

The Effect of Applying the Mentimeter Media Assisted Problem Based Learning Model on Mathematics Learning Outcomes in Data Presentation Materials

Layli Putri Arfianti Harahap¹, Yuli Mulyawati², Elly Sukmanasa^{3*}

Elementary School Teacher Education Department, Pakuan University, Bogor.

*(Layli Putri Arfianti hope)

✉ layliputri18@gmail.com¹

Abstract : *this study aims to determine the effect of the problem based learning models with the aid of the minutes on the mathematics learning outcomes of data presentation materials . The type of research used is a quasi-experimental design using a nonequivalent control group design . this research was conducted at the Lawanggintung 1 State Elementary School , Bogor City, Class VA, and VB as the experimental class and the control class . The data from this study were analyzed using microsoft excel 2021. Data collection to obtain student learning outcomes tests was obtained using pretest and post test . The data analysis technique in this study used the t- test . based on the results of data analysis from hypothesis testing using the t- test , it was obtained $t_{count} = 4.29258$, while t_{table} at a significant level $/2 = 0.025$ of 2.00324 , then obtained $t_{count} > t_{table}$ that is $4.29258 > 2.00324$ so H_a is accepted or H_0 is rejected . Thus , there is an effect of the problem based learning model on the mathematics learning outcomes of the fifth grade students of SDN Lawanggintung 1.*

Keyword : *Problem Based Learning , Minutes , Learning Outcomes .*

PRELIMINARY

Learning outcomes can be influenced by the learning process. In the learning process it is said to be successful if students achieve the expected competencies, because it reflects the students' ability to master a material. Learning outcomes become a reference whether the learning objectives have been achieved optimally or not. The purpose of education is not spared by the learning process in the classroom, with good learning for students and schools, educational goals will be achieved.

Mathematics is learning that is considered the most difficult and the most avoided or feared by students, for this reason appropriate learning models and media are needed so that students' thinking about mathematics can be changed. One of the materials taught in elementary schools is data presentation. This material is further divided into several sub-materials, one of which is presenting data. This material requires students to first understand the concept of statistics, then understand the problems associated with presenting data. If students do not understand statistical concepts, students will have difficulty solving problems related to this material.

Understanding related to the presentation of data is important for students to instill so that the application of these concepts in an effort to solve problems in everyday life can be used appropriately. But in reality, in the implementation of learning the material in class there are still problems that occur. One of these problems is that students have difficulty understanding and solving the questions given. Students' lack of understanding of the concept of presenting data can be fatal in working on more complex questions, such as material about problems in presenting data. This is because the material is a prerequisite for other materials.

Based on the results of observations made on class V teachers at Lawanggintung 1 Public Elementary School, Bogor City, the researchers found low student learning outcomes such as in mathematics in class V Lawanggintung 1 State Elementary School, Lawanggintung Village , South Bogor District, Bogor City. In this school there are 58 students consisting of 29 students in class VA, and 29 students in class VB, based on information it can be seen that the learning outcomes of students still have not reached the Minimum Completeness Criteria (KKM), of the 58 students who take the Daily Examination only 17 students (class VA) and 14 students (class VB) who can achieve KKM (complete).

The problems that occur in learning activities are in the use of learning models and media used by teachers that are not yet effective and have not fostered democratic learning, so innovation is needed in learning by applying learning models that can foster learning motivation and students get maximum learning outcomes, especially in math subject. The use of learning media must be effective and efficient which can make learning more interesting and liked by students. The classroom atmosphere needs to be planned using appropriate learning models and media so that students can get the opportunity to interact with each other so that optimal learning results can be obtained as expected. Efforts that can be made to improve the quality of learning in data presentation material are to involve students becoming more active by using the application of problem based models learning assisted by mentimeter media is expected to improve student learning outcomes in mathematics subject material for presenting data in class V semester 2.

