International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

The Effect of Cooperative Learning Model and ScientificAttitudes toward Mathematics Achievement by Controlling the Intelligence

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Abstract: ***The purpose of this study was to find out empirically, the effects of cooperative learning model and scientific attitude toward mathematics achievement, by controlling the intelligence. The method used is an experimental method to design treatment by level 2 x 2. To test the hypothesis, the data were analyzed with analysis of covariance. Result were obtained after contolling the intelligence: (1) mathematics achivement in the group of students who were taught with cooperative learning model TGT have higher than the group of students who were taught with cooperative learning model Scramble, (2) there was an interaction effect between cooperative instructional model and scientific attitude toward mathematics student achievement, (3) for students who have a positive scientific attitude, mathematics achievement in the group taught with cooperative learning model TGT have higher than the group taught with cooperative learning model Scramble, and (4) for students who have a negative attitude of the scientific, mathematices achievement in the group taught with cooperative learning model TGT have lower than the group taught with cooperative learning model Scramble. Teachers must be creative in teaching using learning models in order to create an effective learning environment and can improve mathematics achivement by optimal.***

Keywords: Cooperative Learning, Scientific Attitude, Mathematics Achievement, Intelligence

1. Preliminary

The main problem in our world of education today is the quality of graduates which is generally still low. The results of the national exams which are held every year do not show a significant increase in student learning outcomes. In 2013, the average national exam results decreased compared to the results of the 2012 national exam. The Minister of Education, Mohammad Nuh stated that the percentage of passing the national exams in 2013 decreased by 0.02% compared to the results in 2012 (Nuh, 2013: 1) . Especially for mathematics at various levels of education is very concerning, because there are still students who score below 4 on a scale of 0-10.In fact, the average score of the 2013 national exam results for mathematics was 5.78 (Ministry of Education and Culture Press Conference, May 2013), which means that there are still grades below 4. This means that mathematics is still considered difficult by most students, even students at universities. tall. This actually happened in the Mathematics Department of FMIPA UNIMA, semester III of the 2011/2012 academic year, especially for the Advanced School Mathematics Studies-1 (KMSL-1) course which cannot be said to be satisfactory because the average score of the course is 2.65 for on a scale of 0-4 and this happens almost every year.

Sudjana (1998: 4) suggests that learning outcomes are a behavior that is shown after students take their learning experiences. Furthermore, it is said that the learning outcomes achieved are influenced by two main factors, namely factors from within the student and factors from outside the student. Factors from within students include their abilities such as learning motivation, interest and attention, attitudes and study habits, perseverance, socio-economic, and physical. Factors from outside the student's self which include everything in the surrounding environment including the school environment, community, and place of residence or family.According to Hudoyo (1990: 139) one indicator of mathematics learning outcomes is that one can construct relationships between the parts of information that have been obtained as understanding. Someone who can understand and master these relationships, can display an understanding and mastery of the subject matter he is studying is called learning outcomes. So, the results of learning mathematics in this study are changes in mental activity in understanding the meaning, relationships, of mathematical symbols to be used in answering questions or mathematical problems.

Professional teachers always try to create an active, innovative and fun learning atmosphere by applying methods, approaches and learning strategies that are appropriate to the learning material in order to develop students' interest in subjects including mathematics, so that learning outcomes are good. So far, the teaching and learning process in the Mathematics Department of FMIPA Unima generally rarely applies the Cooperative Learning Model according to lecture teaching materials. Especially in the KMSL-1 course, the cooperative learning model has never been perfectly implemented. Even though group discussions are often held, which is one of the characteristics of the Cooperative Learning Model, they are only limited to ordinary discussions so that they do not motivate students to learn actively and innovatively.

Slavin (2010: 14) reveals that the cooperative learning model is a model that prioritizes the existence of groups, where each student in the group prioritizes cooperation in solving problems to develop knowledge and skills in achieving learning goals. The Cooperative Learning Model

of the Team Game Tournament (TGT) type, for example, as part of the cooperative learning model can provide an active and fun learning atmosphere because the advantage is in the dimension of joy that is obtained from the use of games and the activities are really fun.

