The Influence of Team Assisted Individualization (TAI) Approach on Students' Mathematical Problem Solving Ability

1st Sri Wahyu Neka
Universitas Negeri Padang
Padang, Indonesia
Sriwahyuneka@gmail.com

2nd Hendra Syariffudin
Jurusan Matematika FMIPA
Universitas Negeri Padang
Padang, Indonesia
hendrasy@yahoo.com

3rd Syahniar
Jurusan BK FIP
Universitas Negeri Padang
Padang, Indonesia
syahniar@konselor.org

Abstract—**This study compared the ability in solving mathematic problem between students taught by using cooperative learning, especially TAI type, and students taught by using conventional approach, which was also seen across students' learning motivation. This study was quasi experimental research. Furthermore, the population of this study was fifth grade students at Mungka sub-district. Samples were taken by using simple random sampling technique in which fifth grade students at SDN 03 Mungka served as control class and fifth grade students at SDN 01 Mungka served as experimental class. Moreover, data were collected through questionnaire and test. The findings of this study show that: 1) students who were taught using cooperative learning especially TAI type had better ability in solving math problem than the students who were taught using conventional approach, detached from student learning motivation, 2) there was no interaction between TAI type of cooperative learning model and students' learning motivation in terms of problem-solving abilities. Therefore, it can be concluded that TAI type of cooperative learning model gave significant effect on enhancing students' problem solving ability.**

Keywords— Cooperative learning, TAI type model, Problem Solving, Learning Motivation

I. INTRODUCTION

Mathematics plays an important role in development of science and technology due to the fact that mathematics trains people to think logically. Learning math can improve students' ability in thinking critically, relating learning material with environment and solving problems associated with the real problem using various ways or methods. Thus, it can be said that the aim of learning mathematics is to develop students' ability in obtaining optimal learning results which can be done by maximizing students' problem-solving ability [1].

Solving problem is often related with real world. Problem-solving is not limited for problems in real world; however, it can be from mathematics itself and these problems can be the sources for problem-solving activities. In addition, problem can be a tool to solve real problem today, meanwhile the same problem is part from a set of regular items tomorrow. When a student has dealt with the previous item, students' character will change [2].

Problem-solving is an important part of mathematic curriculum in which it enables the student to obtain experience and use their knowledge and skills in solving the problem [3]. The National Council of Teachers of Mathematics (NCTM) states that "problem-solving is the main focus in learning mathematics ". Nugent and Vitale also explain that "in problem-solving, the activities such as identifying problem, exploring alternative solution, implementing alternative or the chosen solution, and bringing in the results that are called conclusion are involved" [4].

Based on results report of Program for International Student Assessment (PISA) in 2015, Indonesia was on 69th rank from 76 countries. This result showed that students' outcome in learning math was still low. Hence, based on this result, it is showed that (1) Indonesian students face the difficulty in answering the questions that require problem-solving ability, argument and communication, and (2) they leave questions containing long information and tend to be interested on routine questions which are simply directed to formula. Based on this assessment, it can be concluded that Indonesian students' ability in solving math problems is still low compared to other countries [5].

One way that can be done to improve problem-solving skill is to use Team Assisted Individualization (TAI) type of cooperative learning model. Additionally, cooperative learning models can improve learning outcomes and produce higher achievement than conventional learning; even it is applied in different backgrounds. In accordance with Johnson and Johnson's opinion, it is found that cooperative learning produce higher achievements compared to individual learning even though it is applied in distinctive background [6]. Furthermore, the results of the study carried out by Zakaria also showed that cooperative learning also gave more significant effect on students' achievements than conventional teaching [7].

Moreover, TAI cooperative learning model is a combination of individual and cooperative learning. In this model, each student is facilitated with a student worksheet and given the opportunity to implement the concepts that they understand by working on the student worksheet individually within a set of time. Then, each of them gather in their group and check each other's work. With the peer check, it is hopefully expected that if there is a misunderstanding concept, it will be resolved quickly [8].

