A COMPARISON STUDY: EFFECT OF MATHEMATICS LEARNING WITH PROBLEM POSING AND PROBLEM SOLVING STRATEGY TO THE STUDENTS' LEARNING OUTCOMES OF PERSIAPAN SENIOR HIGH SCHOOL IN STABAT INDONESIA

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Abstract: *This research aims to know the influence of problem posing and problem solving learning strategy to the 1st grade students' learning outcomes of Persiapan Senior High School, Stabat in 2017/2018 and also to find out which one is the better one between problem solving and problem posing learning strategy to the Mathematics score of the students of Persiapan Senior High School in 2017/2018. Population in this research are the students of1st grade of social class that will be divided 2 classes amount 66 students. This research was conducted using arandom sampling which obtain 34 students of 1st grade social 1 class and 32 students of 1st grade of social 2 class.The research instrument uses a written test in essay questionnaire which containing 10 questions thattaken from the question bank. From the result of data analysis by using problem posing learning model obtained mean of data is 81.66 and the standard of deviation is 7.143. Meanwhile for the test of data by using problemsolving learning model obtained mean of data is 70.41 and the standard of deviation is 7.849. The research used liliefors test to know the normality of learning outcomes. The hypothesis testing was performed using Ancova test at α=0,05. From the data calculation hypothesis obtained Farithmetic >Ftable that is 39.15> 4.02 so Ho is rejected. Because of Ho isrejected, there is a significant difference in learning outcomes andit shows sig <0,05 is 0.000 < α =0,05 thus Ho is rejected. It is concluded that at 95% the number of confidence level it means there is influence of learning model to students' learning outcomes of Mathematics.*

Keywords: *Problem Posing, Problem Solving andLearning Outcomes*

INTRODUCTION

Education has an important role in life. According to Law on Indonesion RepublicNo. 20(Indonesia, 2003)education is a conscious and planned effort to create a learning environment and process so that learners actively develop their potential to have spiritual power, self-control, personality, intelligence, a noble character and skills needed by themselves, society, nation and country. A State said to be advanced, one of which can be seen from the level of quality and the quality of education in the country and how optimal human resources they have. Indonesia is one of the countries that pay enough attention to education. For the evident, from the application of the curriculum which from year by year experience changes and improvements.

One of educational study area that is often in the spotlight is Mathematics. Not a few who consider Mathematics is a difficult lesson and need extra understanding that makes students feel reluctant in learning Mathematics. Though Mathematics is one of the disciplines that have a characteristic when compared with other disciplines. The name Mathematics is The Queen of Science provides the understanding that Mathematics is the science that becomes the basis for the other science. Therefore, it should be given to all learners starting from elementary school level in order to equip them to be able to think critically, logically, analytically, systematically and creatively in facing a problem.

One of standards to know the level of success of learning Mathematics can be seen in the students' learning outcomes ofMathematics. Learning outcomesare the form of student achievements and one standard to know the level of students' understanding in learning. The learning outcomes are competencies or certain abilities bothcognitive,affective and psychomotor achievable or controlled learners after following the teaching and learning process. The result of learning Mathematics is very important because Mathematics is the basic science for other science. So that success in learning Mathematics can help students to be master onthe other science. In addition, the importance of Mathematics learning outcomes due to the mastery of Mathematics is very useful in everyday life(Kunandar, 2013).

From the results of interviews to the 1st grade Mathematics teacher at Persiapan Senior High School, Stabat on 16th October, 2017 obtained information that the students' learning outcome of 1st grade is low. The low level of students' learning outcomes in following the subjects Mathematics can be seen from some students who do not like Mathematics lessons. The low level of learning outcome is evident from the results of the Mathematicson the middle semester of each classes in the odd semester many who still have not reached the KKM. Sourced from the data obtained that of 66 existing students, who otherwise have completed only 23 students and who failed are 43 students.

