

# The Difference of Mathematical Problem Solving Ability by Using Student Teams Achievement Division (STAD) and Direct Instruction (DI) on System Linear Equation Two Variable in Grade VIII SMP Negeri 11 Medan

Faradilla Bafaqih

Mathematics Education Program  
Graduate program, State University of Medan  
Medan, Indonesia  
bafaqih.fara@gmail.com

Cecep Nandar

Mathematics Education Program  
Graduate program, State University of Medan  
Medan, Indonesia  
nandarcepi@gmail.com

**Abstract**— Objective of this study is to know whether mathematical problem solving ability by STAD higher than mathematical problem solving by DI on linear equation. The type of research which is used in this study is Quasi experimental research with pretest and posttest with two experiment class. Population of this study is all of student in VIII grade of SMP Negeri 11 Medan. They are experiment class I (VIII-9) taught with STAD and experiment class II (control class) (VIII-8) taught with DI model. The instrument that arranged have legalized by expert validator namely lecture and teacher mathematics. Hypothesis test method that is used in independent sample t-test. Result at this study at  $\alpha = 0.05$  shown that  $t_{count} > t_{table}$  namely  $3.75 > 1.675$ . it means that student mathematics problem solving ability by STAD higher than mathematical problem solving by DI on linear equation two variable system for VIII grade in SMP Negeri 11 Medan.

**Keywords**— STAD; DI; problem solving

## I. INTRODUCTION

Mathematics education can not be regardless of mathematics itself. Therefore, for the learning of mathematics in developing the character of the students would be better if it first revealed the characteristics of an abstract mathematical object, namely, the empty symbols of meaning, and the agreement axiomatic deductive reasoning, and contradiction. Purpose of mathematics education must consider, (1) the formal goals, namely arrangements of reason and formation of the child's personality, (2) the purpose of that is material the application of mathematics and mathematical skills.

However are still there students who feel mathematics as a difficult subject? They think of mathematics as a difficult subject and feared. It is appropriate with [1] says: "from the various fields of study that has been taught in school, mathematics is a study of the most difficult lesson to students are not better learning disabilities and learning difficulties."

In the conventional teaching is more often performed by teachers because it is very simple. Teachers teach students in classrooms that have a one abilities minimum requirement. Activities of teachers in learning activities more stands out so learn centered dependent on teacher. For the learning of mathematics at the Junior High School (SMP) is less press understanding of the concept. Teachers generally select the easy and practical way to it but not how to make the students to learn. When their exercise is given only able to work on the problems similar to those given by the teacher.

Based on the description, it is said that improving the quality of mathematics education in school, not be separated from classroom learning process that involves the interaction of students and teachers, so that increasing students' problem solving abilities have a concept design to achieve specified learning objectives.

Sometimes students assume the material Linier Equation System Two Variable is a difficult lesson to learn. This is supported by a test given at the time of observation the researcher class VIII SMP Negeri 11 Medan with questions that test understanding of students' mathematical problem solving. One of the questions used: *Sani age 7 years older*

than Ari. While the number of their ages is 43 years. What is the age of each.

Based on the test results and the answer given most students only focused search for the answer without making strides in solving the problem. And to resolve the problem solving, there are four steps that must be done, namely: understanding the problem, creating lesson plans, perform calculations, and checking back.

Related to the above description, it is necessary to think about strategies or ways of presenting mathematical material so as to make students active and meaningful learning. One way to develop teaching and learning strategies to students as well as to improve its teaching mathematics is to use a learning model students teams achievement division (STAD).

Problem solving is a process that requires the ability and skills of students in activities. So in order to obtain meaningful learning objectives that will increase problem solving skills, new concepts and new information must be linked to the concepts that already exist or that have been known to students in the cognitive structure.

#### A. Mathematics Learning

First time mathematics created from human experience in their worlds empirically, then that experience will be proceed in ratio world, proceed by analysis and synthesis with logical reasoning in cognitive structure then arrive in a CONCLUSION as mathematics concepts.

For more details, there are some expert opinions about learning meaning below: learning is an effort process that was someone done acquire new behavior changes as a whole, as a result from his own experience in interaction with the environment [2]. Learning is a process that signed about there was changed in a person. The change as a result from learning process that can be indicated in many from such knowledge, understanding, attitude, and behavior, skill, ability, and many aspect changing that found in individual that learn [3].

#### B. Mathematics Problem Solving

The ability of person to do something of activity. Every person has different abilities both in receiving, remembering and using something that receipt. This is caused that each person has a different way in terms of preparing everything observed, seen, remembered or thought. Students can also differ in the way to receive, organize the approach to learning situations and connecting experiences about learning and the way they respond to the teaching method.

