Utilization Of Students Team Achievement Division And Team Game Tournament: Effective Ways To Increase Students' Mathematics Ability

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Utilization Of Students Team Achievement Division And Team Game Tournament: Effective Ways To Increase Students' Mathematics Ability

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Abstract: This research aims at finding out the differences of the mathematics learning outcomes of the students who learnt through Students Team Achieveement Division (STAD) and Team Game Tournament (TGT). A quasy experimental research with posttest only for control group design was implemented where the sampling technique used was simple random sampling. The research found that: STAD and expository learning showed a significant difference where F_{count} = 28.65 which means that the results of the students who learnt through STAD were higher than the ones with expository learning. There was a significant difference as well in the results of the students in TGT and expository learning where F_{count} = 7.33 which means that the result of the students who learnt through TGT were higher than the ones with expository learning method. There was significant difference of the results or outcomes of the students learning through STAD and ones who learnt through TGT in which F_{count} = 6.80.

Index Terms: STAD; TGT; Mathematics ability.

1 Introduction

THE learning process is a communication process that involves three main components: the sender (teacher), the receiver (students), and the messages (subject matter). Sometimes in the learning process there are lacks of communication. It means that the subject matter or message conveyed by the teachers cannot be optimally accepted by students. It also means that not all subject matter can be well understood by students. Even worse, students as recipients of the messages incorrectly capture the contents of the messages conveyed. To avoid these things, teachers can develop learning models and strategies by utilizing various media and learning resources. The use of media would increase the learning motivation of the students so that the attention of the students to the learning materials can be increased and the results obtained will be maximal. However, the real condition is different. Based on the results of the interviews that have been conducted with one of mathematics teachers at eight grade, it was found that there were several obstacles that blocked the maximum utilization of students' learning groups in mathematics learning. The lack of maximum utilization of learning groups of students in mathematics learning include: students are difficult to have discussion with their group members; students have not been able to understand the material in accordance with the applicable curriculum; lack of learning media provided by the school; lack of opportunities for students to ask questions at the end of learning process; lack of activities and exercises during the class; and sometime there were no final test at the end of each chapter due to time constraints. The result of this condition is lower students' outcomes. The students' low scores were not only found in one eight grade classroom. Apparently, other eight grade classrooms also experienced the same case. Based on the Minimum Completeness Criteria (MCC) for mathematics subjects, the minimum scores for VIII-1 were 80, while for VIII-2 to VIII-8 were 75. Daily Test scores of the students were presented in Table 1. The following table proves that students learning outcomes are still low.

Table 1: The percentage of total students who passed and the students who failed the MCC of Mathematics Daily Tests.

Classroom	Total Students	Students' Achievements			
		Passed		Failed	
		Total	%	Total	%
VIII-1	36	25	69	11	31
VIII-2	36	13	36	23	64
VIII-3	34	13	38	21	62
VIII-4	34	13	38	21	62
VIII-5	36	12	33	24	67
VIII-6	36	15	42	21	58
VIII-7	36	13	36	23	64
VIII-8	36	15	42	11	58

Source: Mathematics Teachers' Book Mark

There are many alternatives provided by several scientific experts, includes to use cooperative learning models that are suitable in the process of learning mathematics [1]–[3]. A suitable cooperative learning model can improve students' learning achievements as well as be able to engage students actively, both in groups and individually. According to [4], cooperative learning models are based on the belief that learning is most effective when students are

actively involved in various ideas and work together to complete academic tasks. The same thing was stated by [5]–[7] that direct learning is less effective in determining student learning outcomes, both based on cognitive and affective when compared with cooperative learning models. Furthermore, [8]–[10] explained that to improve students' learning outcomes both based on cognitive and affective, teachers can apply cooperative learning models. In this study, one alternative that will be used to improve student learning outcomes is to apply cooperative learning models of Students Teams Achievement Divisions and Team Games Tournament. Based on research conducted by [11], [12], [12], the STAD and TGT cooperative learning models basically do not replace direct learning as a learning model, but as a way to adjust learning by utilizing the cooperation of each student. This study aims: (1) to find out the learning outcomes of mathematics students who learn to use the STAD higher than expository learning, (2) to find out the mathematics learning outcomes of students who learn to use TGT is higher than expository learning, and (3) to find out differences in mathematics learning outcomes of the students who learn through STAD and TGT. The STAD is one of the models of cooperative learning using small groups with the number of members of each group of 4-5. According to [14], this learning model is the simplest cooperative learning model and is the best model for beginners for new educators using cooperative learning models. According to [13], [14] explained that the STAD model consists of five main components: (1) class presentation; (2) group presentation; (3) quiz; (4) individual progress scores; and (5) team recognition. The steps of learning with the STAD are: (1) forming heterogeneous groups of 4-5 people; (2) teachers' presentation; (3) groups assignments. Members who already understand can explain to other members until all members in the group understand the assignment; (4) teachers give quizzes/questions to all students. During answering the quiz, the students should not help each other; (5) provide an evaluation; and (6) conclusions. Another cooperative learning model is the TGT. According to [14], the TGT is generally the same as the STAD, except for one thing i.e. the TGT using academic tournaments. This means that the TGT uses quizzes and individual progress scores where students compete as representatives of each group with equal academic performance. This is also in accordance with what was stated by [15] stated that each participant in each group will compete to collect points for the team's victory. According to [14], the TGT consists of five main components: (1) class presentation (the same as STAD); (2) team (the same as STAD); (3) games (games); (4) tournaments; and (5) team recognition.

