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The Effect of Modeling Learning on Early Grade Numeracy Learning in Public Primary Schools in Banguntapan Sub-District

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ABSTRACT: The purpose of this study was to determine the effect of modeling learning on the counting ability of early grade students in the District Public Elementary School P. The type of research conducted was quantitative quasi experiment. The research was conducted by involving two groups of classes, namely the experimental group and the control group. The research population included all early grade elementary school students in the District P area. The research sampling technique used was purposive sampling technique. Data were collected through two main techniques, namely counting tests through pre-test and post-test, and observation. Data analysis used descriptive statistical techniques and Paired t-test. The results of the Paired t-test test for modeling learning have an effect on early grade counting learning with a statistical calculation of t count (3.76) > t table (1.68). The conclusion of this research is that modeling learning can significantly improve learning outcomes in arithmetic learning for early grade elementary school students.

KEYWORDS: Modeling Learning, Counting Skills, Elementary School

INTRODUCTION

Learning in the early grades of primary school is a crucial phase in building a foundation of basic knowledge and skills for students. One of the essential competencies taught is numeracy, which forms the basis for learning further mathematical concepts. Numeracy learning in the early grades plays an important role in building a solid foundation for more complex mathematical understanding in the future. However, many students in the early grades often face difficulties in understanding basic numeracy concepts, which can have a negative impact on their subsequent academic development (Fuchs et al., 2018). To address this problem, various learning strategies have been proposed, one of which is modeling learning.

Modeling involves direct demonstration by the teacher or the use of visual aids to explain abstract concepts. This strategy allows students to see the thought processes and steps involved in problem solving, so that they can internalize and apply these strategies independently (Clarke, 2020). Research shows that the use of modeling in mathematics learning can significantly improve students' conceptual understanding and numeracy skills (Hattie & Donoghue, 2016).

According to Ramani and Siegler (2018), students who learn through modeling tend to have better critical thinking skills and more confidence in dealing with mathematical problems. This is supported by Boaler's (2019) findings showing that the modeling approach helps students develop a deeper understanding of mathematical concepts compared to traditional methods.

Fuchs and Fuchs (2019) suggested that modeling helps reduce mathematics anxiety often experienced by students in the early grades. Their research found that students who engaged in modeling learning showed lower levels of anxiety and better performance in mathematics tests. This is in line with the view of Maloney et al. (2020) who stated that modeling can serve as a tool to increase students' motivation and interest in mathematics. Research results from Woodward (2020) also show that modeling learning can help students understand the relationships between different mathematical concepts, which in turn can improve their problem-solving abilities. This opinion is in line with research by Zimmerman and Schunk (2018), who found that modeling can strengthen students' metacognitive skills, helping them become more independent and reflective learners.

Maryati and Purwanto (2020) stated that modeling can help students overcome mathematics learning difficulties, especially in understanding abstract concepts. They found that the use of visual aids and live demonstrations can make mathematical concepts more concrete and easily understood by students. The use of modeling in mathematics learning in elementary schools can significantly improve students' concept understanding and numeracy skills (Suherman, 2019).

According to Zulkardi (2020), the use of modeling in mathematics learning in Indonesia has proven effective in improving students' conceptual understanding. Zulkardi also emphasized the importance of teacher training to improve the quality of modeling learning. Novianti and Wulandari (2019) found that the implementation of modeling learning in elementary schools not only improved students' numeracy skills, but also increased their learning motivation. This research shows that students become more active and enthusiastic in participating in mathematics learning when modeling strategies are applied. The use of technology in modeling learning can improve students' mathematics learning outcomes in Indonesia. Technology integration is essential to support more interactive and interesting learning for students (Wahyudin, 2020).

However, implementing modeling learning is not always easy. According to Clarke and Hollingsworth (2019), teachers often face challenges in designing and implementing effective learning activities and in measuring the impact of these strategies. In addition, Clements and Sarama (2018) mentioned that the lack of training and resources for teachers can hinder the effectiveness of modeling in mathematics teaching. Without adequate training, teachers may struggle to utilize modeling as an effective learning tool. This training should include different modeling techniques, how to use visual aids, as well as strategies for measuring learning impact,

Herman and Anggraini (2019) also emphasize that support from schools and supportive education policies are needed to overcome this challenge. If schools provide adequate support, such as time for planning and collaboration between teachers, the implementation of modeling in learning becomes more effective. In addition, the use of technology can also be a solution to overcome some of these challenges. Technology can provide more diverse and engaging visual aids and allow teachers to save and repeat effective demonstrations. However, they also noted that access to and skills in using technology are still an obstacle in many schools, especially in remote areas (Wulandari, 2020).

