REALISTIC MATHEMATICS EDUCATION IN COOPERATIVE LEARNING VIEWED FROM LEARNING ACTIVITY

Shila Majid Ardiyani, Gunarhadi, Riyadi

Sebelas Maret University, Jl. Ir. Sutami No 36A, Surakarta, 57126, Indonesia
Email: shilafanila@gmail.com

Abstract

This study aimed at searching the different effect of Student Teams Achievement Division (STAD) and Think Pair Share (TPS) types of cooperative learning models with Realistic Mathematics Education (RME) approach on the students' learning outcome viewed from students' learning activity. The observation, interview, questionnaires, and tests were used to obtain the data which were then analyzed using two-way ANOVA. The result of research showed that: (1) STAD with RME approach provides better learning outcome than TPS with RME approach does; (2) the students with high learning activities have mathematics learning outcome better than those with medium and low learning activities; and (3) there is no interaction between the model of teaching and learning activities students to the results of the students' mathematics learning.

Keywords: Cooperative Learning, Realistic Mathematics Education, Learning Activity, Mathematics Learning

Abstrak

Penelitian ini bertujuan untuk mencari perbedaan pengaruh antara model pembelajaran kooperatif tipe Student Teams Achievement Division (STAD) dan Think Pair Share (TPS) dengan pendekatan Realistic Mathematics Education (RME) terhadap hasil belajar siswa ditinjau dari aktivitas belajar siswa. Observasi, wawancara, angket, dan tes digunakan untuk memperoleh data, kemudian data dianalisis menggunakan Anava dua jalur. Hasil penelitian menunjukkan bahwa: (1) STAD dengan pendekatan RME memberikan hasil belajar yang lebih baik daripada TPS dengan pendekatan RME; (2) siswa dengan aktivitas belajar tinggi memiliki hasil belajar matematika yang lebih baik daripada siswa aktivitas belajar sedang dan rendah; dan (3) antara model pembelajaran dan aktivitas belajar siswa terhadap hasil belajar matematika siswa tidak terdapat interaksi.

Kata kunci: Pembelajaran Kooperatif, Pendidikan Matematika Realistik, Aktivitas Belajar, Pembelajaran Matematika

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Mathematics is basic science to study other sciences. It is in line with Kumar & Rao (2006) stating that mathematics is the instrument of many other subjects such as geography, science, and engineering. The objective of mathematics learning at every school level is, among others, to encourage the students to think creatively and logically and to solve a problem related to daily life. Human beings use mathematics in daily life, as to measure distance, body height and body weight, to read table on newspaper, to divide the group, to calculate shopping expenditure, etc. Mathematics can be used to prepare students for dealing with real life situation effectively (Švecová, Rumanová, & Pavlovičová, 2013).

In reality, the quality of mathematics learning at elementary school has not been consistent with the expectation and objective of mathematics learning aforementioned. The quality of mathematics learning can be seen from the students' mathematics learning outcome. The low mathematics learning outcome the elementary school students is encountered in Karangpandan Sub District, which can be seen from the data of learning achievement in National Exam in the school year of 2016/2017

indicating that the students' mathematics mean score is still below that of other subjects, Indonesian Language (Bahasa) and Science. It is confirmed by the fact that the learning outcome of the fifth graders in three elementary schools shows the students' successfully passing rate in mathematics subject is still less than 50%.

Based on the result of interview and observation, it can be found that some factors result in the low learning outcome: (1) teachers have not connected the learning yet to real life or daily life of students; (2) teachers still apply conventional learning model emphasizing on lecturing and assignment; (3) students tend to be passive during the learning process; and (4) the interaction between students and between students and teachers occurs scarcely (group discussion and cooperative problem solving occur scarcely). These causes should be followed up to minimize their effect on the low mathematics learning outcome of students, recalling that the mathematics subject is very important in daily life and becomes one of subjects included into National Exam.

Cooperative learning can be an alternative in this problem. Cooperative learning model, according to Hossain, Tarmizi, and Ayub (2012), can improve students' mathematics achievement and communication ability effectively. There are so many types of cooperative learning models, two of which become the concern in this study, namely Students Teams Achievement Division (STAD) and Think Pair Share (TPS).

