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Application of cooperative learning model type group investigation and student team achievement division towards biology learning outcomes at SMA Negeri 3 Manado

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Abstract
This study aims to analyze the effect of applying the Group Investigation (GI) and Student Team Achievement Division (STAD) cooperative learning models as well as the interaction of the effects of the two models on learning outcomes in Animalia material biology subjects. The population in this study all students of class X MIA at SMAN 3 Manado consisting of 5 classes. The sample in this study were class X MIA 1 students with 34 students and class X MIA 2 with 35 students as the experimental class and X MIA 5 with 34 students as the control class. This research uses a quasi experimental method. Hypothesis testing in this study was carried out using the Two Way Anova test. The research results obtained significance value of the average difference between GI and STAD of 0.734> α = 0.05, these results indicate the two models provide a significant and relatively equal effect on student biology learning outcomes. While the significance value between the GI and Conventional models is 0.040 <α, the significance of the STAD and Conventional models is 0.035 <α, where the results indicate that in this study the GI type is the most effective learning model in improving student biology learning outcomes compared to the STAD type and conventional.

Keywords: group investigation, student team achievement division, learning outcomes

Introduction

School is a place where formal education takes place to form individual personalities so that they can have character, personality, creativity and innovation as well as adequate competencies to be used in the face of globalization. Natural Sciences subjects are part of the subjects taught at school. One part of science learning is Biology. These subjects are taught at all levels of education, both in elementary schools, junior high schools, senior high schools and in tertiary institutions. In its implementation, most biology subjects are in the form of understanding and memorization with foreign terms and there are some materials that must use formulas, so it is not easy for teachers to make students memorize and understand the materials in biology lessons. The weaknesses above cause learning biology is only a transfer of knowledge from the teacher to students to pursue curriculum targets.

The learning process requires variation and innovation from a teacher with the aim of developing the potential of both the teacher and students in exploring their abilities. This can make students more active and motivated in receiving material. The teacher will be helped in developing the concept of learning design so that it can be easier to achieve a targeted result. Learning model is one part of the variation and innovation of a teacher in delivering a material or teaching material in the hope that the material presented will be better understood/understood by students.

Based on the results of preliminary observations made at SMAN 3 Manado it was found that student learning outcomes in biology subjects were still low. This can be seen from the table of average national examination (UN) scores in biology courses over the last four years (2015 - 2018) which continue to decline, respectively 69.73, 54.64, 36.74, and 36 10. The results of interviews with subject teachers obtained information that more than 60% of students were less enthusiastic in participating in learning activities in class, so that difficulties in understanding the material provided, especially in Animalia material.

Animalia is one of the subjects in biology with a very complex and broad range of material, so an appropriate learning model is needed to be able to meet the needs of students in understanding the concept of the material. The observation results obtained by researchers that the provision of animalia material in SMA 3 Manado delivered using conventional methods, in the form of lectures that take place with one-way communication patterns, without the active involvement of students.

To test the level of students' understanding of Biology subject matter, researchers conducted trials in two classes, namely XI IPA 1 and XI IPA 2 classes in SMA Negeri 3 Manado, by giving objective questions (multiple choice) of 60 numbers containing six materials namely protists, fungi, plantae, animalia, and ecology. The trial results obtained that the average value in the two classes tested were still below the Minimum Mastery Criteria (KKM). The number of students who are in the complete criteria for Class XI Science 1 and XI Science 2 are 26% and 21% respectively, while the number of students who are in the incomplete category are 74% and 79%, respectively. The trial results also showed that the Animalia material received the lowest score among the five Biology subjects.

The low student learning outcomes are caused by the learning methods used by teachers in Biology subjects that are not effective. This can be overcome by using appropriate methods in learning, one of which is by applying cooperative learning methods. Cooperative learning trains

students to work together and recognize students' differences from one another. One variant that can be used in cooperative learning methods is Group Investigation (GI)
Group Investigation is a model of cooperative learning in which students are expected to be active in learning so that interaction occurs between students and students and also students and teachers. This learning process can build student character and foster social, responsible, students can work well together and motivate in learning (Medyasari, *et al*, 2017) [7].
The slight variation in learning models is also another inhibiting factor that makes students less interested in learning and only chatting with their peers. When learning takes place, students rarely ask questions or give feedback about the material delivered by the teacher. Students who are less passionate and less active make the learning process saturated and can result in learning goals not being achieved perfectly.
Group discussion is an appropriate teaching and learning strategy to improve the quality of interaction between students (Suprijanto, 2007) [13]. Discussion can encourage the participation of participants, those who are physically and mentally active in discussions, learning more than those who just sit and listen. In addition, discussion encourages someone to listen well, active listening helps clear misunderstandings.
In addition to the Group Investigation type, one variant of cooperative learning models that can be applied in the teaching and learning process is the Student Teams Achievement Division (STAD) which is useful for achieving learning objectives and making students more active by combining the use of lecture, questioning and discussion methods. In the learning process with the STAD type cooperative learning model, students will go through several stages, namely the presentation of material, group division, discussion, individual tests, group awards, and evaluation of teaching and learning activities and concluding learning material. The implementation of the STAD learning strategy can make a positive contribution in achieving the learning objectives and increasing the activeness of students in learning.