2. METHOD

In accordance with the problem of the research, this research is a quasi-experimental study. According to [16]–[18], quasi-experimental research is a way to obtain information which is an estimate for information that can be obtained with actual experiments in circumstances that do not allow for controlling and manipulating all relevant variables. The research design used in this research is Posttest Only Control Group Design as in Table.

Table 2. *Research Design*

Classroom	Treatment	Posttest
Experiment I	X_1	T
Experiment II	X_2	T
Control Class	-	T

Index:

T : The final test is given in experimental class I, experimental class II, and control class at the end of the meeting.
X_1 : STAD model.
X_2 : TGT model.

The variables in this research are: (1) independent variables i.e. the STAD and the TGT and (2) the dependent variable i.e. the learning outcomes of the eighth grade students. This research was held in the eighth grade of SMP N 28 Padang in academic year 2016/2017. The population in this study is all students in eighth grade. Population is an area of generalization which consists of objects/subjects that have certain qualities and characteristics, so that researchers can study it and then conclusions can be drawn. According to [19], the population of the research is the whole of the research subject. Daily Test scores for students are used as population data. In this research, there were three classes as the samples. According to [19], [20], sample is part or representative of the population studied. Samples taken from the population must be truly representative because the placement of representative samples will be able to reflect the entire population. The sampling requirements are true, relevant, and in accordance with the objectives to be achieved so that the conclusion of the research can be accounted for. The population data that has been taken is normally distributed, has a homogeneous variance, and has the same average. Then, the sample is taken by random sampling. Classroom VIII-3 was chosen as the experimental I, VIII-4 as the experimental II, and VIII-5 as the control class. The data used in this research are primary data and secondary data. Primary data is obtained from the final test

based on the results of the treatment of the research subject, while the secondary data is data from Daily Test results obtained from subject educators. The instrument used in this study takes the form of a test of achievement of students' mathematical competencies that are carried out after the experiment takes place. The question of learning outcomes test consists of 5 (five) essay test items. Prior to the study, a test of students' cognitive learning outcomes tests was carried out which included analysis of validity, reliability, power of different items, and level of difficulty of the items. Data collection techniques on student learning outcomes are using the essay test given at the last meeting. After the test, students' answer sheets were collected and examined based on the answer key that has been made previously. The research procedure is divided into three stages: (1) the preparation stage. This stage consists of: asking for initial population data, consulting research schedules, making RPPs, preparing tests, making grids and test questions, validating test questions, conducting tests, analyzing and clarifying tests; (2) implementation phase. In this stage, the implementation of research is divided into the implementation of research in the experimental class and control class. Research in the experimental class I was carried out using the STAD, the experimental class II was conducted using the TGT, while the control class was carried out using expository learning; and (3) the final stage. At this stage, all the subject matter is finished discussed and discussed then a test is carried out at the end of individual learning. The data analysis technique used for the final test of students' learning outcomes is the One Way Anova test followed by the Scheffe test. The Anne Way Anova test is used to determine the average difference of more than two samples, while the Scheffe test is used to determine the best learning model. The Scheffe test formula proposed by [21] is as follows:

$$F_{i-j} = \frac{\left(\bar{X}_i - \bar{X}_j\right)^2}{RKD\left(\frac{1}{n_i} + \frac{1}{n_j}\right)}$$

Index:

F_{i-j} = F_{obs} value in compare with the i-th and the j-th treatment

$\bar{X}_i$ = average value on the i-th sample

$\bar{X}_j$ = average value on the j-th sample

RKD = the average squared error obtained from the calculation of variance analysis

n_i = the size of the i-th sample

n_j = the size of the j-th sample

Scheefe test must be fulfilled by two conditions, namely the sample comes from a population that is normally distributed and the three classes have a homogeneous variance. In this study, testing was conducted to determine differences in learning outcomes of students who learn to use STAD, TGT, and expository learning model.