Another important thing in improving learning outcomes is learning motivation. Learning motivation is the most important thing in the learning process. motivation is probably the most important factor that educators can target

in order to improve learning. Motivation is the most important factor to improve students 'learning outcome. If it is ignored, the learning outcome will be less satisfying [9].

The research questions in this study are stated as follows: (1) are students' mathematical problem-solving abilities who are taught using TAI type cooperative model better than students who are taught using conventional approach? (2) Are mathematical problem-solving abilities of students with high and low motivation taught using TAI better than the students taught using conventional approach (3) is there any interaction between TAI Cooperative Learning Model and students' motivation?

II. METHOD

This study was quasi experimental study which aimed to compare the effect of TAI type of cooperative learning model and conventional approach in solving math problem. The variables involved in this study were problem solving ability as independent variable, TAI type of cooperative model as dependent variable, and learning motivation as moderator variable.

The study was undertaken at elementary school at Mungka which had the same curriculum and the same scoring standard. From all schools at the regency, two classes were randomly selected as research samples. 25 students of elementary school no 1 Mungka were participated in experimental class which was taught using cooperative learning and 25 students of elementary school 03 Mungka were participated in control class which was taught using conventional approach. The data of this study were collected using questionnaire and tests. Questionnaire was used in identifying students' motivation, while test was used to measure students' mathematical problem-solving ability. Questionnaire and tests were validated by experts and tested to meet the criteria for validity and repayment. Indicators of students' mathematical problem-solving abilities used were (1) identifying known elements and the adequacy of the required elements, (2) finding problems or constructing mathematical models, (3) determining strategies to solve problems, (4) explaining or interpreting results of problem solving. To find out the score, students' mathematical problem solving skills were assessed by using assessment rubric. Furthermore, the data were analyzed using t-test and two-way ANAVA after conducting a series of normality and homogeneity tests.

III. RESULTS AND DISCUSSION

Based on the results of data analysis, students' score for problem-solving ability in both experimental and control classes in accordance with learning motivation can be seen in Table 1.

TABLE 1. THE AVERAGE SCORE OF STUDENTS 'PROBLEM SOLVING SKILLS IN ACCORDANCE WITH STUDENTS' LEARNING MOTIVATION

Class	Motivation	N	Problem Solving
Experiment	High	18	80,56
	Low	7	81.14
Control	High	13	78.31
	Low	12	75.5

Table I shows that the students' average score in experimental class was higher than students' score in control class. Besides, based on student learning motivation, the average score in the experimental class was also higher than in the control class.

After conducting a series of normality and homogeneity tests, it was concluded that the t-test was used for four hypothesis testing, and two-way ANAVA was used to test the interaction between the TAI type of cooperative learning model and students' learning motivation in improving mathematical problem solving abilities. A summary of hypothesis testing using Microsoft Excel is presented in the following table.

TABLE II. HYPOTHESIS TESTING

Student's motivation	Result			
		t_t	t_h	*Note*
Total	0.05	2.011	13.33	H_1, Accepted
High	0.05	2,046	9.96	H_1, Accepted
Low	0.05	2.110	4.027	H_1 Accepted

Hypothesis testing results in table II show that all hypotheses were accepted. It means that the students' problem-solving ability in experimental class was higher than the students in control class. This finding also applied to students with high and low learning motivation. It is because the teacher in experimental class familiarized the students with problems-solving skill [10]. Moreover, students were given the opportunity to work in teams, share various views and get involved in solving problem .

The next hypothesis testing used two-way ANAVA which was used to figure out the interaction between the TAI type of cooperative learning model and learning motivation in improving students' mathematical problem solving abilities. The results showed that F_t which was 4.05with = 0.05 was greater than F_h which was 0.032. Therefore, H_0 was accepted. It means that there was no interaction between the TAI type of cooperative learning model and learning motivation in improving students' mathematical problem-solving abilities.