TheMathematics learning outcomes that have not been according to expectations are influenced by several factors. Causation factors include the use of less innovative learning strategies and methods that are less varied also affect students' learning outcomes of Mathematics. Until now, not a few teachers who still apply conventional methods that make learning centered on teachers. This of course makes the student becomes less active and less developing his thinking ability.

One alternative strategy offered is the problemposingstrategy. (Shriki, 2013)concludes that through the problemposing strategy can increase students' reasoning and active student involvement in learning. Through problemposing learning strategy will encourage students to understand the problem by looking for relationships that then modify to change the given problem. Problem posing is a learning strategy that requires students to construct their own questions or break a question into simpler questions. It is expected that learning with problem posing strategy can increase students' motivation to learn so that active learning will be created, students will not be bored and will be more responsive. That will affect the learning outcomes and will be better. Problem posing has some understanding. First, the formulation of simple problems or the re-formulation of existing problems with some changes to make it more simple and understandable in solving complex problems. Second, the formulation of questions relating to the conditions on the completed matter to seek other alternative solutions. Third, the formulation of the problem of information or situation available, whether done before, when, or after the completion of a problem(Silver & Cai, 1996).The lesson with the problem assigning model (problem posing) essentially asks students to ask questions or problems. The issues raised can be based on a broad topic, a problem already in hand, or certain information provided by the teacher.

In the implementation of teaching and learning activities, teachers should choose strategies that involve students actively in learning, both mentally, physically, and socially(Depdiknas, 2008). Questioning is a task that leads to a critical and creative attitude because students are asked to make inquiries from the information provided. When it is associated with improving students' abilities, questioning is a means to stimulate that ability. This is because students need to read a given information and confirm the question both verbally and in writing.

(Chua & Yeap, 2009)put forward the steps of problemposing are identifying material, form a problem, check the solution, review. Theadvantages problem posing strategy is to educate students to think critically, students actively in learning, different opinion between students can be so mud ah directed at healthy discussion, analyzing teaching the problem, teach child to believe in themself.While the lack of problem posingstrategy is: needs considerable time, can not use lower class, not all skilled students asked.

In addition to problem posing strategy, problemsolving strategy can also be the choice of teachers in learning Mathematics. (Polya, 1973)statesproblemsolving or problem solution as an attempt to find a way out of a difficulty, achieving a goal that is not immediately achievable. To solve a problem, a person needs knowledge and abilities that are related to the problem. The knowledge and skills must be mixed and processed creatively in solving the problem. Problem solving is a skill that includes the ability to seek information, analyze situations, and identify problems with the goal of generating alternatives so as to take an action to reach the goal.(Polya, 2004)sets out the steps in problem solving is understanding of the problem, designing of the solution, do the solution, and re-checking. The advantages of problem solving strategies are can train and familiarize the learners to deal with and solve problems skillfully, can develop creative thinking ability of learners creatively, lecturers have started to solve the problem, train the student to design a discovery, to think and act creatively, solve the problems faced realistically, identifythe cation and investigation, interpreting and evaluating the results of observation, stimulate the progress of students' thinking to resolve problem faced with precise, make education schools are more relevant to life, especially the world of work.

In this research, the problem will be limited to problemposing learning strategy on the 1st group experiment, problemsolving learning strategy in the 2sd group experiment,the material limited to the subject of the functioncomposition and Mathematics learning outcomes thatrestricted to improved cognitive ability. And the research aims to know the influence of problem posing and problemsolving learning strategy to the 1st grade students' learning outcomes of Persiapan Senior High School, Stabat in 2017/2018

RESEARCH METHODS

This research was conducted in 3rd grade social 1 class and social 2 class Persiapan Senior High School of Stabat. The sample in this research consists of 2 classes which amounted to 66 students. The sample is first taught without using problem posing model (problem solving) then taught again by using problem posing model (problem solving). This research of two variables are (X_1) and (X_2). (X_1) data is the Mathematics learning outcomes by using problem posing model, while the (X_2) data is the Mathematics learning outcomesby using problem solving model.

