The Effect of Cooperative Learning on Reasoning Ability and Mastery of Mathematical Concepts

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Abstract : The purpose of this study was to determine the effect of learning methods on students' reasoning abilities and mastery of mathematical concepts. In this study, the authors used experimental research methods. Inferential analysis was performed using the Manova statistic (Multavariate Analysis of Arians). The results of the study concluded: (1) There was a significant effect of cooperative learning methods on reasoning abilities and mastery of mathematical concepts. This is evidenced by the value of Fo = 18, 154 and Sig = 0.000 <0.05. In this case, the reasoning ability and mastery of mathematical concepts in the experimental group was higher than the control group. (2) There is a significant effect of cooperative learning methods on mathematical reasoning abilities.-value for the category of mathematical reasoning ability of 0.000 <0.05. Thus the null hypothesis is rejected or there is a significant difference between the mathematical reasoning ability of the group of students who were given the STAD type cooperative learning method and the mathematical reasoning ability of the group of students who were given the Jigsaw cooperative learning method. (3) There is a significant effect of the cooperative learning method. mastery of mathematical concepts. This is evidenced by the test results contained in the Test of Between table- Subject Effects in the statistical test above, it is known that the value of F = 29.894, p . value-the value for the category of mastery of mathematical concepts is 0.000 < 0.05. Thus the null hypothesis is rejected or there is a significant difference between the mastery of mathematical concepts in the group of students who were given the STAD cooperative learning method and the mastery of mathematical concepts in the group of students who were given the Jigsaw cooperative learning method.

Keywords: Cooperative Learning Methods, Reasoning Ability, Mastery of Mathematical Concepts

INTRODUCTION

The world of education today faces a challenge to produce quality human resources, namely human resources who are able to live in the world of globalization. Education as a printer of human resources should receive continuous attention to improve its quality. Improving the quality of education also means improving the quality of human resources.

In order to educate the nation's life, improving the quality of education is very important for sustainable development in all aspects of human life. The national education system must always be developed in accordance with the needs and developments that occur at the local, national and global levels[1].

[1]Mulyasa, E. 2006. Education Unit Level Curriculum. Bandung: PT Teen Rosdakarya.p.4

The development of science and technology must be responded positively by the world of education. One form of positive response from the world of education is to make curriculum changes dynamically in accordance with the fast-moving development of science and technology. This can be realized in the form of a school business as an educational institution by providing the best service for all its students.

Schools as educational institutions must strive to continuously make improvements in various fields, both facilities and infrastructure, administrative and information services, as well as the quality of learning as a whole. Efforts to improve the quality of education in schools do not only depend on teacher factors, but also depend on other factors that are interrelated as a system to produce quality educational outputs. But in essence the teacher is still the main element that determines the most influencing educational outcomes.

Mathematics apart from being a field of science in the world of education is also a very important field of study, both for students and for the development of other sciences. The position of mathematics in the world of education is very beneficial because mathematics is a tool in the education of intellectual development and intelligence.

Mathematical material is arranged in a logical order (hierarchical) in the sense that a mathematical topic will be a prerequisite for the next topic. Therefore, to learn a new mathematical topic, past learning experiences from someone will affect the occurrence of the mathematics learning process. Because of the hierarchy of mathematics, discontinuous learning of mathematics will interfere with the learning process. This means that learning mathematics will occur smoothly if the learning itself is carried out continuously.

Mathematics in general is very difficult for students to understand, because mathematics has abstract objects and requires high enough reasoning to understand every hierarchical mathematical concept, so it is necessary to apply better and more appropriate teaching models to help students mastery as early as possible. at the school level on mathematics. But we need to underline also that a good teaching is not enough to get optimal student learning outcomes, because one of the problems faced by teachers in conducting mathematics teaching is how to grow and stimulate reasoning (logic) abilities and mastery of concepts correctly by students. .

The main characteristic of reasoning in mathematics is deductive, or in other words mathematics is deductive, namely the truth of a concept or statement is obtained as a logical result of previous truths so that the relationship between mathematical concepts or statements is consistent. Rochmadi also said that in principle, in learning mathematics, both inductive and deductive thinking patterns can be used to learn mathematical concepts.[2].

Slavin in Solihatin states that "cooperative learning model is a learning model in which students work in small groups to help each other in learning the subject matter"[3].

Johnson & Johnson in Isjoni stated that "the understanding of the cooperative learning model is to group students in the class into small groups so that students can work together with the maximum ability they have and learn from each other in the group"[4].

