Proceeding: The First International Seminar on Trends in Science and Science Education 2014 – ISBN 978-602-9115-37-6

SE-021

THE DIFFERENCE BETWEEN THE ABILITY OF STUDENTS IN SOLVING PROBLEM BY APPLYING COOPERATIVE LEARNING TYPE STAD WITH AND WITHOUT THE HELP OF GEOGEBRA

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ABSTRACT

This research is the quasi-experimental research. The variables in this research are problem solving and cooperative learning model type STAD. The population in this research is SMP Negeri 4 Balige. With the two grade random sampling technique, two classes were found as sample, one class as the experimental class and one class as the control class. The experimental class was taught by applying cooperative learning model type STAD with the help of Geogebra and the control class was taught by applying cooperative learning model type STAD without the help of Geogebra. The instruments used in this research are the pre-test and problem solving test which each test consists of 5 (five) questions. The pre-test was given before the learning was applied. The problem solving test was given after the learning was given. Before the tests which were used to measure students' ability in solving problems were used, the tests were first validated and tried. The solving problem tests were acknowledged valid and reliable with the validity of each question is 0.44; 0.48; 0.79; 0.74; 0.65 and the reliability is 0,63. The data analysis which was used is covariant analysis. The research finding showed that there is a difference between students' ability in solving problems by applying cooperative learning model type STAD with the help of Geogebra and cooperative learning model type STAD without the help of Geogebra. The ability of students in solving problems by applying cooperative learning model type STAD with the help of Geogebra is better than the ability of students in solving problems by applying cooperative learning model type STAD without the help of Geogebra.

Keywords *: Cooperative learning model type STAD, Geogebra, Problem Solving.*

INTRODUCTION

Iwan Pranoto said that the global trend of mathematics education nowadays is directed to the expert thinking that involves competency of analysis, problem solving and curiosity, while the mathematic teaching in Indonesia is not relevant to the global trend. The education in Indonesia is still based on cognition or knowledge aspect and not to the problem solving issue. The same opinion is said by Didi Suryadi a Lecturer in Study program of Mathematic education of Indonesia Education University in Kompas January 21, 2010 who said that education practice in Indonesia is opposed the global trend, while in developed countries such as Singapore, the science education in particular the mathematic is directed to prepare the student with problem solving competency.

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In order to develop the problem solving competency of student, the choosing of appropriate teaching approach is very important. In this teaching process, the applied teaching approach is cooperative teaching approach. Cooperative teaching model has 5 variations. But the applied cooperative teaching model is STAD type (Student Team Achievement Division). The reason of choosing the STAD type in this research is because according to Slavin (2009) in his book entitled : "Cooperative Learning Teori, Riset dan Praktik" said that the best model for the beginning of teacher who use the cooperative strategy is STAD type. In addition, STAD type is suitable to the new paradigm of mathematics education in which teacher is a facilitator. The teacher as facilitator, in this learning process the student is guided to develop his knowledge on basic competency will be achieved. The last reason why the researcher choose STAD type in this research is because STAD type is controlled and orderly and implemented structurally. If in the learning process it needs the widest discussion, the teacher as mediator is easy to control and limited than the other type of teaching that did not required the expanded discussion. Therefore the limited time can be used optimally.

In this teaching model, the using of software application is required. This is based on the reason of Olsen in his paper entitled "Top Ten Reasons for Using Computers and Calculator to help student learn mathematic", namely : (1) by the technology the student will see the change; (2) the technology create impossible representation by using whiteboard or paper, ()3) student has a closed access to the real problem, (4) the student has a better access to do the investigation; (5) technology can combine the content of teaching, (6) Student can see the pattern; (7) technology help student for the student centered teaching or active teaching; (8) the student focus to the problem and all of teaching process without bored on unimportant calculations, (9). The student is in a real world; (10) technology is rapid and accurate.

METHODOLOGY

The type of study applied in this research is quasi experimental study. The research was conducted at SMP Negeri 4 Balige. The population in this research is SMP N Balige that consist of 18 classes for the number of student is 592 persons. The sample in this research is Class IX-F and IX-E. The design of this research is non equivalent control group design. The table of research design are as follows (Tabel 1).

In this research the independent variables would be measured and analyzed is teaching model and preliminary competency of student. The STAD teaching model using Geogebra software or without Geogebra is independent variables of treatment. The preliminary competency of student is uncontrolled independent variable with the effect to the variable is controlled. The instrument is pre test set namely a prerequisite matter knowledge (essay test)

and problem solving competency test in post test (essay test). The hypothesis of research is "The problem solving competency of student who taught by STAD teaching approach with Geogebra software is better than student with STAD teaching method without Geogebra software".

