

APPLICATION OF COOPERATIVE LEARNING GROUP INVESTIGATION MODEL ON THREE DIMENSIONAL GEOMETRY MATERIALS

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ABSTRACT

The aim of this research is improving student learning outcomes and see the students' response to investigation model study group on the three-dimensional geometry of the material. This research uses quasi-experimental research with two classes. Instruments used : tests , student questionnaire responses and sheets observation. Result this study were (1) the responses given to the model student group investigation is positive , (2) the observation data based on the criteria of the average - average final assessment , the model group investigation goes well (3) the application of learning models of investigation group to the material three-dimensional geometry improve learning outcomes of students in class XI Vocational High School of Sartika Rantau Utara Academic Year 2014/2015.

Keywords: *Cooperative learning, model group investigation*

Introduction

Education is an activity that aims to establish an individual who has the potential of knowledge skills, as well as the mental attitude that later can be used in private and public life. So to realize the educational goals established educational institutions, one of which school. Schools are formal institutions that implementation is done in-system and inside contained some subjects one of them mathematics.

Mathematical one of the subjects in school is a subject that is very useful and a lot to give assistance of various skills and vocational, Cornelius (abdurrahman, 2002: 253) argues "Five reasons for the need to learn maths because a (1). Means a clear and logical thinking, (2). Means for solving everyday problems, (3). Means recognize the relationship patterns and generalization of experience, (4). Means to develop creativity and (5). A means to raise awareness of cultural development ".

Slameto (2003: 2) says "learning is a process attempts person to obtain a new behavior changes as a whole, as a result of his own experience in interaction with the environment". Learning mathematics should be done gradually because the topics in mathematics arranged hierkis ranging from the most difficult.

Factors causing low math scores are external factors and internal factors. External factors (originating from outside the student) that competition (ability) of teachers, where teachers are less able to

choose the method of delivery of math that causes the learning process is less effective whereas internal factors (derived from the student) is the lack of attention and interest arising from self the child.

Math skills one depending on the other capabilities. Someone will successfully learn a concept if the concept of the prerequisites have been mastered. This makes the mathematics seem elusive and a scourge for students.

Learning is an activity undertaken everyone. Someone said to have learned when certain changes have occurred to him. Changes that occur in a person a lot of good nature and type. Because it was not any change in a person is a change in the sense of learning. According Trianto (2007) that: "The results of the study to low learning outcomes of students, it was because the learning process is dominated by traditional learning". One model which is currently developing learning is cooperative learning. According to Slavin (1985): "cooperative learning is one model of learning in which students learn collaboratively with members of 4-6 people with a heterogeneous group structure".

Many experts argue excel in helping with the cooperative learning students understand difficult concepts. Cooperative learning also gives effect to the acceptance of individual differences across both racial, diversity, culture, gender, and socio-economics. Besides the most important thing to teach cooperative learning skills work together in a group or teamwork. One cooperative learning model of Group Investigation. In the Dictionary of Indonesia (2001): "the investigation is an investigation by noting or recording the facts to make a deviation, trial and forth with the aim memproleh answer to the question". On investigating this group of teachers acts as a motivator and facilitator who provided the impetus for students to express their opinions or ideas and using prior knowledge of students in understanding the new situation.

Model investigation group first developed by Thelan. In the development of this model is augmented and refined by Sharan from Tel Aviv University. Ibrahim, et al (2000: 23) states: "In a model of cooperative investigation group (GI) teacher divides the class into groups of 5 or 6 members of a heterogeneous student by considering the familiarity and the same interest in a particular topic. Students choose their own topics to be studied, and the group formulating the investigation has been formulated. In this class discussion exchange of ideas takes precedence involvement of the students ". The stages in the implementation of cooperative learning model of investigative group is (1) Stage grouping (Grouping) is the stage of identifying the topics that will be investigated as well as establish an investigation group, with each group consists of 4 or 5 people. (2) The planning stage (Planning) or planning stage learning tasks. At this stage the students jointly plan about what they learned, how they learn, and who did what and for what purpose they investigate the topic. (3) phase of the investigation (Investigation) is investigating student project implementation phase. (4) Phase organizing (Organizing), namely preparation of the report. (5) Stage presentation (Presenting) stage presentation of the final report. (6) evaluation phase (Evaluating), ie through the work process and the results of student projects.