[2]Rochmadi. 2008. The Use of Inductive-Deductive Mindset in Constructivism Toxic Mathematics Learning. Paper at the National Seminar on Mathematics Education: Teacher Certification, at the Postgraduate Campus of UNNES Semarang, January 16, 2008

[3]Solihatin, E. 2007. Cooperative Learning: Analysis of Social Studies Learning Model. Jakarta: Earth Literacy.

[4]Isjoni. 2007. Cooperative Learning. Bandung: Alphabeta p. 14

Sanjaya stated that "cooperative learning is more than just group learning or group work because in cooperative learning there is a cooperative structure of encouragement or tasks that allow open interactions and effective interdependent relationships among group members"[5].

From some of the definitions above, it can be concluded that cooperative learning is one of the effective learning methods by forming small groups to work together, interact, and exchange ideas in the learning process. In cooperative learning, learning is said to be incomplete if one of the friends in the group has not mastered the lesson material.

The philosophy underlying cooperative learning in education is homo homini socius which emphasizes that humans are social creatures. The cooperative learning model is very different from direct teaching. In addition to cooperative learning models developed to achieve academic learning outcomes, cooperative learning models are also effective for developing students' social skills.

Elements and Characteristics of Cooperative Learning Elements of Cooperative Learning. Positive Interdependence. Positive interdependence requires promotive interactions that allow fellow students to motivate each other to achieve optimal learning outcomes. Each student depends on other members because each student gets different material or different assignments, therefore students need each other because if there are students who cannot do the task, the group assignments cannot be completed.

From the description above, the authors are interested in conducting research that wants to know: "The Effect of Cooperative Learning Methods on Reasoning Ability and Mastery of Mathematical Concepts.

METHODS

The research was conducted in class VII of SMP Negeri 1 Cikulu, Lebak Regency and SMP Negeri 2 Cileles. The research method used is the experimental method, this method was chosen because it is a research method whose purpose is to find the causal factors and effects, to control events in the interaction of variables, and to predict the results at a certain level of accuracy.[6].

The research sample was students of class VII B and VII C of SMP Negeri 1 Cikulur with 20 students as the experimental class using the STAD method, and 20 students from class VII B and VII C, as the control class using the Jigsaw method. This data collection is to determine the reasoning ability and mastery of high and low mathematical concepts. Data Analysis Prerequisite Test, Data Normality Test. The data normality test was conducted to determine whether the data from each group was normally distributed or not. The normality test of the data will be tested with the Liliefors test. According to Nana Sudjana, the normality test of the data was carried out using the Liliefors (Lo) test with the following steps. It begins with determining the significance level, which is at a significance level of 5% (0.05). Then the Homogeneity Test of 4 Variants and the Homogeneity Test of the Covariance Variance Matrix

[5]Sanjaya, Vienna. 2009. Educational Process Standard Oriented Learning Strategy. Jakarta: Kencana Prenada Media group.
[6]Suharsimi Arikunto. 2008. Basics of Educational Evaluation. Jakarta: Earth Literacy Publisher.

RESULT AND DISCUSSION

The normality test of the data was carried out using the Kolmogorov-Smirnov test with a significance level of = 0.05. The summary of the results of the normality test is presented in the following table.

Table 1. Calculation Results of Data Normality Test

One-Sample Kolmogorov-Smirnov Test

		Y1A1	Y1A2	Y2A1	Y2A2
N		40	40	40	40
Normal Parameters	mean	35.82	32.68	15.82	13.90
	Std. Deviation	2,086	2.505	1,430	1,614
Most Extreme Differences	Absolute	.158	.227	.149	.150
	Positive	.112	.132	.118	.125
	negative	-158	-.227	-149	-.150
Kolmogorov-Smirnov Z		1.002	1.433	.940	.947
asymp. Sig. (2-tailed)		.268	.033	.339	.331

Test distribution is Normal

The table above shows that all data groups tested for normality with the one-sample Kolmogorov-Smirnov test with SPSS obtained that the data group gave a significant value in the Asym row. Sig (2-tailed) were 0.268, 0.033, 0.339, and 0.331, respectively.

From the value of sig. These all produce a sig value. > 0.05. Thus it was concluded that the four data groups in this study came from a normally distributed population. This shows that one of the prerequisites for the F test in the study has been fulfilled.