Likewise with the Scramble learning model as stated by Widodo (2009) that, the Scramble type Cooperative Learning model is a learning model in the form of a mathematical game, compiling steps to solve random questions and students are expected to be able to arrange the answers correctly.

Raharjo (2000: 241) suggests that one of the goals of using a learning model is to improve students' abilities while studying. With the selection of learning methods, strategies, approaches and techniques, it is hoped that there will be a change from memorizing or rote learning towards thinking and understanding, from the lecture model to the discovery learning approach or inquiry learning, from individual learning to cooperative, and from subject centered to clearer centered or the construction of student knowledge.

Scientific attitude is a psychological factor that needs to be considered by lecturers in carrying out teaching assignments. Because a scientific attitude is a person's tendency to act or behave in order to solve problems systematically through scientific steps, students who have a positive scientific attitude understand learning material more easily than students who have a negative scientific attitude (Ulum's, 2011: 2). Rino (2010: 1-2) suggests "An attitude as a degree of positive or negative affect associated with some psychological objects" where attitudes are related to objects accompanied by positive feelings (favourable) or negative feelings (unfavourable).So a scientific attitude is a scientific attitude. Furthermore, it was stated that the scientific attitude In this study there were four variables observed, namely the learning model as the treatment variable (independent), mathematics learning outcomes as the dependent variable, scientific attitude as the moderator variable, and intelligence as the control variable. The treatment variable in question is the application of the TGT type cooperative learning model and the Scramble type in two predetermined classes, namely the experimental class and the control class. The data collection for the mathematics learning outcomes variable was used as a learning achievement test instrument, to collect data about intelligence was used an IQ test with the help of a psychologist, and to collect data about scientific attitudes an attitude scale questionnaire was used. Attitude scale scores were used to determine groups of students who had positive scientific attitudes and groups of students who had negative scientific attitudes, while the learning outcomes and IQ scores collected from the experimental and control classes were used for hypothesis testing. Before data collection was carried out, the attitude scale instrument and learning achievement test instrument were tested for validity and reliability in order to prove that the two instruments has the following characteristics: (1) curiosity, (2) flexibility, (3) critical reflection, (4) honest attitude.

Another psychological factor that influences the results of learning mathematics is intelligence. According to Suharnan (2005: 345-349), intelligence is a mental, mind or human intellectual ability and is part of a higher cognitive process (higher order cognition) and is generally called intelligence. Intelligence is one of the factors that determine the success of a learning process. Intelligence is essentially the ability to solve problems, create a product that is valuable in one or several cultural environments of society.

This study aims to obtain empirical data about the effect of cooperative learning models and scientific attitudes on mathematics learning outcomes, after controlling for intelligence.

2. Research Procedure

The method to be used in this study is an experimental method with a treatment by level 2 x 2 design. The design in question can be described in a matrix as presented in the matrix as follows:

Table 1: Treatment by Level 2x2 Experiment Design

B	A	
	A_1	A_2
B_1	$(X,Y)_{ij}$ $i = 1, 2,\ldots k$ $j = 1, 2,\ldots k.$	$(X,Y)_{ij}$ $i = 1, 2,\ldots k.$ $j = 1, 2,\ldots k.$
B_2	$(X,Y)_{ij}$ $i = 1, 2,\ldots k.$ $j = 1, 2,\ldots k.$	$(X,Y)_{ij}$ $i = 1, 2,\ldots k.$ $j = 1, 2,\ldots k.$

were feasible to use to collect data on the variable in question.

After the research was completed (for 3 months), data on mathematics learning outcomes from both research classes (experimental and control) were collected through test instruments that had been declared valid. Data on mathematics learning outcomes and IQ were analyzed statistically, both descriptively and inferentially in relation to testing the research hypothesis (after all analysis requirements were met).

3. Results and Discussion

The results of data analysis were descriptive and inferential about the results of learning mathematics from two student study groups, both those taught using the TGT Cooperative Learning Model (experimental group) and those taught with the Scramble Cooperative Learning Model (control group). The results of the descriptive analysis are presented in the following figure.

