Effectiveness of Demonstration Learning Model on Understanding the Concept of Mathematical Operations on Whole Numbers

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Abstract
Understanding the concept of mathematical operations on whole numbers is one of the obstacles for students in learning mathematics. This study aims to determine the effectiveness of the application of the demonstration learning model on understanding the concept of mathematical operations on whole numbers. The type of research is quantitative. The research sample was 65 fifth grade students of public elementary schools in Selogiri sub-district. Data collection techniques through a description test that has been tested for validity, reliability, and differentiating power. Data analysis was carried out using simple linear regression techniques and t-test. The validity test results have a calculated r value of 0.691> r table 0.2816, so it can be said to be valid; the reliability test has a *Cronbach's Alpha* value> 0.60, namely 0.725, so it can be said to be valid; the differentiating power test has 2 easy, 5 medium and 3 difficult questions. The results of data analysis provide a correlation value (R) = 0.692; the *coefficient of determination* R *Square* = 0.775; for a significant value of 0.00 <0.05 get a t value of 2.881> t table 1.669 which means accepting the alternative hypothesis. The conclusion of the research is that the application of the demonstration learning model is effective on understanding the concept of mathematical operations on whole numbers, with an influence contribution of 77.5%.
Keywords: Learning, demonstration, math operation concepts, whole numbers.

Abstrak
Pemahaman konsep operasi matematika pada bilangan bulat merupakan salah satu kendala bagi peserta didik dalam pembelajaran matematika. Penelitian ini bertujuan untuk mengetahui efektivitas penerapan model pembelajaran demonstrasi terhadap pemahaman konsep operasi matematika pada bilangan bulat. Jenis penelitiannya adalah kuantitatif. Sampel penelitian sebanyak 65 peserta didik kelas V sekolah dasar Negeri di kecamatan Selogiri. Teknik pengumpulan data melalui tes uraian yang telah teruji validitas, reliabiltas, dan daya pembedanya. Analisis data dilakukan dengan menggunakan teknik regresi linier sederhana dan uji-t. Hasil uji validitas memiliki nilai r hitung 0,691 > r table 0,2816 maka dapat dikatakan valid; uji reliabilitas memiliki nilai *Cronbach's Alpha* > 0,60 yaitu 0,725 maka dapat dikatakan valid; uji daya pembeda memiliki materi soal 2 mudah, sedang 5 dan sukar 3. Hasil analisis data memberikan nilai korelasi (R) = 0.692; *koefisien determinasi* R *Square* = 0,775; untuk nilai signifikan sebesar 0.00 < 0,05 mendapatkan nilai t hitung 2,881 > t tabel 1,669 yang artinya menerima hipotesis alternatif. Kesimpulan penelitan adalah penerapan model pembelajaran demonstrasi efektif terhadap pemahaman konsep operasi matematika pada bilangan bulat, dengan kontribusi pengaruh sebesar 77,5%.
Kata kunci: Pembelajaran, demonstrasi, konsep operasi matematika, bilangan bulat.

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INTRODUCTION

Learning in elementary schools needs to pay attention to the learning style and empirical experience that students have. Piaget's learning theory provides an understanding that the characteristics of elementary school students, namely: in learning are still in the concrete operational stage, like to play, and like to be in groups. From this learning theory, learning should choose a model that is able to utilize the experience and potential of students.

Learning (learning and teaching) is a communication process between teachers (Wardani, 2019). As communicants in the learning process are students while the communicators are teachers and students. If a group of students become communicators to other students and the teacher as a facilitator, there will be a process of interaction with high learning. This is in line with the opinion of Azis (2019) that learning is an interaction between educators and students in a learning environment. Learning is an effort made by educators or other adults to help students in the learning process, so that they can achieve optimal learning outcomes (Indrianie, 2015). Based on the opinions of the experts above, it can be concluded that learning is a process of interaction between educators and students in a learning environment where students are communicators and educators are communicators.

According to Sanjaya (in Fitrah, 2017) argues that concept understanding is the understanding of students in the form of mastery of some subject matter, but not only remembering a number of existing concepts, students are also able to explain back into other forms and apply them to concepts that match the cognitive thinking of these students. Understanding concepts is the foundation for mastering principles and theories, so students need to understand the concepts that make up these principles and theories first. Therefore, it is very important for students to master mathematical concepts, because not understanding this can have a fatal impact (Diana *et al.*, 2020).

Understanding mathematical concepts is important in learning mathematics, because understanding concepts will make it easier for students to apply these concepts in everyday life and make it easier for students to solve problems given by the teacher (Meidianti *et al.*, 2022). Concept understanding is a fundamental skill in mathematics. This ability is an important foundation for students in their efforts to think critically and solve problems, both in the context of mathematics and in everyday life (Kesumawati in Ningsih, 2016). The concept of mathematical operations is the basic ideas of how numbers are manipulated through various actions such as addition, subtraction, multiplication and division (Mulyono, 2018). Based on the opinions of the experts above, it can be synthesized that understanding mathematical concepts is the mastery of students in learning mathematics which students can apply in everyday life to solve problems given by the teacher in the form of addition, subtraction, multiplication and division.