According to [4]: Learning problem solving is the highest type of learning because is more complex of the formation of the rules. Indicator which shows the ability of solving problem includes: (1) Demonstrate understanding of the problem. (2) Organize data and choosing relevant information in problem solving. (3) Presents a mathematical problem in a variety of forms. (4) Choosing an approach and a method of problem-solving appropriately. (5) Develop problem-solving strategies. (6) Create and interpret mathematical models of problem situations. (7) Resolving problems with routine.

To complete the questions used the strategies or steps formulated by [5] in problem solving, there are four steps that must be done: (1) Understanding The Problem, (2) Devising a Plan, (3) Carrying Out The Plan, (4) Looking Back.

#### C. Cooperative Learning STAD

Cooperative learning is ruled by the constructivist theory. Cooperative Learning Model characterized by cooperative task, goal, and reward structures. Student independent in cooperative learning situation are encouraged and required to work together on a common task and they must coordinate their efforts to complete the task.

Reference [6] said that "cooperative group work that is designed to allow the pupils to express, and hence test, their own ideas and to discuss the current focus of class work aids mastery and retention of new information and is motivating for the pupils concerned". According to [7] that "Cooperative learning model was developed to achieve three important instructional goals: academic achievement, tolerance and acceptance of diversity, and social skills development".

## II. RESEARCH METHOD

#### A. Type of Research

This research is a quasi experimental study in order to determine differences in mathematical problem-solving ability of students who were taught using the model student team achievement division and learning conventional in class VIII SMP Negeri 11 Medan. The research was conducted in the SMP Negeri 11 Medan in class VIII. When the study conducted in the first semester of school year 2013/2014

#### B. Population and Sample

Research population was all students in class VIII SMP Negeri 11 Medan academic years 2013/2014 in nine class. The sample used in this study is a class VIII-6 as a class experiment with use learning model student team's achievement division and class VIII-3 as a control class by using the conventional learning.

STAD [8] consists of five main components namely: classroom presentations, team, quizzes, score of individual progress, and recognize team.

- Class presentation

Material in STAD first introduced in the presentation in the classroom. Beginning with teaching directly led by teacher, but can also include audiovisual presentations. The class presentation focuses on STAD unit. In section, students will realize that the need to really pay full attending during class presentations: because its will be helpful those to do quizzes and their quiz to determine their team score.

- Team

The team consists of four or five students representing all parts of the class in terms of academic performance, gender, race, and ethnicity. The main

function of this team is to ensure that all team members are actually learning, and more specifically, is to prepare its members to be able to do the quiz as well. Once a teacher delivering the material, the team assembled to study the activity sheet or other material. Team is the most important features in STAD. At each point the emphasis is to make the team do their best for team, and teams must do their best to help the understanding of each member. STAD [8] consists of five main components namely: classroom presentations, team, quizzes, score of individual progress, and recognize team.

- Quizzes

After one or two period teacher gives presentations or about one or two period team practice, students take individual quizzes. Students are not allowed to help each other in doing the quiz

- Score of Individual Process

Score of progress individual is to give each student performance than ever before. Each student can contribute to his team max points in this scoring system. Each student is given the initial score obtained from the performance of students in doing the same quiz. Furthermore students will accumulate points for their team based on the rate of increase in their quiz scores compared with their initial score

- Recognize Team

The team will get an award form the other team scores on average if they reach a certain criteria [8]. Groups can be given a certificate or other of award. The award given depends on creativity of teachers.

### C. Research Procedure

Steps to conducting research - the following:

#### 1) Preparation Phase

- Scheduling research.
- Instructional plan using a model of student teams achievement division (STAD) on the subject Linier Equation System Two Variable and lesson plans using conventional learning on the subject Linier Equation System Two Variable. Created lesson plans each class in 6 sessions, where one session is 2 x 40 minutes
- Setting up a data collection tool, in the form of pretest and posttest.
- Validate a matter of research instruments.

