Effects of Cooperative Learning STAD on Mathematical Communication Ability of Elementary School Student

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Abstract. The aim of this study is to describe the increasing of mathematical communications capability, and difference between students who get STAD cooperative learning and students who receive Direct Instruction. This study is a quasi-experimental study with pretest posttest study design. Subjects in this study in one of the fifth grade elementary school located in Cibeureum District, Kuningan. The research instrument used was a written test mathematical communication skills. The results showed that the improvement of mathematical communication capabilities Direct Instruction students who scored significantly better than students who learned with STAD cooperative learning. By grouping according to the ability of students will show a positive impact on student achievement in the classroom.

1. Introduction

Learning mathematics in primary schools has significance for the students, because in this level of mathematics learning was first laid out multidisciplinary basic abilities about mathematics in the environment. Mathematics in primary school aims to master the competency standards have been set and the children are able to solve simple problems systematically. Because mathematics is the basic science and the development has an important role in a variety of disciplines and promote the power of human thought. As mentioned in *The Ontario Curriculum* [1] that "The of mathematics equips students with the knowledge, skills, and habits of mind that are essential for successful and rewarding participation in such a society". Learning mathematics equips students with the knowledge, skills and habits of thought which is essential for a successful and useful in society.

Mathematics is a language. Mathematics is a language that symbolizes the series of meanings of the statement to be conveyed [2]. The symbols are artificial and will have a meaning after a meaning given to it, without the math merely a collection of axioms, definitions, theorems and formulas that are less meaningful. Math is a language, a way of expressing or explaining a certain way [3]. The mathematics languages are the terminology, notation and mathematical symbols. The capability of communication is one of important aspect for students to have a mathematical problem solving abilities [4]. Without communication in mathematics, we will only have a bit of information, data, and facts about the students' understanding of the process and the application of mathematics [5]. This argument implies meaning that the communication of mathematics, teachers are helped to understand students' abilities when interpreting and expressing his understanding of mathematical ideas that are being or they have learned during the learning process. As for the creation of more learning situations provide a conducive atmosphere to optimizing the mathematics communication ability of students, students can be organized in small groups. Model learning in small groups enables the emergence of communication and interaction between students in a higher quality.
Recognizing the importance of active students to develop communication skills and mathematical understanding of students, then teachers need to choose a model or approach which are suitable to engage students in learning groups to create a discussion. Activities of students in small groups provide an opportunity for students to perform mathematical communication through a number of metacognitive questions that focused on the problem, build prior knowledge with new knowledge, and the use of appropriate strategies to solve problems [6]. The learning which led the students in the learning setting in a small group called cooperative or collaborative learning.

Cooperative learning has various types, one of which is Student Team Achievement Divisions (STAD). Student Team Achievement Divisions (STAD) is one of the most cooperative learning method is simple and good for beginner teachers who use a cooperative approach [7]. STAD cooperative learning is considered suitable for the class which is unfamiliar or rare to the discussion or groups learning. Thus, it makes easier to explain the rules of learning in the new learning conditions.

By looking at the background above, the researcher is interested to assess the extent of "The Effect of Cooperative Learning STAD on Mathematical Communication Skills for Elementary School Students"

The purpose of this study is to determine whether there are the distinction in improvement of mathematical communication capabilities between students who get STAD cooperative learning with Learning Directly. Communication is one of the factors that are important in the mathematics learning process inside or outside the classroom. Communication plays an important role in mathematics. Communication is considered as a tool that can help teachers and students to share learning processes, understanding and learning mathematics. Everyone with an interest in mathematics will require communication in finding more information.

Related to the role of communication, one of the aim to be achieved in mathematics is to provide greater opportunities for learners to develop and integrate communication skills [8]. There are many ways to develop the communication skills is through speech and writing, modeling, drawing, and presented what they have learned.

Communication ability of mathematics is the ability to include and contain a variety of opportunities to communicate in the form of: (1) reflect the real objects, pictures or ideas of mathematics, (2) create a model of a situation or problem using the method of oral / oral, written, concrete, graphics, and algebra, (3) using the skills of reading, writing, and studying to interpret and evaluate ideas, symbols, terms and mathematical information, (4) respond to a statement / problem in the form of a convincing argument.

The indicators used in this study are: 1) The ability to express mathematical ideas through speech, writing, and demonstrate and describe it visually; (2) The ability to understand, interpret, and evaluate mathematical ideas, either orally, in writing, or in other visual forms. Both indicators adapted to the material that will be taken on the geometry. [9]

Cooperative learning STAD (Student Teams Achievement Division) is a method developed by Slavin, this learning method involves competence between groups. Students are grouped in various ways based on ability, gender, race, and ethnicity. Students learn the material together with friends in the group. In the process of discussion, groups of students who already understand the material presented, shall teach the material to members of the group who do not understand the material presented, then they are tested individually through the quiz. STAD advantages of this method are: all students be ready in learning; in the process of discussion going on cooperation and mutual communication between students; and can motivate students to learn. In addition STAD also has the disadvantage that students are familiar with reward and less conducive classroom conditions at the time of division of the group, thereby reducing the effectiveness of the learning.

STAD has the learning steps as follows: Submission of Interest and Motivation, Distribution Group, Presentation of Teachers, Learning Activities Team (Teamwork), Quiz (Evaluation) and Award Presentation Team. [7].
Based on the explanation above, the STAD cooperative learning is intimately connected with the students' mathematical communication skills.

