers. Peer tutoring is essentially similar to mentoring programs that aim to provide support by students and for students, enabling them to achieve optimal learning outcomes (Abdul Mukhlis, 2016).

Before selecting a tutor, the teacher must consider several factors to ensure that the intended learning objectives can be achieved. According to Anggorowati, a peer tutor should meet the following criteria: (1) Possess academic abilities that are above the class average; (2) Be able to work collaboratively with fellow students; (3) Have high motivation to achieve strong academic performance; (4) Demonstrate tolerance and consideration toward peers; (5) Be highly motivated to make the discussion group successful; (6) Exhibit humility, courage, and a strong sense of responsibility; and (7) Enjoy helping others who are experiencing learning difficulties (Mutma'inah, 2022).

B. Method

This study is an experimental research using a quantitative approach. Experimental research is a method used to determine the effect of an independent variable (treatment) on a dependent variable (outcome) under controlled conditions (Sugiyono, 2020).

This study applied a quasi-experimental design in the form of a nonequivalent control group design. A quasi-experiment is a type of pseudo-experimental design in which a control group exists, but not all external variables can be controlled during implementation.

The first step involved administering a pre-test to both the experimental class and the control class. Then, the experimental class received treatment in the form of the peer tutoring model, while the control class received conventional learning. After the treatment, a post-test was administered to both classes to determine the difference in students' problem-solving abilities after receiving different treatments.

This research was conducted from October 7 to October 22, 2024. The population of the study consisted of all fifth-grade students in public elementary schools in the Darussalam sub-district. The sample included 25 students from SDN Ujong Kuta (experimental class) and 7 students from SDN Tanjung Selamat (control class). The sampling method used was simple random sampling, which is a technique of selecting sample members randomly without considering strata within the population (Sugiyono, 2020).

The data used in this study were obtained from tests. The instrument was in the form of a mathematical word problem-solving test, designed to measure students' ability to solve story problems. The test was constructed based on problem-solving indicators and was administered before learning (pre-test) and after learning (post-test).

The collected data were then analyzed to determine whether there was an influence of the peer tutoring model on students' mathematical word problem-solving ability. Data analysis included prerequisite tests and a t-test. The prerequisite tests included a normality test and a homogeneity test, analyzed using SPSS version 26.

The Shapiro–Wilk test was used for the normality test, as it is suitable for sample sizes less than 50 ($n < 50$). The decision criteria were: if the significance value is greater than 0.05, the data are normally distributed; otherwise, they are not.

The homogeneity test was also conducted, with the decision criterion being: if the significance value is greater than 0.05, the data have homogeneous variance; otherwise, the variance is not homogeneous.

Once the data met the assumptions of normality and homogeneity, a t-test was conducted. The decision criteria for the t-test are:

a. If the significance value (2-tailed) > 0.05, then H_0 is accepted and H_a is rejected.

b. If the significance value (2-tailed) ≤ 0.05, then H_0 is rejected and H_a is accepted.

The hypotheses of this study are as follows:

a. H_0: $\mu_1 = \mu_2$ The peer tutoring model has no significant effect on the ability to solve mathematical word problems in Grade V students.

b. H_a: $\mu_1 > \mu_2$ The peer tutoring model has a significant effect on the ability to solve mathematical word problems in Grade V students.

C. Results and Discussion

1. Description Peer Tutor Model Implementation Data Analysis

The researchers implemented the peer tutoring model in the experimental class. Data were obtained from student test activities, where the test questions were designed to reflect the

assessment indicators used as the basis for evaluating students' mathematical word problem-solving abilities.

Table 1 presents the indicators and scoring guidelines used for the evaluation.

Table 1. Indicators Evaluation Ability Solving Math Story Problems

No	Indicator	Information	Mark
1	Understanding	- Writes both the known and the asked information correctly	4
		- Writes either the known or the asked information correctly	3
		- Writes both the known and the asked information, but inaccurately	2
		- Does not write the known and the asked information	1
2	Problem Transformation	- Develops a complete and accurate plan to solve the problem	4
		- Develops a partial plan that still leads to the correct answer	3
		- Develops a plan that leads to an incorrect answer	2
		- Does not develop a problem-solving plan	1
3	Process Skills	- Solves the problem systematically with a correct result	4
		- Solves the problem systematically, but with an incorrect result	3
		- Solves the problem unsystematically but gets a correct result	2
		- Solves the problem unsystematically and gets an incorrect result	1
4	Final Answer & Conclusion	- Writes the final answer and conclusion correctly and completely	4
		- Writes the final answer and conclusion correctly, but not completely	3
		- Writes the final answer and conclusion incorrectly	2
		- Does not write the final answer or conclusion	1

Source: Adapted from Aprilia Afwika, Nida Jarmita, and Zikra Hayati (Journal)