Table 1. Research Design of Non Equivalent Control Group

Group	Pre-test	Treatment	Post-test
Experiment	O_1	X_1	O_1
Control	O_1	X_2	O_2

O_1 = prerequisite matter test, X_1 = Teaching with STAD model and using Geogebra software, X_2 = teaching with STAD model without using Geogebra software, and O_2 = Post test of problem solving competency. Source : Modified from Ruseffendi (without year, 47)

The statistical test is Anacova. Anacova is statistic method to test the different of multivariate as combination between regression analysis (Anareg) and variance analysis (Anava). In particular in Anacova, there is residue analysis in regression line, i.e. by compare the residue variance intra group and residue variance in a group. Any variable terms will used in Anacova are : (1) criterion is dependent variable (y) is influenced variables where the data in the form of interval or ratio, (2) co-variable that known as control variable, concomitant variable with X symbol and the data in the form of interval or ratio, (3) factor is term for independent variable or experimental variables will be studied its influence and the data is in the form of nominal or ordinal. Based on the hypothesis, the first and third research the dependent variables is problem solving competency, the controlled variable is preliminary competency of students and its factor is the STAD teaching with or without Geogera software. Before to use the Anacova as analysis method, there are any condition must be fulfilled (biswal, 14.4), i.e. : (1) Score that distributed normally for each group, (2) the data variance is homogenous, (3) the effect of treatment is constant, (4). The sample is took randomly from the population, (5). There is a linear correlation between X and Y and (6). The regression line must similar and homogenous to each group. Therefore, each condition must be tested before using anacova in decision making.

RESULTS AND DISCUSSION

Data normality test. The first assumption in anacova statistical analysis is the processed data group is distributed normally. This research involves the data of preliminary competency of student either in experiment class or on control class and the data of problem solving test of student either in experiment or control classes. So the normality of preliminary competency of student in control class or experiment class and problem solving competency of student either in experiment or control classes is tested.

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By using the results of SPSS output the competency of problem solving of student in experiment class is distributed normally in which based on significance test of Kolmogorof – Smirnov and Shapiro Wilk test it found 0.200 > 0.05 and 0.700 > 0.05 means the data of problem solving competency of experiment class is distributed normally. The competency in problem solving in control class is distributed normally in which based on significant test of Kolmogorof – Smirnov and Shapiro Wilk test it found 0.200 > 0.05 and 0.615 > 0.05 means the data of problem solving in control class is distributed normally.

Data homogeneity test. Test of problem solving competency is followed by 32 students in experiment class and 34 students in control class. The variance of problem solving competency test in experiment class (S_E^2) = 153.544 and variance of problem solving competency test in control class (S_K^2) = 163.911.

Therefore $F_{calculated} = \frac{S^2_{bigger}}{S^2_{smaller}} = \frac{163{,}911}{153{,}544}$ = 1.0675 and F_{table} = 1.76 from F table with numerator dk = 34 -1 = 33 and denominator dk =32 – 1 = 31 on significant level (α) = 5%. Because $F_{calculated} < F_{table}$ so H_o is accepted means the data of problem solving competency of student is homogenous.

Linear correlation test between X and Y. Based on the preliminary competency test and problem solving test it found the regression equation for control and experiment class. For the problem solving test with preliminary competency as control variable, the regression equation is Y_{TP} = 20.272 + 0.53 X_{TP} and the regression equation for experiment class is Y_{GP} = 28.981 + 0.766 X_{GP}. According to Sudjana (1983 : 10), the regression equation must be tested on the linearity of regression and the significance of regression. The linearity test is to check whether the regression line between X and Y form a linear line or not. And the objective of the significance test is to test whether the regression coefficient especially the direction coefficient is zero (it is not significant).

Linearity test of regression equation on the understanding of mathematic in control and experiment class. It had known that the regression equation of the problem solving competency in control class is Y_{TP} = 20,272 + 0,53 X_{TP}. It test statistically whether the regression equation is linear or not. The hypothesis is :

H_o : The model of problem solving regression in control class is liner

H_a : The model of problem solving regression in control class is not linear

The hypothesis is tested by statistic F = $\frac{S^2TC}{S^2G}$ ($F_{calculated}$) compared to F_{table} with numerator dk = k – 2 and denominator dk = n - k. The criteria of decision making is H_o is rejected if $F_{calculated}$ is larger than F_{table}. Based on output of SPSS, $F_{calculated}$ = 0.875 with significant

level = 0.625. The value of F_{table} in significant level α = 5% and dk (23.9) is 2.9. It means thast $F_{calculated} < F_{table}$. Therefore H_o is accepted or the model of problem solving regression in control class is linear. It means, there is a correlation between the preliminary competency of problem solving in control class is linear. In addition to F_{test}, the decision on hypothesis test on the linearity of regression equation of problem solving is determined by using significant on Anova table. On the table, the significance is 0.625 > 0.0.5 means that the regression model is linear. Therefore, the regression equation Y_{TP} = 20,272 + 0,53 X_{TP} is linear really.