Research Methods

The method used in this research is quasi or quasi-experimental methods. This research is part of a quantitative method. Quasi experimental research serves to determine the effect of experiments/treatments on the characteristics of the subjects desired by researchers. This experimental research has treatment, thus the experimental research method is a research method used to find the effect of certain treatments on others under controlled conditions.
The experimental design model used in this study is completely presented in the following table:

Table 1: Research Design Control Group Pre Test Experiments - Post Test

A/B	Group Investigation (GI)	Student Team Achievement Division (STAD)	Konvensional
Pretest	A1B1	A2B1	A3B1
Postest	A1B2	A2B2	A3B2

Information
A = Learning Model
A1 = Group Investigation (GI) Learning Model
A2 = Student Team Achievement Division (STAD) Learning Model
A3 = Conventional Learning Model
B = Testing Phase
B1 = Pretest
B2 = Posttest

The three class groups were given a pretest before being given treatment, then proceed by giving treatment to each class. After being given treatment in each class, then posttest is done to get the value of the final learning outcomes which will then be able to show the effectiveness of the treatment given in improving student achievement.
This research was conducted at SMA Negeri 3 Manado. The population in this study were all students of class X MIA in SMA 3 Manado consisting of 5 classes. The sample in this study was class X MIA 1 with 34 students, and class X MIA 2 with 35 students as the experimental class, while class X MIA 5 with 34 students was taken as the control class. The sampling technique in this study, namely by using purposive sampling with consideration of the three classes have relatively the same ability.

The procedure in this study consisted of
1. Planning
a) School observations
b) Determine the sample
c) Make a questionnaire
d) Make RPP
e) Make a matter of pretest and posttest

2. Implementation
a) Conducting a pre-test (pretest) as well as giving a questionnaire to the experimental and control classes to determine the initial conditions of students.
b) Facilitating students in study groups.
c) Researchers explain teaching material and guide group learning using the Group Investigation model and the Student Team Achievement Division model in two experimental classes, while the control class is given lecture treatment (conventional models).
d) Researchers conducted a final test (posttest) and also distributed questionnaires to the experimental class and the control class.

The instrument used to collect data in this study is a test of learning outcomes in the form of multiple choice / objective, which is used to determine the learning outcomes of students' cognitive domains in applying concepts that have been given before and after learning (treatment). Before being used, the instrument is firstly judged by expert lecturers or field study teachers, then trialled on groups that are not research subjects. This is done to determine the validity and reliability of the instruments used in the study, so that they can be declared eligible for use.

Data analysis in this research was carried out through stages
1. Analysis of statistical assumptions
Analysis of statistical assumptions (also called prerequisite test analysis) is carried out to meet the test requirements using parametric statistical tests. Statistical assumptions analysis in this study consists of a normality test to find out whether data is normally distributed or not as a condition for

conducting a variance analysis test (Purwanto, 2011) [9] using the Kolmogorov-Smirnov test. Next is the homogeneity test of population variance to find out if the sample used in the study came from a homogeneous population using the Bartlett test (Sudjana, 2005) [12].

2. Hypothesis analysis techniques

This study uses a 3x2 factorial design, then the analysis tool that will be used is a two-way analysis of variance (Two Way ANOVA), which is a method used to test the difference in variance of two or more variables. The main element in the analysis of variance is the variance between groups and the variance within groups. Variance between groups can be said as a numerator and variance within a group as a denominator (Gudono, 2015).

