THE EFFECTIVENESS COMPARISAN OF SCIENTIFIC LEARNING WITH COOPERATIVE LEARNING STUDENT TEAM ACHIEVEMENT DIVISIONS (STAD) AND JIGSAW IN TERMS OF STUDENTS' MATHEMATCS LEARNING ACHIEVEMENT OF JUNIOR HIGH SCHOOL GRADE VII

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Abstract

This study aimed to: (1) find out the effectiveness of scientific learning with cooperative learning STAD in terms of students' mathematics learning achievement, (2) find out the effectiveness of scientific learning with cooperative learning Jigsaw in terms of students' mathematics learning achievement, and (3) find out which one is more effective between scientific learning with cooperative learning STAD and scientific learning with cooperative learning Jigsaw in terms of students' mathematics learning achievement. This study was a quasi-experimental research with the nonequivalent pretest-posttest group design. The study population included all students of grade VII in SMP Negeri 3 Mlati and the sample was class VII A and class VII B which were randomly selected. Data were analyzed by one sample t-test and independent sample t-test with significance value of 5%. The results of this study showed that: (1) scientific learning with cooperative learning STAD is effective in terms of students' mathematics learning achievement, (2) scientific learning with cooperative learning Jigsaw is effective in terms of students' mathematics learning achievement, and (3) scientific learning with cooperative learning STAD is not more effective than scientific learning with cooperative learning Jigsaw in terms of students' mathematics learning achievement.

Keywords: scientific learning, cooperative learning, STAD, Jigsaw, learning achievement

INTRODUCTION

Globalization has become part of every aspects of life including education. The demand for quality is increasingly concerned to improve global competitiveness. Quality education can produce quality human resources so that the human resources can get provision of adequate attitudes, knowledge, and skills to prepare the future.

The quality of education in Indonesia can be seen from its participation in PISA (Program for International Students Assesment) and TIMSS (Trends in International Mathematics and Science Study). PISA is an international assessment of 15-year-old students in science, reading, and mathematics literacy. Based on data from National Center for Education Statistics (2016), the result of PISA 2015 particularly in mathematics shows the average score of Indonesia i.e. 386 with a defined scale i.e. 0-1000. The TIMSS results are also indicated similar things. TIMSS is an international study measuring student knowledge and skills in mathematics and science. The result of TIMSS 2015 particularly in mathematics shows average score of Indonesia for grade 4 i.e. 397 with a defined scale i.e. 0-1000.

The score results of PISA and TIMSS 2015 shows that the mathematics learning achievement is still low. Based on the structure of the Curriculum 2013, mathematics is a subject that must be learned at school. Mathematics

covers a vast range of competences such as geometry and measurement, algebra, numbers, statistics, and probability. According to data of the national examination results from Kemdikbud, the average value of national examination for Junior High School has decreased during the last three years. National examination results can be seen in the below.

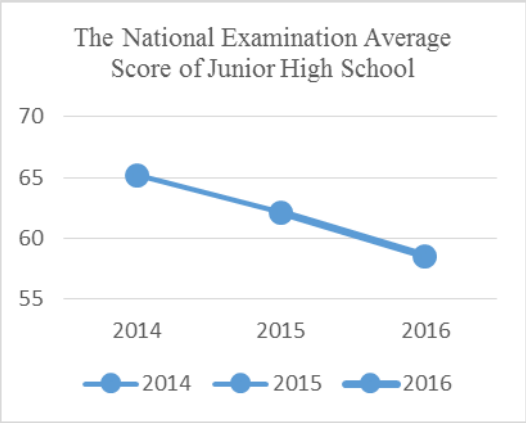

Figure 1. The National Examination Average Score of Junior High School

Based on the data of national Junior High School examination, it is also obtained the average value for mathematics i.e. 50,24 in D category. Furthermore, the percentage of mastery of the material indicators can also be seen from that data. Based on this data, the mastery average of grade VII materials is still low i.e. 48,53%. The materials are about integers, set, comparison, relation between angles, social arithmetics, etc.

Learning achievement is important to know about learning objectives achievement. Sudaryono (2012: 12) said that learning achievement is different with learning outcome. Learning achievement only measures two aspects, cognitive and psychomotor. It can be inferred that learning achievement is the achievement of students in the mastery of learning materials in the form of knowledge and skilss. Learning achievement is influenced by internal and external factors. According to Majid and Rochman (2012: 191-195), some external factors that influence learning achievement is learning process and the teachers role in involving the students liveliness.