METHOD

This research is a quantitative research. The research method used is an experimental method with a quasi - experimental research design , namely a research design that has a control group, but cannot fully function to control external variables that affect the implementation of the experiment, Sugiyono (2017: 114).

The research method used by researchers in this study is a quasi experiment . The chosen quasi - experimental research design was the pretest-posttest comparison group design in pairs with the control group.

Table 1. Randomized Subjects Pretest-Posttest Design Group Control

Class/Group	Pretest (Treatment)	Treatment	Post test
Experiment (KE)	O ₁	X	O ₂
Control (KK)	O ₁	-	O ₂

quasi - experimental research design required two classes, namely the experimental class and the control class. Both of these classes were given an initial test (*pretest*) with the same test. Then the two classes were given different treatment. Furthermore, the researcher will give another test for both classes as a final test (*posttest*). This research was conducted at Lawanggintang 1 Public Elementary School , Bogor City. The research was conducted in VA and VB classes, even semester of the 2021/2022 school year in April 2022.

The collection technique used in this research is using pretest and posttest . The data collection tool used in this test technique is a test in the form of multiple choice questions of 40 questions. The data analysis technique used in this study was scoring the pretest and posttest to measure students' cognitive abilities, calculating the normalized N-Gain score. To analyze the pretest and posttest learning outcomes data according to Meltzer quoted by the PGSD Lecturer Team (2021: 78) mentions by comparing pretest and posttest scores with the N-Gain formula, as below :

$$N - Gain = \frac{S_{posttest} - S_{pretest}}{S_{maksimal} - S_{pretest}}$$

Image 1.

The N-Gain Formula

Calculating the average score (mean) and standard deviation (SD) is as follows

Average (mean) :

$$Mean = \bar{x} + \frac{\sum fi \cdot xi}{n (fi)}$$

Figure 2.

Formula Means

Perform prerequisite tests with normality and homogeneity tests. test for normality with the *Liliefors* test . The normality test with the *Liliefors test* is carried out if the data is single or single frequency data, not group frequency distribution data. The normality test uses the *liliefors* test (L_o) done with the following steps. (Hanief, 2017: 68) the normality test formula with the *Liliefors* test is as follows:

$$L_o = |F(Z_i) - S(Z_i)|$$

Figure 3.
Normality Test Formula with *Liliefors* Test

Homogeneity Test with Barlett Test Homogeneity test of variance, carried out with the aim of knowing whether the variances of two groups are the same or different. The variance homogeneity test has the test criteria $\chi^2_{count} < \chi^2$ then H_a is accepted and the data is homogeneous. Test the homogeneity of variance using the Barlett test, namely by calculating:

$$S_i^2 = \left(\sqrt{\frac{n \cdot \sum Y - (\sum Y)^2}{n(n-1)}} \right)^2$$

Figure 4.
Barlett's Test Formula

Research Hypothesis Testing. Hypothesis testing was carried out to determine differences in students' cognitive abilities in two different classes. The two mean difference test aims to determine the significance of the average score between the two classes. Hypothesis testing can be done after the data on student learning outcomes is declared to be normally distributed and homogeneous.

RESULTS AND DISCUSSION

The results of learning mathematics in the presentation of data are described based on the results of the *pretest* and *posttest* . the *pretest* was given to the experimental class and the control class before participating in the mathematics learning process. after the learning process was carried out, a *posttest* was carried out in the experimental class that received treatment and also in the control class which did not receive treatment. This *posttest* activity aims to measure the level of success of students after participating in learning on the mathematics content in class V. The next step is to compare the results of the *posttest* from the two classes.

