

Effects of the Jigsaw and Teams Game Tournament (TGT) Cooperative Learning on the Learning Motivation and Mathematical Skills of Junior High School Students

Syahrir, S.Pd

*Departement of Mathematics Education
Teachers' Training College of Mataram
Jl. Pemuda No. 59A Mataram, www.ikipmataram.ac.id*

Abstract

This study aims to: 1) describe the effectiveness of the jigsaw and TGT cooperative learning in the learning motivation and mathematical skills of junior high school (JHS) students, and 2) investigate the significant difference in the learning motivation and mathematical skills between the JHS students learning through the jigsaw cooperative learning and those learning through the TGT cooperative learning. This study was a quasi-experimental study using the non-equivalent pretest and posttest group design. This study involved two experimental classes. The research population comprised Year VII students of SMP Pembangunan Piyungan and the research sample consisted of two classes selected from all Year VII groups, with Year VII.A receiving a treatment of the jigsaw cooperative learning and Year VII.B receiving a treatment of the TGT cooperative learning. The instruments consisted of a test, i.e. a mathematical skill test, and a non-test, i.e. a questionnaire of mathematics learning motivation. To investigate the effectiveness of the jigsaw and TGT cooperative learning in the learning motivation and mathematical skills of JHS students, the data were analyzed using the one sample test. To investigate the significant difference in the learning motivation and mathematical skills between the students learning through the jigsaw cooperative learning and those learning through the TGT cooperative learning, the data were analyzed using the T^2 Hotelling. To compare the effectiveness of the jigsaw and TGT cooperative learning in the learning motivation and mathematical skills of the students, the data were analyzed using the t-test. The normality was tested using the univariate approach, namely the Kolmogorov Smirnov, the homogeneity using the Box' M test, and the equivalence of the variance-covariance matrix using the Levene's test. The results of the study show that: 1) the jigsaw cooperative learning is effective for the JHS students' mathematical skills and mathematics learning motivation; 2) the TGT cooperative learning is effective for the JHS students' mathematical skills and mathematics learning motivation; 3) there is a difference in the effectiveness of the jigsaw and TGT cooperative learning in the JHS students' mathematical skills and mathematics learning motivation; 4) the jigsaw cooperative learning method is more effective than the TGT cooperative learning method for the JHS students' mathematics learning motivation; and 5) the jigsaw cooperative learning method is more effective than the TGT cooperative learning method for the JHS students' mathematical skills.

Keyword: Cooperative Learning, Jigsaw, Teams Game Turnament, Learning Motivation, Mathematics Skill.

A. Introduction

The development of increasingly competitive world of education and compete in their respective competence. Education institutions as providers of education in our beloved homeland, continue to work to improve the quality of both the administration and management of the quality class continued to compete. Continuously updated education system for smooth learning process, especially on learning mathematics. Learning mathematics is a systematic concept learning, one of

This paper has been presented at International Seminar and the Fourth National Conference on Mathematics Education 2011 "Building the Nation Character through Humanistic Mathematics Education". Department of Mathematics Education, Yogyakarta State University, Yogyakarta, July 21-23 2011

which students are required to understand the concrete conditions associated with everyday life.

Development of mathematical concepts is largely determined by the ability of teachers to develop math skills and learning motivation of students who rely on the learning process takes place. Problems complete and incomplete answers to the students in solving problems - math problems experienced obstacles such as accuracy and speed, resulting in students' math skills to be not good. Contributing factor is the less skilled students to solve math problems and students' motivation. Mathematics skills of students is quite low due to more specific methods used by teachers in the learning process, still less is conventional and provides the opportunity for students to develop a mindset in accordance with their respective capabilities that can improve students' math skills.

As a result, student math skills do not develop optimally. Therefore, teachers need to choose a way of teaching can help develop students' math skills. Robert Gagne (Bell, 1978: 108) explain that mathematical skill are those operations and procedures which students and mathematicians are expected to carry out with speed and accuracy. then Shumway (1980: 207) explain skill are generally characterized in terms of (a) proficiency or accuracy and (b) efficiency or speed.