Gersten et al. (2019) found that administrative support and collaboration between teachers are critical to the successful implementation of modeling learning. They also emphasized the importance of continuous assessment to assess student progress and adjust learning strategies as needed. This finding is supported by research results from LeFevre et al. (2019) who showed that a collaborative approach in mathematics teaching can increase the effectiveness of modeling.

This study aims to explore the effect of modeling learning on the numeracy skills of early grade students in Sekolah Dasar Negeri sub-district P. This research will examine how the application of modeling strategies can improve students' understanding and numeracy skills, as well as identify factors that influence the effectiveness of such learning. Thus, it is expected that the results of this study can make an important contribution to the development of more effective learning practices in primary schools.

RESEARCH METHODS

This study adopted a quasi-experimental research type with a pretest-posttest group design to test the effectiveness of modeling learning in improving the counting skills of early grade students at the Public Elementary School of Kecamatan P. The research was conducted by involving two class groups, namely the experimental group that received learning using the modeling method, and the control group that received conventional learning. Based on the research design, the research population included all early grade students at the Kecamatan P Public Elementary School. The research sample was selected using purposive sampling technique with criteria including early grade students who were willing to be the experimental and control classes, as well as students who did not have significant learning barriers and had parental consent to participate in the research.

The main instrument used was a numeracy test, which was designed to measure students' ability in numeracy, including addition, subtraction, multiplication and division. Before use, the test was validated by mathematicians and pilot-tested to ensure its validity. Data were collected through two main techniques: arithmetic tests conducted before and after the learning treatment, as well as observations during the learning process in the experimental and control classes. Data analysis used descriptive statistical techniques to describe student characteristics, numeracy test results, and student learning activities. In addition, inferential analysis was conducted using t-test to compare the difference in learning outcomes between the two groups before and after the learning treatment. By using this approach, this research is expected to be able to provide a deeper understanding of the effectiveness of modeling learning in improving the counting skills of early grade students at Banguntapan State Elementary School, Banguntapan Subdistrict, Bantul.

RESULTS AND DISCUSSION

Results

Data from students' post-test and pre-test results

The first result of the pretest data analysis is used to determine the initial data on the initial state of problem solving ability in numeracy learning in the initial class conducted by the research. The data used is the value derived from giving pretest questions. The question is from a question that is already valid. This initial data analysis uses normality test and homogeneity test.

Second, data analysis is obtained from the post-test scores given by students according to the problem solving ability indicators. After the initial class is given material and adapted to modeling learning according to the treatment. This data analysis uses normality test and homogeneity test.

Table 1. Average results of pre-test and post-test in the initial class

Description	Experiment		Control	
	Pre-test	Post-tets	Pre-tets	Post-test
Number of Learners	26	26	26	26
Nilai Maximum	65	100	70	85
Nilai Minimum	40	75	35	55
Mean	47.65	87.75	45.50	75.50
Completeness	0%	95.33%	12.35%	87.45%

Based on the table data above, the average value of the pre-test results in the initial experimental class was 47.65 and the control class for 45.50. While the average value of the post-test results in the experimental initial class was 87.75 and for the control class was 75.50.

Data on the results of student learning activities

Table 2 Results of Student Learning Activity Questionnaire

Table 2. Hasil Angket Aktivitas Belajar Peserta Didik

Description	Experiment	Control
N	26	26
Mean	23.35	16.65
Skor maxsimum	5	4
Skor minimum	1	1
Criteria	Active	Less active

Based on the table above, it can be seen that the average activity of the experimental class was in the active category when using the modeling learning method, so it can be concluded that students responded positively to the learning method used. Furthermore, it can be seen that the average activity of the control class is in the less active category. So it can be concluded that the experimental class that uses the modeling learning method has a higher category than the control class that does not use the modeling learning method.

Prerequisite analysis data

1) Normality test

Student pretest data

Table 3. Normality Test of Pretest and Post-test

Description	Class	Sig.	Conclusion
Pre-test	Eksperimen	0.211	Normal
	Kontrol	0.078	Normal
Post-test	Eksperimen	0.188	Normal
	Kontrol	0.191	Normal

Based on the results of the calculation of the normality test of the Pretest and Post-test of students, it shows that the significance value of the data in table 3> the specified significant level (0.05), so it can be concluded that the data obtained is distributed data.