2. Experimental Method
This study uses a quantitative approach with quasi experimental method. Design of experiments in this study refer to the Nonequivalent Control Group Design with two variables: learning discourse with the strategy of mathematical bet line (X) as the independent variable (Independent Variable) and the ability of mathematical communication of students (Y) as the dependent variable (Dependent variable). Here is a picture of quasi-experimental research design that will be done.

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**Figure 1. Nonequivalent Control Group Design [10]**

Description:
X : The treatment use cooperative learning STAD type  
O : Pre-posttests communication ability mathematical

The subjects were fifth grade students in one of the public elementary schools in the Cibeureum district. In this study, one class were being an experimental class will be given STAD cooperative learning, while the other class will be used as a control class given direct instruction.

The test instrument used in this study is a mathematical communication test. Problem mathematical communication ability tests are given to the experimental class and control class in the beginning of treatment as a pretest and a posttest treatment in the end. The tests are given to students in order to determine upon ability mathematical communication. Therefore, it is based on indicators of mathematical communication skills.

3. Results and Discussion
The study is about the application of learning cooperative courses STAD on mathematical learning about the concept of geometry in 5th grade of elementary school. The research was carried out during eight meetings. Before doing the study, the researchers first do a pre-test of the two classes. Results of preliminary data analysis indicate that the data are not normally distributed in experimental class, while the control class data is normally distributed. Then Mann Whitney was tested to determine the difference average of mathematical communication ability to control class and experimental class before the action is taken. The results showed the Sig. (2-tailed) are 0.038 lower than $\alpha = 0.05$ significance level, so that $H_0$ is rejected. This means that there are no differences in average mathematical communication ability between the experimental class and control class before the class action or both originate from the same condition.

In this study, the data were analyzed overwhelm the score of pre-test and post-test communication capabilities. Based on the score of pre-test and post-test gain value calculated normalized (N-gain) the ability of mathematical understanding well the experimental class and the control class. The following descriptive statistics score pretest, posttest, and N-gain the experimental class and control class.
After getting a different treatment, it appears that the data post-test mathematical communication capabilities of the two classes are different. This is also evidenced by the statistical test with the result that the two classes are not normally distributed. So, the next test was to test the difference average n-gain with the Mann-Whitney U test. The test of the difference in the average N-gain mathematical communication skills was done to prove the research hypothesis, that there is a difference mathematical communication ability of students who received SATD cooperative learning and improvement of mathematical communication skills students who got the direct instruction. The test results showed the Sig. (2-tailed) that is 0.038 less than the significance level $\alpha = 0.05$ so that $H_0$ is rejected. This means that there are differences in the average increase in the ability of mathematical understanding between the experimental class and control class.

Based on the results of data processing and analysis, there was found an increasing in mathematical communication skills of students who take SATD cooperative learning and the students who take the Direct Instruction. The improvement of communication of experimental class mathematically proved with N-gain is 0.49 is in the middle criteria. Meanwhile, the control class with N-gain of 0.67 is in the middle criteria. The test results of statistical testing showed that the ability of understanding mathematical communication of the fifth grade students in a public elementary school in Cibeurerum district who follow the direct instruction better than the students who take SATD cooperative learning geometry.

Based on the analysis, the steps of learning affect the improvement of communication capabilities. Overviewing the steps of learning, the Direct Instruction provides a freedom for students to communicate with each other. Students who have the low proficiency can learn how to communicate mathematically in high proficiency with the other students. Communication primarily looks dominant in step Direct Instruction that is currently structured drills and exercises under the guidance of teachers. The step of Direct Instruction requires students to be more communicative with their peers, then the planning, the implementation, and finding report assigned indicated that these students can finish well. While at SATD, the freedom to communicate between students just showed only in a group discussion. Because the material given to the SATD group was already given classically by the teacher. The freedom of communication on the Direct Instruction, this is according to the researchers, it raise the difference quality and improvement on the students' mathematical communication skills.

The results of the study suggests that the effect of SATD cooperative learning and Direct Instruction for high-ability students. In a various group of high-ability students often as a "teacher" and explain the concept shown to other students strengthen their understanding of the role that [11]. In a joint study group, students teach the knowledge shown to the group, and when students teach something is shown to other students, they tend to learn more in depth [12].

In addition to the above effect is seen on the n-gain and pretest posttest scores of students, the effect of both learning to high-ability students are also visible from the motivation factor. A highly capable student other than internal motivation to learn, it is because of the influence of cooperative
learning, especially in this study is STAD and Direct Instruction will increase the external motivation of students. This is due to that the cooperative groups will provide an assessment of the group in addition to an assessment of the individual. This will give a sense of responsibility over to the students, especially high-proficiency students to get the maximum score. High proficiency students will usually do something to get a good score, avoid punishment, to get reward or any other reason that he and other members will strive to get good grades. Learning which there is co-operation will generate extrinsic motivation of students, because there the students will perform a challenge not only for personal use but also for the benefit of the group [11].

From the explanation above, it is clear that the measures and the characteristics of cooperative learning effect for students to improve achievement or ability class, both for their cooperative groups or because of rewarding of the two learning makes students are challenged to get the achievement of a better capability. In this research is directed to students' communication abilities.

4. Conclusion
Based on the research that has been conducted on improvement of communication capabilities mathematical students between groups of students who received STAD cooperative learning and student groups who received direct learning can be concluded from the results that, there are the differences in improvement of mathematical communication capabilities of the students who treated with STAD cooperative learning and improvement of communication ability of students who treated with direct instruction. By grouping according to the ability of students will show a positive impact on student achievement in the classroom. Direct learning can be used to develop the skills of mathematics. In direct instruction the teacher can better control the students and the ability to be achieved.

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