In response group investigation cooperative learning can be translated as a reaction to the stimulus (stimulus / action). The response included in the factors that affect student learning because of the good response then the students will give attention to the study of mathematics. Changes in social aspects in the classroom and open atmosphere that invites students to discuss. This demands a free atmosphere (permissive) in the classroom, where each student does not feel any pressure or hindrance to express their opinions. Freedom of speech and respect for different even if that opinion is irrelevant, it should always be kept within the boundaries of existing disciplines.

A geometry lesson math lesson we learned since elementary school, be it geometrical dimensions of two or three-dimensional geometry or we get to know the geometry of flat wake and wake geometry of space. Some geometrical shape (three-dimensional) eg cube, cone beam, tube, circles and so on. Wake-up space has several elements like ribs, plane, vertex, diagonal field, diagonal and diagonal field of space. In this investigation model of cooperative learning students together in one group to investigate the number of elements contained in the geometrical investigation and find and calculate the surface area and volume in the wake of the space.

Method

The research is a quasi-experiment using quantitative data because the data is the value or figures of student learning outcomes and qualitative data where the data in the form of words or symbols derived from questionnaire data. The location of this research was conducted at Vocational High School of Sartika is located at JL. Islamic Center of North Rantau. The research was conducted in the second semester of academic year 2014/2015. The subjects were a class XI student of Vocational High School Rantau Sartika North, amounting to 40 students which is an experimental class using a model of investigative group and 37 students a class controls using conventional learning. The object of research is the result of student learning in mathematics in three-dimensional geometry of the material by using a model of cooperative learning group investigation.

This research data collection tool is a test (post-test), observation and questionnaires. The test aims to determine the extent to which the results diproleh students to the material after a learning experience. Questionnaire is used to determine the students' response to the learning model used. Questionnaires given to the students after the study is completed, which included a very good response or positive if the average value of the questionnaire meets the criteria. Observation is intended to observe the activities of students and teachers during the learning takes place. Learning is said to be effective if they observed include the category of good learning.

Data analysis techniques using t test with the following conditions:

- calculate the average post test results using the formula: $\bar{x} = \frac{\sum x_i}{n}$
- calculate the standard deviation of the results of post test with formula : $S = \sqrt{\frac{n\sum x_i^2 - (\sum x_i)^2}{n(n-1)}}$
- normality test using normality test Liliefors.
- T test with using: $t_{hitung} = \frac{M_1 - M_2}{\sqrt{\frac{\sum X_1^2 + \sum X_2^2}{N(N-1)}}}$

Research procedures, to fare the required data then researchers conducted a study procedures as follows:

- The preparation phase, including the implementation of learning plan and make the research instruments.
- The implementation stage, including studying with learning model group investigation. Measure student learning outcomes on issues cubes and blocks with the provision of post-test. And analyzing data on post-test results are given to students.

Result

At the level of student mastery of the class obtained using the model of the investigation group of 40 students there are 37 students who achieve a score of $\geq 65\%$ and 3 students achieved a score of $<65\%$.

Grade test results table group investigation

Level of Mastery	Category	Students	% Total of Students
90% - 100%	Very high	2	5%
80% - 89 %	High	11	27,5%
65% - 79%	Medium	24	60%
55% - 64%	Low	2	5%
0% - 54%	Very low	1	2,5%

The level of mastery that use conventional of 37 students, there are 33 who achieve a score of $\geq 65\%$ and 4 students achieving a score of $\leq 65\%$.

Conventional classroom test results table

Level of Mastery	Category	Students	% Total of Students
90% - 100%	Very high	3	8,1%
80% - 89 %	High	6	16,2%
65% - 79%	Medium	24	64,8%
55% - 64%	Low	3	8,1%
0% - 54%	Very low	1	2,8%

Special achievement of learning objectives (TPK) is said to be completed or reached if the percentage of specific learning objectives that achieve a score of $\geq 75\%$. TPK calculation model based investigative group of seven specific learning objectives, 6 of them achieved a percentage value $\geq 75\%$ whereas with conventional 7 there are three specific learning objectives are achieved. It can be concluded with an investigation group learning objectives achieved well.