The teacher-centered learning makes students to be a passive students because the learning is only a transfer of knowledge from teachers to students. Learning should invovle students actively in the search for knowledge, instead of simply receiving knowledge. According to Mulyasa (2015: 65), learning should be oriented to the students interest according to their characteristics in order to create a conducive climate in learning. According to NCTM (2000: 20), students should learn with understanding, actively construct new knowledge from the experience and prior knowledge.

The learning process is guided by the curriculum which became the reference for the learning design in the classroom. Based on the Curriculum 2013, scientific approach is used in the learning implementation. According to Saefuddin and Berdiati (2014: 43), scientific learning not only looks at the results as the final estuary, but the learning process is seen to be very important. Scientific approach includes the five activites or 5M i.e. observing, questioning, collecting information, associating, and communicating.

The research result from Aji Wibowo (2017) showed that scientific learning approach is effective in terms of students learning achievement. The learning with scientific

approach is expected to facilitate the students to be involved actively in the learning activities. Thus students will have a better competence and the learning achievement may increase. Nevertheless, students activeness problems are still happening in the implementation of the Curriculum 2013. The research result of Heri Retnawati (2015) showed that one of the obstacles of junior high school teachers in implementing the new curriculum is the difficulties in activating the students.

Scientific approach can be supported with specific learning model. Based on Permendikbud Nomor 22 Tahun 2016 about Standar Proses Pendidikan Dasar dan Menengah, one of the points about the learning principles is that whoever is a teacher, whoever is a student, and whereever is a class. Based on these principles, learning is not only an interaction between the teacher and students, but also an interaction between students. That is because the students can learn from anyone including the other students. In this case, the learning that can support scientific learning is cooperative learning because it is based on the team work so that interaction between the students can be preferred.

Majid (2013: 173) said that cooperative learning is a learning model which prioritizes cooperation to achieve the learning objectives. According to Hamzah and Muhlisrarini (2014: 160-161), there are five basic elements as the characteristics of cooperative learning i.e. positive-interdependence, individual responsibility, face to face activity, communication between the members, and evaluation of group process. It can be seen that students can interact each other so they can help each other to achieve learning objectives.

The completion of task in cooperative learning is carried out with discussion and developing ideas with each other. The students ensure that all group members understand the material. Each member of the group have the contribution to the group success. It affects the students' learning achievement. Arends (2008: 5) said that cooperative learning model was developed to reach at least three important objectives: academic achievement, tolerance and acceptance of diversity, and development of social skills.

Cooperative learning consists of several types. These types can be selected to design the learning in the classroom. Two of the cooperative learning types are Student Team Achievement Divisions (STAD) and Jigsaw. Both types of learning model are based on the cooperation of the group in accordance with the basic of cooperative learning.

According to Jihad and Haris (2012: 33), STAD and Jigsaw have in common in terms of cognitive goals, social goals, group structure, topic selection, and assessment. The group structure in STAD and Jigsaw are heterogeneous. After the learning process, there is also an individual quizzes for the assessment. In addition, individual responsibility is very important in STAD and Jigsaw though the learning give priority to working groups.

Students have to do the quizzes individually in STAD and the progress score from each students will affect the group score. At

the other side, each students in Jigsaw are responsible to master one of the learning materials and then they can teach it to the other members of the same group. There are two kinds of groups in Jigsaw, home group and expert group.

STAD and Jigsaw have a different learning process. The steps of STAD according to Lestari and Yudhanegara (2015: 46-47) are class presentation, team, quizzes, individual score progress, and team recognition. In the STAD learning, 5M activities of scientific leaning can appear as a combination. Students can observe, ask, collect information, associate, and communicate in the team. Thus scientific learning with STAD can facilitate students to understand the concept actively through cooperation in STAD. This is confirmed by the result of the research of Rinda Naviano and Dhoriva Urwatul Wutsqa (2017). It showed that scientific learning with cooperative learning model STAD is effective in terms of motivation and mathematics learning achievement.