Based on the data obtained before students get learning using the *problem based model learning* with the help of mentimeter media , can be seen through the following table

Table 2. Frequency Distribution of N-Gain Scores for Experimental Class Groups Through the Problem Based Model Learning

Interval Class	Class Boundary	Point (X_i)	f absolute (f_i)	$f_i . x_i$	f Relatif (%)
18-29	17.5-29.5	23	7	161	24.10%
30-41	29.5-41.5	35	8	280	27.60%
42-53	41.5-53.5	47	5	235	17.20%
54-65	53.5-65.5	59	2	118	6.90%
66-77	65.5-77.5	70	4	280	13.80%
78-89	77.5-89.5	83	3	249	10.30%
Amount			29	1,323	100 %

Based on the frequency distribution table above, the histogram graph of mathematics learning outcomes in the material for presenting data through a *problem based model learning* with the help of mentimeter media can be seen in Figure 5.

Based on the histogram, the results of learning mathematics in the material for presenting data through a *problem based model learning* with the help of mentimeter media in figure 1, there is a highest frequency of 8. Values at class limits are 29.5-41.5. After calculating descriptive statistics, an average N-Gain score of 73, Mode 33, Median 39 is obtained.

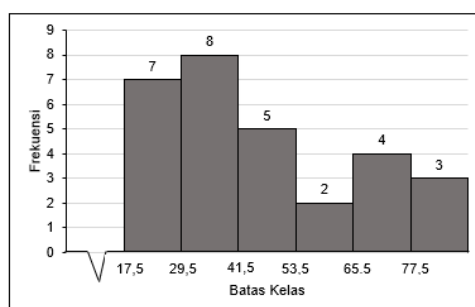


Figure 5. Histogram of Mathematics Learning Outcomes in Data Presentation Material Problem Based Model Learning Media Mentimeter Assisted

Based on the data obtained before students receive learning using the control class model, N-Gain is calculated so that a minimum value of 32 is obtained, the maximum value is 100, and the average N-Gain value is 60. The frequency distribution of the data can be seen in table 3 .

N-Gain Frequency Distribution for the Control Class Group

Interval Class	Class Boundary	Point (X_i)	f absolute (f_i)	$f_i \cdot x_i$	f Relatif (%)
13 – 24	12.5-24.5	18	5	90	17.2%
25 – 36	24.5-36.5	30	8	240	27.6%
37–48	36.5-48.5	42	3	126	10.3%
49–60	48.5-60.5	54	2	108	6.9%
61–72	60.5-72.5	66	10	660	34.5%
73 - 84	72.5-84.5	78	1	78	3.4%
Amount			29	1.302	100 %

graph of mathematics learning outcomes in the material for presenting data through the control model can be seen in Figure 4.2.

Based on the histogram of learning outcomes of data presentation material through the control learning model in Figure 4.2, there is a highest frequency of 10. Grades at class limits are 60.5–72.5. After calculating descriptive statistics, the average *N-Gain score* is 68, Mode 77, and Median 39.

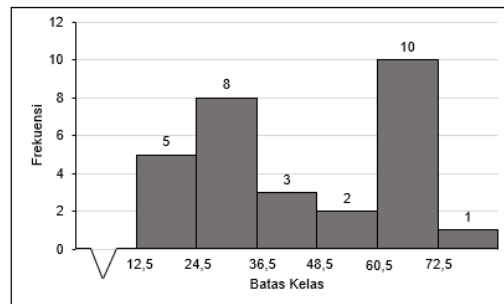


Figure 6. Histogram of Mathematics Learning Outcomes in Data Presentation Material through the Control Class Model

Based on data on the *pretest* average score, *posttest* average score, and *N-Gain* average score obtained by the *problem - based model class group learning* assisted by media meter and control class

it was seen that there were differences in the results in each class group. The differences in learning outcomes can be seen in table 4 and the histogram graph can be seen in figure 7 .

Table 4. Recapitulation of Differences in Mathematics Learning Outcomes Data Presentation Material with Experimental Class Group and Control Class

Group Class	N	Average Score (Mean)		Average Score (N-Gain)	Mastery Learning Outcomes (%)
		Pretest	Posttest		
Experiment	29	47	88	73	100%
Control	29	46	85	68	96%

Based on the average value recapitulation table above, the histogram graph of the value of learning data presentation material can be seen in Figure 7 .