The response data is data obtained from questionnaires using two alternatives are "yes" and "no", also wants to put a value on each answer. For example, a value of 1 for "yes" and 0 for "no". Therefore the answer "yes" and "no" is not usually necessary in value, but simply summed. The average score of 90.90% total questionnaire in which it is included excellent response or positively impact model of cooperative learning group investigation on three dimensional geometry of the material at the grade XI Vocational High School Sartika Rantau Utara. The average value of the end for the observation of 3.18 based on the average assessment criteria can be concluded end of the learning model in this study group investigation went smoothly.

To test data normality test was used for normality.

Results of data normality test

Treatment	Value	Conclusion
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	L_{hitung}	L_{tabel}	
The results with using group investigation	0,1156	0,1399	normal
The results with using conventional	0,0789	0,1457	normal

From the table is obtained for each student learning outcomes have $L_{hitung} < L_{tabel}$. so it can be concluded that student learning outcomes derived from normal distributed population.

By using t statistical test at the significant level $\alpha = 0,05$ in testing the hypothesis obtained $t_{hitung} = 13,04$ and obtained $t_{tabel} = 2,038$ so that $t_{hitung} > t_{tabel} = 13,04 > 2,038$. This shows that the accepted hypothesis that there are significant differences in learning outcomes of students using cooperative learning model of investigation group on three-dimensional geometry of the material.

Discussion

The results of the research that has been done is as follows:

a. Completeness students

At the level of student mastery of the class obtained using the model of the investigation group of 40 students there are 37 students who achieve a score of $\geq 65\%$ and 3 students achieved a score of $< 65\%$. So from these data complete student can write in the following table.

Table mastery learning class group investigation

Percentage absorption	Students	Percentage of total students	Completeness
$\geq 65\%$	37	92,5%	Complete
$< 65\%$.	3	7,5%	Not complete

The level of mastery that use conventional of 37 students, there are 33 who achieve a score of $\geq 65\%$ and 4 students achieving a score of $\leq 65\%$.

Table completeness conventional classroom learning

Percentage absorption	Students	Percentage of total students	Completeness
$\geq 65\%$	33	89,1%	Complete
$< 65\%$.	4	10,9%	Not complete

b. Response data

Data obtained from the questionnaire using two alternatives are "yes" and "no", also wants to put a value on each answer. For example, a value of 1 for "yes" and 0 for "no". Therefore the answer "yes" and "no" is not usually necessary in value, but simply summed. So on the results of research that has been done obtained an average score of 90.90% total questionnaire in which it is included excellent response or positively impact model of cooperative learning group investigation on three dimensional geometry of the material at the grade XI SMK Sartika Rantau Utara.

c. Observation

Observation sheet descriptive analysis of the learning process is said to be good if it was a good learning implementation. For the assessment formulated observations: $N = \frac{\text{The scores}}{\text{many statements}}$ and to determine the average ratings are according to the formula :

$$R = \frac{\text{last scores}}{\text{many observasion}}$$

The criteria average observational studies by E. Soegito (2005: 13) is:

- 0 - 1,1 Less
- 1,2 - 2,1 Low
- 2,2 - 3,1 Good
- 3,2 - 4,0 Very Good

In the research that has been done, it obtained an average final value to the observation of 3.18 based on the average assessment criteria can be concluded end of the learning model in this study group investigation went smoothly.

d. Hypothesis testing

The hypothesis being tested is:

$$H_o = \mu_1 \leq \mu_2$$

$$H_a = \mu_1 > \mu_2$$

To test the average difference by comparing the average value of student learning outcomes with the investigation group and the average value of student learning outcomes with conventional t test formula is:

$$t_{hitung} = \frac{M_1 - M_2}{\sqrt{\frac{\sum X_1^2 + \sum X_2^2}{N(N-1)}}}$$

Testing criteria is price t_{hitung} compared with t_{tabel} obtained from t distribution table. If $t_{hitung} > t_{tabel}$ the real level of 0.005 with db = n-1, so then H_a accepted and H_o rejected. From the list of t distribution for $\alpha = 0.05$ and db = n - 1 = 40-1 = 39, is between 39 and db = db = 40, then t_{tabel} calculated by linear interpolation, namely:

$$\text{For db = 30 and } \alpha = 0,05 \text{ be obtained } t_{(1-\frac{1}{2}\alpha)} = t_{(0,975)} = 2,04$$

$$\text{For db = 40 and } \alpha = 0,05 \text{ be obtained } t_{(1-\frac{1}{2}\alpha)} = t_{(0,975)} = 2,02$$