The steps of Jigsaw according to Huda (2015: 121) are discussion in the expert group, discussion in the home group, and processing individual quizzes. 5M activities can appear in Jigsaw learning steps as a combination with scientific learning. There are some activities i.e. observing, questioning, and collecting information in the expert group discussion. Then, the students come back into the home group to associate and communicate the information.

Based on the research of Suratno (2014), cooperative learning Jigsaw is effective in terms of students' mathematics learning achievement. Scientific learning with Jigsaw can facilitate the students to understand the concept actively through the Jigsaw learning process. Thus, students learning achievement can be increased.

Based on the theory and relevant research, researcher assumed that scientific learning with cooperative learning STAD and Jigsaw can be applied to reach the learning objectives so they can get high learning achievement. However, scientific learning with STAD is felt to be superior in case of grouping process and giving awards to the students.

Based on the above description, the researchers conducted an experiment to test the effectiveness of scientific learning with cooperative learning STAD and Jigsaw, and the effectiveness comparison between those learning in tearms of learning achievement of Junior High School grade VII. This research was limited to the material of lines and angles with a target was the students of SMP Negeri 3 Mlati grade VII. Learning is said to be effective if the students achieve an average value more or equal to KKM school i.e. 75.

RESEARCH METHOD

This study was a quasi-experimental research with the nonequivalent pretest-posttest group design. Based on the design, the first step to do was to specify the group of experiments 1 and 2. The second step was to give the same pretest for the groups. Then, both of the groups were given different treatment. After that they were given the same posttest. The research design can be seen in the table 1.

Table 1. Research Design

Class	Before Treatment	Treatment	After Treatment
E_1	*Pretest*	Scientific learning with STAD	*Posttest*
E_2	*Pretest*	Scientific learning with Jigsaw	*Posttest*

This study was carried out in SMP Negeri 3 Mlati located in Mlati, Sleman, Yogyakarta on 2 March-9 April 2017.

The population in this study was the whole grade VII in SMP Negeri 3 Mlati on 2016/2017 school year. Sampling was done randomly by taking 2 classes. The selected sample were class VII A (32 students) and VII B (30 students). Those classes became class experiment 1 and class experiment 2 after the second randomization was done.

The free variable in this study was the students' mathematics learning achievement. The bound variables were scientific learning with STAD and scientific learning with Jigsaw. The control variables were the teacher, lesson hours, and learning materials.

The data in this study were obtained from pretest and posttest about lines and angles. The non-test instrument were the observation sheets of learning implementation.

The data were analysed by descriptive and inference analysis. Descriptive analysis was used to describe the pretest and posttest data. While the inference analysis was used to take conclusions based on the data retrieved. The data must meet the prerequsites test analysis which consist of normality test and homogeneity test. Then the next steps were to do a different mean test and hypothesis test.

The first and second hypothesis were to find out the effectiveness of scientific learning with cooperative learning STAD and Jigsaw in terms of students' mathematics learning achievement. The test used was one sample t-test. The third hypothesis test then proceeded to find out the effectiveness comparison of learning by independent sample t-test.

RESULTS AND DISCUSSION

The implementation of each learning model can be known by the observation sheet. Based on the score calculation, the percentage of the learning implementation on the experiment group 1 is 95,83%. While the percentage of the learning implementation on the experiment group 2 is 91,30%.

The data of mathematics learning achievement test were obtained from pretest and posttest. Learning achievement test results were then described and can be seen in the following table.

Table 2. Description of Learning Achievement Test

Data	SL-STAD		SL-Jigsaw	
	Pretest	Posttest	Pretest	Posttest
The lowest value	5	51,67	5	53,33
The highest value	25	98,33	25	93,33
Mean	14,32	79,47	14,94	78,83
Standard dev.	5,059	11,811	5,352	10,059
Completeness	0%	71,87%	0%	76,67%

Based on the table above, the pretest means of the two experiment group are relatively the same i.e. 14,32 and 14,94. The posttest mean of experiment group 1 is 79,47 while the posttest mean of experiment group 2 is 78,83. The standar deviation at the two groups both pretest and posttest are relatively the same.

The assumption of normality and homogeneity should be met before doing the hypothesis test. The purpose of normality test is to find out whether the pretest and posttest data are derived from a normally distributed population. In this study, the normality was tested by Kolmogorov Smirnov with SPSS 21. The data is derived from normally distributed population if the significance value is more than 0,05. The results of normality test can be seen in table below.