1. Homogeneity Test of Covariance Variant Matrix

a. Covariance Variance Matrix . Homogeneity

Tests were carried out using Box's test of equality of covariate matrices. The test results are as follows.

Table 2

Box's Test of Equality of Covariance Matrices

Box's	*2.171*
F	*.704*
df1	*3*
df2	*1.095E6*
Sig.	*.550*

To fulfill the manova assumption, we try to accept the null hypothesis if the p-value of Box's M test > 0.05. The test results obtained the value of*p-Value* sig is 0.550 > 0.05. Then the null hypothesis is accepted, which means that the variance-covariance matrix between the learning method groups is homogeneous.

b. Homogeneity of Variance

Testing the homogeneity of variance using Levene's test as follows.

Table 3 Levene's Test Equality of Error Variances

	F	df1	df2	Sig.
Reasoning Ability	3.006	1	78	.087
Concept Mastery	.001	1	78	.977

a. Design:Intercept + MB

The requirement that the data homogeneity of arithmetical significance value > significant value (0.05), then the null hypothesis (H0) is accepted according to the requirements. The results of the homogeneity test of 2 groups of learning mathematics for mathematical reasoning abilities obtained the value of sig. = 0.087 which means the value of sig. > 0.05. So it can be concluded that the variance of the mathematical reasoning data between the STAD and Jigsaw type learning method groups is homogeneous.

Furthermore, the results of the homogeneity test of 2 groups of learning mathematics for mastery of mathematical concepts obtained the value of sig. = 0.977 which means the value of sig. > 0.05. So it can be concluded that the variance of the data for mastery of mathematical concepts between the STAD and Jigsaw learning method groups is homogeneous.

2. Hypothesis test

Table 4

Multivariate Test

Effect		*Value*	*F*	*Hypothesis df*	*df error*	*Sig.*	*Party Eta Squared*
Intercept	*Pillai's Trace*	*.996*	*1.032E4a*	*2,000*	*77,000*	*.000*	*.996*
	Wilk's Lambda	*.004*	*1.032E4a*	*2,000*	*77,000*	*.000*	*.996*
	Hotelling Trace	*268,026*	*1.032E4a*	*2,000*	*77,000*	*.000*	*.996*
	Ray's Largest Root	*268,026*	*1.032E4a*	*2,000*	*77,000*	*.000*	*.996*
MB	*Pillai's Trace*	*.320*	*18.154a*	*2,000*	*77,000*	*.000*	*.320*
		.680	*18.154a*	*2,000*	*77,000*	*.000*	*.320*

	Wilk's Lambda	*.472*	*18.154a*	*2,000*	*77,000*	*.000*	*.320*
	Hotelling Trace	*.472*	*18.154a*	*2,000*	*77,000*	*.000*	*.320*
	Ray's Largest Root						

a. Exact statistics

b. Design:Intercept+MB

Table 5

Test of Between-Subjects Effect

Source	***Dependent Variable***	***Type III Sum of Squares***	***df***	***Mean Square***	***F***	***Sig.***	***Party Eta Squared***
Corrected Model	*Reasoning Ability*	*204,800a*	*1*	*204,800*	*36,710*	*.000*	*.320*
	Concept Mastery	*74.113b*	*1*	*74.113*	*29,894*	*.000*	*.277*
Intercept	*Reasoning Ability*	*93982.050*	*1*	*93982.050*	*1.685E4*	*.000*	*.995*
	Concept Mastery	*17671,513*	*1*	*17671,513*	*7.128E3*	*.000*	*.989*
MB	*Reasoning Ability*	*204,800*	*1*	*204,800*	*36,710*	*.000*	*.320*
	Concept Mastery	*74.113*	*1*	*74.113*	*29,894*	*.000*	*.277*
Error	*Reasoning Ability*	*435150*	*78*	*5.579*			
	Concept Mastery	*193.375*	*78*	*2.479*			
Total	*Reasoning Ability*	*94622,000*	*80*				
	Concept Mastery	*17939,000*	*80*				
Corrected Total	*Reasoning Ability*	*639,950*	*79*				
	Concept Mastery	*267,488*	*79*				

a. R Squared = .320 (AdjustedR Squared = .311)

b. R Squared = .277 (AdjustedR Squared = .268)

The Multivariate Test table explains the average comparison of students' reasoning abilities and mastery of mathematical concepts between the two cooperative learning methods. There are four statistical tests, namely Pillai's Trace, Wilk's Lambda, Hotelling's Trace, and Ray's largers

Root. These four tests are based on the eigenvalues where the formula for each statistical test is as follows.

