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Research Paper

The effect cooperative learning model resolution of mathematics problem solving and students' mathematics communication

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Abstract. This research is aimed to analyze the influence of cooperative learning model toward the ability of problem solving in mathematics and students' ability in mathematics communication. This research uses experiment method. Data analysis uses MANOVA (Multivariate Analysis of Variants). Result shows that: there is influence of cooperative learning model to the ability of mathematics problem solving and the ability of mathematics communication multivariately. It shows that there is difference between matrices of ability of Mathematics problem solving and mathematics communication to the given cooperative learning model type STAD (Student Team Achievement Division) and type TPS (think, pair, share). By univariate, the result shows: (a) there is no difference in the ability of mathematics problem solving to those who were given cooperative learning model type STAD and type TPS. It indicates the influence cooperative learning model to the ability of students' mathematics problem solving. (b) there is difference in terms of students' ability of mathematics communication to who were given cooperative learning model type STAD with type TPS. It shows that there is an influence of cooperative learning model to the ability of mathematics communication. Result of this research recommends improving the ability of mathematics problem solving and the ability of students' mathematics communication can be done in the same time using cooperative learning model type STAD.

Keywords: MANOVA, ability of mathematics problem solving, ability of mathematics communication, cooperative model type STAD, cooperative model type TPS.

INTRODUCTION

Mathematics is universal science which constitutes growth of modern technology. Mathematics has important role in so many disciplines and improves human's thought and intellectual. Fast growth in information technology area and communications these days is constituted by growth of mathematics in the areas of number theory, algebra, analysis, probability theory and Mathematics of discrete. In order to master and create technology in the future needs strong Mathematics mastery.

In studying mathematics, someone can be separated with problems. Success or failure of someone in learning Mathematics is marked by the existence of ability in finishing the problem that is faced by him. Hudoyo (2008:172) explains that in mathematics question or problem will become problem if there is no certain law or order which immediately can be utilized to find the answer. According to that opinion, it can be known that question becomes problem to student. If he/she cannot immediately answer the question, then student cannot answer the question by using routine procedure which he/she have known.

National Council of Teachers of Mathematics (NCTM), in placing ability of problem solving as main target of

Mathematics education (Romberg, 1994) in Sudirman (2009:179). NCTM suggests that to solve problem have to become focus of mathematics studied at school. Mathematics have to be organized in problem solving area, as an method of invention of application, by using approach of problem solving to investigate, and comprehend Mathematics content, also developing knowledge of new mathematics through problem solving.

Besides, studying mathematics, problem solving represents one of the targets of which will be reached. In line with the statement, studying mathematics *in kurikulum tingkat satuan pendidikan (KTSP)* is aimed to: (1) students will be able to comprehend concept lesson of mathematics, (2) able to use reasoning in mathematics, (3) able to solve problem in mathematics, (4) able to communicate idea or communicate using mathematics, and also (5) able to have appreciate the usefulness of mathematics in life. Based on NCTM and the purpose of studying mathematics in KTSP, problem solving in mathematics should get attention and require to be developed in course of studying mathematics.

Evans in (Suhaman, 2005:289) defines that problem solving is an activity related to select suitable way for certain action to change current situation into expected situation. Polya in (Prasetyo et al., 2011:15) interprets problem solving is as an effort searching way out for certain problem to reach certain purposes not in immediate time. Kenney in (Abdurrahman, 2003:257) suggests there are four steps of problem solving process of mathematics: (1) comprehending problem, (2) planning problem solving, (3) executing problem solving, and (4) reexamining result of problem solving. Explanation above indicates that ability of problem solving in mathematics is an important thing which has strategic role in developing students' thought.

Polya (2005:28) explains that solving the problem is a very high intellectual activity. Because of solving problems, students should be able to complete and use the rules that have been studied to make the formulation of the problem. Mental activity which can be reached in problem solving, among others, is to remember, recognize, explain, differentiate, implement, analyze and evaluate. The fact observed in the application area indicates that students' ability of problem solving in studying Mathematics is not trained well. In the process of studying Mathematics, students only memorize lesson given by the teachers and unable to use the knowledge they gain to solve real problem. So, if the students meet problems related to problem solving, they are unable to determine the problem and formulate its solution.