For that, the math skills of students in this study is a mathematical operation performed with the right students in solving math problems. Arouse students' motivation to not easily get bored or lazy is not easy for teachers. Low motivation to learn which is actually caused by an obstacle that resides in the student. For that, how to generate the necessary motivation to learn in a practice by doing certain activities. Not infrequently when students are motivated to do something but do not know how to do it, can not use the existing infrastructure, or can not arrange the activities in a learning process, so it does not do. High motivation to learn to be dashed because when you try to start studying, someone collided with difficulties that should not happen.

Hook & Vass (2010: 65) explain that motivation can be defined as a state of need or desire that results in a person becoming activated to do something. Motivation results from an unsatisfied need. We cannot make our students learn- what we can achieve is a manipulation of their enviroment (physical and

psychological) in such a way that they might become more motivated. then Cohen & Swedlik (2005: 550) explain that motivation may be conceptualized as stemming from incentives that are either primarily internal or primarily external in origin. Another way of stating this is to speak of intrinsic motivation and extrinsic motivation. in intrinsic motivation, the primary force driving the individual stems from things such as the individual's involvement in work or satisfaction with work products. In extrinsic motivation, the primary force driving the individual stems from reward, such as salary and bonuses, or from constraints, such as job loss.

Mathematics learning that leads students to compete in a healthy academic atmosphere in the small groups of mutually exchange ideas, and motivate the group members, students can build its structure-structure to accommodate new knowledge and the students were active in the learning process in class, Slavin (2005: 17) clarifying that cooperative learning to cognitive theories emphasize the effects of working together in itself (whether or not the groups are trying to achieve a groups goal). There are several different cognitive theories, which fall into two major categoris: developmental theories and cognitive elaboration theories.

Through cooperative learning in the classroom students are expected to active individuals, active discussion, bold ideas and receive ideas from others, find creative solution to a problem encountered and have high confidence in learning mathematics is a type of jigsaw cooperative learning and TGT (Teams Game Turnament). pembelajaran kooperatif tipe jigsaw by Arends (1997: 120) clarifying that cooperative learning tipe jigsaw where students are assigned to five or six member heterogeneous study teams. academic materials are presented to the students in text form, and each student has the responsibility to learn a portion of the material.

Arends dan Kilcher (2010: 316) clarifying this approach to cooperative learning divides up the learning materials so group members can work on particular topics. Students start out in heterogeneous home or base teams comprised of four or five members. Members number of and then move to expert groups. Each expert group learns a different part or aspect of the assigned topic. They read and discuss learning materials provided by the teacher and help each other learn about their assigned topic. They also decide how best to present the material to others when their home teams reconvene. Each member of the team teaches their part to other home

team members. Following home team meetings and discussions, students are tested independently on the material.

Cooperative learning type Teams Game Tournament (TGT) by Borich (2007: 389) explain that a cooperative learning activity closely related to STAD is the use of teams game tournaments (TGT). TGT uses the same general format as STAD (4 to 5 member groups studying work sheets). However, instead of individually administered quizzes at the end of a study period, students play academic games to show their mastery of the topic studied. Where as Slavin (2006: 338) explain that Teams-Games-Tournament, or TGT, uses games that can be adapted to any subject. games are usually better than individual games; they provide an opportunity for teammates to help one another and avoid one problem of individual games, which is that more able students might consistently win. If all students are put on mixed ability teams, all have a good chance of success.

Learning mathematics can be seen through the evaluation at the end of the lesson so that it can be developed changes that occur in these students. By looking at changes in students, teachers are required to have appropriate teaching methods and varied in the process of learning mathematics. Costs vary widely studied object problem both internally and externally, the problem requires the solution of various parties, both the teacher and the relevant agencies and parties observer of education so students are able to solve problems, both individually and corporately. One of the problems that appear as the students do not understand the subject matter, whether it's understanding of concepts and solve problems in particular math problems

Using cooperative learning and jigsaw type TGT (Teams Games tournament) is assumed to affect the motivational aspects of learning and learning math skills with emphasis on the learning experience of students and learning in small groups during the learning process takes place.