Integers are non-fractional numbers consisting of positive integers, zero numbers and negative integers, while in terms of operations, integer operations consist of addition operations, subtraction operations, multiplication operations and division operations (Yanala *et al.*, 2021). Tristanti *et al.,* (2021) argued that integers are a collection of numbers that include negative numbers, zero, and positive numbers {..., -2, -1, 0, 1, 2, ...}. In everyday life, integers are used for various things, such as calculating the amount of money, buying and selling transactions, birth dates, determining age, and others. In addition, the concept of integers also has a relationship with other materials, both in mathematics and other sciences. According to Eliana (2016), introducing the concept of whole number counting operations is done in 3 stages. In the first stage, there are 2 models of demonstration that can be developed, namely using the set approach (using props of beads), while the second model uses the length law approach (using number line blocks or number line ribbons or number line ladders). In the second stage, the

process of working on arithmetic operations is directed using a number line and in the third stage students are introduced to the concepts of abstract arithmetic operations.

From the results of the research obtained data, students in learning to understand counting operations, tend to use memorization. For example, in problems that use two adjacent symbols, such as? Then it will be memorized into a problem. This condition makes students only focus on changing math symbols without understanding the meaning. Here, the learning model set by the teacher should be able to provide understanding to students to be able to reveal this meaning.

Learning carried out at school, there are many kinds of learning models that can be applied, one of which is the demonstration learning model. The demonstration model is the presentation of lessons by demonstrating or showing students about a process, a situation of certain objects, either actually or just an imitation (Aprinawati, 2017). According to Muhibbin (Shoimin, 2014) suggests that the demonstration model is a teaching model by demonstrating goods, events, rules and sequences of doing an activity, either directly or using lesson media relevant to the subject matter being presented. Hamalik in (Maufur, 2016: 243) suggests that the use of learning media in the teaching and learning process can arouse new desires and interests, arouse motivation and stimulation of learning activities and even have a psychological influence on students which also affects their learning outcomes. This is in line with Risnayati's (2021) opinion that the demonstration model is a format of teaching-learning interaction that deliberately demonstrates or demonstrates actions, processes, or procedures carried out by teachers or other people to all students or some students.

According to Mulyati (2021), explains that the advantages of the demonstration model are that students' activeness and experience will increase, the lessons given are more durable, reduce errors, and questions or problems in students can be answered when students observe the demonstration process. The weaknesses of the demonstration model are that it can be considered an unnatural model if the props used are incomplete or the exposure is not clear, the demonstration learning model will not be effective if the time used is not possible for students to practice material in mathematics (Widianingsih, 2020).

Based on the description above, the research can formulate a problem formulation, namely: is the application of the demonstration learning model effective for understanding the concept of mathematical operations on whole numbers? The purpose of this study was to determine the effectiveness of the application of the demonstration learning model on understanding the concept of mathematical operations on whole numbers.

METHODS

This research uses a type of quantitative research with a true experimental method. According to Punch (2013) quantitative research is empirical research where the data is in the form of something that can be calculated. Quantitative research pays attention to data collection and analysis in numerical form. The population in this study were all fifth grade students of public elementary schools in Selogiri sub-district. The sampling technique uses *random sampling* technique or random. The results of sampling obtained as many as 65 students of class V of State elementary schools in Selogiri sub-district. The data collection technique is a description test that has been tested for validity, reliability, level of size, and differentiating power. Data analysis using simple linear regression techniques and hypothesis testing with Independent Sample t-test to see the effectiveness of the application of the demonstration learning model on understanding the concept of mathematical operations on whole numbers.

RESULTS AND DISCUSSION

Research Results

The data obtained in the field is processed according to the needs of supporting research. The processing stages, namely:

Descriptive Statistical Test

Descriptive statistical analysis aims to provide an overall description of the data used in the study, by paying attention to the average value, standard deviation, variance, maximum value, minimum value and total. The results of the descriptive statistical test can be seen in the following table

Table 1. Table Of Descriptive Statistical Test Results

Paired Samples Statistics

		Mean	N	Minimum	Maximum	Std. Deviation	Std. Error Mean
Math Test	*Pretest*	58.78	65	42	81	11,345	2,567
	Posttest	80.56	65	67	98	10,986	2,248

Table 1, shows that the average pretest score of the experimental class is known to be different from the average posttest score. The average pretest score was 58.78 and the average posttest score was 80.56. The average score of the experimental class increased by 21.78 Thus it can be concluded that the demonstration learning model has had a positive impact on the learning process in elementary schools.

Results of Validity, Reliability, and Bed Power

To test the validity of each item of descriptive test material, it is done by comparing r count with r table. Where if r count> r table then it can be said that a statement item is declared valid. vice versa if if r count < r table then a statement item is declared invalid. In this study, r count 0.691 and r table 0.2816, where r count is more than r table and can be said to be valid.

