

THE EFFECTIVIVITY OF MATHEMATICS COOPERATIVE LEARNING MODELS THINK PAIR SHARE (TPS) AND STUDENT TEAMS-ACHIEVEMENT DIVISIONS (STAD) COMBINED WITH SCIENTIFIC APPROACH IN TERM OF MATHEMATICAL COMMUNICATION SKILL OF STUDENTS GRADE 8TH SMP N 1 SLEMAN

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Abstract

The aim of this study was to determine: (1) the effectiveness of cooperative learning model Think Pair Share (TPS) with Scientific approach in terms of mathematical communication skills of learners; (2) the effectiveness of cooperative learning model Student Teams-Achievement Divisions (STAD) with Scientific approach in terms of mathematical communication skills of learners; and (3) which is more effective among cooperative learning model Think Pair Share (TPS) with Scientific approach and cooperative learning Student Teams-Achievement Divisions (STAD) with Scientific approach to mathematical communication skills of learners. This is a quasi-experimental study, using two experimental groups. Instruments to measure the ability of mathematical communications in the form of shaped test item description. Based on hypothesis testing using a significance level of 5% can be concluded that: (1) cooperative learning model type TPS with scientific approach was effective in terms of communication skills of mathematics, (2) cooperative learning model type STAD scientific approach was effective in terms of communication skills mathematical , (3) cooperative learning model type TPS with scientific approach more effective than the cooperative learning model type STAD cooperative with the scientific approach in terms of mathematical communication skills.

Keywords : *effectivity, cooperative learning model type Think Pair Share (TPS), cooperative learning model type Student Teams-Achievement Division (STAD), scientific approach, mathematical communication skill.*

INTRODUCTION

Education is a process of interaction between educators and learners. According Sugihartono, et al. (2013: 3), education is an effort that is done consciously and deliberately to change human behavior both individually and collectively to mature humans through teaching and training efforts. One manifestation of the efforts of teaching and training is a process of learning.

A learning process is effective if the purpose of the learning process can be achieved. In mathematics at school students need the ability to think logic, this resulted that a few students think mathematics is a difficult matter.

According to Johnson and Rising (Erman Suherman et al, 2001) mathematics is thinking patterns, patterns of organizing, proof logic, mathematics is a language that uses the terms defined carefully, clear, and accurate, representation with symbols and dense, more a language of symbols the idea rather than sound.

Mathematics is language because mathematics is not just a tool to solve a problem, but an activity of communicating an idea clearly and coherently. According Marsigit (2011) the purpose of teaching mathematics in secondary schools is improving the ability of search patterns and relationships, improve the ability to communicate mathematics, increasing interest in

using mathematics in everyday life, as well as improving problem solving abilities. Similarly, the purpose of which is expected by the National Council of Teachers of Mathematics (NCTM) (Jaya Dwi Putra, 2013), which sets the standards of mathematical communication skills such as problem solving, reasoning and proof, communication, connections, and representation. According to Erman Suherman (2003: 62), in mathematics at school, teachers should use strategies, approaches, methods, and techniques that involve students actively in learning, both mentally, physically, and socially. Scientific approach is the approach adopted in the curriculum of 2013. The purpose of some of the processes that exist in the scientific approach emphasizes that learning does not just happen in a classroom, but also in the school environment. In addition to the approach, the experts also has developed several models of learning. One model of learning that has been developed is cooperative learning. Cooperative learning emphasizes the presence of peers who interact with one another as a team to resolve or discuss a problem or task. To optimize the benefits of cooperative learning, membership should be heterogeneous, both of ability and other characteristics.

Cooperative learning models that have been developed include learning model *Think Pair Share (TPS)*, *Student Teams-Achievement Divisions (STAD)*, *Jigsaw*, *Numbered Heads Together (NHT)*, *Team Games Tournament (TGT)*, *Snowball Throwing*, *Group Discussion*, *Take and Give*, *Scramble* and many other cooperative learning model. Based on the various models of learning, learning model *Think Pair*

Share (TPS) and *Student Teams-Achievement Divisions (STAD)* is a learning models that is often used in the learning process. According to Anita Lie (2008: 57), cooperative learning *Think Pair Share (TPS)* gives students the opportunity to work independently and in collaboration with other students so that they can optimize student participation. The main idea of cooperative learning model *Student Teams-Achievement Divisions (STAD)* is to motivate the students in order to support and assist each other in mastering the skills taught by the teacher (Slavin, 2005).