In contrast, at the moment junior high school student have to prepare themselves to live in society which demands understanding and appreciation of mathematics. Students are demanded to apply skill of mathematics in reality. Besides, students' achievement in Mathematics is worrying, even the score gained in this lesson is lower that other subjects. It happens because students think Mathematics is hard lesson, too many that should be counted and full of formula, also it is boring. Lee S. Schulman (in Clarizio, 1983:193) said, mathematcs is also hard to be communicated whether in the written form or spoken form because it is collided with symbols, in the form of abstract.

Mathematics learning is done by the teachers to the students is aimed to make the students to be able to understand and solve the problems questioned by the teacher, but the students never or perhaps ask the explanation of the answer which resulted the students rarely communicating in mathematics. It is also approved by the opinions of some mathematics teachers that in reality students find it difficult to communicate the lesson they have learned. The ability of communication is hard to be seen well in written and spoken form because students only see and follow their competent friends in the class. Besides, there are only few students who ask and answer questions. If the students are actively involved in the process of learning, they will be able to develop ideas and concepts in mathematics. So that, students will have concept about the topic that they have learned in Mathematics. Also, they will develop the ability to interpret daily language in mathematics language.

In the 2013 curriculum, students are demanded to be active in the learning process so that students indirectly have to communicate the result of studying mathematics. In contrast, students find it difficult to be active because of their lack of mathematics communication ability, so teachers are the active agents in the class. To decrease this situation, students need to familiarize with and communicate their ideas to others according to their intepretation of symbols in mathematics as stated by Walle and Van (2010:04), listen to the someone thought and explanation about the reasons, thus having opportunity to develop their own understandings. So that, it is necessary to develop communication skills in learning process and it becomes a challenge for the mathematics teacher. The challenge is "how to improve mathematics learning process which can improve students Mathematics communication ability."

Communication needs language. Mathematics is one of the languages used to communicate. Mathematics is a universal language where one symbol in mathematics is understood worldwide, for example Mathematics expresses amount using $\sum$ (read sigma). According to Barton (2008:152) mathematical ideas of communication have to be systematic. Mathematics and language should develop together. Commonly, Mathematics uses four categories; (1) symbols for ideas (numbers and elements), (2) symbols which indicate how ideas are connected one to another, (3) symbols for operation which indicate what is done with the ideas, and (4) symbols for punctuation mark which indicate sequence done by mathematics.

In contrast, the process of teaching and learning mathematics is a difficult task, not interesting and boring

for students generally. It is shown by low level mastery of mathematics and low scores of the students get in test whether test for each kompetensi dasar (KD), mid term test (UTS), or National Exam.

Mathematics learning model has an important role in answering problems that are faced by the students. Mathematics learning should be guided to make the students active in the learning process. Cooperative learning model is one of the Mathematics learning models which encourages students becoming active in the process of teaching and learning. Abdurrahman and Bintoro (in Nurhadi and Senduk, 2004:61) stated that cooperative learning is a system which connects many elements. The elements are: (1) positive interdependence, (2) face to face interaction, (3) individual accountability, and (4) skill to maintain relation among others or social skill which intentionally taught.

Recently, various model study of cooperative was developed rapidly. Cooperative learning model which is proved effective to improve problem solving skill and mathematics communication is cooperative learning model type STAD (Students Team Achievement Division) and cooperative learning model type TPS (Think Self Pair).

In learning model type STAD (Students Team Achievement Division), students are asked to make groups consist of 4 to 5 students. Each group has heterogenetic academic ability. In one group, there will be one high profile student, two or three average students, and one low ability student. Teachers' role in the type of STAD is to teach about new knowledge every week to the students whether in written or spoken form.