So then t_{tabel} can be calculated as follows:

$$t_{tabel} = 2,02 + \frac{39-30}{40-30} (2,04 - 2,02) = 2,038$$

From the list of t distribution for $\alpha = 0.05$, and db = n - 1 = 40-1 = 39 then obtained $t_{tabel} = 2,038$ the results of linear interpolation.

By comparing the prices between t_{hitung} with price t_{tabel} be obtained $t_{hitung} = 13,04$ and price $t_{tabel} = 2,038$ so then $t_{hitung} > t_{tabel} = 13,04 > 2,038$. Therefore H_a accepted and H_o rejected, it can be concluded that there is an increase in student learning outcomes with the model group investigation on the subject of three-dimensional geometry at the grade XI Vocational High School of Sartika Rantau Utara in 2014/2015 academic year.

Conclusion

From the results of research and discussion in the previous chapter can be inferred by comparing the results of the investigation of student learning and conventional groups are in the medium category, so there is a difference in student learning outcomes.

Based on the implementation of learning that includes aspects of the level of mastery of the material, the thoroughness of learning outcomes, achievement of specific learning objectives and the results of observations and the statistical test group investigation model learning can improve student learning outcomes in the three-dimensional geometry of the material.

Based on observations based on the sheet student questionnaire responses showed that students responded positively cooperative learning model of investigative groups. based on the criteria of the average final assessment can be summed learning model in this study group investigation went smoothly.

So based on calculations that have been done by researcher then to make use of statistical tests t at the significant level $\alpha = 0.05$ in hypothesis testing diproleh $t_{hitung} = 13.04$ and the price $t_{tabel} = 2,038$ so $t_{hitung} > t_{tabel} = 13.04 > 2.038$. This shows that the accepted hypothesis that there are significant differences in learning outcomes of students using cooperative learning model of investigation group on three-dimensional geometry of the material.

The results of this study are consistent with the findings of previous Tran, Van D, (2014) the findings obtained from t-test analysis on the psychology posttest scores showed a significant difference ($t(108) = 9.60, p = .000$) between the experimental group ($M = 77.36, SD = 4.52$) and the control group ($M = 67.00, SD = 6.60$). The magnitude of the difference in the means (mean difference = 10.36) was very large ($ES = 0.46$). The results showed that the experimental group which had engaged in learning together produced a higher overall improvement in scores on the psychology posttest scores. This finding supports the first hypothesis which states that students who are taught by learning together will have greater achievement in the psychology course than those taught through lecture-based teaching.

Whicker, Kristina M, Bol & Nunnery (2010) The results obtained from a repeated-measures multivariate analysis of variance (with pretest scores as the covariate) showed a significant Group \times Time interaction. Students in the cooperative learning group had increasingly higher test scores than students in the comparison group and significantly outscored the comparison group.

Hendary, Isky (2014) Based on the hypothesis results using one-way t-test on the third Post-test with $df = 78, \alpha = 0.05$, obtained results $t_{count} = 2,42$ and $t_{table} = 1,6646$ or $t_{count} > t_{table}$, so the hypothesis is accepted. It can be concluded that all three results of hypothesis using t-test are showed that the hypothesis is accepted, which means that students learning outcomes in the class that treated with cooperative learning model group investigation type are better than the class that does not treated with cooperative learning model group investigation type.

Suggestion

Expected to teachers of mathematics in order to give the concept of mathematical understanding that can be experienced by students in everyday life, for example in the wake of space cubes and blocks thus attracting students to learn For researchers continued to use the results of this study as the basis for the development of research on materials other math.

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