Table 1: The Sample of Research

No	Class	Number of Student	Group
1	3rd Grade Social 1 Class	34	Experiment I
2	3rd Grade Social 2 Class	32	Experiment II
Total		66 Students	

The method used to collect data in this research is the documentation methods and test methods. The instruments used in this study were tests administered before learning using the Guided Discovery Learning model and the test after using the Guided Discovery Learning model. The test used is taken from the question bank with the number of tests as many as 10 questions. Because the test is taken from the question bank so that the researcher does not seek the validity, reliability, item difficulty test and item discrimination.

Data analysis technique is a way to process data in order to be presented information from research that has been implemented. After the data obtained, then processed statistically and analyzed with the steps as follows:

1. Calculating Average Score

Determining the average value of both groups by the formula:

$$\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i}$$ (Sugiyono, 2016)

Standard of deviation with the formula:

$$S = \sqrt{\frac{N\sum f_i x_i^2 - \sum(f_i x_i)^2}{n(n-1)}}$$

Information:
$\bar{x}$ = mean of x data
f_i = frequency of x data
x_i = x data
S = Standard of Deviation
n = The Number of Student

After the data obtained then further testing of prerequisite analysis.

2. Normality Test

Normality test is used to determine the normal or not the distribution of data as a requirement to determine the type of statistics that will be used in further analysis, the normality test using the Liliefors test at the significance level α = 0.05. The normality test steps are as follows:

1) The hypothesis used is:
   H_0: data comes from normally distributed populations

   Hα: data comes from an abnormally distributed population

2) Determining the price $L_0 = L_{Count}$
   Observation of $Z_1, Z_2, \ldots, Z_n$ made a raw number $X_1, X_2, \ldots, X_n$ by using formula $Z_i = \frac{x_i - \bar{x}}{s}$

Information:

Z_i: Raw Number
X_i :i Data
$\bar{X}$: Average
s : Standard of Deviation

For each of these raw numbers use the standard normal distribution list, then calculated the odds $F(Z_1) = P(Z \leq Z_1)$.

3) Next is calculated proportion $Z_1, Z_2, \ldots, Z_n$ which is smaller or equal to Z_1. If this proportion is expressed by $S(Z_1)$ then:
   $$S(Z_1) = \frac{Number\ of\ Z_1, Z_2, \ldots, Z_n}{n} \text{ or } S(Z_1) = \frac{fk}{n}$$
4) Calculate the difference of $F(Z_1) - S(Z_1)$ then determine the absolute price. Take the biggest price among the absolute price of the difference, this absolute price is called $L_{Count}(L_0)$ then compared with L_{table}.

   Criteria Testing:

   Accepted of H_0: if $L_0 < L_{table}$ that the data distribution is normal
   Accepted of H_0: if $L_0 > L_{table}$ that the distribution data is not normal

3. Homogenity Test

Homogeneity test is intended to find out whether the two classes have variants or variations that are not much different either the class using the problem posing model or the class that uses the problemsolving model. If both classes have the same variant then the two classes are said to be homogeneous and vice versa if the variant is different (not the same) then the two classes are said not homogeneous.

The hypothesis is as follows:

H_0 = homogeneous variances

H_I = homogeneous variances

To do homogenity variant using Fisher test as for the formularumusnya

$$F = \frac{The\ Highest\ Number\ of\ Variances}{The\ Smallest\ Number\ of\ Variances}$$ (Sugiyono, 2016)

Criteria test are accepted of Ho ifF_{count}<$F_{table.}$ On the other hand rejected of Ho if F_{count}>$F_{table.}$ With a real level of5% (α = 0,05) dk numerator = NB – 1 dk denominator = NK-1

4. Hypothesis testing

After implemented the learning model using problem posing and problem solving, then given the test using the test sheet for each learning model. With sheet testing obtained data of student learning outcomes. The data has been obtained then created then tested hypothesis. To perform hypothesis test used Covarian Analysis test (ANCOVA)