B. Research Method

This study was a quasi-experimental study using the non-equivalent pretest and posttest group design. This study involved two experimental classes. The research population comprised Year VII students of SMP Pembangunan Piyungan and the research sample consisted of two classes selected from all Year VII groups, with Year VII.A receiving a treatment of the jigsaw cooperative learning and Year

VII.B receiving a treatment of the TGT cooperative learning. The instruments consisted of a test, i.e. a mathematical skill test, and a non-test, i.e. a questionnaire of mathematics learning motivation. To investigate the effectiveness of the jigsaw and TGT cooperative learning in the learning motivation and mathematical skills of JHS students, the data were analyzed using the one sample test. To investigate the significant difference in the learning motivation and mathematical skills between the students learning through the jigsaw cooperative learning and those learning through the TGT cooperative learning, the data were analyzed using the T^2 Hotelling. To compare the effectiveness of the jigsaw and TGT cooperative learning in the learning motivation and mathematical skills of the students, the data were analyzed using the t-test. The normality was tested using the univariate approach, namely the Kolmogorov Smirnov, the homogeneity using the Box' M test, and the equivalence of the variance-covariance matrix using the Levene's test.

C. Research Result

1. Data Description

a. Data students' math skills test.

Math skills test data consists of data that described the pretest and post-test data. In summary, the results of tests math skills of students in both groups are presented in Table 1 below:

Table 1. Description of students' math skills test data

Description	Group Jigsaw		Group TGT	
	Pretes	Post-tes	pretes	Post-tes
Mean	51.61	85.74	57.09	77.98
maximum value	64.94	100.00	74.03	100.00
Minimum value	23.38	65.12	28.57	65.12

Based on the results of descriptive statistical data analysis, as shown in table 1, the overall highest score achieved by students is 100 and the lowest value is 23.38. From the data obtained showed an increase in math skills of students in classroom experiments and classroom experiments jigsaw TGT. From the results of post-test experimental jigsaw classroom, the student has met minimum standards of

completeness with the number of students who complete a total of 100%. While in the experimental class with the TGT that is 92.86% increase.

b. Data students' motivation

Data motivation to study can be described and conclusions drawn based on the specified category. In summary, the motivation to study in both groups are presented in table 2.

Table 2. Description students' motivation data

Description	Group Jigsaw		Group TGT	
	Awal	akhir	awal	akhir
Mean	74.88	106.19	73.32	98.82
Maximum value	99.00	123.00	99.00	117.00
Minimum value	64.00	85.00	58.00	85.00

Data on students 'motivation and TGT jigsaw classroom experiments conducted before research showed most of the students' motivation to have 44.45% and 57.14% with enough categories. Having carried out the research process, the motivation to study the data obtained showed that most students' motivation to have 44.44% and 32.14 classified as having high motivation to learn students who are taught through cooperative learning methods type Jigsaw and TGT.

2. Data Analysis

a. Effectiveness Analysis of Learning Methods

1) Analysis of effectiveness of each method are reviewed from the aspect of learning math skills

To see the effectiveness of each method against the students' math skills test conducted one-sample t test. The hypothesis being tested is:

1) The hypothesis is as follows:

H_0 ; Type of jigsaw cooperative learning methods are not effective against the math skills of students

H_1 ; Type of jigsaw cooperative learning methods are effective against the math skills of students.

From the analysis using SPSS 16 for windows obtained thitung = 9.004 with a significance value of 0.000. If related to the testing criteria with a significance value of 0.05, H_0 is rejected.

2) The hypothesis is as follows:

H_0 ; TGT type of cooperative learning methods are not effective against students' math skills

H_1 ; TGT type of cooperative learning methods are effective against students' math skills.

From the analysis using SPSS 16 for windows obtained $t_{hitung} = 7.447$ with a significance value of 0.000. If related to the testing criteria with a significance value of 0.05, H_0 is rejected.

2) Analysis of effectiveness of each method of learning in terms of aspects of students' motivation

Furthermore, one sample t test conducted to test the effectiveness of each method on students' motivation in mathematics.

1) The hypothesis is as follows:

H_0 ; Type of jigsaw cooperative learning methods are not effective against the students' motivation in mathematics.

H_1 ; Type of jigsaw cooperative learning method is effective against students' motivation in mathematics.