Meanwhile, cooperative learning model type TPS (Think Pair Share) is a kind of cooperative learning model which emphasizes on students training to reconstruct knowledge they have. TPS gives time to think and repond also help each other. TPS consists of three main stages; 'think' means that students think individually about the problem, 'pair' means that students discuss the answer with partners, and 'share' means that students in pair share the answer in front of the class and other students give response about it.

Teachers must be able to play a role as learning innovator. A teacher must use various model of learning to change students' streotype about mathematics. Appropriate learning model will encourage students to be interested with and love mathematics and in the end the objectives of learning mathematics can be achived.

Based on the explanation above, researchers want to know the effect of both cooperative learning models in improving students' problem solving ability and mathematics communication. The use of learning model should be suitable to the classroom condition, students competence, and problems face by most of the students studying mathematics. In line with this matter, this research is aimed to; (1) analyze the matrices difference of students' problem solving ability and mathematics communication to those who were taught by using STAD model and TPS model. (2) analyze the influence of cooperative learning model to students problem solving ability and Mathematics communication partially.

Theoretical framework and research hypothesis

Mathematics education plays an important role in improving human resource quality. Mathematics learning process must give opportunity to the students to see and experience the use of mathematics in daily life. According to Nurhadi and Senduk (2004: 203) the functions of mathematics are to develop calculation ability, measure, degrade, use mathematical formula used in daily life through geometry, algebra, and trigonometry. In line with this, Soedjadi (in Panjaitan, 2009: 216) explains that mathematics is one of human activities, so learning mathematics should be emphasized on students' activities to search, find, and construct their own knowledge so that learning process is students centered. Mathematics learning also needs to give students opportunity to understand the use of Mathematics. Mathematics learning should correlate problem with reality. Through mathematics learning, students are facilitated to be aware of the importance of mathematics.

Learning process which correlates Mathematics concept with other disciplines will guide the students to Mathematics communication. According to Asikin (2001:01), mathematics communication ability is shown by the students' skill to express their ideas in the form of mathematical symbols. Communication form of mathematics may happen between mathematics with other subjects, between mathematics with real life, and even concept connection among topics discussion in mathematics itself.

Mathematics learning process must give opportunity to students to speak, write, read and listen in mathematical symbols. This kind of learning models gives many advantages because it makes students to be able to communicate mathematically. Sardiman (2006:120) explains that communication in learning mathematics is given in the form of communication symbols, written communication and spoken communication which contains mathematics ideas. These kinds of communication forms are important part of mathematics education. Mathematics learning model should train students to be able to communicate their ideas in written and spoken form using mathematical symbols and other language verbal symbols.

According to Schoen et al. in Bistari (2010:19) (in Journal of Pratiwi, Sujadi, Pangadi, UNS), the ability to give presumption about pictures are also part of mathematics communication ability. Through communication, students can explore and consolidate mathematics thought. Knowledge and the development of problem solving are using verbal language can be developed, so mathematics communication can be formed.

Besides, students are also demanded to interpret daily problems into mathematics symbols. This kind of competence will lead the students to the ability of mathematics problem solving. The Competences of students who can solve mathematics problems are able to identify every problem in real life and solve it using mathematics concept. Real life problems which are described verbally can be stated of mathematics sentences which are more efficient, universal and simpler. The ability of mathematics problem solving is one of practical advantages in learning Mathematics.

Low result in mathematics is evaluated in five aspects formulated by NCTM (2000):

> "Highlighting students to learn mathematics through understanding and actively develop knowledge which are gained previously. To realize this, mathematics learning should be formulated in five common objectives; first, learn to communicate; second, learn to do reasoning; third, learn to solve problems; fourth, learn to relate ideas; and five, learn to form positive attitude about mathematics."