From the results of the study, it can be seen that students in experimental class were trained to answer questions which was based problems. It can be seen from the students' answer sheets from the first meeting to the sixth meeting, there were significant changes. At the first meeting, students had not been able to understand the purpose of the problem, as the result, they did not answer correctly, as it is shown in the following picture
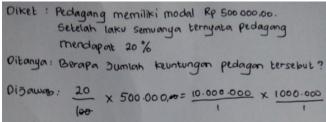
Figure 1.Completion of students' worksheet at meeting 1

At the third meeting, the students were able to understand the question, so they were able to answer the questions correctly even the indicator of problem solving abilities was not complete yet as it is shown in the following picture.

Figure2.Completion of students' worksheet at meeting 3

In the sixth meeting, students were accustomed to solving problems based on problem solving, so that students were able to choose strategies that are right on target in accordance with the rising problems. It can be seen in the following picture.
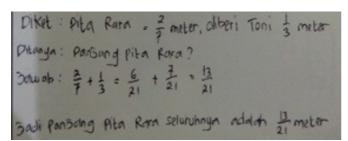

Figure 3. Completion of students' worksheet at meeting 6

From the examples of student's responses, the students' ability in solving problem can be trained and taught. Besides, in the final test there were significant differences between students' scores in experimental class and students' scores in control class. It can be seen in the following figure.
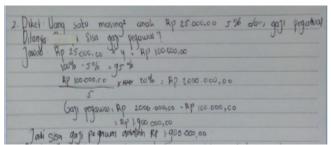

Figure 4. Completion of experimental class problems

In the picture above, students` answer in experimental class has met the indicator in problem-solving skill. The students were able to determine the elements correctly; then, they were able to formulate the problem. Thus, they could determine the right strategy in accordance with the raising problems. They also did not forget to make conclusions based on the results. Unlike the students' answer in control class, students have not been able to determine the elements and formulate the problem. Yet, they just copied the questions. Hence, they could not determine the right strategy to solve the problems. Besides, they also did not make conclusions based on the answers. Student answers in control group can be seen in the following picture.
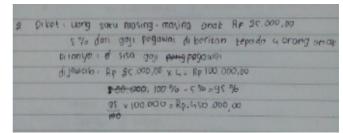

Figure 5. Completion of questions in control class

TAI type of cooperative learning is a model that combines group learning and individual learning. In this model, teachers initially introduce material to students. Then, students mutually work together by discussing with the group to find, understand and deepen the concepts which is guided by students' worksheet. The group is usually formed heterogeneously. Furthermore, the students apply concepts that they understand by doing exercises individually. At this point, it is expected that students want to try to do the exercises without waiting for his friend to finish the work [8].

After students do the exercises individually within the allotted time, they check each other's work. Then, they discuss to check it together. With this activity, it is highly expected that if there are students who have not been able to understand the problem and determine the appropriate strategy to solve the problem, it will be quickly resolved. Before the lesson stops, there will be a quiz that is done individually. Every student is given the initial score, then they will collect points for their team based on quiz score. This can trigger students' enthusiasm in learning so that students' ability to implement problem-solving skill will be better.

In control class, the teacher explains the lesson and the students listen to the explanation. Next, the teacher provides the opportunity for students to ask about material that have not been understood by them. The teacher gives several examples of questions, and then the teacher gives exercises with questions that are almost similar to those described by the teacher. As a result, students' problem-solving skill in this class is not well developed.

Based on the explanation above, it can be seen the differences in problem solving abilities of students in the experimental class and the control class in which the

average score of students in experimental class was higher than the score in control class. Learning by using the TAI type of cooperative learning model can improve student achievement in mathematics [11]. TAI type of cooperative learning is more effective for students because students are provided with opportunity to cooperate in teams and get engaged in solving problems [12]. Thus, learning by using the TAI type of cooperative learning model can improve students' mathematical problem solving abilities.

IV. CONCLUSIONS

Based on the results of the study and discussion, it can be concluded that the TAI type of cooperative learning model gives a better result than conventional approach in improving students' mathematical problem solving abilities. This conclusion also applies to students with high and low learning motivation since there is no interaction between the TAI type of cooperative learning model and learning motivation in improving students' mathematical problem solving abilities.

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