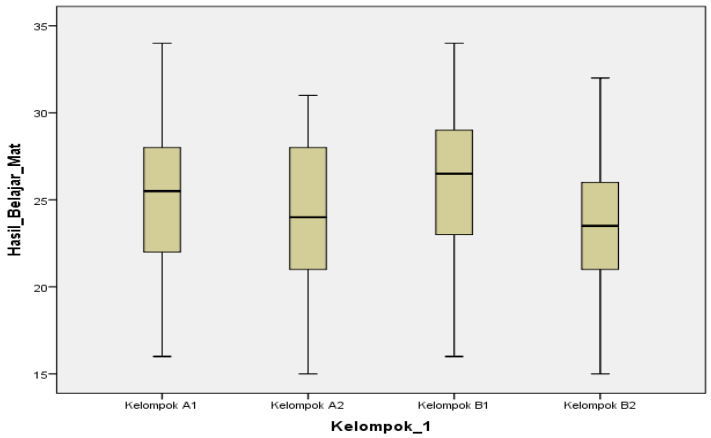

Figure 1: Boxplot diagram of Mathematics Learning Outcomes in Groups A and B

Based on the display of the Boxplot diagram in **Figure 1**, it can be concluded that in groups A1 and B1 the distribution of data is skewed to the right, which means that the results of learning mathematics for these two groups tend to be high. In group A2 the distribution of data is skewed to the left, which means that the mathematics learning outcomes for this group tend to be low. Whereas in group B2 the distribution of data is symmetrical, which means that the mathematics learning outcomes for this group are evenly distributed.

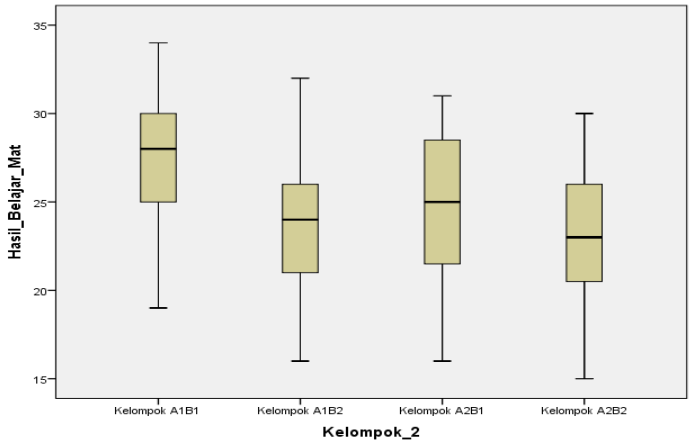

Figure 2: Boxplot diagram of Mathematics Learning Outcomes in Groups A1B1, A1B2, A2B1, and A2B2

Based on the display of the Boxplot diagram in **Figure 2**, it can be concluded that in groups A1B1 and A1B2 the data distribution is skewed to the right. That is, the results of learning mathematics for these two groups tend to be high. In group A2B1 the distribution of data is symmetrical, which means that the learning outcomes for this group are even. Whereas in the A2B2 group the distribution of data is skewed to the left, which means that the learning outcomes for this group tend to be low. In all experimental groups, there were no outlier data.

Table 2: Results of the analysis of differences in the mean Y according to factor A and the effect of interaction A*B on Y after controlling for IQ

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	760.451[a]	4	190.113	22.528	.000
Intercept	10.425	1	10.425	1.235	.271
X	600.117	1	600.117	71.112	.000
A	56.201	1	56.201	***6.660***	.013
B	29.726	1	29.726	3.522	.066
A * B	77.236	1	77.236	***9.152***	.004
Error	464.149	55	8.439		
Total	37830.000	60			
Corrected Total	1224.600	59			
a. R Squared = .621 (Adjusted R Squared = .593)					

The results of inferential data analysis related to hypothesis testing can be described as follows:

1) Main Factor Hypothesis Testing

The results of research data analysis for testing the main hypothesis are presented in the following table.

Based on the test results in **Table 2**, especially in row A, the Fcount value = 6.66 with a p-value = 0.013 is obtained. At the real level $\alpha = 0.05$ and dk = 1; 55 obtained Ftable = 4.02. If the two F values are compared, it turns out that Fcount = 6.66 > ttable = 4.02. If the p-value is compared with α, it turns out that p-value = 0.013 < α = 0.05. This can be interpreted that there are differences in mathematics learning outcomes between groups of students taught with the TGT Cooperative Learning Model and the learning outcomes of groups of students taught with the Scramble Cooperative Learning Model, after controlling for intelligence.