Problems cannot be separated from human beings, thus mathematics problem solving becomes the main objective of mathematics learning. Laster (Branca: 1980) in Sugiman and Yahya (2009: 179) states that “problem solving is the heart of mathematics”. Furthermore, *NCTM (National Council of' teachers of Mathematics)* affirms that ability of problem solving is one of the important aspects in making humans become literate in mathematics as Romberg stated in (Sugiman and Yahya et al., 2009:179). From the above opinions, it can be expressed that problem solving represents an important matter in studying mathematics.

In studying mathematics, students face difficulties especially in solving mathematics problems as stated by Sumarmo (in Suhenri, 2006: 03) that students’ ability to solve mathematics problems in general is not satisfying. Thus, to get the ability of mathematics problem solving, one needs to be trained from the beginning. This ability is needed by the students to solve problems they face in daily life. In line with this, Ruseffendi (1991: 291) stated that the ability of problem solving is so important not only for them who apply this well in other area of disciplines but also for their daily needs.

To encourage students who have communication ability and mathematics problem solving ability, there is need for suitable a mathematics learning model. Teachers should understand and choose learning models which can develop mathematical competences. Learning models should be chosen based on students centered view, which enables students to become active in learning mathematics. Mathematics learning should apply relevant cooperative learning model. Cooperative learning model which enables students become active, develop communication ability and problem solving ability can be done through STAD cooperative learning model and TPS cooperative learning model.

Cooperative learning encourages students to communicate actively and positively in group. In cooperative learning, there is open space to exchange and check ideas to solve problems in mathematics learning. This condition can encourage students to optimize and develop potential, creativity, and various activities. Cooperative learning will assure the dynamics in learning process.

In cooperative learning model, teachers’ role as facilitator becomes a connector to higher understanding. Teachers should not only give knowledge to the students but also encourage students to reconstruct their knowledge. Students have opportunity to gain knowledge from applying their ideas. This condition is an opportunity for students to find their own ideas so that they solve problems in mathematics and also communicate it in mathematics language.

Therefore, researchers assume there is influence of cooperative learning model to students’ mathematics problem solving and mathematics communication ability.

METHODOLOGY

This research was conducted with quantitative approach using experiment research method. Specifically, this experiment research uses quasi experiment technique. This research will test influence of cooperative learning model to students’ mathematics communication ability and problem solving ability. Independent variable of treatment in this research is Cooperative Learning Model (A) with scale of category divided to 2 (two) categories, they are: cooperative learning model type STAD and cooperative learning type TPS. In this research, there are 2 criterions variable (dependent variable) they are: Ability of Mathematics Problem Solving (Y_1) and Ability of Mathematics Communications (Y_2) with numerical data scale. The experiment design used in this research is Quiz - Posttest Design with multivariate analysis of variance (MANOVA).

Research population includes all students of Private Junior High School representing National Standard School (SSN) in South Bogor. Sampling method uses multi stage sampling done in three phases, which are: School selection phase, classroom selection phase and students’ selection phase as the subject sample. The size of sample is 80 students divided to 40 students as experiment class sample and 40 students as control class sample. Variable criterion data which consists of ability of mathematics problem solving and mathematics communication ability were collected by using research instrument in the form of essay test which have been validated previously. Data obtained were analyzed descriptively and inferentially. Inferential analysis was

Table 1. Research design.

A			
A_1		A_2	
Y_{11}	Y_{21}	Y_{12}	Y_{22}

A = cooperative model; A_1 = cooperative type of STAD; A_2 = cooperative type of TPS; Y_1 = ability of Mathematics problem solving; Y_2 = ability of Mathematics communications.

conducted to test the truth of research hypothesis using technique of MANOVA.

RESULTS

Descriptive analysis

The result of the descriptive analysis about ability of problem solving and mathematics communications ability for each research group is shown in Table 2.

Test requirement analysis

Normality univariate test of mathematics problem solving ability data (Y_1)

Normality data test of mathematics problem solving ability univariately was done by using test of Kolmogorov-Smirnov. The test uses significance level α = 0.05. Result of normality data univariately is shown in Table 3.

