AN EXPERIMENTAL COOPERATIVE LEARNING MODEL THINK TALK WRITE (TTW) AND NUMBERED HEADS TOGETHER (NHT) ON THE TOPIC OF FUNCTION IN JUNIOR HIGH SCHOOL SURAKARTA

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Abstract

The purpose of this research is to determine which one gives better mathematics achievement, students who are taught by learning cooperative model Think Talk Write (TTW), Numbered Heads Together (NHT) or Direct learning model in the topic of Function.The kind of this research is a quasi-quantitative experimental method. The population is the eighth grade of junior high school students at Surakarta in academic year of 2016/ 2017. The sampling technique were used stratifield cluster random sampling. The data collecting used documentation method and achievement test. The try out of test included difficulty level, discrimination index and reliability index. The data was analyzed using a one-way analysis of variance with unbalanced cells following the normality test with Liliefors method and homogeneity test with Barlett method. Both experimental and control classes should have equal earlier mathematics achievement. Based on result of the research, it can be concluded that students who are taught by TTW and NHT have better mathematics achievement than Direct learning but students who are taught by TTW have equal mathematics achievement with NHT.

Keywords : Cooperative, TTW, NHT.

Introduction

Indonesia will success at various competencies in the globalization era if it has high human quality. Educated human is a key of the nation progress. One of indicators that influences the nation progress is education. Education is a conscious effort that is made so that the students can achieve certain goals and reach the maturity. The main point of the qualified planning and implementation is about how to develop and optimize the students' abilities. Teacher has an important role in these efforts. "By 2030, all governments ensure that all learners are taught by qualified, professionally trained, motivated and well supported teacher" (Unesco, 2014). Mathematics is a branch of science that plays an important role in developing science and technology. Tella (2008: 74) argues:

> Mathematics is not the language of science, but essential nutrient for thought, logical reasoning and progress. Mathematics liberates the mind and also gives individuals an assessment if the intellectual abilities by pointing towards direction of improvement. Mathematics is the basis of all sciences and technology and thereforeof all human andevours. Application of mathematics cut across all areas of human knowledge.

Function is one important topic in mathematics. Doorman et al. (2012) state "the concept of function is a central but difficult topic in a secondary school Mathematics curriculum".

Learning model is one of factors that should be considered in teaching learning process because it can influence the students' achievement. Ajaja and Eravwoke (2010) argue "a significant higher achievement test score of students in cooperative learning group than those in traditional classroom. One of cooperative learning that can be implemented by teacher is Think Talk Write (TTW) that has three phases namely: thinking, talking, and writing. Those phases are closely related to constructivism approach. Banikowski (1999) argues "maintenance rehearsal involves repeating the information in your mind. As long as you repeat the information, you can maintenance it in your working memory indefinitely.

The other learning cooperative model is Numbered Heads Together (NHT) that has four phases namely: numbering, asking questions, thinking together and answering questions. Those phases are closely related to constructivism approach. Maheady (2006: 24), "previous research has shown that Numbered Heads Together is an efficient and effective instructional technique to increase student responding and to improve achievement".

Based on background, the problem formulation of this research is ***which one gives better mathematics achievement, students who are taught by learning cooperative model Think Talk Write (TTW), Numbered Heads Together (NHT) or Direct learning model*** in Function subject matter.

Therefore, ***the purpose of this research is to determine which one gives better mathematics achievement, students who are taught by learning cooperative model Think Talk Write (TTW), Numbered Heads Together (NHT) or Direct learning model*** in Function subject matter.

The benefits of this research is to develop the theory in education field especially in Mathematics subject related to cooperative learning model in order to increase education quality through increasing students' Mathematics achievement.

Finding and Discussion

This research used quasi-experimental research. The sampling technique is stratified cluster random sampling. The sample of this research is taken from one school having high ability, one school having medium ability, and one school having low ability based on the rank in Mathematics National Examination of 2014/2015 academic year. In every school, the sample is divided into three classes, one class is as control class and two classes are experimental class. The sample are SMP Negeri 9 Surakarta, SMP Negeri 19 Surakarta and SMP Muhammadiyah 8 Surakarta. It is taken from the population of all the eighth grade Junior High School students in the first period at Surakarta in the academic year of 2014/2015 that consists of 73 State and Private Junior High School.

In collecting the data, the researcher used documentation and test. Documentation is used in collecting the data about student's initial ability. While test is to obtain the data of student's Mathematics achievement. The test instrument is objective form arranged based on blue print that has been made before. After the research instrument is arranged, it is tested the validity, then it is tried out. The purpose of the try out is to determine whether the research instrument has fulfilled requirements as a good instrument.