The steps in the two way ANOVA calculation are:

1. Identification of values: t (number of treatments), r (number of blogs),
2. Calculate the total number of observations (n), i.e. n = r x t,
3. Calculate the total number of squares with the formula:

$$SS_T = \sum (X_{ij})^2 - \frac{(\sum T_j)^2}{n}$$

4. Calculate the number of treatment squares with the formula:

$$SS_P = \sum \frac{\sum (P_1)^2}{r} - \frac{(\sum T_j)^2}{n}$$

5. Calculate the sum of squares between blocks with the formula:

$$SS_B = \sum \frac{\sum (B_1)^2}{t} - \frac{(\sum T_j)^2}{n}$$

6. Find the price of F-Calculate using the formula listed in the following table:

Table 1: Kalkulasi Perhitungan Anova Dua Jalur (Two Way Anova)

Sumber Variasi	df	SS	MS	F-HITUNG
Antar Blok	r-1	SS_B	$MS_B = \frac{SS_B}{r-1}$	$\frac{MS_B}{MS_E}$
Antar Perlakuan	t-1	SS_p	$MS_p = \frac{SS_p}{t-1}$	$\frac{MS_p}{MS_E}$
Dalam Perlakuan (error)	(n-1)-(k-1)-(t-1)	$SS_E = SS_T - SS_B - SS_p$	$\frac{SS_E}{(r-1)-(t-1)}$	
Total	n-1	SS_T		

7. Find the price of the F table by considering (1) the level of significance (α), (2) df1 which is the df of the largest MS, and (3) df2 which is the df of the smallest MS.
8. The hypotheses tested in this study are:

H0: There is an influence of the GI and STAD cooperative learning model on student learning outcomes

H1: There is no influence of the GI and STAD cooperative learning model on student learning outcomes

Test Criteria

a) If the significance value is> 0.05, then Ho is rejected, which means there is no effect.
b) If the significance value <0.05, then Ho is accepted, which means there is influence. (Agus, 2004).

In this study, researchers used SPSS for Windows v.24 to help test hypotheses with two way ANOVA.

Results and Discussion

Research result

1. Classical Assumptions Analysis

Multivariate data normality testing is carried out on the residual value. Data that are normally distributed are indicated by significance values above 0.05 or 5%. Kolmogorov Smirnov test results obtained statistical values for the test of 0.099, with a significance value (Sig.) = 0.117. The significance value = 0.117 is greater than 0.05, so it can be concluded that the data used in this study are normally distributed, or meet the assumptions of data normality. Furthermore, the homogeneity variance test results obtained significance value (Sig.) of 0.069, which is more than the significance level of 0.05. Thus it is based on the null hypothesis testing criteria which states that the value of biology learning achievement between treatment groups is accepted. The conclusion is that the variance in the value of biology learning achievement by groups between columns is homogeneous.

From the two results of testing the analysis requirements consisting of normality test with the Lilleifors or Komogorov-Smirnov test technique and the variance homogeneity test with the Barlett test technique (Levene Statistics) states that the analysis requirements needed for the analysis of two ways variance (two ways ANOVA) have been fulfilled.

2. Research Hypothesis Test

Based on ANAVA test results with IBM SPSS 24, a summary of the results of two-way variance analysis with a 3x2 factorial design can be seen in the following table:

Table 2: Summary of Results of Two-Way Variance Analysis

Tests of Between-Subjects Effects						
Dependent Variable: Hasil Belajar						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	2627.937[a]	5	525.587	5.911	.000	.129
Intercept	1208561.144	1	1208561.144	13592.963	.000	.985
Metode	429.111	2	214.555	2.413	.092	.024
Tahapan	1571.182	1	1571.182	17.671	.000	.081
Metode * Tahapan	630.470	2	315.235	3.546	.031	.034
Error	17782.160	200	88.911			
Total	1228576.000	206				
Corrected Total	20410.097	205				

a. R Squared = .129 (Adjusted R Squared = .107)
b. Computed using alpha = .05

From the table above, it can be interpreted as follows

1. Corrected Model, shows the effect of independent variables (Learning Method, Test Stages (Pretest-Posttest) and Interaction between the two) together to the dependent variable (Test Value). If Significance (Sig.) <A = 0.05, then it is declared significant. From the above table, the Sig. equal to 0,000, which means the model is valid.
2. Intercept, shows the value of changes in the dependent variable without the need to be influenced by the presence of the independent variable, meaning that without the influence of the independent variable, the dependent variable can change in value. If Significance (Sig.) <A = 0.05, then it is declared significant. From the table above obtained a Significance value of 0,000, which means a significant intercept.
3. Method, the results of this test show the different effects of the application of the three learning methods on the test scores in the model. If Significance (Sig.) <A = 0.05, then Significance is stated. In the table above the significance value is 0.092 which means that it is not significant, which means that the three learning models in this study are equally influential on learning outcomes.
4. Stages, showing differences in test scores obtained by students at the pretest and posttest stages. If Significance (Sig.) <A = 0.05, then Significance is stated. From the table above obtained a Significance value of 0,000, which means that there are significant differences in the value of biological tests in the pretest and posttest.
5. Method * Stages, showing the effect of treatment in the form of the application of learning methods on test scores. If Significance (Sig.) <A 0.05, then Significance is stated. In the table above a significance value of 0.0031 is obtained, which means that the application of the learning method affects the test scores as indicated by the difference in scores at the pretest and posttest stages.