Furthermore, the regression eqution of problem solving for experiment class is Y_{GP} = 28,981 + 0,766 X_{GP}. It test statistically whether the regression equation is linear really. Its hypothesis is :

H_o : Regression model of problem solving in experiment class is linear

H_a : regression model of problem solving in experiment class is not linear.

Based on output of SPSS, $F_{calculated}$ = 0.796 in significant level 0.676. the value of F_{table} on significant level α = 5% and dk (17.13) is 2.46. It means $F_{calculated} < F_{table}$ means Ho is accepted or the regression model of problem solving in experiment class is linear. It means that there is a correlation between the preliminary competency in problem solving competency in experiment class is linear. In addition to F_{test}, the decision on hypothesis test about the linearity of regression equation in problem formulation in experiment class is indicated by using significant in Anova table. From the table, the significant is 0.675 > 0.05 means the regression model is linear. Therefore, the regression equation Y_{GP} = 28,981 + 0,766 X_{GP} is linear.

Significance test of regression equation in problem solving in control and experiment class. The regression equation of the problem solving competency for control class is Y_{TP} = 20,272 + 0,53 X_{TP}. It test whether the coefficient of direction of the regression equation is significant or not. To test the significance of regression coefficient the hypothesis is formulated as follows :

H_o : Direction coefficient of regression is not significant ($\theta_1 = 0$)

H_a : Direction coefficient of regression is significant ($\theta_1 \neq 0$)

The hypothesis is used the statistic analysis F = $\frac{S^2reg}{S^2sis}$ ($F_{calculated}$) compared to the F_{table} with numerator dk = 1 and denominator dk = n – 2. The criteria of decision is reject Ho if $F_{calculated}$ is larger than F_{table}. The output of SPSS it found that $F_{calculated}$ = 8,121 and F_{table} with α = 5% and freedom degree (1.32) is 4.15. Therefore $F_{calculated} \geq F_{table}$ that cause H_o is rejected and Ha is accepted. In addition the decision is make based on significant table of Anova where 0.0008 < 0.05 cause Ho is rejected. So, $\theta_1 \neq 0$ or regression coefficient is significant. And there is positive

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(significant) influence of preliminary competency test of student (X) to the problem solving test (Y) for control class. Therefore, the regression model of problem solving in control class is used the regression equation Y_{TP} = 20,272 + 0,53 X_{TP}.

Furthermore, the regression equation on the problem solving competency for experiment class is Y_{GP} = 28,981 + 0,766 X_{GP}. It test whether the direction coefficient of regression equation is significant or not. In order to test the significant of regression coefficient, the hypothesis is formulated as follows :

H_o : coefficient of regression direction is not significant ($\theta_2 = 0$)

H_a : coefficient of regression direction is significant ($\theta_2 \neq 0$).

The hypothesis is tested using statistic analysis F = $\frac{S^2reg}{S^2sis}$ ($F_{calculated}$) compared to F_{table} with numerator dk = 1 and denominator dk = n – 2. The criteria of decision making is reject Ho if F-calculated is lager than F-table. Based on output of SPSS, the F-calculated = 13.546 and F-table with α = 5% and freedom degree (1.30) is 4.17. therefore $F_{calculated} \geq F_{table}$ that cause H_o is rejected and H_a is accepted. The decision can make based on significant table of ANova, where 0.001 > 0.05 that cause H_o is rejected and H_a is accepted. Therefore, $\theta_2 \neq 0$ or regression coefficient is significant. And there is positive (significant) influence of the preliminary test of problem solving competency of student (X) to the problem solving test (Y) for experiment class. The regression model of problem solving in experiment class is use the regression equation Y_{GP} = 28,981 + 0,766 X_{GP}.

Parallel and Homogeneity test. The regression equation of problem solving for control and experiment class is Y_{TP} = 20,272 + 0,53 X_{TP} and Y_{GP} = 28,981 + 0,766 X_{GP}. Based on the 6th assumption of anacova, it test whether both of the regression on equation of problem solving in control class is parallel and homogenous.