2) Homegenity test

Table 4. Homogeneity test of Student Pre-test Data

Homogeneity Test	Sig.
Based on Mean	0.387

The test uses the Levene test, with the information that if the significance value of Based on Mean> significant level (0.05), then the data is homogeneous (has the same variance). Conversely, if the significance of Based on Mean < the significant level (0.05) then the data is not homogeneous (does not have the same variance). looking at table 4, the data obtained in the study is homogeneous.

3) Balance Test

The balance test is carried out to see the two groups have the same condition before treatment. The balance test was calculated using the independent sample Paired t-test. The balance test results are as follows:

Table 5. Two Group Balance Test

Item	Experiment	Control
S^2	121.765	115.652
Mean	47.65	45.50
Calculation		
Sp2	1142.376	
Sp	38.635	
T count	-0.684	
T table (0.025, 26)	2.056	

Based on the table above, t count (-0.684) < t table (2.056), it can be concluded that the two groups have the same ability before the research action.

4) Hypothesis testing

After it is known that the data from the pretest and posttest results of students are normally distributed and homogeneous, then the two classes are tested for differences in student math learning outcomes in accordance with the predetermined hypothesis using parametric statistics, namely the Paired t-Test test. The table in determining the t-test is as follows:

Student pretest and posttest data

Table 6. Paired t-Test Test Results

Class	N	T count	T_{table}	Conclusion
Experiment	26	3,76	1.68	H_a Accepted
Control	26			

Based on the results of the calculation of the statistical test of students' pretest and posttest data using the t-test formula, it shows that t count (3.76) > t table (1.68) in accordance with the t-test testing criteria and the t table shown in the t table with a significant level of 5%, Ha is accepted.

DISCUSSION

The results showed that the application of the Modeling learning method significantly improved students' numeracy learning achievement in the early grades of elementary school. The increase in the average post-test score in the experimental group shows that this method is effective in helping students understand basic counting concepts. The Modeling method allows students to see and follow concrete examples, which is very helpful in learning basic math concepts.

Based on the post-test results in table 3 above, it can be seen that the results of students' arithmetic learning achievement in the early elementary school class using the Modeling the Way learning method with the average score result is 87.75 with the highest and lowest scores are 100 and 75 and classical completeness is 95.33%. While the class taught using other learning models obtained an average score of 75.50 with the highest and lowest scores being 85 and 55 and classical completeness was 87.45%. The average score on student activity for the experimental class was 23.35 with the highest and lowest scores being 5 and 1. Meanwhile, the control class obtained an average score of 16.65 and the highest and lowest scores were 4 and 1.

Based on the results of these calculations, the pretest and post-test difference data entered into the t test formula obtained the value of tcount = 3.76 and t table = 1.68 at a significant level of 5%. Because t count> t table, so it can be said that students taught with the Modeling the Way method have more influence on the results of counting in early elementary school classes.

Based on the discussion above, it shows that the Modeling the Way learning method has an effect on early grade arithmetic learning. And when compared to when using other methods, students' numeracy learning outcomes are more

influential using modeling the Way. This is because using the Modeling the Way learning method each student is required to understand the concept or material presented. In this learning method, students are invited to play a rotating role to make questions about counting until they get the correct answer. Here it will be seen that the student's ability to absorb the material presented. With the application of this method, the atmosphere in learning is not tense because students are actively involved directly, then it will attract student attention. Thus, based on the discussion above, the Modeling the Way learning method has an effect on early grade counting skills.

CONCLUSION

Based on the results of the research that has been carried out, this study shows that the Modeling learning method significantly improves the learning outcomes of early grade elementary school students. This is evidenced by an increase in the average post-test score in the experimental group using the Modeling method. The average post-test score in the experimental class (87.75) was higher than the control class (75.50). In addition, the T-test results strengthen the hypothesis that students who are taught with the Modeling the Way method have more influence on the numeracy results of early elementary school classes. The Modeling method is effective to use for several reasons: 1) it helps students in understanding the basic concept of counting through concrete examples, 2) it involves students actively in the learning process, 3) it creates a learning atmosphere that is not stressful and interesting.

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