From the analysis using SPSS 16 for windows obtained $t_{hitung} = 13.749$ with a significance value of 0.000. If related to the testing criteria with a significance value of 0.05, H_0 is rejected.

2) The hypothesis is as follows:

H_0 ; TGT type of cooperative learning methods are not effective against the students' motivation in mathematics

H_1 ; Type TGT cooperative learning method is effective against students' motivation in mathematics

From the analysis using SPSS 16 for windows obtained $t_{hitung} = 13.645$ with a significance value of 0.000. If related to the criteria of testing with a significance value of 0.05, H_0 is rejected.

b. Analysis of Preliminary Condition

1. Normality Test

Normality test performed on two groups: the group that uses cooperative learning and jigsaw type TGT (team tournament games) to determine whether or not normally distributed population. Measurement results and the motivation to learn math skills of students in mathematics in both groups of normally distributed.

2. Testing Homogeneity of variance-covariance matrix

Tests of homogeneity for multivariate test using Box's M test. The calculation result obtained SPSS 16 for windows significance $0.355 > 0.05$ it was concluded that the variance-covariance matrix of the two populations are equal or homogeneous.

3. Multivariate Test

After doing the test for normality and homogeneity tests as well as meeting the criteria of normal and homogeneous states that the data are normally distributed and homogeneous, then proceed as follows multivariate hypothesis testing. The hypothesis is as follows:

H_0 ; math skills and students 'motivation in mathematics students in the class A not differ math skills and students' motivation in mathematics students in the class B.

H_a ; math skills and students 'motivation in mathematics of students in class A does different with math skills and students' motivation in mathematics students in the class B.

Criteria for acceptance and rejection of the hypothesis is H_0 is rejected if the significance value is smaller than 0.05 or $\geq F_{hitung} F_{tabel}$ at significance level of 5%. The results of calculations with SPSS 16 for window shows that the number of significance 0.068. If associated with the acceptance criteria, the numbers of significance > 0.05 , H_0 is accepted. Therefore concluded that the math skills and students' motivation in mathematics at grade A is not different from the skills and motivation to study mathematics at the mathematics of students in class B

c. Analysis of Final Conditions

1. Normality Test

Normality test performed on two groups: the group that uses cooperative learning and jigsaw type TGT (team tournament games) to determine whether or not normally distributed population. Measurement results and the motivation to learn math skills of students in mathematics in both groups of normally distributed.

2. Testing Homogeneity of variance-covariance matrix

Tests of homogeneity for multivariate test using Box's M test. The calculation result obtained SPSS 16 for windows significance $0.347 > 0.05$ it was concluded that the variance-covariance matrix of the two populations are equal or homogeneous.

3. Homogeneity of Variance Test

Homogeneity test of math skills (post-test) and students' motivation in mathematics (motivation end) individually, using the Levene test. The results of tests on each variable using SPSS 16 for windows, show significance value is 0.056 on the skill aspect and the aspect of students' motivation in mathematics is 0.052, because the significance value of each variable is greater than the 0.05 level then concluded the second variance is the same population, with respect to the dependent variable and the motivation to learn math skills of students in mathematics.

4. Hypothesis Testing

a. Multivariate test.

To investigate the effectiveness of different types of jigsaw cooperative learning methods and IGT in terms of math skills and motivational aspects of student learning in mathematics is done by a multivariate test with data normally distributed and homogeneous. The first phase of testing hypotheses with the following hypotheses:

H_{01} ; There was no difference in the effectiveness of cooperative learning methods and types of jigsaw in terms of aspects TGT math skills and students' motivation in mathematics.

H_{a1} ; There are differences in the effectiveness of methods of cooperative learning and jigsaw type TGT terms of math skills and motivational aspects of student learning in mathematics.

Based on the results of tests using SPSS 16 for windows obtained value of $F = 5.421$ or 0.007 significance value. If associated with a significance level of 5% then H_0 is rejected.

b. Univariate test

Based on the results of the first phase of testing the hypothesis that there are differences in the effectiveness of cooperative learning methods and TGT jigsaw type of math skills and students' motivation in mathematics, then performed statistical t test to determine the variables that contribute to overall differences with the data normally distributed and homogeneous. For the next hypothesis was tested that:

1. The second phase of testing hypotheses, the following hypotheses:

H_{02} ; Type of jigsaw cooperative learning methods are not more effective than the methods of cooperative learning TGT type of math skills of students.