Result of normality univariate test of mathematics communication ability data (Y_2)

Normality test of ability Mathematics communication data univariately was done by using test of Kolmogorov-Smirnov. The test uses significance level α = 0.05. Result of normality data univariately is shown in Table 4.

Result of normality test multivariate matrix data of problem solving ability (Y_1) and students' mathematics communication (Y_2) group using STAD

Singgih (2012:217) explained that if the data in every group univariately are distributed normally, multivariately those data matrix were also distributed normally. Test result univariately of problem solving ability and mathematics communication in students' group given STAD learning model (experiment group) are shown in Table 5.

Based on Table 5, it can be concluded that multivariately data matrices of mathematics problem solving ability (Y_1) and mathematics communication ability (Y_2) in the experiment group (students who were given STAD learning model) are distributed normally.

Result of multivariate normality test of problem solving ability data matrix (Y_1) and students' mathematics communication (Y_2) group using TPS cooperative learning model

Test result of univariate problem solving ability and students' mathematics communication data to students group given cooperative learning model type TPS (controlled group) are shown in Table 6.

Based on Table 6, it can be concluded that mutlivariate data matrices of mathematics problem solving ability (Y_1) and mathematics communication ability (Y_2) in the controlled group are distributed normally.

Result of homogeneity data variant test of mathematics problem solving ability (Y_1) between STAD and TPS groups

Homogeneity data variant test was done by using Levene Test Statistic. The test uses significance level α = 0.05. Results of homogeneity data variant test of mathematics problem solving ability between students who were given STAD learning model (experiment group) and TPS learning model (controlled group) are shown in Table 7.

Result of homogeneity data variant test of mathematics communication ability (Y_2) between STAD and TPS groups

Result of homogeneity data variant test of mathematics communication ability between students' group given STAD learning model (experiment group) and TPS learning model (controlled group) is shown in Table 8.

Result of homogeneity covariance matrices data test of problem solving ability (Y_1) and mathematics communication (Y_2) between STAD and TPS groups

Homogeneity covariant matrices data test was done by using *Box's Test Equality of Covariance Matrices* statistic. The test uses significance level α = 0.05. The result of homogeneity covariance data of Mathematics problem solving ability (Y_1) and Mathematics communication ability (Y_2) between students' group given STAD learning model (experiment group) and TPS learning model (controlled group) is shown in Table 9.

Inferential analysis

Inferential analysis to test research hypothesis was done

Table 2. Students' calculus learning results in each research group.

A				Total	
A_1		A_2			
Y_1	Y_2	Y_1	Y_2	Y_1	Y_2
n = 40	n = 40	n = 40	n = 40	n = 80	n = 80
$\overline{Y}$ = 50.75	$\overline{Y}$ = 60.35	$\overline{Y}$ = 52.07	$\overline{Y}$ = 42.72	$\overline{Y}$ = 51.41	$\overline{Y}$ = 51.54
s = 18,66	s = 7.08	s = 17.91	s = 6.32	s = 18.18	s = 11.10
Y_{min} = 24	Y_{min} = 49	Y_{min} = 24	Y_{min} = 28	Y_{min} = 24	Y_{min} = 28
Y_{max} = 80	Y_{max} = 71	Y_{max} = 80	Y_{max} = 53	Y_{max} =80	Y_{max} = 71

A = cooperative model; A_1 = cooperative type of STAD; A_2 = cooperative type of TPS; Y_1 = ability of Mathematics problem solving; Y_2 = ability of Mathematics commuication.

Table 3. Result of normality test. Mathematics problem solving ability data (Y_1).

No.	Group of data	Score K-S	Sig. score	Conclusion
1	Studying with STAD	0.584	0.885	Distributed normally
2	Studying with TPS	0.901	0.391	Distributed normally

Table 4. Result of normality test mathematics communication ability data (Y_2).

No.	Group of data	Score K-S	Sig. score	Conclusion
1	Studying with STAD	0.647	0.797	Distributed normally
2	Studying with TPS	0.923	0.361	Distributed normally

Table 5. Result of normality test data matrices of problem solving ability (Y_1) and mathematics communication (Y_2) in the group using STAD.