In STAD learning, students are divided into some groups by academic ability, sex, and ethnic, and then teachers deliver material and students work in group to conceive the material to be discussed (Zakaria & Iksan, 2007). Khan and Inamullah (2011) states that the mean score of STAD learning model can surpass the mean score of control group. Thint and Nyunt (2015) suggest that TPS is an activity telling the students to reflect problem and then, to share thinking with others. TPS has been recommended for its advantage of enabling the students to express their reasoning, to reflect what they have in their mind and to get direct feedback to their understanding (Kothiyal, Majumdar, Murthy, & Iyer, 2013). Tardi, Budiyono, and Iswahyudi (2014) reports that TPS model with Realistic Mathematics Education provides better learning achievement of students than TPS and conventional models do. Suripah (2015) states that both STAD and TPS learning model are effective in mathematics learning.

STAD and TPS models are very flexible to apply to a variety of subjects but are less specific to mathematics learning as in mathematics many abstract concepts that should be minimized are found. Therefore, for the result of research to be more maximal, this model is combined with Realistic Mathematics Education (RME) approach. Realistic Mathematics Education (RME) is a Dutch learning approach first introduced and developed by Freudenthal Institute in the Netherlands since 1970. RME is based on the claim that the students work from the context that makes sense to enhance the understanding of the mathematics (Dickinson & Hough, 2012). The word logical here means to be compatible with real-world context corresponding to daily life the students can imagine. Sukri & Widjajanti (2015) states that RME approach affects the students' learning motivation and

achievement positively. To confirm, Saleh, Prahmana, Isa and Murni (2018) study found that the students' achievement in mathematics learning with RME approach is better than that with conventional learning.

In addition to learning model and approach, another factor may also affect the mathematics learning outcome. The learning should take the students' learning activity into account. Learning activity, according to Hamalik (2009) is an activity the students do in the learning process. Othman, Asshaari, Bahaludin, Tawil, & Ismail (2012) states that students using cooperative learning model can have better understanding and perception on the experience acquired from learning activity. Furthermore, Gull & Shehzad (2015) states that the activity in cooperative learning affects the students' learning outcome positively. Also, Arsaythamby & Zubainur's (2014) study suggested that the mathematics learning activity of students taught with RME approach is higher than that with the conventional approach. Therefore, learning activity is used as a review in this study.

Research regarding STAD model and TPS has been done by Sutrisno (2013) by combining cooperative learning model STAD types and TPS with SAVI approach. In this study, each of TPS and STAD was combined with RME approach. In additin, while the research of Sutrisnoo (2013) was participated by students at junior high school, this research was participated by students at grade five of elementary schools.

The objective of research is to find out: (1) whether or not STAD-RME learning model provides better learning outcome than TPS-RME learning model does; (2) which ones have better mathematics learning outcome, students with high, medium, or low learning activity, and (3) whether or not there is an interaction between learning model and students' learning activity on the students' mathematics learning.

METHOD

Type of Research

This is a quasi-experimental research which aims to obtain information that can be obtained through actual experiment because researchers cannot control all research variables (Budiyono, 2003). The research design employed was a 2x3 factorial design to find out the effect of two independent variables on the dependent variable.

Research Location and Sample

This research was taken place in Public Elementary Schools throughout Karangpandan Sub District. The subject of research was the 5th graders of Public Elementary Schools throughout Karangpandan Sub District. In this study, the samples were taken using stratified cluster random sampling. This technique was used since the population has heterogeneous and stratified members. The samples used in this research were taken from high, medium, and low categories based on the school's rank in National Exam of Mathematics subject in year 2016.

The population consisted of 26 Public Elementary Schools throughout Karangpandan Sub District, from which 3 (high, medium, and low) groups were taken, and each group consisted of 3 schools. Therefore, the samples consisted of 9 schools representing the population: SD N 2 Doplang, SD N 1 Karangpandan, SD N 3 Dayu, SD N 1 Ngemplak, SD N 2 Karang, and SD N 1 Doplang. This study employed two classes: Experiment I and Experiment II classes. The Experiment I class was the group of students treated using STAD type of cooperative learning model with RME approach, and the Experiment II class was that treated using TPS type of cooperative learning with RME approach. This research was conducted by determining two treatments on the subject of research. The experiment group treated with STAD learning model and RME approach consisted of 64 students, while that with TPS and RME approach consisted of 50 students.