H_{a2} ; Jigsaw method of cooperative learning is more effective than the type of cooperative learning methods TGT type of math skills of students.

The criteria used is the Bonferroni criterion which signifikansinya level is α / p ($p = 2$) so for $\alpha = 0.05\%$ for each t test criteria used $.05 / 2 = 0.025$. The test criteria is H_0 is rejected if $t_{hitung} \geq t(0.025; n1 + n2-2)$ or smaller significance value 0.025. The results of hypothesis testing using SPSS 16 for window shows the value of $t = 2.695$, or a significance value is 0.009. If associated with a significance value of 0.025 then H_0 is rejected.

2. The third stage of testing hypotheses, the following hypotheses:

H_{03} ; Type of jigsaw cooperative learning methods are not more effective than the methods of cooperative learning TGT type of students' motivation in mathematics.

H_{a3} ; Jigsaw method of cooperative learning is more effective than the type of cooperative learning methods TGT type of students' motivation in mathematics.

The criteria used is the Bonferroni criteria where the significance level is α / p ($p = 2$) so for $\alpha = 0.05\%$ for each t test criteria used $.05 / 2 = 0.025$. The test criteria is H_0 is rejected if $t_{hitung} \geq t(0.025; n1 + n2-2)$ or smaller significance value 0.025. The results of hypothesis testing using SPSS 16 for window shows the value of $t = 2.583$, or a significance value is 0.013. If associated with a significance value of 0.025 then H_0 is rejected.

D. Discussion

Research instruments used were the instruments of math skills and students' motivation to learn an instrument. Both instruments are validated by two lecturers who have doctoral academic degrees, one lecturer who has a master's academic degree and one math teacher. From the results of the validation of these experts argue that the instrument fit for use if revised. Revised instrument was then performed field tests on a class VIII student SMP Pembangunan Piyungan some 27 students to see kevalidan and reliable. Validity and reliability test results show 13 items instrument of mathematical skills is valid and reliable, while 25 items showed students' motivation to learn an instrument valid and reliable. Having tested the validity and reliability declared valid and reliable or in other words, the instrument is fit for use for research. When the research took place, the type of jigsaw cooperative learning methods and TGT serve as an alternative learning method used

Based on the experimental results of both methods show that there are different types of methods of cooperative learning jigsaw cooperative learning method type TGT (Teams Games tournament) reviewed aspects of metamtika skills and motivation to study by using Hotelling Trace test (T^2). This makes it possible to continue testing with the t test and the results showed that the learning of mathematics with the jigsaw method of cooperative learning is more effective type of cooperative learning methods in terms of type TGT math skills and motivational aspects of student learning. The results of the analysis will be discussed one by one as follows:

1. The effectiveness of teaching methods

Implementation of research with the type of jigsaw cooperative learning method begins with an introduction to the topic will be studied on a chalkboard. The teacher asked the students what they know about the set. The teacher divides the class into 5 groups of origin consists of 5 to 6 members per group. The group was formed from the learning process takes place before being implemented, after the original group formed, the teachers divided into 5 groups of origin for the group of experts responsible for reviewing in depth the concept of the set every Student Worksheet (BLM) provided expert groups. Then, each student returned to the home group and share what they learned to colleagues in his group. This is what causes the type of jigsaw cooperative learning method is effective against math skills and students' motivation.

Cooperative learning method type TGT (Teams Games tournament) begins by dividing the number of 5 groups. The groups working on worksheets, and group representatives to present to the class discussion group. After students have conducted group discussions and class discussions the students are given a game that is divided into tables tournament. This is what causes type TGT cooperative learning method is effective against math skills and students' motivation.

This fact is supported by the effectiveness of aspects of mathematical skills and motivation to study VII.A class is taught by the method of cooperative learning and jigsaw type VII.B grade students taught by cooperative learning method type TGT. If associated with a predetermined criteria and the thoroughness of test results of one sample t test we can conclude that both types of jigsaw method of cooperative

learning and cooperative learning method type TGT effective in achieving the goals of learning mathematics in terms of aspects of students 'math skills and students' motivation.