The objective of parallel test is to review whether the competency of problem solving of student is an effect of one of preliminary competency of student and teaching model or both of them is simultaneous. In another work, to see whether there is interaction between the preliminary competency and the teaching model to the problem solving competency of student. (modified from Sudjana (1983 :148). The same opinio0n said by Pallant, Julie (2002 : 272) who said that :

This final assumption (homogeneity of regression slopes) concern the relationship between the covariate and the dependent variable for each of your groups. What you are checking is that there is no interaction between the covariate and the treatment or experimental manipulation.

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Parallel test is related to the test of regression direction coefficient. Based on the test of problem solving competency of student, the regression equation for control class Y_{TP} = 20,272 + 0,53 X_{TP} and for experiment class Y_{GP} = 28,981 + 0,766 X_{GP}. It test whether two of regression direction coefficient is differed significantly or not. Its hypothesis is :

H_o : the direction coefficient of regression is homogenous ($\theta_1 = \theta_2$)

H_a : the direction coefficient of regression is not homogenous ($\theta_1 \neq \theta_2$)

Based on output of SPSS, the $F_{calculated}$ for regression equation test is 1.120 with significant in 0.294 while F_{table} with α = 5% and dk = (H-1, N-2H) = (1.62) = 3.99. Because $F_{table} < F_{calculated}$ that H_o is accepted and H_a is rejected. It means that the regression coefficient of problem solving competency between control and experiment class is homogenous or it tid not different significantly. The same decision also take by using significant on table 4.31, i.e. 0.294 > 0.05 so H_o is accepted and H_a is rejected.

According to Sujana (1983, 154) the homogenous test to the Constanta of regression line is conducted after believe that direction coefficient is not different significantly. In this sense, the direction coefficient of regression of problem solving in control and experiment class is homogenous. In this condition, the homogenous test of constant of regression will ask whether the effect of STAD treatment with Geogebra software is more effective than STAD treatment without Geogebra software. (modified from Sudjana (1983 : 154). Its hypothesis is:

H_o : Constanta of regression equation is homogenous ($\theta_3 = \theta_4$)

H_a : Direction coefficient of regression is not homogenous ($\theta_3 \neq \theta_4$)

Based on table, $F_{calculated}$ for Constanta test of regression is 9.197 with significance 0.004. and F_{table} with α =- 5% and dk = (H-1, H-2H) = (1.62) = 3.99. Because $F_{table} > F_{calculated}$, H_o is rejected and H_a is accepted. It means that moth of linear regression model between control and experiment class is snot homogenous or non coincide significantly. It means that the effect of STAD treatment with Geogebra is better than STAD treatment without Geogebra. The same decision also get by using significance 0.024 < 0.05 so H_o is rejected and H_a is accepted.

Because the assumptions of the using of anacova had fulfilled so the anacova can used to test the first hypothesis of this research, i.e.

H_o : By control the preliminary competence, the problem solving competency of student who taught by STAD teaching with Geogra software is better than student who taught by STAD teaching without Geogebra.

H_a : By control the preliminary competence, the problem solving competency of student who taught by STAD teaching method with Geogbra Iis poor thn student who taught by STAD teaching method without Geogebra.

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Based on output of SPSS, $F_{calculated}$ for problem solving competency is 20.587 with significance 0.000. By using db = 1 and 63 (66-2-1) the F_{table} is 3.99 in significant level 5%. Because the test in this research is test of one side, i.e. left side test with F_{table} = 3.99, $F_{calculated}$ is 20.587 that fall into the acceptance of H_o. Therefore it conclude that the teaching method by STAD with Geogebra software is better than student who taught by STAD teaching method with Geogebra software, in which the average of experiment class is 71.360 and control class is 50.190.

CONCLUSION AND RECOMMENDATION

Based on results of data analysis and the results of previous study during STAD type cooperative teaching method without Geogebra and with Geogebra that focus to the problem by compare the preliminary competency and attitude of student, the researcher conclude that the problem solving competency of student that taught by STAD teaching method with Geogebra software is better than student who taught by STAD teaching method without Geogebra Software . Based on the results of research, the difficultness in mathematic learning in abstract will helped by using relevant media. One of media is Geogebra software. The STAD cooperative teaching with Geogebra software is better for use to increase the problem solving competency of student with lower , medium, higher capability. Therefore, the STAD type cooperative teaching model with using Geogebra software in the teaching method will be a consideration of teachers in its application.

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