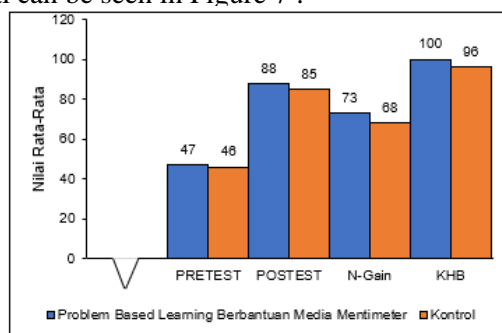


Figure 7. Histogram of Differences in Mathematics Learning Outcomes Data Presentation Material with Experimental Class Group and Control Group

According to the description above, it can be concluded that the results of learning mathematics in the material for presenting data using a *problem based model learning* assisted by media meter is better than the results of learning mathematics in the material for presenting data using a control class model. This is evident from the data tables and histograms above, there are differences in learning outcomes in mathematics in the matter of presenting data through *problem - based models learning* assisted by media meter and control class models.

Analysis of the research data was carried out by calculating the hypothesis test using the t test technique. Before conducting data analysis, a hypothesis prerequisite test was first carried out , namely carrying out normality and homogeneity tests.

Table 5. Normality Test (*Liliesfors Test*)

No.	Distribution Group Treatment	L count	L table	Conclusion
1	Study results mathematics on matter presentation of data through a <i>problem-</i>	0.1430	0.1645	Normal Distribution

	<i>based learning model</i> assisted by meter media			
2	Study results mathematics on matter presentation of data through class models control	0.1580	0.1645	Normal Distribution

Based on the normality test using the *Liliefors Test* in the experimental class using a *problem based model learning with the help of media meter* . Can be obtained L_{count} of 0.1430 This figure is compared with the L_{table} figure of 0.1645 with an error level of 5%. Then the distribution of experimental class data uses a *problem based model learning with the help of the media meter* is declared normal.

normality test in the control class with the application of the control class model, obtained L_{count} of 0.1580. This figure is compared with the L_{table} figure of 0.1645 and an error rate of 5%. Then the distribution of the control class data is declared normal.

Homogeneity test (*Barlett test or Fisher's Test*) . This homogeneity test was carried out to analyze mathematics learning outcomes in data presentation material which aims to determine whether the two sample population data have a homogeneous variance or not. Homogeneity test using *Fisher's test* . The criteria for testing the data are said to be homogeneous if $F_{is\ calculated} \leq F_{table}$. The following table shows the results of the homogeneity test in the *problem - based model class learning* assisted by media meter and control class.

Table 6. Homogeneity Test Results for Mathematics Learning Outcomes Instruments On Data Presentation Material

Variance Tested	Dk	F _{count}	F _{table}
<i>Problem Based Learning Assisted by Media Minutes</i>	28	1.029	1,882
Control	28		
Amount	56		

Based on a significant level of 5% ($\alpha = 0.05$) with $dk_1 = n_1 - 1$ and $dk_2 = n_2 - 1$. The decision-making criteria are: "If $F_{count} \geq F_{table}$ then it is not homogeneous and If $F_{count} \leq F_{table}$ then homogeneous. Obtained F_{count} of 1.029 and F_{table} of 1.882. So thus it can be concluded that $F_{count} \leq F_{table}$ so that it can be said that the variance distribution comes from a homogeneous group.

Testing the Research Hypothesis. After testing the prerequisites, two groups of normal and homogeneous distributions were obtained. The next test is hypothesis testing. This hypothesis testing is done to find out whether the null hypothesis (H_0) is accepted or rejected. Testing the hypothesis as follows.

H_0 : There is no effect of applying the *problem based model learning* media -assisted

minutes on results study mathematics on data presentation material.

H

H_a : There is an effect of applying the *problem based model learning* with the help of media meter on the results of learning mathematics in the material presentation of the data.