Then the calculation of the average corrected mathematics learning outcomes of each group was carried out and the following results were obtained.

$$\bar{Y}_{y(res)A1} = 25.68$$
$$\bar{Y}_{y(res)A2} = 23.71$$

If the corrected average values are compared, it turns out that . Thus it can be concluded that the mathematics learning outcomes of the group of students who were taught with the TGT Cooperative Learning Model were higher than the group of students who were taught with the Scramble Cooperative Learning Model, after controlling for intelligence.

2) Testing the Interaction Effect Hypothesis

Based on the results of testing the interaction effect hypothesis as presented in Table 2 above, specifically for row A*B, the value of Fcount = 9.152 is obtained with a p-value = 0.004. At the real level α = 0.05 and dk = (1.55) Ftable = 4.02. If the two F values are compared, it turns out that Fcount = 9.152 > Ftable = 4.02. Or, if the p-value is compared with α, it turns out that p-value = 0.004 < α = 0.05. These results indicate that there is an interaction effect of the learning model with a scientific attitude towards mathematics learning outcomes, after controlling for intelligence.Because the interaction effect hypothesis was tested, further tests were carried out on the simple effect hypothesis.

3) Testing the Simple Effect Hypothesis

Testing the simple effect hypothesis was carried out on 2 (two) hypotheses, namely differences in mathematics learning outcomes between all levels of the learning model factors for each scientific attitude factor, after controlling for intelligence. Testing these two hypotheses was analyzed using the Univariate GLM procedure with the X B A*B design. The results of the analysis are presented in the following table.

Table 3: Parameter Estimation of the Mean Y Between All Levels of Factor A for Each Factor B, after Controlling for X

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	-4.343	3.444	-1.261	.213	-11.245	2.558
X	.266	.031	8.433	.000	.202	.329
[B=1]	-.842	1.077	-.782	.438	-3.001	1.316
[B=2]	0[a]	.	.	.	.	.
[A=1] * [B=1]	4.251	1.080	***3.935***	.000	2.086	6.415
[A=1] * [B=2]	-.297	1.066	***-.279***	.782	-2.434	1.839
[A=2] * [B=1]	0[a]	.	.	.	.	.
[A=2] * [B=2]	0[a]	.	.	.	.	.
a. This parameter is set to zero because it is redundant.						

Based on the values in **Table 3**, it can be seen in the row that the value of tcount = 3.935 with p-value = 0.0001 is obtained. At the real level α = 0.05 and dk = n-2 = 30 – 2 = 28, we get t_{table}(0.05;28) = 1.701. If the two t values are compared, it turns out that tcount = 3.935 > t_{table} = 1.701. Or, if the p-value is compared with α, it turns out that p-value = 0.0001 < α = 0.05. This means that in the group of students who have a positive scientific attitude, there are differences in learning outcomes in mathematics between students taught with the TGT Cooperative Learning Model and students taught with the Scramble type Cooperative Learning Model, after controlling intelligence.

Then the calculation of the average corrected mathematics learning outcomes of each group was carried out and the following results were obtained:

$$\bar{Y}_{res(A1B1)} = 27.54$$
$$\bar{Y}_{res(A2B1)} = 23.29$$

If the corrected average values are compared, it turns out that . Thus it can be concluded that in the group of students who have a positive scientific attitude, the mathematics learning outcomes of the group of students who are taught with the TGT type Cooperative Learning Model are higher than the group of students who are taught with the Scramble type cooperative learning model, after controlling for intelligence. In the line, the value of tcount = -0.279 is obtained with a p-value = 0.782. By using the real level α = 0.05 and dk = n-2 = 30–2 = 28, we get ttable(0.05;28) = 1.701. If the two t values are compared, it turns out that tcount = -0.279 < ttable = 1.701. Or, if the p-value is compared with α, it turns out that p-value = 0.782 > α = 0.05. This means that in the group of students who have a negative scientific attitude, there are differences in learning outcomes in mathematics between students taught with the TGT Cooperative Learning Model and students taught with the Scramble Cooperative Learning Model, after controlling for intelligence.