1. The hypothesis used is:

   H_0 : AcceptedifF_{Count}<F_{table} (there was no significant difference between the research variables)

   H_0 : Rejected ifF_{Count}>F_{table} (there is a significant difference among the research variables)

2. Calculates the sum of the total squares (Jkt) on the criteria, covariables and product XY
   a. Criteria (Y)
      $Jkt_y = \sum Y_t^2 - \frac{(\sum Y_t)^2}{N}$
   b. Covariable (X)
      $Jkt_x = \sum X_t^2 - \frac{(\sum X_t)^2}{N}$
   c. Product (XY)
      $Jkt_{xy} = \sum X_t Y_t - \frac{(\sum X_t)(\sum Y_t)}{N}$
3. Calculates the sum of squares in the criterion, covariable, and product XY groups
   a. Criteria (Y)
      $Jkd_Y = \sum Y_t^2 - [\frac{(\sum Y_1)^2}{n_1} + \frac{(\sum Y_2)^2}{n_2}]$
   b. Covariable (X)
      $Jkd_x = \sum X_t^2 - [\frac{(\sum X_1)^2}{n_1} + \frac{(\sum X_2)^2}{n_2}]$
   c. Product (XY)
      $Jkd_{xy} = \sum X_t Y_t - [\frac{(\sum X_1)(\sum Y_1)}{n_1} + \frac{(\sum X_2)(\sum Y_2)}{n_2}]$

4. Calculates the total squares of residuals (Jrres), in and between groups.
   a. Total (Jkres)
      $Jkres_t = Jkt_Y - \frac{(Jkt_{xy})^2}{Jkt_x}$
   b. In Groups ($Jkres_d$)
      $Jkres_d = = Jkd_y - \frac{(Jkd_{xy})^2}{Jkd_x}$
   c. Among Groups ($Jkres_a$)
      $Jkres_a = Jkres_t - Jkres_d$
5. Calculates total degrees of freedom (db), in and between groups
   a. db_t= N – 2
   b. db_a= K – 2
   c. db_d= N – K – 1
6. Find the residual variant by calculating the mean of squares of residuals between groups($Rkres_a$) and in groups ($Rkres_d$)
   $Rkres_a = \frac{Jkres_a}{db_a}$
   $Rkres_d = \frac{Jkres_d}{db_d}$
7. Calculating the residual F ratio (F)
   $F = \frac{Rkres_a}{Rkres_d}$

RESULTS AND DISCUSSION

The data obtained from this research is the learning outcomes of Mathematics students using by problem posing and problemsolving model on Students of Persiapan Senior High School, Stabat in 2017/2018.

1. Description of Research Data

After the data is collected then the next step is to analyze the data in order to know the effect of using problem posing and problemsolving model in improving the increase of Mathematics learning outcomes on the main topic of Composition Functions. Briefly it can be stated that the description of this data reveals information about the mean, minimum, maximum, sum, and standard deviation.

Table 2: The Description of Research Data Summary

Basic Statistic	Using by Problem Posing Learning model (X_1)	Using by Problem Solving Learning model (X_2)
N	29	29
Mean	81,65	70,41
Standard of Deviation	7,142	7,849
Minimum	72	60
Maximum	93	83

Based on the table, it can be seen that the value of the learning test that using by the lowest score of problem posing model is 70 and the highest score is 93, the average is 81.65 and the standard deviation of 7.142, and on the value of learning test using by the lowest score of problem Solving model is 60 and the highest score was 83, the average was 70.41, and the standard of deviation was 7.849.