Based on the test results, the significance value (Sig.) Of the Corrected Model is obtained, which is smaller than α = 0.05, which means significant. This shows that the application of the three learning methods in this study gives differences in the value of students' biology tests on the pretest and posttest. Intercept results also show significant results, which means that the three learning models in this study are equally influential on student biology learning outcomes. Furthermore, the test results show that the significance value for the method is 0.092, which means that the three learning models in this study are equally influential on student biology learning outcomes. However, to find out whether all the learning methods applied have a significant effect, further testing needs to be done.

The test results also indicate that there are differences in the test scores obtained by students at the pretest and posttest stages in each group of learning models applied, with a significance value (Sig.) For Stages = 0,000 which is smaller than α = 0.05. These results indicate that the three learning models each affect the learning outcomes of student biology. This is a temporary conclusion, to ensure which learning method has a significant influence, further testing is needed.

Furthermore, the ANAVA test results above show that the significant value obtained for the Method * Stages of 0.031 <0.05, which means that there is an interaction between the learning model of the test stage (pretest - posttest). To further analyze the level of significance of the effect of each treatment, further testing is needed whose results can be seen in the following table:

Table 3: Further Test Estimates Parameters

Parameter	**B**	**Std. Error**	**t**	**Sig.**	**Partial Eta Squared**
Intercept	75.059	1.617	46.416	.000	.915
[Metode=1 (GI]	6.638	2.304	2.881	.004	.040
[Metode=2 (STAD)]	6.313	2.271	2.780	.006	.037
[Metode=3(KONVENSIONAL)]	0[a]	.	.	.	.
[Tahapan=1]	-.706	2.287	-.309	.758	.000
[Tahapan=2]	0[a]	.	.	.	.
[Metode=1] * [Tahapan=1]	-6.248	3.235	-1.932	.055	.018
[Metode=1] * [Tahapan=2]	0[a]	.	.	.	.
[Metode=2] * [Tahapan=1]	-8.208	3.211	-2.556	.011	.032
[Metode=2] * [Tahapan=2]	0[a]	.	.	.	.

From the above table it can be seen that in the intercept function, only method 1 (GI type cooperative cooperative model) and method 2 (STAD type cooperative learning model) have a significant effect on student biology learning outcomes with the resulting significance value <α = 0.05 and the resulting effect size are 4% and 3.7%, respectively. The significance value of the intercept also shows that there is an interaction between the learning model of the test stages of each class, as well as significant interactions between the GI and STAD methods.

Furthermore, because there was an interaction between the learning models and the stages of the test of each class, further tests (Post Hoc) are needed, where the test results can be seen in the following table:

Table 4: Further Test Results (Post Hoc)

	(I) Metode Mengajar	(J) Metode Mengajar	Mean Difference (I-J)	Std. Error	Sig.
Tukey HSD	Metode GI	Metode STAD	1.20	1.606	.734
		Konvensional	3.41*	1.617	.040
	Metode STAD	Metode GI	-1.20	1.606	.734
		Konvensional	2.21*	1.606	.035
	Konvensional	Metode GI	-3.41*	1.617	.040
		Metode STAD	-2.21*	1.606	.035

From the above table it can be concluded as follows

1. Significance Value (Sig.) The average difference between the GI Method and the STAD Method is 0.734> α = 0.05, so it is declared insignificant. These results indicate that the GI method and the STAD method have relatively the same effect, or there is an interaction between the two learning methods on the biology learning outcomes of SMA Negeri 3 Manado students.
2. The significance value (Sig.) of the average difference between the GI Method and the Conventional Method is 0.040, where this result is smaller than α = 0.05, so it is declared significant. These results indicate that the application of GI type cooperative learning methods has a more significant influence on student biology learning outcomes compared to conventional methods.
3. The significance value (Sig.) of the average difference between the STAD Method and the Conventional Method is 0.035 <α = 0.05, so that it is declared significant. These results indicate that the application of STAD type cooperative learning methods has a more significant influence on student biology learning outcomes compared to conventional methods.