Then the calculation of the average corrected mathematics learning outcomes of each group was carried out and the following results were obtained:

$$\bar{Y}_{res(A1B2)} = 23.84$$
$$\bar{Y}_{res(A2B2)} = 24.13$$

If the corrected average values are compared, it turns out that . Thus it can be concluded that in the group of students who have a negative scientific attitude, the mathematics learning outcomes of the group of students who are taught with the TGT Cooperative Learning Model are lower than the group of students who are taught with the Scramble Cooperative Learning Model, after controlling for intelligence. The mathematics learning outcomes for the student class taught with the TGT Cooperative Learning Model are higher than the mathematics learning outcomes for the student class taught with the Scramble Cooperative Learning Model, after controlling for student intelligence. This happens because in groups of students who are taught using the TGT Cooperative Learning Model, students are stimulated to find their own answers to each question asked,

thus requiring reasoning and a high level of critical thinking.Whereas in the group of students who were taught using the Scramble type cooperative learning model, answers were provided for each question and the student's task was to choose the answers and sort them according to the most appropriate work steps, so that it did not stimulate students to think critically. This finding is supported by the results of Saryantono's research (2013) at SMP PGRI 3 Bandar Lampung with the title "The Effect of Teams Games Tournament-type Cooperative Learning on Mathematics Learning" which concluded that the TGT (Teams Games Tournament) type of cooperative learning model has an effect on mathematics learning outcomes. Sugiarta (2012: 9) through his research entitled "Application of the Scramble-type Cooperative Learning Model to Increase the Activity and Learning Outcomes of Class XI Students of SaraswatiSingaraja High School in Economics Subjects" with the conclusion that the application of the Scramble-type cooperative learning model can improve economic learning outcomes in students class XI SMA SaraswatiSingaraja.

Based on the results of the research that has been disclosed, it can be concluded that in fact the application of cooperative learning models of the TGT and Scramble types affects learning outcomes in mathematics. Even if the findings of this study conclude that the mathematics learning outcomes of the group of students taught with the TGT type cooperative learning model are higher than the group of students taught with the Scramble type cooperative learning model, it can be interpreted that the effect of applying the cooperative learning model on mathematics learning outcomes varies greatly, depending on suitability of the material with the type of learning model chosen.

There is an interaction effect of the learning model with a scientific attitude on student mathematics learning outcomes, after controlling for intelligence. This happens because in learning using the cooperative learning model students work together in small groups, help each other, discuss, argue to hone knowledge, foster relationships between groups and between friends, and increase self-esteem. This situation triggers a person (student) to have a positive attitude towards learning activities, including towards lecturers, fellow students, and the teaching materials being studied, so that learning outcomes can increase. This finding is supported by the results of research conducted by Fakhruddin, Eprina and Syahril (2010: 21) in their research entitled "Scientific Attitudes of Students in Learning Physics by Using Computer Media through the Tepe STAD Cooperative Model in Class X Students of SMA Negeri I Bangkinan Barat" . They concluded that "students' scientific attitudes towards the subject matter of heat by using computer media through the STAD type learning model in physics lessons, experienced significant changes, especially in class X students of SMA N1 Bangkinan Barat".

This conclusion can be interpreted that the application of the STAD type cooperative learning model with computer media in the subject matter of heat physics resulted in a significant positive change in students' scientific attitudes. In other words, the application of the cooperative learning model results in a positive scientific attitude of students. Even though it was not concluded and reported through their research, if possible student learning outcomes were measured at that time, with full confidence it could be ascertained that they had experienced a very significant increase. In accordance with the results of Putri's research which concluded that cooperative learning of the STAD and Scramble types could improve the learning outcomes of class VII C students of SMP Anggrek Banjarmasin. Because the application of the STAD-type cooperative learning model affects scientific attitudes and the application of the STAD-type cooperative learning model also improves mathematics learning outcomes, it is certain that the interaction between the use of learning models and scientific attitudes significantly influences mathematics learning outcomes.