The purpose of cooperative learning model *Think Pair Share (TPS)* and *Student Teams-Achievement Divisions (STAD)* with *Scientific* approach is to increase the active participation of students both discussion groups and in pairs. When student discuss they will deliver their opinions, so they can forming a good mathematical communication skills. In communicating mathematics students express their ideas and opinions they have.

Cooperative learning model *Think Pair Share* with *Scientific* is a learning approach where students are conditioned to work in pairs, and then given the problems in the form of worksheets that must be solved by observing, ask, gather information, associates, and communicate. The worksheet is done individually first, then discussed with their partner. Cooperative learning model *Student Teams-Achievement Divisions* with the approach *Scientific* is a learning where students will work in groups of four or five people to solve the problem given by the teacher in the form of

worksheets that must be done by observing, ask, gather information, associate and communicate.

SMP Negeri 1 Sleman is one of the junior high that used the curriculum of 2013. Based on observations conducted by researchers during teaching practice and pre-studies in class VIII SMP Negeri 1 Sleman the school year 2014/2015 during the learning process takes place, there are some problems faced by students among other things: 1) some students have an active role in the classroom, but there are still some students who are passive and do not dare express their opinions; 2) during a presentation in front of the class, students have not been using mathematical symbols correctly and have not been able to interpret it in a sentence of mathematics; 3) to discuss the group some students are still working on an individual basis so that cooperation among groups less visible; 4) teachers have started using a scientific approach, but the application of learning the scientific approach still needs to be optimized as there are steps in the scientific study that has not been implemented.

Meanwhile, research on cooperative learning model *Think Pair Share (TPS)* and *Student Teams-Achievement Division (STAD)* has been done and showed positive results, one of them in improving communication skills of mathematics. Mathematical communication skills of students of SMP Negeri 1 Sleman seen to be enhanced by the implementation of cooperative learning model *Think Pair Share (TPS)* and *Student Teams-Achievement Division (STAD)*, combined with a scientific approach that used in the curriculum of 2013.

Based on the above, it is necessary to study on the effectiveness of using cooperative learning model *Think Pair Share (TPS)* and *Student Teams-Achievement Division (STAD)* with *Scientific* approach in terms of mathematical communication skills class VIII SMP N 1 Sleman.

RESEARCH METHOD

Types of Research Method

This study was a quasi-experimental research. The research design was *pre-test post-test group design*.

Table 1. Research Design

Group	Pre-test	Treatment	Post-test
E ₁	O ₁	X ₁	O ₂
E ₂	O ₁	X ₂	O ₂

Time and Place

This research did at SMP N 1 Sleman on February 14th to March 6th 2015.

Population and Sample

The population in this research was the students of grade 8th SMP N 1 Sleman. Te samples were students of class VIII C as the first experiment class and VIII A as the second experiment class. The sample had been chosen randomized.

Data, Instrument, and Data Collection Techniques

The instruments in this study were the test of mathematical communication skill. The test were *pre-test* and *post-test* about mathematical communication skill that given before and after the treatment. This study also

4 *Journal of Mathematics Education and Science Edition ...*
 uses observational methods used to obtain
 information about the feasibility study.

Data Analysis Technique

The data that used is the result of *pretest*
 and *posttest* mathematical communication skills
 of learners.

In the *post-test* results of mathematical
 communication skills conducted three tests of
 hypotheses, there are:

- 1) cooperative learning model *Think Pair Share*
 (TPS) with *Scientific* approach was effective
 in terms of mathematical communication
 skills of learners.
- 2) cooperative learning model *Student Teams-*
Achievement Divisions (STAD) with *Scientific*
 was effective approach in terms of
 mathematical communication skills of
 learners.
- 3) cooperative learning model type *Think Pair*
Share (TPS) with *Scientific* approach is more
 effective than cooperative learning model
 type *Student Teams-Achievement Divisions*
 (STAD) with *Scientific* approach in terms of
 mathematical communication skills of
 learners.

were statistically tested using the following
 hypotheses:

- 1) $H_0: \mu_1 \leq 74,99$ (cooperative learning
 model *Think Pair Share*
 (TPS) with *Scientific* was
 not effective)

$H_1: \mu_1 > 74,99$ (cooperative learning
 model *Think Pair Share*
 (TPS) with *Scientific* was
 effective)

Significance level = 0,05.

Test statistic :

$$t = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}}$$

Description :

\bar{x} : the average results of post-test of the
 first experimental class

μ_0 : 74,99

s : standard deviation

n : the quantity of the first experimental
 class's student

H_0 rejected if $t_{test} < t_{(0,05;n-1)}$.