2. Peer Tutor Model Implementation Data Analysis

a. Class Pre-test and Post-test Data Experiment

Table 2. Class Pre-test and Post-test Conversion Scores Experiment

Student Code	Pre-test score (conversion)	Post-test score (conversion)
NU	45,815	62,086
NM	41,072	59,524
NA	25,956	42,163
SK	39,910	62,086
MF	38,389	40,158
BK	33,199	48,571
KS	33,199	46,092
RF	20,000	31,776
NY	38,495	62,086
RG	33,199	45,519
M N	20,000	42,415
A.F.	22,314	49,271
GB	40,202	62,086
FQ	36,818	55,091
HA	20,000	35,554
FR	42,084	62,086
SM	35,364	54,817
AH	33,199	53,858
M	36,450	50,862
MY	27,889	53,131
US	27,114	47,588
MI	33,199	41,116
DA	46,759	62,086
FI	20,000	38,580
MF	20,000	40,552

Source Data: Research Results

b. Class Pre-test and Post-test Data Control

Table 3. Class Pre-test and Post-test Conversion Scores Control

Student Code	Pre-test Score (conversion)	Post-test score (conversion)
NM	34,110	29,989
A.F.	33,557	35,180
AG	28,768	28,207
DH	36,589	36,196
KS	45,224	54,300
ML	44,737	44,535
NH	28,768	29,989

Source Data: Research Results

c. Data analysis

Based on the data obtained in this study, the next step was to analyze the data using prerequisite tests and a t-test.

1) Normality Test

Normality Test Results

		Shapiro Wilk		
	class	Statistics	df	Sig.
The ability to solve mathematical word problems	class pre-test experiment	.922	25	.058
	post- class test experiment	.928	25	.078
	class pre-test control	.873	7	.198
	post-test class control	.866	7	.173

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Based on Tables 2, 3, and 4, it can be seen that the pre-test and post-test data on students' ability to solve mathematical word problems in both the experimental and control classes are normally distributed, as the significance values are greater than 0.05. Therefore, it can be concluded that the data in this study are normally distributed.

2) Pre-test Homogeneity Test

Table 5. Results of the Pre-test Homogeneity Test

Test of Homogeneity of Variance

		Levene Statistics	df1	df2	Sig.
The ability to solve mathematical word problems	Based on Mean	.876	1	30	. 357
	Based on Median	.751	1	30	.393
	Based on Median and with adjusted df	.751	1	29,827	.393
	Based on trimmed mean	.933	1	30	.342

Based on Table 5, it can be seen that the significance value (Sig.) is 0.357. Since 0.357 > 0.05, it can be concluded that the pre-test data from the experimental and control classes come from populations with equal variances (homogeneous).

3) Post-test Homogeneity Test

Table 6. Results of the Post-test Homogeneity Test

Test of Homogeneity of Variance

		Levene Statistics	df1	df2	Sig.
The ability to solve mathematical word problems	Based on Mean	.175	1	30	.679
	Based on Median	.344	1	30	.562
	Based on Median and with adjusted df	.344	1	28.108	.562
	Based on trimmed mean	.266	1	30	.610

Based on Table 6, it can be seen that the significance value (Sig.) is 0.679. Since 0.679 > 0.05, it can be concluded that the post-test data from the experimental and control classes come from populations with equal variances (homogeneous).

4) t-test

Table 7. Results of the Independent Sample t-test on the class post-test data experiments and classes control

Independent Samples Test

		Levene's Test for Equality of Variances		t-te st for Equality of Means						
									% Confidence Interval of Diffe re nce	
		F	Sig.	t	df	Sig. (2-taile d)	Me an Diffe re nce	Std. E rror Diffe re nce	Lowe r	Uppe r
The ability to solve mathematical word problems	Equal variances assumed	.175	.679	3.232	30	**.003**	13.052446	4.038838	4.804037	21.300854
	Equal variances assumed			3.231	9,638	.009	13.052446	4.039807	4.005190	22.099701

Source Data : SPSS For Windows 26

Based on Table 7, it can be seen that the significance value (2-tailed) is 0.003. Since 0.003 < 0.05, it can be concluded that H_a is accepted and H_0 is rejected. This means that the peer tutoring model has a significant effect on the ability of Grade V students to solve mathematical word problems.

D. Conclusion

The implementation of the peer tutoring model by the researcher for the Grade V students at Ujong Kuta Elementary School was carried out effectively. This is supported by the results of the study, which examined the effect of implementing the peer tutoring model on students' ability to solve mathematical word problems. The following conclusion was obtained: Based on the results of the hypothesis test, the significance value (2-tailed) was 0.003. Since 0.003 < 0.05, it can be concluded that H_a is accepted and H_0 is rejected. This means that the peer tutoring model has a significant influence on the mathematical word problem-solving ability of Grade V students.

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