Discussion

The results of hypothesis testing conducted, the results obtained are that the GI type and STAD cooperative learning methods both have a significant influence on the biology learning outcomes of SMA Negeri 3 Manado students. The findings of this study are in line with Sugiyanto (2007) [11], who revealed that cooperative learning is a learning approach that focuses on using small groups of students to work together in maximizing learning conditions, so that it is more effective in achieving learning goals. This finding is also in line with research conducted by Dewi (2014) [3], where the results of the study found that STAD and GI learning both had a significant influence on student achievement.

With the application of cooperative learning methods both GI and STAD types, all students are directly involved in learning activities. On the ability of students to remember, understand, and apply the material being honed more effectively and efficiently. The active role of students in learning activities directly can improve students' cognitive abilities, because they carry out learning activities directly so they get their own learning experiences. As expressed by Simsek (2012) [10], which states that students learn more when doing an active activity rather than just watching and listening. So that learning activities that involve students actively make students learn more and get more knowledge too.

The results showed that the application of the GI type of cooperative learning models was most effective compared to the GI type and conventional learning models. This is because the GI learning model demands a high level of social interaction in students. Adora's research (2014) states that the Group Investigation model can build students' leadership attitudes and social skills, and involve students in learning activities that can build the habit of working together and building student creativity.

The habit of positive attitude in learning that has been started since the beginning and is carried out continuously will be able to foster students' ability to understand the subject matter, so that it will help students to achieve maximum learning outcomes. Furthermore, research conducted by Praptiwi and Handika (2012) [8] also found that the GI method was more than the STAD method in improving student achievement. It was further explained that the GI (Group Investigation) type of cooperative learning methods students put more emphasis on group performance to find a concept by carrying out investigative activities and each group member had a sense of responsibility and contributed to the success of the group. Whereas in the STAD (Student Teams Achievement Divisions) method, students only emphasize peer tutorials and student achievement is less than the maximum.

Furthermore, in general the results of the comparative study showed that the cooperative learning model both the GI type and the STAD type was more effective or better than the conventional learning model. This can occur because in the cooperative learning model students are not too dependent on the teacher so that they can increase the confidence in thinking skills, determine information from various sources, and learn from other students. Besides that the cooperative learning model can also help empower each student to be more responsible in learning. While using conventional learning models students are less able to achieve the expected competition because teacher-centered learning. In practice the teacher as the main source of information takes a central role in conventional classroom learning, whereas in the cooperative learning model students experience role development. The development of this role has a good impact on student development both cognitive, affective and psychomotor.

In the GI (Group Investigation) type of cooperative learning methods students place more emphasis on group performance to find a concept by carrying out investigative activities and each group member has a sense of responsibility and contributes to the success of the group. Whereas in the STAD (Student Teams Achievement Divisions) method, students only emphasize peer tutorials and student achievement is less than the maximum.

Furthermore, the results of the two-way ANAVA test concluded that there were significant differences in the value of biological tests in the pretest and posttest for the GI type and STAD cooperative learning models. These results reinforce the conclusion that the application of the GI type and STAD cooperative learning model has a significant effect on Biology learning outcomes of SMA Negeri 3 Manado students.

The effectiveness of the cooperative learning model type Group Investigation (GI) and Student Team Achievement Division (STAD) in learning Biology will be able to develop students' thinking processes to more actively master and explore the competencies that must be mastered and which are their responsibilities, because the principle of cooperative learning emphasizes students cooperatively master and explore certain subject matter which subsequently between students teach each other.

Further tests on two-way ANAVA, the results obtained that the GI method and STAD method both have a significant influence on learning outcomes, or there is an interaction between the two learning methods on the biology learning outcomes of SMA Negeri 3 Manado students. These results indicate that the two cooperative learning models are equally effective in improving student learning outcomes, both used alone or together by combining the two models.

These results are in line with research conducted by Kusdiwelirawan *et al*. (2007), in which the results show that there is a significant interaction between the GI learning model and STAD on student physics learning outcomes in terms of student achievement motivation. It was further disclosed that based on the results of this study, it was possible to improve physics learning outcomes using models that varied according to the needs of students and the material to be studied, either by using the GI or STAD learning models, or by combining or combining the two.

Conclusion

The application of the GI type and STAD cooperative learning methods has a significant effect on biology learning outcomes of SMA Negeri 3 Manado students. There is a significant difference in effect between the use of GI type, STAD type and conventional models on the learning outcomes of biology students in SMA Negeri 3 Manado. The Group Investigation (GI) type of cooperative learning model is the most effective or best compared to the conventional and STAD type cooperative learning model. Furthermore STAD type is more effective or better than conventional learning models. Both cooperative learning models (GI and STAD) are equally effective in improving student learning outcomes, both used alone or together by combining the GI and STAD methods.

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