From the table above in the intercept label section, the value of Pillai's Trace is positive, which is 0.996. Increasing this value has a significant effect on cooperative learning methods or significant average differences between groups of data. The value of Wilk's Lambda ranges from 0 to 1, if the value of Wilk's Lambda is close to 0 it means that there is a significant effect on the cooperative learning method or a mean difference between the data groups. On the other hand, the value of Wilk's Lambda is close to 1, which means that there is no significant effect on the cooperative learning method or there is no significant difference in average between groups of data. From the table above Wilk's Lambda value is 0.004 close to zero,

The Hotelling's Trace value shows a positive value, which is 268, 026. The increasing Hotelling's Trace value is always greater than the Pillai' trace value, the Hotelling's Trace value above shows a significant influence on the learning method, but in some cases if the eign value is small then Hotelling's Trace and Pillai' tarce values will be close together. This shows an indication that there is no significant effect on the learning method.

The value of Roy's Largest is positive, namely 268.026, the value of Roy's Largest is always less than or equal to the value of Hotelling's trace. This value indicates a significant influence on the cooperative learning method.

In the learning method line, the significance figures were tested using Pillai's Trace, Will's Lambda, Hotelling's Trace, and Ray's largest Root procedures. The first four procedures show a significance number below 0.05 (ie 0.000, 0.000, 0.000, 0.000) then H0 is rejected, so it is concluded that there is an effect of cooperative learning methods on students' reasoning abilities and mastery of mathematical concepts.

Levenu's test was used to test the homogeneity of variance univariately. The results of the homogeneity test of the two groups of cooperative learning methods for reasoning abilities obtained the value of sig. = 0.087 which means the value of sig. > 0.05. It can be concluded that the variance of the mathematical reasoning ability data between the STAD and Jigsaw cooperative method groups is homogeneous. Furthermore, the results of the homogeneity test of the two groups of cooperative learning methods for mastery of mathematical concepts obtained the value of sig. = 0.977 > 0.05. So it can be concluded that the variance of the data for mastery of mathematical concepts between the STAD and Jigsaw cooperative method groups is homogeneous.

The Test of Between-Subject Effect table describes the univariate model testing. It can be seen that the p-value for the cooperative learning method category for the response to mathematical reasoning ability is 0.000 < 0.05, as well as the response to mastery of mathematical concepts is 0.000 < 0.05, which means that there is a significant difference between the average reasoning ability and mastery of concepts. mathematics between the two cooperative learning methods.

Discussion

The test results prove that in cooperative learning there is a positive interdependence between students. In cooperative learning students feel that they are working together to achieve one goal and are bound to one another. A student will not be successful unless all members of his group are also successful. Students will feel that they are part of a group that also contributes to the success of the group. then the increasing interaction between students. Cooperative learning increases the interaction between students. This, occurs in the event that one student will help other students to succeed as a member of the group. This mutual assistance will take place naturally because a person's failure in a group affects the group's success. To solve this problem, Students who need help will get it from their group of friends. The interaction that occurs in cooperative learning is in terms of exchanging ideas about the problem being studied together.

CONCLUSION

There is a significant effect of cooperative learning methods on reasoning abilities and mastery of mathematical concepts. This is evidenced by the value of Fo = 18,154 and Sig. = 0.000 < 0.05. In this case, the reasoning ability and mastery of mathematical concepts in the experimental group was higher than the control group.

There is a significant effect of cooperative learning methods on mathematical reasoning abilities. This is evidenced by the test results contained in the Test of Between –Subject Effects table in the statistical test above, it is known that the value of F = 36,710, the p-value for the category of mathematical reasoning ability is 0.000 <0.05. Thus the null hypothesis is rejected or there is a significant difference between the mathematical reasoning ability of the group of students who were given the STAD type cooperative learning method and the mathematical reasoning ability of the group of students who were given the Jigsaw cooperative learning method.

There is a significant effect of cooperative learning methods on the mastery of mathematical concepts. This is evidenced by the test results contained in the Test of Between – Subject Effects table in the statistical test above, it is known that the F value = 29.894, the p-value for the category of mastery of mathematical concepts is 0.000 <0.05. Thus the null hypothesis is rejected or there is a significant difference between the mastery of mathematical concepts in the group of students who were given the STAD cooperative learning method and the mastery of mathematical concepts in the group of students who were given the Jigsaw cooperative learning method.

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