Table 3. The Result of Normality Test

Group	Data	Normality Test		Conclusion
		Sig.	Interpretation	
SL-STAD	Pretest	0,781	H_0 is accepted	Normal
	Posttest	0,483	H_0 is accepted	Normal
SL-Jigsaw	Pretest	0,713	H_0 is accepted	Normal
	Posttest	0,559	H_0 is accepted	Normal

Based on the table 3, it can be noted that all significance value are more than 0,05. It means the pretest and posttest data comes from normally distributed population.

After the data was known to be come from a normally distributed population, then the data was analysed by homogeneity test. It aimed to find out whether the groups have same variance or not. The test was carried out by Levene's test with the help of SPSS 21. The data from the two groups is homogeneous if the significance value is more than 0,05. The following table shows the results of the homogeneity test.

Table 4. The Result of Homogeneity Test

Data	Homogeneity Test		Conclusion
	Sig.	Interpretation	
Pretest	0,743	H_0 is accepted	Homogeneous
Posttest	0,349	H_0 is accepted	Homogeneous

Based on the table above, it can be noted that all the significance value are more than 0,05. It means the data from both groups are homogeneous.

The hypothesis test was conducted after the normality and homogeneity test were met. Before doing the hypothesis test, it was conducted the mean difference test of pretest data first. It was done by independent sample t-test with SPSS 21. There is no mean difference if the significance value is more than 0,05. The following is a table sowing the results of mean difference test.

Table 5. The Result of Mean Difference Test

Value	Significance	α	Conclusion
Pretest	0,640	0,05	There is no mean difference

Based on the table 5, it is known that the significance value is 0,743 over 0,05. It means there is no difference between the mean of the experiment group 1 and 2.

The first hypothesis test was done to find out whether the scientific learning with cooperative learning STAD is effective in terms of students' mathematics learning achievement. The learning effectiveness can be known from posttest data. Learning is said to be effective if the mean of posttest reaches a minimum completeness criteria (KKM) i.e. 75. Based on the result of posttest data analysis using one sample t-test, the obtained significance value is 0,0195 whice is less than 0,05. H_0 is rejected so scientific learning with STAD is effective in terms of students' mathematic learning achievement.

Scientific learning gives a priority for students to be involved actively in learning. It is realized by learning steps with student worksheet

as the media. Scientific learning supports the learning to facilitate the students in observing, questioning, collecting information, associating, and communicating activities.

The actively students involvement can make students find their knowledge concept so that it can have an effect on learning completeness. It is also supported by the research results by Uki Suhendar and Djamilah Bondan Widjajanti (2016) stated that scientific approach is effective on terms of learning achievement.

The actively students involvement can be realized with a group discussion through the steps of STAD. The individual score progress in STAD is accumulated into group score progress. This case makes the contributions of each students in the group is important and students are actively involved in the group discussion. Students should do a maximum effort so that their group can get the best score progress. This is supported by the opinion of Warsono and Hariyanto (2013: 197) stated that the activities in the STAD encourage students to work together and help each other in solving a problem, but ultimately held responsible independently. The role of each student influent the achievement of learning objectives which is showed by the learning achievement. This is in line with the research of Badrun and Hartono (2013) which indicates that the cooperative learning model is effective in terms of learning achievement and motivation.

Scientific learning was combined with STAD in order that students can be actively involved throught interactions between students. In STAD, the activites that can appear are observing, questioning, collecting information, associating, and communicating.

The relevant research conducted by Rinda Naviano and Dhoriva Urwatul Wutsqa (2017) showed that learning with scientific approach through cooperative learning model STAD and TPS are effective in terms of motivation and learning achievement. It means the STAD model with scientific approach is effective reviewed from learning achievement.

The second hypothesis test was done to find out whether the scientific learning with cooperative learning Jigsaw is effective in terms of students' mathematics learning achievement. Learning is said to be effective if the posttest mean meets the minimum completeness criteria (KKM) i.e. 75. The data was analysed using one sample t-test. Based on the results, the significance value is 0,0225 which less than 0,05. H_0 is decided to be rejected. It means the scientific learning with cooperative learning Jigsaw is effective in terms of students' mathematic learning achievement.