So, the conclusion of the overall data is the average test score using problem posing model is greater than the average test score using the problemsolving model.

a) The distribution frequency of the experimental I class value can be seen in table 1.3, and histogram shows infigure 1.1

b)

Tabel3: Indigenous Frequency Distribution Experiment I Class

No	Test Value Interval	Absolute Frequency
1	72-77	9
2	78-83	9
3	84-89	6
4	90-95	5
Total		29
Average ($\bar{X}$)		81,65
Standard of Deviation (S)		7,142

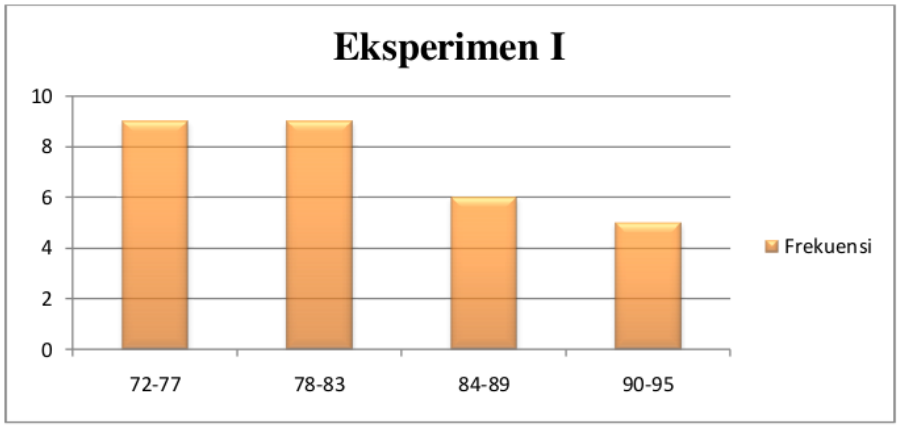

Fig1: Histogram Distribution of the Value of Mathematics Learning Outcomes Experiment I Class

Based on the table and figure, it can be stated that learners who have the most Mathematics learning outcomes at intervals of 72-77 and 78-83 with a frequency of 9 learners and learners who have the least Mathematics learning outcomes in the 90-95 interval with frequency of 5 students. Categorization is based on mean, standard deviation and test variance.

a) The distribution frequency of values experimental II class can be seen in table 1.4, and histogramnya is figure 2

Tabel4: Indigenous Frequency Distribution Experiment II Class

No	Test Value Interval	Absolute Frequency
1	60-65	11
2	66-71	6
3	72-77	4
4	78-83	8
Total		29
Average ($\bar{X}$)		70,41
Standard of Deviation (S)		7,849

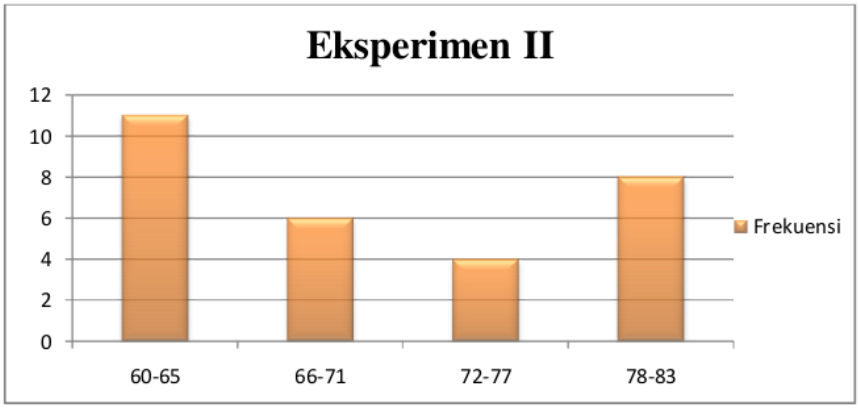

Fig2: Histogram Distribution of the Value of Mathematics Learning Outcomes Experiment II Class

Based on the tables and figure, it can be stated that learners who have the most Mathematics learning outcomes at intervals of 60-65 with a frequency of 11 learners and learners who have the least Mathematics learning outcomes located at intervals of 72-77 with a frequency of 4 learners. Categorization is based on mean, standard deviation and test variance. The complete formula can be seen in the appendix.