- 2) $H_0: \mu_1 \leq 74,99$ (cooperative learning
 model *Student Teams-*
Achievement Divisions
 (STAD) with *Scientific*
 was not effective)

$H_1: \mu_1 > 74,99$ (cooperative learning
 model *Student Teams-*
Achievement Divisions
 (STAD) with *Scientific*
 was effective)

Significance level = 0,05.

Test statistic :

$$t = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}}$$

Description :

\bar{x} : the average results of post-test of the
 second experimental class

μ_0 : 74,99

s : standard deviation

n : the quantity of the second
 experimental class's student

H_0 rejected if $t_{test} < t_{(0,05;n-1)}$.

- 3) $H_0: \mu_1 \leq \mu_2$ (cooperative learning
 model type *STAD* with

RESULT AND DISCUSSION

Table 2 below presents the statistical data of student’s mathematic communication ability test.

Table 2. The average value of mathematic communication skills

		A	B	C	D
		Score	Score	Score	Score
E ₁	Pre-test	40,4	50,98	48,5	47,6
	Post-test	87,9	76,5	80,5	78,5
E ₂	Pre-test	41,2	50	47,9	46,9
	Post-test	86	72,55	76,3	76

Description :

- A : The ability to writing terms, symbols, and mathematical operations.
- B : The ability to write information, express opinions, give answers, and make inquiries.
- C : Ability to present the problems of daily life in the form of images, graphics, or algebra, or vice versa, ie, interpret images, graphics, or sentence into a mathematical description of the contextual and appropriate.
- D : The ability to communicate their mathematical ideas.

From table 2 shows that the average value of the post-test in every aspect of mathematical communication skills first experimental class is higher than the second experimental class.

Before testing the hypothesis, first do a test of normality and homogeneity of data. Normality test aims to determine whether the data comes from a population of normal distribution or not. Decision criteria: H₀ is rejected if the significance is smaller than, the significance level = 0.05.

Scientific approach mpre effective than cooperative learning model type TPS with Scientific approach effective in terms of communication skills of mathematics)

$H_1: \mu_1 > \mu_2$ (cooperative learning model type TPS with Scientific approach mpre effective than cooperative learning model type STAD with Scientific approach effective in terms of communication skills of mathematics)

Test statistic independent sample t test.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s_{gab} \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

with $v = n_1 + n_2 - 2$ and

$$s_{gab} = \sqrt{\frac{(n_1 - 1)s^2_1 + (n_2 - 1)s^2_2}{n_1 + n_2 - 2}}$$

Description :

\bar{x}_1 : the average results of post-test of the first experimental class

\bar{x}_2 : the average results of post-test of the second experimental class

n_1 : the quantity of the first experimental class’s student

n_2 : the quantity of the second experimental class’s student

s_{gab} : combine standard deviation

Significance level = 0,05.

H_0 rejected if $t_{test} < t_{(0,05;n-1)}$.

Table 3. Normality Test Results

	Kelas	Signifikansi	A	Hasil
Score	E ₁	0,198	0,05	Normal
<i>Pre-test</i>	E ₂	0,119	0,05	Normal

From the table it is known that $p\text{-value} > \alpha = 0,05$. It shows that the value of the pre-test have normal distribution.

The aims of homogeneity test is to determine whether the two groups have the same variant or not. Homogeneity test carried out on the pre-test value of the two classes that receive different treatment.

Table 4. Homogeneity Test Result

Data	Significance	A	Result
<i>Pre-test</i>	0,564	0,05	Homogen
<i>Post-test</i>	0,363	0,05	Homogen

From the table it is known that the test results of pre-test of the first and second experimental class produce $p\text{-value} > \alpha = 0,05$. It shows that the data pre-test and post-test of the experimental class first and second are homogeneous.

After normality and homogeneity tests done then followed by hypothesis testing. Before testing the hypothesis to answer the problem formulation, the first testing whether the experimental class first and second experimental class have the same ability.

Table 5. The Different Average Test Results

Data	Signifikansi	A	Hasil
<i>Pre-test</i>	0,107	0,05	There is no average difference

Based on the table it is known that the significance of the pretest $0,107 > \alpha$ so that H_0 is accepted. This means that there is no average difference between the experimental class first and second experiments for mathematical communication skills.

Cooperative learning model type TPS with scientific approach was effective in terms of communication skills of mathematics

Based on the results of the analysis showed that the experimental class first get the value of $t = 1.437 < t_{table} = 2.042$ so that H_0 is rejected. It states that the cooperative learning model *Think Pair Share (TPS)* with *Scientific* approach effective in terms of mathematical communication skills of learners.