Research Instrument

Data collection was conducted through interview, observation, questionnaire, and test. The interview was conducted to explore information from teacher and students related to mathematics learning conducted. Observation was conducted to find out the implementation of mathematics learning in the class. To collect data on students' learning activity was used questionnaire method. Meanwhile, to collect data of students' learning outcome was used test method in the least common multiple (Indonesian: *Kelipatan Persekutuan Terkecil* or KPK) and greatest common divisor (Indonesian: *Faktor Persekutuan Terbesar* or FPB) subject matter. The instrument of research had been validated and revised according to the experts' feedback first before being used, including linguist and mathematics education expert. Instrument trial was then conducted outside experiment class, SD N 2 Bangsri.

Indicators of mathematics learning activity used in this study were: (1) preparation and participation in attending mathematics learning; (2) listening to; (3) questioning; (4) expressing opinion; (5) writing or recording; (6) reading; (7) relearning; and (8) practice.

Learning Activity

Djamarah (2008) suggests that learning is not a process in a vacuum. It is never empty of activity. No one learns without involving his physical activity. Learning activity, according to Hamalik (2009), is an activity done by students in the learning process. The learning activity intended here focuses more on learning activity conducted by the students. Learning activity tends to be more dominant methodologically over the students while teaching instructional is conducted by the teacher (Susanto, 2013). Teaching-Learning process is characterized by the presence of students' active learning activity both physically and mentally (Suryani & Agung, 2012). So, teaching-learning activity will be less maximal when students are passive during the learning process, because it is the students who should learn, while teacher serves as a facilitator only.

Research Limitation

This study focuses on the material related to least common multiple (Indonesian: *Kelipatan Persekutuan Terkecil* or KPK) and greatest common divisor (Indonesian: *Faktor Persekutuan Terbesar* or FPB) in the 5th grade of Elementary School.

Data Analysis

Quantitative data in this research was obtained from the test on mathematics learning outcome and the questionnaire of students' learning activity. Data of prior ability was obtained through pretest and questionnaire of students' learning activity used to classify the students into high, medium, and low learning activities. In this research, there were two variables observed: independent and dependent ones. Independent variables of research were learning the model and students' learning activity. Meanwhile, the dependent one was mathematics learning outcome. Data analysis in this study employed SPSS version 16.

RESULTS AND DISCUSSION

A set of test consisting of 20 multiple-choice items were examined to students in experiment and control classes. Considering the result of the test, the mean score of students' learning outcome test is 66.682 for STAD-RME class and 61.385 for TPS-RME class. Before conducting a two-way ANOVA test, normality test was conducted first on the data. Normality test on the data of students' mathematics learning outcome was conducted using SPSS at a significance level of 5%. The result of analysis of student mathematics learning achievement test with normality test is presented in Table 1.

Table 1. Normality Test on Students' Learning Achievement Test

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
STAD-RME	0.098	64	0.200
TPS-RME	0.079	50	0.200

The results from table 1 show that the significance value in STAD-RME and TPS-RME classes is > 0.05, $0.200 > 0.05$; therefore it can be concluded that the sample of the test comes from the normally distributed population. Data is on the results of student learning after doing normality's tests, then done homogeneous tests. Test results homogeneous depicted in Table 2.

Table 2. Homogeneity Test on Student Learning Outcome Test

Levene Statistic	df1	df2	Sig.
0.824	1	112	0.366

Table 2 shows sig. value = $0.366 > 0.05$. It means that the population is homogeneous or has the same variance. After that is analyzed the research data using two-way ANOVA test. The results of research hypothesis test are depicted in Table 3.

Table 3. The Result of Research Hypothesis Testing

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	25887.376[a]	5	5177.475	38.204	0.000
Intercept	437671.538	1	437671.538	3.230E3	0.000
Model	748.735	1	748.735	5.525	0.021
LA	25192.014	2	12596.007	92.945	0.000
Model*LA	71.571	2	35.786	0.264	0.768
Error	14636.308	108	135.521		
Total	506700.000	114			
Corrected Total	40523.684	113			

Table 4. The Result of Post Hoc Tests Anava

(I) LA	(J) LA	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
High	medium	21.165*	2.670	0.000	15.874	26.457
	low	40.142*	2.946	0.000	34.303	45.980
Medium	high	-21.165*	2.670	0.000	-26.457	-15.874
	low	18.977*	2.655	0.000	13.714	24.240
Low	high	-40.142*	2.946	0.000	-45.980	-34.303
	medium	-18.977*	2.655	0.000	-24.240	-13.714