3. RESULTS AND DISCUSSION

Learning outcomes data in this study were obtained from the third final test of the sample class. The final test consists of 5 (five) item descriptions. The final test was followed by three sample classes consisting of 34 people for the experimental class I, 34 for the experimental class II, and 36 for the control class. From the analysis carried out, then obtained an overview such as in the following table:

Table 3. Results of the final test description

Aspect	Experimental I	Experimental II	Control
x_{max}	97	94	85
x_{min}	65	60	40
$\bar{x}$	81.56	74.94	68.17
s	9.708	10.855	11.525

Based on the average value of the three sample classes, it can be seen that the average value of the experimental class I is 97 higher than the experimental class II which is 94 and the control class is 85. This means that the learning outcomes of students based on the final test that is learning using the learning model cooperative type STAD is higher than the TGT and expository learning models. Based on the second standard deviation of the three sample classes, it can be seen that the control class standard deviation is 11.525 higher than the experimental class I namely 9.708 and experimental class II is 10,855. It means that the learning outcomes of students in the control class have greater diversity than the experimental class. In addition, it is seen that the diversity of students in the experimental class I and experiment II is not too different from the control class. The ability of the three classes is almost uniform. Analysis of learning outcome data for experimental class I, experimental class II, and control class is done to test hypotheses that have been formulated, accepted, or rejected. To find out about this, the normality test and homogeneity of variance were first tested on the mathematics learning outcomes of students in the three sample classes. The results of the calculation of the third normality test of the sample class are normally distributed and the results of the third homogeneity test of the sample class have a homogeneous variance. The normality test results of the three sample classes are presented in the following table.

Table 4. *Test the normality of the sample class*

Classroom	L_0	L_{table}	Conclusion
Experimental I	0.09739	0.151948	$L_0 < L_{table}$
Experimental II	0.11365	0.151948	$L_0 < L_{table}$
Control	0.09594	0.151948	$L_0 < L_{table}$

Based on the results of the normality test obtained from each sample classroom, it can be concluded that all three sample classes are normally distributed. It is because the L_{table} value of each sample class is greater than the value of L_o. For the experimental class I the value of L_o is $L_0 = 0{,}09739$; for the experimental class I the value of L_o is $L_0 = 0{,}09739$; and for the control class is value of L_o is $L_0 = 0{,}09594$ with the value of $L_{table} = 0{,}151948$. Homogeneity test is done with the aim of seeing the three sample classes have a homogeneous variance or not. The testing criteria used are: if $\chi^2_{count} < \chi^2_{table}$, the three sample classes have a homogeneous variance. After the homogeneity test for learning outcomes was χ^2_{count} = 1,184 and χ^2_{table} = 5,991 with α = 0.05 and $k = 3$. Based on the results obtained, it can be seen that $\chi^2_{count} < \chi^2_{table}$. This condition shows that all three sample classes have homogeneous variances. Based on the normality test and the variance homogenization test that has been carried out, it turns out that the three sample classes have a homogeneous variance, so to know the hypothesis is accepted or rejected, the One Way Anova test is followed by the Scheffe test. The testing criteria used is $F_{count} > F_{table}$. The result are (1) the learning outcomes of students using cooperative type STAD are higher than expository learning (2) the learning outcomes of students who use the TGT are higher than expository learning (3) the difference in learning outcomes students who use the STAD with the TGT. Based on the results of the acquisition of learning data, it was obtained consecutively with F_{count} = 28.65, F_{count} = 7.33, and F_{count} = 6.80; whereas F_{table} = 6.14, with α = 0.05 and *degree of freedom* (df) = 102. Based on the results obtained, it can be seen that. This shows that the three learning models give different results. Of the three, the highest is the STAD cooperative learning model with the mean is 81.56, followed by the TGT cooperative learning model with a mean of 74.94, and the expository learning rate is 68.18. In detail we can stated that (1) the learning outcomes of students who use the STAD cooperative learning model are higher than expository learning, (2) the learning outcomes of students who use the TGT type of cooperative learning model are higher than expository learning, and (3) there are differences in results learners who use STAD and TGT cooperative learning models. From the first, second, and the next meeting on the STAD, students have been divided into several groups whose members consist of 4 to 5 people heterogeneously (mix according to achievement, gender, ethnicity and so on) then teachers present the lessons and after the lecturing session, teachers give students' work sheets to the groups to be worked on by group members and discuss them, when students discuss the subject matter of the students' work sheets, the participants ask each other questions about the subject matter and the interaction of students with other students is better seen during group discussions students share their opinions with each other, the task given by the teachers is done by all members of the group. Members who already understand can explain to other members until all members in the group understand so that each member understands the students' work sheets that are given. Teachers then ask the representatives of the group to explain the students' work sheets that have been discussed and the other groups respond. At the end of the learning, students are given a quiz to evaluate students' understanding of the material they have discussed. When answering quizzes, students are not allowed to help each other. After the implementation of the quiz, educators with students discuss the quiz questions and give a score in the range 0-100. Furthermore, teachers give credit for the success of the group that has the highest score. Judging from the steps of heterogeneously based on their achievement, implementing the STAD in the learning process consists of 5 stages, students are divided into several groups whose members consist of 4 to 5 people gender, ethnicity and so on [22]–[25]. What distinguishes it from the TGT learning model is the existence of games and academic performance. Before starting the game and academic education, educators first place students in a team that represents heterogeneity. Each student will later represent his group to compete in the tournament table. After students are divided into several small groups, the educator then presents the material and then the students work on the students' work sheets in their respective groups. If there are group members who do not understand the material and the tasks given, then the other group members are in charge of giving answers and explaining them before the question is asked to the educator. To ascertain whether all group members have mastered the material, students will compete in games and academic tournaments. The game is only attended by representatives from each group, while the tournament is attended by all students. When academic tourism, students will be separated from their original groups to be shown in