According to Anita Lie (2008: 57), cooperative learning model type TPS gives students the opportunity to work alone and in collaboration with other students so that they can optimize student participation. It can be seen from the participation of mathematical communication skills of each learner. Cooperative learning model type *Think Pair Share (TPS)* with *Scientific* approach focuses on the activity of thinking independently beforehand, thinking in pairs, and presented the results of discussions. Activities think independently will make the students solve the problems given in accordance with its knowledge and understanding. Thinking activities in pairs will train students to discuss and express their opinions about the results of his thinking on the activities of independent thinking to solve the next problem. The next activity is to present the results of discussions by

Cooperative learning model type TPS with scientific approach more effective than the cooperative learning model type STAD cooperative with the scientific approach in terms of mathematical communication skills

some groups. *Scientific* approach used in this learning model outlined in the Student Activity Sheet which consists of several activities: to observe, ask, try, associate and communicate.

Cooperative learning model type STAD scientific approach was effective in terms of communication skills mathematical

Based on the results of the analysis showed that the experimental class first get the value $t = 0.402 < t_{table} = 2,039$ so H_0 is rejected. It states that the cooperative learning model *Student Team Achievement Division (STAD)* with *Scientific* approach effective in terms of mathematical communication skills of learners.

Cooperative learning model *type Student Team Achievement Division (STAD)* with *Scientific* approach to organizing students in discussion groups of four students is heterogeneous or represent all parts of the class. According to (Haydon, Todd et al: 2010) when students are conducting discussions, the teacher explains that each student in each group should ensure the other members in the group understand the results of the discussion. It trains students to be responsible for other members in the group so that each member of the group really understand the problems of a given settlement. After the presentations and question and answer it at the end of each lesson the teacher will give a quiz to each student to work individually. The results of this quiz is the progress of individual students' scores, the scores of individual progress of each student will be collected by each group. The group had an average score of the highest individual progress will be rewarded.

Based on the analysis we find that $t = 0.03 < t_{table} = 1,999$ so H_0 is rejected. It is claimed that the model of cooperative *Think Pair Share (TPS)* with *Scientific* approach is more effective than using a model of cooperative learning *Student Team Achievement Division (STAD)* with *Scientific* approach in terms of mathematical communication skills of learners.

Cooperative learning model *Think Pair Share (TPS)* with *Scientific* approach and cooperative learning model *Student Team Achievement Division (STAD)* with *Scientific* approaches have in common that both are giving students the opportunity to discuss and present the results of their discussion.

Inspite of there are similarity between both of cooperative learning models, the number of members in each group of cooperative learning model *Think Pair Share (TPS)* with *Scientific* approach less than the cooperative model of type *Student Teams-Achievement Division (STAD)* with *Scientific* approach, a small number of group members encourage each student to be more active. Cooperative learning model *Think Pair Share (TPS)* gives students time to develop the ability of thinking because students are given time to solve the problem individually first. After that students will discuss with his partner, the discussion process in the learning model *TPS* will run easily and the students will be active each individual to express his opinion. The active participation of students will be highly

CONCLUSION AND RECOMENDATION

Conclusion

Based on the analysis and discussion that has been obtained, the researchers concluded: 1) The cooperative learning model *Think Pair Share (TPS) Scientific* approach effectively in terms of communication skills mathematical learners can be seen from the results of t-test were getting value $t = 1,437 < t_{tabel} = 2,042$; 2) The cooperative learning model *Student Teams-Achievement Division (STAD)* the Scientific approach effective in terms of mathematical communication abilities of learners seen from the results of t-test were getting value $t = 0,402 < t_{tabel} = 2,039$; 3) cooperative learning model *Think Pair Share (TPS)* with *Scientific* approach more effective than learning to use the cooperative model of type *Student Team Achievement Division (STAD)* with *Scientific* approach terms of communications capabilities mathematical learners based on t-test analysis with the results of $t = 0,03 < t_{tabel} = 1,999$.

Recomendation

For other researchers who will conduct research using cooperative learning model *Think Pair Share (TPS)* with *Scientific* approach and cooperative learning model *Student Team Achievement Division (STAD)* with *Scientific* approach can be done by adding variables and other matters with regard limitations and suggestions in this study thus obtain better research results.

For school, cooperative learning model *Think Pair Share (TPS)* with *Scientific* approach can be used as an alternative model of learning that can improve students' mathematical communication.

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