The results of the calculation of the above can be interpreted that: 1) the effect of STAD-RME learning model on mathematics learning outcome has F statistic 5.525 with the sig. 0.021 < 0.05, so that H_0 is rejected. From the results, it can be concluded that there is a difference of mathematics learning outcome between students in the experiment (using STAD-RME learning model) and those in control classes (using TPS-RME learning model). The mean score of mathematics learning outcome test for the group of students with STAD RME learning model is higher than that for the one using TPS-RME learning model. 2) The effect of learning activity on mathematics learning outcome has F statistic of 92.945 and sig. 0.000 < 0.05, this means that there is a difference of effect between learning activity categories. Based on Table 4 indicates that there is a difference of learning outcome between high, medium, and low learning activity categories. The students with high learning activity category have better mathematics learning outcome than those with medium and low learning activity categories, while those with medium learning activity category have better mathematics learning outcome than those with low learning activity category. 3) Table 3 shows that column Model*LA obtains sig. = 0.768 > 0.05, showing that there is no interaction between learning model and students' learning activity on students' mathematics learning outcome.

Table 5. The Result of the Comparison Category of Learning Activities

Learning Model	Learning Activity			Marginal Average	Many Sample
	High (b_1)	Medium (b_2)	Low (b_3)		
STAD-RME (a_1)	85,937	66,607	47,500	66,682	64
TPS-RME (a_2)	83,000	60,000	37,812	61,385	50
Marginal Average	84,469	63,304	44,327	64,033	

From Table 5, it can be found that there is a difference of learning outcome between high and medium and low categories of learning activity. Mathematics learning outcome, also, to be affected by learning model, is also affected by students' learning activity. The result indicates that the students with high learning activity have learning outcome better than students with the medium and low learning activity, while those with medium learning activity has learning outcome better than those with the low learning activity.

The result of the research shows that the mathematics learning outcome of students using STAD-RME learning model is better than that using TPS-RME learning model. It is confirmed by studies conducted by Pambudi (2016) and Rohmawati (2017) concluding that STAD model provides a better outcome than TPS model does. Additionally, the result shows that there is a difference of effect between students' learning outcome. It is in line with the studies conducted by Sartono (2011), Apriandi (2012), and Prabawanti, Sujadi, & Suyono (2013) concluded that students with high learning activities have the results of the study that is superior compared to the students with the medium learning activities and low learning activities, while the students with medium learning activities can surpass the results of student learning with low learning activities .

Based on the result of research, it can be concluded that there is no interaction between learning model and students' learning activity on the students' mathematics learning outcome. It is in line with Prihandwiyani (2012). In each of learning models, the students with high learning activity have learning outcome better than those with medium and low learning activities, and the students with medium learning activity have learning outcome better than those with the low learning activity (Revina & Leung, 2018; Fitri & Prahmana, 2018; Wahyu, Amin, & Lukito, 2017; Prahmana, 2013). In each of learning activity categories, STAD-RME learning model provides better learning outcome than TPS-RME model does.

The result of data analysis is possible because STAD model gives the students the opportunity of discussing with the heterogeneous group. STAD can be used to motivate the students to help each other in understanding the learning materials (Slavin, 2008; Lestari & Prahmana, 2017). In STAD model, students are divided into heterogeneous groups, each of which consists of four or five members, to discuss problem-solving, so that the students can express their opinion more actively.

CONCLUSION

The results of learning mathematics students between groups of children with the STAD-RME and TPS-RME is not the same, student learning outcome between each of the learning activities is not the same, and learning model and students' learning activity on the students' mathematics learning outcome is no interaction. The research results can be concluded that the effect of STAD-RME can improve the students' mathematics learning outcome better than TPS-RME learning model can.

In addition to a learning model, students' learning activity also affects the mathematics learning outcome of students significantly. Different categories of learning activity and the result of research regarding learning model can be used theoretically to develop a learning activity supporting the tree learning activity categories so that different learning activity of individual students is expected to be supported with the good learning process to improve the learning outcome. The limitation of the research is due to the use of STAD and TPS types of cooperative learning model combined with RME approach. Therefore, further studies still need to be conducted on the effect of other types of cooperative learning model combined with a different approach.

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