2. Testing Prerequisite Analysis

a. Normality Test

Ujinormalitasinidimaksuduntukmengetahuiapakah yang diperolehberdistribusi normal atautidak. Untukmenentukanujinormalitas X_1dan X_2digunakanujilillieforspadatarafnyata α = 0.05 dengankriteria:

Normality test is intended to determine whether the obtained normal distribution or not. To determine the normality X_1 and X_2 test used lilliefors test on the level of real α = 0.05 with criteria:

Table5: Normality Research VariableTest

Value	L_{count}	L_{table}	Conclusion
Experiment I	0,1341	0,163	Normal
Experiment II	0,1368	0,163	Normal

According the table, L_{hitung}taken from the highest price between the difference, so the above table obtained L_{hitung} 0,1341, whileL_{table} = 0,163 with n = 29 on the actual level α = 0,05 is 0,163 soL_{count}<L_{table}so it can be concluded that the post test data of the experimental I class is normally distributed. From the table then $L_{hitung}$is taken from the highest price between the difference, so L_{count}= 0,1368, whileL_{table} = 0,163 with n = 29 at the real level α = 0,05 is 0,163 soL_{count}<L_{table}so it can be concluded that posttest data of experimental II class is normally distributed.

b. Homogenity Test

After performing the normality test on the data test of experimental I and II classes, it is known that all samples are normally distributed. The homogeneity test will then be conducted to determine whether the two populations have the same or different variance. By comparing the values of α = 0.05 where significant> 0.05, it can be concluded that in experimental I and II class experiments are valued from the population with the same or homogeneous variance.

Tabel6: The Result of Homogenity Test

Value	Variance	F_{count}	F_{table}
Experiment I	52,09	1,182	1,86
Experiment II	61,60		

ObtainedF_{count}= 1,182. Next, compare the prices ofF_{count}withF_{table}. since n_1 = 29, makaderajatkebesanuntukpembilangnyaadalah 29 – 1 = 28 dan n_2 = 29, the degrees of magnitude for the numerator are 29 -1 = 28 and the error rate used is 0,05 to obtain the price ofF_{table} = 1,86. BacauseF_{count}<F_{table}, then according to test method, the sample data test of experiment I and II class are homogeny or have the same variant

c. Hypothesis Test

Because the data of both groups are normally distributed and have homogeneous variance, then to the hypothesis test whether accepted or rejected by the formula of covariance analysis and using statistical formulation as follows:

Tabel7: The Result of Hypothesis Test

Value	Total Project Value	F_{count}	F_{table}
Experiment I	2365	39,15	4,02
Experiment II	2043		

Ho rejected there is a significant difference in learning outcomes when viewed from teaching methods used after the scores of Mathematics learning ability is controlled. Where learning strategies by problem posing is better in increased right learning outcomes, namely the Total Project Value of 2365 and a problemsolving learning strategy has only a total value of 2043.

Table 8: The Result of CovarianceTests of Between-Subjects Effects

Dependent Variable:Students' Score

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	2321.142[a]	2	1160.571	23.954	.000
Intercept	7122.328	1	7122.328	147.002	.000
KAM	488.797	1	488.797	10.089	.002
ModelPembelajaran	1803.176	1	1803.176	39.157	.000
Error	2664.789	55	48.451		
Total	340298.000	58			
Corrected Total	4985.931	57			

a. R Squared = .466 (Adjusted R Squared = .446)