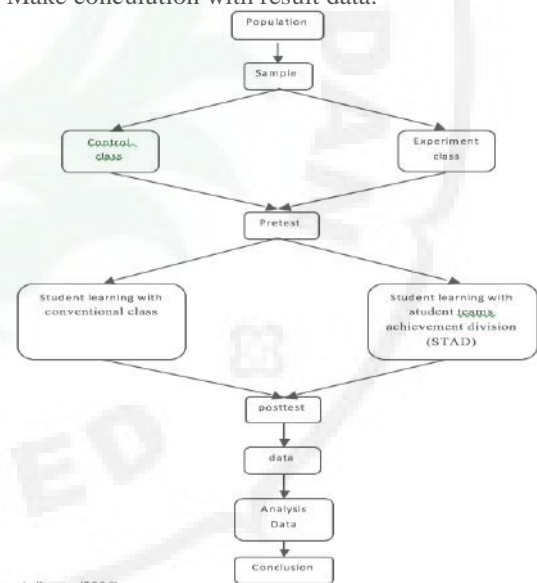
#### 2) Implementation phase

- The samples were randomly taken two classes: one class used as the experimental class and the control class to be the class.

- Gives a test pretest given before applying of study in the two samples. Initial results analyzed to see if the beginning of the second class capability equal or not.
- Instructional held in two classes with the same materials and time, just learning different. To be given treatment that is experimental class learning model of student team achievement division while the control class treatment given conventional learning.
- Gives posttest to both classes by using a posttest. Long execution time and posttest in both classes are the same.

#### 3) Final Phase

- Test results of the two groups were compared to see how differences in mathematical problem-solving skills of students who are taught using a model student teams achievement division and conventional models.
- Conducting data analysis
- Make conculution with result data.



Scheme Research Procedure [9]

### D. Problem Solving Ability Test

The test is a tool or procedure that is used to determine or measure something in the atmosphere and the way the rules that have been defined. In this study tests were given to students purpose to determine students' mathematical problem solving ability. Form of test used is the test description (Essay test). In this study the test is divided into two parts, namely the initial test (pretest) and the end of the test (posttest).

TABLE I. TECHNIQUE IN GIVING PROBLEM SOLVING SCORE

Indicator	Score	Reaction to the problem
Understanding the problem	0	There is no answer
	1	Wrong in interpreting half of question
	2	Writing information from question completely and correctly
Making in plan strategy	0	There is no plan
	1	Writing strategy that is no relevant
	2	Writing strategy correctly but not completely
	3	Writing strategy correctly and completely
perform calculation	0	There is no solution
	1	Using the steps of solution that related to the correct solution but not completely.
	2	Using the steps of solution that related to the correct solution but the result is false
	3	Result and correct process.
checking back the results obtained.	0	There is no information all
	1	There is checking result but not completely
	2	Process of checking the answer completely for showing a truth result and process.

The criteria determine of problem solving ability mathematics students is shown from level of student mastering in material that taught. The level of mastering will be appeared in high and low score. The criteria that are used as follow (table):

TABLE II. CRITERIA LEVEL OF STUDENT PROBLEM SOLVING ABILITY [10]

Mark (%)	Criteria
90 – 100	Very High
80 – 89	High
65 – 79	Moderate
55 – 64	Low
0 – 54	very low

### III. RESULT AND DISCUSSION

#### A. Result

After conducting learning with two different models, direct interaction in the control class and student teams achievement division (STAD) in the experiment class. From the posttest score of two classes, the mean score of control class and experiment class respectively 76.26 and 83.92. then test the hypothesis by using t-test to determine if there is significant difference in the score or difference is large enough to reject the null hypothesis.

Based on the calculation of hypothesis test, the result is as the following:

TABLE III. RESULT OF HYPOTHESIS TEST

Data	Mean Score	t-count	t-table	CONCLUSION
Control	76.26	3.75	1.675	Hypothesis null rejected
experiment	83.92			

From the above table can be seen that t-account > t-table that is  $3.75 > 1.675$ . since t-account > t-table the hypothesis null rejected it means the student problem solving ability that by student team achievement division higher than by direct instruction on system linear equation two variable in grade VIII SMP Negeri 11 Medan.

#### B. Discussion

In this research, there used two difference model of learning, namely STAD model and direct instruction model. Researchers take two classes at random. The first class for experiment class using STAD method and the second class for control class using direct instruction and each class has 36 students.

Before learning model was given to each class of experiment, first performed a pretest to determine students initial and as a basic for the formation study group. From the research result, the average pretest in experiment class is 51.42 and average in control class is 49.86. These indication that the two classes can be said have same initial ability because of the result of average pretest both class are small difference. Based on normality and homogeneity testing, two classes were concluded as normality distributed and homogeneous.

This relates to the syntax of the treatment or the steps of the STAD and direct instruction models that follows:

- The process of learning experiment classroom

In experiment class using STAD model. Before the lesson begins the teacher prepares lesson plans and worksheets. The teacher divide the student into groups with each member has the ability homogeneous. Teacher determine baseline scores through pretest and group seating arrangements. At each meeting the teacher the teacher give motivation and learning objectives. The teacher provide students with the exposition of material in a demonstration or reading material. The teacher provide tutoring and assigns each group after group discussion result give a presentation in front of class. The teacher give award praise and applause.