No.	Variable	Score K-S	Sig. score	Conclusion
1	Mathematics problem solving ability (Y_1)	0.584	0.885	Distributed normally
2	Mathematics communication ability (Y_2)	0.647	0.797	Distributed normally

Table 6. Result of normality test data matrices of problem solving ability (Y_1) and mathematics communication (Y_2) in the group using TPS.

No.	Variable	Score K-S	Sig. Score	Conclusion
1	Mathematics problem solving ability (Y_1)	0.901	0.391	Distributed normally
2	Mathematics communication ability (Y_2)	0.923	0.361	Distributed normally

by using one factor of MANOVA (*Multivariate of Variants*). The result is shown in Table 10.

Influence of cooperative learning model to mathematics problem solving ability and mathematics communication mutivariately

First hypothesis expresses "There is influence of cooperative learning model to mathematics problem solving and students' mathematics communication." Based on the analysis from Multivariate Test for statistical test of Pillai's Trace altogether get f value = 77.283, with value of sig equal to 0.000 < 0.05. It indicates there is significance difference of matrices column of problem solving ability and students' mathematics communication ability among the students given cooperative learning model STAD and cooperative learning model TPS. Multivariately, the ability of mathematics problem solving and ability of mathematics communications at experiment group (which learned using study model of STAD) differ significantly than controlled group (which learned using model study of TPS). This phenomenon concludes that there is significant influence of cooperative learning

Table 7. Result of homogenity test data variant of mathematics problem solving ability (Y_1) between STAD and TPS groups.

Score F	df_1	df_2	Sig. score	Conclusion
0.197	1	78	0.658	Homogen

Tabel 8. Result of homogeneity test. Data variant of mathematics communication ability (Y_2) between STAD and TPS groups.

Score F	df_1	df_2	Sig. score	Conclusion
2.597	1	78	0.111	Homogen

Table 9. Result of homogeneity test. Data covariance matrices of problem solving ability (Y_1) and mathematics communication (Y_2) between STAD and TPS groups.

Score *box's M*	Score F	df_1	df_2	Sig. score	Conclusion
2.398	0.777	3	1095120.000	0.506	Homogen

model to mathematics problem solving ability and students' mathematics communication.

Influence of cooperative learning model to mathematics problem solving

Second hypothesis expresses "There is influence of cooperative learning model to mathematics problem solving". Based on analysis result at the table of Test of Between-Subject Effects above, for line A and Y_1 category (ability of Mathematics problem solving) obtained f value = 0.105 and significance score = 0. 747 > 0.05. It shows there is no significant average difference of mathematics problem solving ability between the students who learned using STAD model (experiment group) and TPS model (controlled group) this phenomenon concludes that there is no significant influence of cooperative learning model to students' mathematics problem solving.

Influence of cooperative learning model to mathematics communication ability

Third hypothesis expresses "There is influence of cooperative learning model to mathematics communication ability". Based on the analysis of Test of Between-Subject Effects (Table 11), for line A and Y_2 category (ability of Mathematics communications) obtained f value = 137.942 and significant score = 0.000 < 0.05. It shows that there is significant average of mathematics communication ability between the students who learned using STAD model (experiment group) and TPS model (controlled group). This phenomenon concludes that there is significant influence of cooperative learning model to students' mathematics communication.

DISCUSSION

Result of inferential analysis concludes that by multivariate, there are influence of cooperative learning model to the ability of problem solving and ability of junior high school students' Mathematics communications. This result is in line with opinion of Isjoni (2007:12) who posited that cooperative learning can improve students' attitude in helping each other in social behavior of the student. This conclusion is supported also by the result of descriptive analysis which shows the difference of matrix mean column in problem solving ability (Y_1) and the ability of Mathematics communications (Y_2) between experiment group with control group. Experiment group is students who are given study use cooperative model of STAD, while control group is given students who study using co-operative model of TPS. Furthermore Isjoni (2007:23) stated that the student who learn using cooperative learning model will get increasing of his/her academic ability, improving to think and understand, forming friendship, getting various information, learning to use politeness, improving students' motivation, improving attitude to school and learning and decreasing unfavorable sellable story level, and also assisting students in esteeming idea of others. This picture is strengthened also by result of research of Suryadi (1999) in Isjoni (2009:12) which finds that the study of mathematics conclude one of the effective study models to increase students' ability to think *cooperative learning*.