From the data management table 1.8 can be interpreted as follows the significant number (in column 6) for KAM variable is 0.002. This shows that the number of significance is less than α which has been set before, ie 0.05. Thus,H_0 is rejected. It means that (ignoring the influence of the learning model) on a 95% confidence level there is a linear relationship between KAM and student learning outcomes. Means the assumption of covariance analysis that requires linearity between response variables Y has been met. Next is the test to see the effect of problem posing learning model and problem solving on students' Mathematics learning outcomes. Regardless of KAM's effect from the model it appears that the significant number (in column 6 of Table 1.8) is 0.000. Number 0.000 < α = 0,05 thus H_0 is rejected. It is concluded that at 95% confidence level there is influiyence of learning model to student learning outcome of Mathematics. For look KAM and influence difference learning model on simultaneous, can seen in column 1 of table 1.7 in line first is the Corrected Model. The significance is 0,000. number, 0,000 < α = 0,05 means H_0 is rejected. This means that at the level of 95% KAM and differences in learning model problem posing and problem solving simulatively (simultaneously) have an effect on student learning outcomes Mathematics.

DISCUSSION

(Shriki, 2013)concludes that through problem posing strategy can improve students' reasoning and active student involvement in learning. And(Polya, 2004)states problem posing or problem solving as an attempt to find a way out of a difficulty, achieving an objective that is not immediately achievable. This implementation is done with the aim to find out whether there is influence of learning problem posing and problemsolving on student learning outcomes the students of Persiapan Senior High School, Stabat in 2017/2018. And to know whether the model of problem posing learning is better than theproblemsolving model on the Mathematics learning outcome the student of Persiapan Senior High School, Stabat in 2017/2018.

Based on the findings and hypothesis testing that the comparison of student learning outcomes by using problem posing model and using problem solving model can be proved from the average value of learning outcomes using problem posing learning model obtained greater than using problem solving learning model. For the average value using problem posing 81.66 learning model with the highest score 93 and the lowest score 72 and the standard of deviation is 7,142. while the average value

using problem solving model is 70.41 with the highest value 83 with the lowest value 60 and the standard of deviation is 7,849. Overall of this research can be seen that the value obtained by students in the class that uses the model of problem posing was greater the value of learning outcomes compared with the model by using problem solving.Thus it can be concluded that "there is an influence of problem posing and problem solving learning strategy on the Mathematics learning outcomes of 3rd grade social class of Persiapan Senior High School, Stabat in 2017/2018" and "problem posing learning strategy is better than problem solving model of Mathematics learning outcomes of Persiapan Senior High School, Stabat in 2017/2018".

CONCLUSIONS AND SUGGESTIONS

Conclusions

From the data analysis results obtained, for the lowest score experimental class score is 72 and the highest score is 93, the average score (mean) of 81.66 with standard of deviation is 7,143. In the control class obtained the lowest score is 60 and the highest is 83, the average score (mean) 70.41 with standard of deviation is 7,849. This indicates that the learning outcomes obtained in the experimental class is higher when compared with the control class learning outcomes.

Based on hypothesis test calculationF_{hitung} = 39,15andF_{tabel} = 4,02 because the value of F_{hitung}>F_{tabel}, then Ho is rejected. With Ho rejected then there is a significant difference in learning outcomes when viewed from the teaching method used after the learning ability of Mathematics is controlled. Where the learning strategy through problem posing is better in improving the results of learning is the number of values of 2365 and problemsolving learning strategy only has the number of values of 2043. It means there is a positive and significant influence of problem posing and problemsolving strategy on the learning process of Mathematics Learning Process of Persiapan Senior High School, Stabat in 2017/2018.

Suggestions

The conclusion that researchers take as a suggestion to the parties involved in the process of Mathematics teaching and learning, among others, as follows:

1. The process of Mathematics learning is expected to improve learning outcomes by one way that is by using problem posing model in the learning process in order to create an effective learning atmosphere.
2. The results of the research should be used as guidance in taking steps that are used in an effort to improve students' Mathematics learning outcomes by using problem posing on learning.
3. Expected to teachers, if with the use of problem posing learning model in the learning process, teacher's proficiency in teaching can be improved, as evidenced from the results of this study which showed significant differences in learning outcomes.
4. For students who will conduct further research, if more attention to control of the learning model that can make students more actively participate in the learning process and get new experiences that will affect the increase in Mathematics learning outcomes.

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