For groups of students who have a positive scientific attitude, the learning outcomes of students who are taught using the TGT cooperative learning model are higher than students who are taught with the scrambel type cooperative learning model after controlling intelligence. This is caused by the application of the cooperative learning model can trigger a person (student) to have a positive attitude towards learning activities as a whole and TGT type cooperative learning emphasizes critical thinking, thus enabling better learning outcomes to be achieved. This finding was corroborated by Damanik (2013: 24) in his research entitled "Analysis of Critical Thinking Ability and Scientific Attitude in Physics Learning Using Inquiry Training (IT) and Direct Instruction (DI) Learning Models" which concluded that (1) the ability to think critically in Physics students who use the Inquiry Training learning model are better than the critical thinking abilities of students who use the Direct Instruction learning model, (2) the critical thinking skills of students who have a high scientific attitude are better than the critical thinking abilities of students who have a low scientific attitude.

From these two findings it appears that different learning models affect students' Physics critical thinking abilities and this difference occurs in groups of students who have different scientific attitudes. If examined more deeply, it can be ascertained that in the group of students who have a high scientific attitude, the critical thinking skills of students who are taught Physics with the Inquiry Training learning model are higher than students who are taught with the Direct Instruction learning model. Because in groups of students who have a low scientific attitude the effect of the learning model can be reversed. So, the influence of the learning model on the critical thinking skills of Physics in this case, depends on the differences in students' scientific attitudes.

For groups of students who have a negative scientific attitude, the learning outcomes of students who are taught using the TGT cooperative learning model are lower than students who are taught with the Scramble type cooperative learning model. This is because the more positive the scientific attitude of a person (student), the higher the learning outcomes. Judging from the learning model applied, the Scramble type cooperative learning model places less emphasis on critical thinking, making it easier for students to obtain better learning outcomes even though their scientific attitude is negative.

Ekan (2013: 9) in his research entitled "The Contribution of Scientific Attitudes and Interest in Learning on Science Learning Outcomes of Fifth Grade Students at SDN Banyuasri, Buleleng District, Buleleng Regency" concluded that "there is a significant contribution to students' scientific attitudes toward science learning outcomes for fifth grade students at SDN Banyuasri Buleleng District" The contribution of scientific attitudes to learning outcomes is significant, meaning that the more positive a person's scientific attitude is, the better the learning outcomes will be. So, if in a group of students who have a high scientific attitude, the learning outcomes of students who are taught with the TGT cooperative learning model are higher than students who are taught with the Scramble type cooperative learning model, then in the group of students who have a negative scientific attitude, there will be differences. the opposite.

So, it is true that in the group of students who have a negative scientific attitude, the learning outcomes of students who are taught using the TGT cooperative learning model are lower than students who are taught with the Scramble type cooperative learning model, after controlling for intelligence.

4. Conclusions and Suggestions

The conclusions from the results of this study are: First, the learning outcomes of mathematics in the student class taught by the TGT type cooperative learning model are higher than the mathematics learning outcomes in the student class taught by the Scramble type cooperative learning model, after controlling for intelligence. Second, there is an interaction effect between learning models and scientific attitudes towards students' mathematics learning outcomes, after controlling for intelligence. Third, for groups of students who have a positive scientific attitude, the learning outcomes of mathematics in the student class taught using the TGT cooperative learning model are higher than the mathematics learning outcomes in the student class taught with the Scramble type cooperative learning model, after controlling for intelligence. Fourth, for groups of students who have a negative scientific attitude, the learning outcomes of mathematics in the student class taught using the TGT cooperative learning model are lower than the mathematics learning outcomes in the student class taught with the Scramble type cooperative learning model, after controlling for intelligence. So, a responsible teacher should try to creatively apply various learning models that are appropriate to the teaching material so that the learning process can take place properly and learning outcomes can be achieved optimally..

Acknowledgement
The author expresses his gratitude to the Faculty Leaders and Department Leaders, especially the Dean of FMIPAK, who allowed this research to be carried out. The author also expresses his gratitude to the Management of Manado State University who facilitated this research with the amount of funds needed to complete the research and be able to publish it.

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