In carrying out the null hypothesis test (H_0) it is carried out using statistical techniques t test. Testing the null hypothesis (H_0) was carried out by calculating the average *N-Gain score* of mathematics learning outcomes on data presentation material between experimental class groups with the application of *problem - based models learning* minutemeter media rock and control class group with the application of the control class model.

In the next stage, testing was carried out with the t test at a significant level of 5% or 0.05, so the two-way test $\alpha/2 = 0.05/2 = 0.025$.

Based on the average value of *N-Gain class group problem based model learning* assisted by media meter and control model class groups, the data from the t test results are presented in table 7.

Average t test results *N-Gain class group problem based model learning* assisted by media meter and control class

Group Class	N	Dk	<i>N-Gain</i>	t- count	t- table
<i>Problem Based learning</i> assisted by media meter	29	56	73	4.29258	2.00324
Control	29		68		

From the calculation results obtained t - count of 4.29258 and dk (degrees of freedom) of 56, it is obtained t- table at a significant level $\alpha/2 = 0.025$ of 2.00324. As for testing the hypothesis using a two-way test, the test criteria are H_0 is rejected if $t_{-count} - 2.00324 > t_{-count} 2.00324$ The following is the curve for the rejection and acceptance of H_0 in the *problem - based model group learning* assisted by media meter and control.

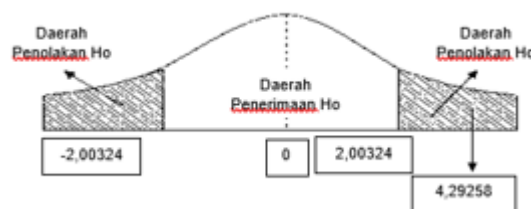


Figure 8 Rejection and Acceptance Curves of H_0 in the *problem based model class learning* assisted by media meter and control class group

$H_0 : \mu_0 = \mu_1$: Application of *problem - based models learning* with the help of media meter not to the results of learning mathematics in the material presentation of the data.

$H_a : \mu_1 \neq \mu_0$: Application of *problem - based models learning* help medi a minutemeter

effect on the results of learning mathematics in the material presentation of the data.

If t_{table} lies between -2.00324 and 2.00324 then H_0 is accepted, but if t_{count} does not lie between -2.00324 and 2.00324 then H_a is accepted. Obtained t_{count} 4.29258 and is not accepted between -2.00324 and 2.00324. So the results of the study are that H_0 is rejected and H_a (alternative hypothesis) is accepted. Therefore, there is $t_{count} > t_{table}$ ($4.29258 > 2.00324$), it can be concluded that there is an effect of applying the *problem based model learning* with the help of media meter on the results of learning mathematics in the material presentation of the data.

Discussion on the results of this study obtained an average score of the *N-Gain* results of learning mathematics in the matter of presenting data to the experimental class and also the control class. Based on the average *N-Gain* value, it can be seen that the average *N-Gain value* for the experimental class is a *problem based model learning* media -assisted mentimeter is 73 and the average *N-Gain value* of the control class with the control class model is 68. This proves that higher learning outcomes using the *problem - based model learning* assisted by media meter compared to the control class, meaning that there is influence from the use of *problem - based models learning* using the media meter that has been applied.

When the t test is performed the average *N-Gain value* in the experimental group and the control group is obtained $t_{count} > t_{table}$ that is $13.53898 > 2.00324$ with details of a two-way t test with dk (degrees of freedom) of 56 ($29+29-2$) and t_{table} at a significant level of $0.05/2 = 0.025$ of 2.00324. When compared $t_{count} > t_{table}$ (H_0 rejected) while $t_{count} > t_{table}$ (H_a accepted), and the result is $t_{count} > t_{table}$. Thus, there is an effect of using a *problem - based model learning* assisted by mentimeter media on mathematics learning outcomes in data presentation material, namely higher learning outcomes in the experimental class that uses *problem - based models learning* with the help of media meter.