tournament tables. Each tournament table consists of several students representing their respective groups. The determination of where the tourism table will be occupied by students is carried out by educators, namely by looking at academic homogeneity. Here, students who are in one tournament table are students with equal academic abilities. It can be determined based on the value obtained during the daily test 1. The tournament tables are sorted from high to low ability level. The teachers could design table 1 for students with high abilities, table 2 for students with moderate abilities, table 3 for students with abilities below students at table 2, and so on. At the tour desk students will compete to answer the questions provided representing their group. The tournament questions are designed by teachers so that students of all levels of ability can contribute points to their groups. Teachers make difficult questions for smart learners, and cards with easier questions for students who are less intelligent. If the tour has ended, students record the number they have won on the game score sheet. The next point is given by educators. Furthermore, teachers give credit for the success of the group that has the highest score. In the learning process using the cooperative learning model type STAD and TGT provides experience to students how to realize the needs of students in learning, thinking, problem solving, and integrating knowledge with skills, and can improve social interaction skills [4], [14], [26]. So it can improve students' learning achievement. The cooperative learning model type STAD and TGT used by educators is quite successful. It can be seen from the average final test results in the experimental class I shows higher than the control class, experimental class II shows higher than the control class, and there are differences in experimental class learning outcomes. I and experiment II. Based on the results of the tested hypotheses it can be concluded that: (1) students' learning outcomes of mathematics who learn to use STAD type cooperative learning model is higher than expository learning grade VIII SMP N 28 Padang, (2) mathematics learning outcomes of students who learn to use learning models cooperative type TGT is higher than expository learning grade VIII junior high school, and (3) there are significant differences in mathematics learning outcomes of students who learn to use STAD type cooperative learning model with TGT type cooperative learning model. The results of this study are consistent with the results of [4] stated that STAD learning provides better learning outcomes compared to the TGT model, STAD learning is better than conventional learning and TGT learning is better than conventional learning. The results of this study are also in accordance with the results of the research of [4], [14]) that the students' mathematics learning outcomes using the STAD type cooperative learning model is better than using the TGT type cooperative learning model.

4. CONCLUSION AND RECOMMENDATION

Based on the research, it can be concluded that mathematics learning outcomes of students who learn to use STAD is higher than expository learning with an average value of STAD is 81.56 while the average value of expository learning is 68.17. Then, mathematics learning outcomes of students who learn to use the TGT is higher than expository learning with the average value of the TGT cooperative learning model is 74.94 while the average value of expository learning is 68.17. In short, there are significant differences in mathematics learning outcomes of students who learn to use the STAD with the TGT model with the average value of STAD is 81.56 while the TGT is 74.94. The authors recommend that the researchers can arrange the time in conducting group discussions to discuss students' work sheets, so that other groups can present the results of their discussions. Finally, for further research, researchers can determine the subject matter that matches the level of ability of students when using the TGT type cooperative learning model.

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