From the result of analysis of inferential by univariate, this research concludes as follows: first, there is influence of cooperative learning model on the ability of students' mathematics problem solving. This matter is supported with the result of descriptive analysis which obtain mean

Table 10. Multivariate tests.

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta squared
Intercept	Pillai's Trace	0.984	2334.071[b]	2.000	77.000	0.000	0.984
	Wilks' Lambda	0.016	2334.071[b]	2.000	77.000	0.000	0.984
	Hotelling's Trace	60.625	2334.071[b]	2.000	77.000	0.000	0.984
	Roy's Largest Root	60.625	2334.071[b]	2.000	77.000	0.000	0.984
A	Pillai's Trace	0.667	77.283[b]	2.000	77.000	0.000	0.667
	Wilks' Lambda	0.333	77.283[b]	2.000	77.000	0.000	0.667
	Hotelling's Trace	2.007	77.283[b]	2.000	77.000	0.000	0.667
	Roy's Largest Root	2.007	77.283[b]	2.000	77.000	0.000	0.667

Table 11. Tests of between-subjects effects.

Source	Dependent variable	Type III sum of squares	Df	Mean square	F	Sig.	Partial Eta Squared
Corrected Model	Y1	35.112[a]	1	35.112	0.105	0.747	0.001
	Y2	6212.812[b]	1	6212.812	137.942	0.000	0.639
Intercept	Y1	211459.613	1	211459.613	632.329	0.000	0.890
	Y2	212489.113	1	212489.113	4717.847	0.000	0.984
A	Y1	35.113	1	35.113	0.105	0.747	0.001
	Y2	6212.813	1	6212.813	137.942	0.000	0.639
Error	Y1	26084.275	78	334.414			
	Y2	3513.075	78	45.039			
Total	Y1	237579.000	80				
	Y2	222215.000	80				
Corrected total	Y1	26119.388	79				
	Y2	9725.887	79				

of students' mathematics' problem solving ability at experiment group (using STAD model) which has no significant result with controlled group (using TPS model). The experiment group obtained mean ability of students' Mathematics problem solving = 50.75 with standard deviation = 18.66; while at controlled group = 52.07 with standard deviation = 17.91. The difference of mean ability of problem solving of mathematics between using model of STAD with model of TPS only equal to –1.32, and after it was tested inferentially this difference showed unreal (insignificant) result. This picture shows that cooperative learning model of STAD and TPS have the same effectiveness in improving the ability of junior high school student in problem solving of mathematics. This matter in line with the result of finding of Slavin and Karweit (1984) in Sharan (2009:8) is concluded from their research that STAD and of TPS model can improve students' learning ability to be more effective.

Secondly, there is influence of cooperative learning model to students' ability of mathematics communications. This matter is supported with result of descriptive analysis which obtaining mean ability of students' Mathematics communications at experiment group (learning process using STAD model) differs its result with controlled group (learning process using TPS model). The difference of mean mathematics communications ability among them by using STAD and TPS models in learning process equal to 17.63, and after being tested inferentially this difference showed real result (significant). In this case, the result of ability of mathematics student communications who used STAD model in the learning process is higher than the students who used TPS model in the learning process. This picture indicates that cooperative learning model of STAD is more effective to increase the ability of junior high school students' mathematics communications than

cooperative learning model of TPS.