- Classroom learning process control

In the control class using direct instruction model. At each meeting the students and teacher draw close attention to motivate students to participate in learning. Teacher provide learning objectives to the students through the lesson plan contain a summary of the material and learning time. She reminded the learning return to the previous way of linking the learning lesson that will be given. The teacher explains the material step by step by demonstrating in front of the class. Teacher give assignments to students training.

After being given a different treatment for each class and all the materials are given then last meeting student were given a posttest to determine whether there are differences in problem solving ability of students.

Based on result data (posttest) obtained average value 83.92 of experiment class (high) and average value control class 76.25 (moderate). Of the data there are differences between experiment class and control class. This proved by the result of statistical calculation where  $t\text{-account} > t\text{-table}$  that is  $7.73 > 1.675$  which means that the students' problem solving abilities by using STAD higher than direct instruction.

The above CONCLUSION is in accordance with the research of Vera Dewi Susanti, Budiyo, and Imam Sujadi [11] with the result is cooperative learning type STAD model better than direct learning model and also better than NHT model on system linear equation two variable.

The differences of two models are in STAD model us emphasize to student activity is study group award. In this model student construct their own knowledge, and it create pleasant atmosphere, attractive and effective learning. While in direct instruction learning emphasize listening activities (through lecture) and demonstration. Teacher as a center and controller of the learning process. Because of the different activities and emphasize of learning, the result of student achievement that research by two models are different.

### C. Finding

From the research find a positive and negative side of cooperative learning by researchers. The plus side is that students can be responsible for learning and students active role in expression without having focused the way the teacher. The less of reference materials so that students have a discussion in the group is less satisfied.

Based on study results that was conclude in SMP Negeri 11 Medan and based on some theoretical framework proven that the student problem solving ability that by STAD higher than direct instruction on system linear equation two variable in grade VIII SMP Negeri 11 Medan.

## IV. CONCLUSION

Based on the research and processing of data it can be concluded:

1. Mathematical problem solving ability by using STAD higher than mathematical problem solving ability by using direct instruction on system linear equation two variable in grade VIII SMP Negeri 11 Medan.
2. From two class sample that have not be given the treatment, student have level of problem solving ability are the same and homogeneous. After given different treatment, learning of student by using STAD is 87.78% with 28 student completeness and 8 students incomplete. While learning outcomes of students by using DI is 61.11% with 20 students completeness and 16 students

incomplete on system linear equation two variable in grade VIII SMP Negeri 11 Medan.

## REFERENCES

- [1] M. Abdurrahman. "Pendidikan Bagi Anak Berkesulitan Belajar," Jakarta: Rineka Cipta, 2009, pp. 252-256
- [2] Slameto. "Belajar dan Faktor - Faktor yang Mempengaruhinya", Jakarta: Penerbit Rineka Cipta, 2010, pp. 2-5
- [3] Trianto. "Mendesain Model Pembelajaran Inovatif-Progressive", Jakarta: Kencana, 2009, pp. 8-12
- [4] M. Wena. "Strategi Pembelajaran Inovatif Kontemporer", Jakarta: Rineka Cipta, 2009, pp. 53-55
- [5] Polya. "How To Solve It," Expanded Princeton Science Library Edition., 2004
- [6] D. Galloway, and A. Edward. "Secondary School Teaching & Educational Psychology: The Effective Teacher Series", New York: Longman Publishing, 1992, pp. 82-85
- [7] R.I. Arends, et al. "Learning To Teach", Seventh Edition. New York: McGraw-Hill, 2007, pp. 35-40
- [8] Slavin, R.E. "Cooperative Learning", Bandung: Nusa Media, 2005
- [9] Arikunto, S. "Procedure Penelitian Suatu Pendekatan Praktik," Jakarta: Rineka Cipta, 2006.
- [10] W. Sanjaya. 2010. Strategi Pembelajaran berorientasi Standar Process Pendidikan. Jakarta: Kencana.
- [11] D.S. Vera, Budiyo, and I. Sujadi, "Perbandingan prestasi belajar matematika siswa dengan pendekatan ctl antara model pembelajaran kooperatif tipe stad dan nht pada pokok bahasan sistem persamaan linier dua variabel ditinjau dari kepercayaan diri siswa kelas viii smp negeri di kabupaten madiun," FKIP UNS Journal System, Vol. 1, No. 3, 2013, pp.297-305