This research activity has proven that there is influence on the use of various learning models and media such as the *problem - based model learning* and media measurement, because it can be seen from the learning outcomes that have increased higher than the control class model, of course there are several other factors that participate in increasing the value of this learning outcome, such as using the right learning model, using the right learning media, using various methods, teacher expertise in delivering material, as well as good classroom management.

Application of *problem - based models learning* assisted by media meter which turned out to be superior in increasing learning outcomes compared to the control class this happened because there were indeed advantages in the *problem based model learning* and millimeter media. This is because the model is *problem based learning* has advantages as expressed by Oktaviana (2020: 1078) stating that: 1) Can measure learning outcomes that are applied to the PBL model and does not measure problem solving abilities with the PBL model. 2) This model can also measure students' problem-solving abilities by focusing on subjects with a high level of abstractness. 3) Can know the increase in students' problem solving abilities with the PBL model. In addition, according to Hasyiyati, (2021)

suggests that meter media can increase student activity in class and has a positive effect for being used as a learning medium, with meter , students get more benefits from digital tools and directly interact with the material they are studying.

Through previous research conducted by Marinta (2018) showed that student learning outcomes were taught using the *problem - based model experimental group learning* assisted by media *magic addition machine* is higher than using the control group in class V students at SDN 04 Kaur in the mathematics lesson about arithmetic operations. Based on data analysis with the results of calculations using the t test, seen from the results of the Hypothesis Test, namely where t_{table} is determined first df or $db = (N1 + N2) - 2 = (24 + 24) - 2 = 48 - 2 = 46$. Based on the above calculation , if consulted with t_{table} df 50 at a significant level of 5%, namely 2.013. So $t_{count} > t_{table}$ ($4.412 > 2.013$) which means the working hypothesis (H_a) in this study is accepted, with the average (*mean*) *posttest* learning outcomes of the experimental class namely 81 and the learning outcomes *posttest* control class is 70 is in the medium category. So these results show that there is a significant difference in the results of learning mathematics between students who are taught through a *problem - based model learning* (PBL) assisted by media *magic addition machine* with students who are taught through a control class.

From the results obtained by researchers in this study, comparison with previous studies lies in the average *posttest results*, namely the *posttest scores* in the experimental class 88 and the value of the control class with an average of 85. Both comparisons are seen from the degrees of freedom (dk) where the researcher obtained the results of degrees of freedom (dk) 56 obtained t_{count} 4.29258 and t_{table} 2.00324. Thus the effect of applying the *problem based model learning* the aid of mentimeter media in this study was greater than in previous studies. In addition, from the previous research above shows that the model is *problem based learning* assisted by mentimeter media can have a better influence on the results of learning mathematics in the material for presenting data.

Based on observations , it shows that the learning process occurs using a *problem based model learning* the help of meter media is more fun in learning activities . The results of the responses given to students showed that there was an influence on students in the experimental class who obtained a very good average score. This can be seen when learning takes place students look active in the learning process.

SIMP U LAN

Based on the discussion of the research results that have been presented, it can be concluded that there is a positive influence from the *problem based model learning with the help* of mentimeter media on mathematics learning outcomes in data presentation material for students in class VA and VB of Lawanggintung 1 State Elementary School, Bogor City, Even Semester, 2021/2022 Academic Year. This can be seen from the average *N-Gain value* in the experimental group (VA) through the *problem based model learning* assisted by mentimeter media , which is 73, while the average value of *N-Gain* in the control group through the control class model is 60. In addition, the completeness of the learning

outcomes obtained in the experimental group is 100%, while in the control class group is 96%. hypothesis testing stated $t_{\text{count}} (4.29258) > t_{\text{table}} (2.00324)$ with DK 58 and a significance level of 5%, then in the two-way test $\alpha/2 = 0.05/2 = 0.025$. Then the null hypothesis (H_0) is rejected and the alternative hypothesis (H_a) is accepted.

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