Sabri (2005:79) explained that factors influencing learning at school are mostly from students' internal factors and only a few from students' external factors. Social background of the student like family, friends and society are parts of external factors that influence the differences of student in learning. To overcome the condition, teachers can provide an appropriate learning model. Within the appropriate learning model, the goal of learning target can be achieved satisfyingly.

The big role of mathematics education in increasing the quality of human resources shall be supported with process learning mathematics that gives an opportunity for the student to be able to see and experience by him/herself the use of mathematics in real life. Hence, the ability of mathematics problem solving is expected to solve problem of daily life to use mathematical concepts studied. Students who have the ability of problem solving of mathematics will be able to simplify everyday's complex life problems, systematic, tactical, and practical thinking. On the other hand, the ability of mathematics communications represents the ability of the student to transform the problem of verbal sentences into symbols and efficient mathematical sentences to be more efficient and universal, and also to deliver student's ideas or thoughts into mathematical sentences.

Cooperative learning model in mathematics problem solving is highly needed by the students. Mathematics is a study which is developed by the ability to think logically. Each problem or question can be presented in various ways so that each problem has variant level also, starting from easy, medium to difficult. Different problems have to be finished with different steps. Learning model that can be used is STAD cooperative learning model. Such condition requires teachers' mastery of STAD cooperative learning model and students' ability to collaborate various knowledge and experiences. Slavin (in *Nur*, 2011: 32) states that one of the cooperative types is to emphasize on the existence of activities and interactions among student to assist each other in mastering lessons' material to reach maximum achievement. And, in stipulating cooperative learning model, STAD (Student Teams Achievement Division) is one of the cooperative learning models which emphasizes on special structures designed to influence students interaction patterns and has a main purpose of increasing ability/mastery of academic content.

While cooperative learning model TPS type is one way learning process from teacher to students, TPS model is less effective because the teacher finds difficulty in determining core team because students have less self confidence in explaining lessons material to their friends and there are too many students in one class. This matter is in line with Killen (1998:76) who stated that the weakness of TPS model is difficulty to assure students in discussing learning materials with their friends and applying this model to a bigger class (more than 40 students) is very difficult, but can be resolved by team teaching. This condition shows the role of teacher in explaining the materials which are easily understood by the core team and supporting students to the core team.

Based on quantitative information above, it can be concluded that there is influence of cooperative learning model towards mathematics problem solving and ability of students' mathematics communications.

CONCLUSIONS

Based on obtained data, result of hypothesis examination and discussion of research result, it can be concluded that:

a) Students cannot solve the problems of mathematics and mathematical communication without the use of cooperative learning model.
b) The provision of cooperative learning model can make mastery of the material easier, especially math field algebra.
c) The teacher is should not just be a speaker, but a friend in the study because his/her job is only to assist students in mathematical problem solving and mathematical communication.
d) Students can learn together in a group without being accompanied by a teacher, because in every group students with high ability are inserted.

RECOMMENDATION

Based on the conclusion of this research, some recommendations for the improvement of problem solving of mathematics and ability of the students' mathematics communications are as follows:

1. It is suggested to teachers, in the effort of improving ability of mathematics problem solving and ability of mathematics communications, that cooperative learning model of STAD is the represented model which is effective enough to grow, stimulate, and also increase the ability of mathematics problem solving and students' mathematics communications. In dividing into group of learning, each group should be assisted by students who have higher ability of mathematics problem solving and mathematics communications.
2. It is suggested that giving items in study of mathematics, create joyful and pleasant learning atmosphere, so that the students feel incapable of finishing the given problems would like to try their best and finish the problems themselves. The teacher should explain the materials based on the students' abilities.
3. There should be further research in this area, this research only reveal some of small problems related to the ability of Mathematics problem solving and students'

mathematics communications. Research finding shows that there are still many factors which are influencing ability of mathematics problem solving and students' Mathematics communications which have not been revealed in this research. These factors can originate from the students themselves, such as intelligence factor, learning enthusiasm, and students' achievement motivation to mathematics subject and from outside student are teacher professionalism, learning atmosphere and studying time.

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