Scientific learning with cooperative learning Jigsaw made a learning with an actively students involvement through home group and expert group discussion to find their own knowledge. The learning steps were home groups division, expert group discussion, home group discussion, and quizzes. The activities appeared in that learning steps were observing, questioning, collecting information, associating, and communicating as the characteristics of scientific learning. The actively students involvement make the students to build their own

knowledge and they can reach the learning objectives.

In Jigsaw, each students in the home group get a piece of material to be learned, so the role of each students is important. Students in the home group can not obtain complete information if there are students who do not contribute to share the results of expert group discussion.

The students' involvement can help the students each other to achieve the learning objectives, so the Jigsaw model is effective in terms of students' mathematics learning achievement. This is supported by the opinion of Slavin (2008: 4-5) which stated that one of the onjectives based on supporting basic research is the use of cooperative learning can improve students' achievement. This is in line with with the research result of Suratno (2014) which showed that cooperative learning TPS and Jigsaw are effective in terms of mathematics learning achievement and students characteristics. The other relevant studies are the research of Lella Tahlilla Yasna (2016) and the research of Auni Shabrina and Jailani (2015). The result showed that cooperative learning Jigsaw is effective in terms of students' mathematic learning achievement.

The third hypothesis test was done to find out which is the more effective between scientific learning with cooperative learning STAD and scientific learning with cooperative learning Jigsaw. The hypothesis is tested by independent sample t-test. The significance value is 0,812 over 0,05. It means the scientific learning with cooperative learning STAD is not more effective than scientific learning with cooperative learning Jigsaw. This is not in line with the hypothesis and are inconsistent with the research of Ida Novianti (2012).

Based on the research of Idha Novianti (2012), learning mathematics using STAD gives better mathematics learning achievement than Jigsaw because there is learning materials presentation before the group discussion so the students can understand the material better. The material presentation in question is a class presentation on STAD model. Although the class presentation can be in the form of material presentation by the teachers, in this study it was done with minimize the dominance of the teachers because the learning was combined by scientific learning. In this activity, teachers delivered the learning objectives in detail so students acquired complete information about materials which will be learned.

In this study, scientific learning was combined with different cooperative learning, STAD and Jigsaw. STAD has advantages in terms of the group formation and team recognition. However, the result of the data analysis shows that scientific learning with STAD is not more effective than scientific learning with Jigsaw. The group formation in STAD focuses on the same group. This is simpler than the group formation in Jigsaw. It requires twice group discussion with different members from the different groups. However, this does not become a constraint because students are actively involved in the learning.

. In STAD, there is a team recognition. Students must be actively involved because it contributes to the group progress. Each students

need to put maximum effort to make their groups get the best score group progress. In Jigsaw, although there is no group appreciation, students should be actively involved because they contribute as members of the expert group who will deliver the materials to their home group. Students with high, medium, or low achievement should be responsible to learn its part as the member of expert group. This causes both of the learning give their each benefits.

The relevant research of effectiveness comparison between scientific learning with STAD and Jigsaw was done by Curie Putri Hijrihani and Dhoriva Urwatul Wutsqa (2015). The result of the research demonstrates cooperative learning STAD is not more effective than Jigsaw. Based on the study, both of the learning models have same influence in increasing students' learning achievement. In this study, both of STAD and Jigsaw influence the learning achievement. This is supported by the opinion aof Arends (2008: 5) which stated that one of the important goals developed by cooperative learning model is academic achievement.

CONCLUSIONS AND SUGGESTIONS

Conclusions

Based on the research, it is obtained some conclusions as follows: scientific learning with cooperative learning STAD is effective in terms of students' mathematics learning achievement, scientific learning with cooperative learning Jigsaw is effective in terms of students' mathematics learning achievement, and scientific learning with cooperative learning STAD is not more effective than scientific learning with cooperative learning Jigsaw in terms of students' mathematics learning achievement.

Suggestions

Based on the conclusions, there are some suggestions as follow: the teachers are suggested to apply the scientific learning with STAD and Jigsaw because both of the learning is effective in terms of students' mathematic learning achievement, the teachers are suggested to do a good preparation for the implementation of scientific learning with STAD and Jigsaw, and the next researchers are recommended to expand the variables research besides the students' mathematics learning achievement and expand the learning materials in addition to the lines and angles.

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