Reliability test is used to determine whether the description test material used is reliable or reliable as a measuring tool. The credibility of a questionnaire can be seen from the Cronbach's Alpha value, where if the Cronbach's Alpha value> 0.60 then the questionnaire can be said to be reliable, but if the Cronbach's Alpha value <0.60 then the questionnaire is considered unreliable. In this study Cronbach`s alpha> 0.725 so it can be said to be reliable

Differentiating power is the ability of the item to be able to distinguish between participants who have mastered the material being asked and participants who are less or have not mastered the material being asked. In this study, the composition of the question material is 2 easy, 5 medium and 3 difficult.

Simple Linear Regression Test

Based on the results of the SPSS output, it is known that the magnitude of the correlation value (r) between the independent variable of the demonstration learning model and the dependent variable of understanding the concept of mathematical operations on integers is 0.692. This can be interpreted that the value of the independent variable increases, it is likely that the value of the dependent variable will also increase or have a positive linear relationship between the two variables. The coefficient of determination R Square in this study obtained a value of 0.775. It can be interpreted that the demonstration learning model variable gives 77.5% influence on understanding the concept of mathematical operations on whole numbers.

Prerequisite Test t-tests

Normality test

Normality test is conducted to evaluate whether the sample comes from a normally distributed population or not. This study used the Shapiro-Wilk normality test because

the sample in this study was less than 100 (<100). The results of the normality test in this study can be seen in the following table:

Table 1. Normality Test

Tests of Normality						
	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistics	Df	Sig.	Statistics	df	Sig.
Pretest	,193	6	,200*	,953	6	,771
Posttest	,187	6	,200*	,959	6	,808

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

a. *Lilliefors Significance Correction*

Based on table 1, it is known that the Sig. value for the pretest is 0.771 and the Sig value for the posttest is 0.808. The Sig value of both tests is > 0.05 so it can be concluded that the samples come from a normally distributed population.

Homogeneity Test

Homogeneity test is a statistical method used to show that the variance of the sample comes from the same population (homogeneous). The results of the homogeneity test in this study can be seen in the following table.

Table 2. Homogeneity Test Results

Test of Homogeneity of Variance			
Levene Statistics	df1	df2	Sig.
3,316	1	3	0.074

Based on table 2, it can be concluded that the Significance value is greater than 0.05. (sig. 0.074 > 0.05). So it can be interpreted that the samples come from the same population (homogeneous).

Hypothesis testing

This study uses a paired sample t-test to see if there is a difference in mean values between two samples that are paired or related to each other. The results of this research homogeneity test can be seen in the following table.

Table 3. T-Test Result

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pretest-Posttest	-12,087	10,879	3,319	-20,134	-5,678	2,881	5	,000

Based on table 3, it is known that the two-way Significant value (2-tailed) is 0.00 < 0.05 and get the value of t count (2.881) > t table (1.669). So it is concluded that this study accepts the alternative hypothesis, besides that there is an average difference between the pretest and posttest results which means that there is an effect of the demonstration learning model on the concept of understanding mathematics on integers.

Discussion

The results showed that the demonstration learning model was effective on understanding the concept of mathematical operations on whole numbers. It can be seen that this model has an influence of 77.5%. The learning model has a big influence on students' understanding. This is because the more appropriate the learning model used, the easier it is for students to receive the material. In using this model educators can

become demonstrators. This model can arouse students' curiosity and visual stimulation. The demonstration model is a very effective teaching model to help students find answers to the questions given (Hakim, 2023).

The demonstration learning model has a positive impact on understanding the concept of mathematical operations on whole numbers. This can be seen in the average pretest score of 58.78 and the average posttest score of 80.56. The average score of the experimental class increased by 21.78. Ermawati (2019) explains that the demonstration model has a positive impact on student learning outcomes. With the demonstration method, students have the opportunity to develop the ability to observe all objects that are involved in the process and can draw the expected conclusions.

Understanding of mathematical concepts will be formed if the learning model used can link material with real experiences and contexts that are relevant to students. In addition, models that are interactive and encourage active participation of students in the learning process will also strengthen their understanding of the concepts taught. The learning model serves as a guide for educators in planning learning activities in the classroom, starting from the preparation of learning tools, media, and tools, to evaluation tools that aim to achieve learning objectives (Mirdad, 2020).

CONCLUSION

Based on the results of the study, it can be concluded that the demonstration learning model on understanding the concept of mathematical operations on whole numbers is effectively applied in learning. This conclusion is based on the results of the average pretest score of 58.78 and the average posttest score of 80.56. The average score of the experimental class increased by 21.78. In addition, supported by the results of statistical data analysis provides a correlation value (r) = 0.692; for a significant value of 0.00 <0.05 get the value of t count 2.881> t table 1.669 which means accepting the alternative hypothesis. The coefficient of determination R Square = 0.775, meaning that the application of the demonstration learning model is effective on understanding the concept of mathematical operations on whole numbers, with an influence contribution of 77.5%. This shows a positive impact after the application of the demonstration learning model.

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