2. Effectiveness learning methods difference

Hotelling Trace test results (T^2) shows that there are differences in the effectiveness of cooperative learning methods with the type of jigsaw cooperative learning methods are reviewed TGT type of math skills and motivational aspects of student learning. The difference is evidenced by the test of this hypothesis suggests that although both methods of learning but there are differences in effectiveness have advantages and disadvantages of each and also a different syntax causes the different results.

T test results showed that the learning of mathematics with the type of jigsaw cooperative learning method is more effective than learning math with type TGT cooperative learning methods in terms of aspects of students' math skills and motivational aspects of student learning. This is due to the type of jigsaw cooperative learning methods that emphasize the role of students to learn in groups and each student is responsible for the success of individual and group learning, encouraging students to help each other understand the course material because of the success of each individual is also determined by other individuals in the the same group.

Type of jigsaw cooperative learning methods effectively to motivate students in learning mathematics both in the classroom or individually at home. High student motivation to learn must be the factor that plays an important role in determining the success of students in learning mathematics. In the type of jigsaw cooperative learning methods, students' motivation was built when the students received awards from both the teacher and when studying a group of friends. Students are praised, rewarded when an opinion will be increasingly keen to learn and complete academic tasks and can eventually achieve a good learning.

E. Conclusion and Suggestion

Conclusion

Based on the results of data analysis and discussion, it was concluded some of the following:

1. Methods of cooperative learning and jigsaw type TGT (Teams Games tournament) is effective against the skills and motivation to study math class junior school VII Pembangunan Piyungan year 2010/2011.
2. There are differences in the effectiveness of cooperative learning methods with the type of jigsaw cooperative learning method type TGT (Teams Games tournament) on the math skills and motivation to study math class junior school VII Pembangunan Piyungan year 2010/2011.
3. Jigsaw method of cooperative learning is more effective than the type of cooperative learning methods TGT type of motivation to learn and math skills class VII class student junior school VII Pembangunan Piyungan year 2010/2011.

Suggestion

Based on the results and research findings, and taking into account the limitations of the study, the advice can be delivered are as follows:

1. It is recommended to apply them in learning mathematics with the Jigsaw method of cooperative learning and type TGT (Teams Games tournament).
2. It is recommended that teachers should implement type the Jigsaw cooperative learning methods to achieve optimal results.
3. It is recommended to apply the methods of cooperative learning and jigsaw type TGT (Teams Games tournament) on the subject matter and the other dependent variables.

F. Bibliography

- Arends, R.I & Kilcher, A. (2010). *Teaching for student learning: becoming an accomplished teacher*. New York: Published in the Taylor & Francis e-Library.
- Arends, R.I. (1997). *Classroom instruction and management*. United States of America: The McGraw Hill Companis, inc.
- Bell, F.H. (1978). *Teaching and learning mathematics (in secondary schools)*. Iowa: Brown Company Publishers.
- Borich, G.D. (2007). *Effective teaching methods “research-based practice*. Ohio: Pearson Education Inc.
- Cohen R.J, & Swedlik M.E. (2005). *Psychological testing and assesment “an introduction to tests and measurement” sixth edition*. New York: McGraw Hill Published.
- Creswell, J.W. (2003). *Research design “qualitative, quantitative, and mixed methods approaches”*. California: Sage Publications.
- Hook P & Vass A. (2000). *Creating winning classrooms*. London: David Fulton Publishers.

-
- Nitko, A.J. & Brookhart S.M. (2007). *Educational asesment of students*. New Jersey: Pearson Education.
- Shumway, R.J. (1980). *Research in mathematics education*. Ohio: The National Council of Teachers of Mathematics, inc.
- Slavin, R.E. (2005). *Cooperative learning “theori, research and practice*. London: Allyn and Bacon.
- _____. (2006). *Education psychology “theory and practice” eighth edition*. Johns Hopkins University: Pearson Education International.
- Stevens J. (2002). *Applied multivariate statistics for the social sciences*. London: Lawrence Erlbaum Associates, Publishers.