After the instrument is tried out, it is analyzed to know the validity and reliability. Based on the result of the computation, there are 30 questions that is used

as research instrument. Because the Mathematics achievement test are valid and reliable so it used in collecting the data from the sample of research.

The following is the data of the research, they are the data of initial Mathematics ability, the data of the try out result of test, and the data of student's Mathematics achievement on Relations and Functions subject.

The result of the normality test in experimental class I is $L_1 = 0{,}0715 < L_{0.05;88} = 0{,}0944$, experimental classII is $L_2 = 0{,}0811 < L_{0.05;85} = 0{,}09610$ and control classis $L_3 = 0{,}0727 < L_{0{,}05;88} = 0{,}0944$so that it is obtained $L_{obs} \notin$ DK and $H_0$is accepted. It means that the sample is in normal distribution.

Based on homogeneity test using Bartlett test, it is obtained $\chi^2_{obs} = 3{,}009 < \chi^2_{0{,}05;2} = 5{,}991$. It means that the sample is homogeneous. Then, equality test using a one-way ANOVA with unbalanced cells delivers the result of $F_{obs} = 2{,}408 < F_{alpha} = 3$. It means that the sample is equal.

The data analysis for hypothesis testing is a one-way ANOVA with unbalanced cells. Before the data is analyzed for hypothesis testing, normality and homogeneity test with significance level of 5 % must be done. The following is the summary of normality test in Mathematics achievement.

Table 2. The Summary of Normality Test in Mathematics Achievement.

Normality Test	L_{obs}	$L_{0{,}05;n}$	Result	Conclusion
TTW	0,0838	0,0944	H_0accepted	Normal
NHT	0,0928	0,0961	H_0accepted	Normal
Direct	0,0757	0,0944	H_0accepted	Normal

Based on Table 2, it can be seen that the data is in normal distribution. Beside normality test, homogeneity test also must be done as requirement testing. The following is the summary of homogeneity test using Bartlett test in Mathematics achievement.

Table 3. The Summary of Homogeneity Test in Mathematics Achievement

Homogeneity Test	k	χ^2_{obs}	$\chi^2_{0.05;k-1}$	Result	Conclusion
Learning Model	3	0,6826	5,991	H_0accepted	Homogeneous

Table 3 showed that the sample was homogeneous. After normality and homogeneity test are fulfilled, hypothesis test using a one-way ANOVA with unbalanced cells can be done with significance level of 5%. The following is hypothesis test using a one-way ANOVA with unbalanced cells.

Table 4. The Summary of a one-way ANOVA with Unbalanced Cells

The Summary of a one-way Anova					
Source	SS	df	MS	Fobs	F alpha
Method	10707.15868	2	5353.579338	31.7527732	3
Error	43499.30195	258	168.6019455		
Total	54206.46062	260			

Table 4 showed that H_0 is rejected because Fobs > F alpha, so that there is a difference effect between the implementation of learning model and student's Mathematics achievement. The following is marginal average of Mathematics achievement based on learning model.

Table 5. Marginal Average

Marginal Average		
TTW	NHT	Direct
67.704	65.504	53.649

Table 4 showed that H_0 is rejected so that multiple comparison between row should be done to know which one better achievement between the students' taught using TTW, NHT, or direct learning model. The following is the result of multiple comparison using Scheffe method.

Table 6. The Summary of Multiple Comparison between Rows

Model	Comparison	F_{obs}	F_{alpha}	Conclusion
TTW-NHT	$\mu_{1.}$ vs $\mu_{.2.}$	1.289	6	accepted
TTW-PL	$\mu_{1.}$ vs $\mu_{3.}$	53.528	6	rejected
NHT-PL	$\mu_{2.}$ vs $\mu_{3.}$	37.420	6	rejected

Table 6 showed that the students taught using TTW and NHT have better achievement than the students taught using direct learning while the students taught using TTW have equal achievement with the students taught using NHT. It is caused both of the cooperative learning models can increase the student's participation especially in small group. Hence, the students learn from their own experiences, construct knowledge then give meaning for that knowledge. The characteristic of TTW and NHT has constructivism approach so that the student's Mathematics achievement taught using TTW is as good as the students taught using NHT. In direct learning model, there is no collaboration between group and the learning process is dominated by teacher. It makes the student's Mathematics achievement using TTW and NHT is better than using direct learning. Araban, dkk (2012) states "cooperative learning is a set of instruction procedures that enable students working together in groups, usually with the goal of completing a specific task. These methods can help students develop the ability to work with others as a team".

Conclusion

Based on the underlying theories and the research finding, the conclusion is as follows student's Mathematics achievement taught using TTW model and NHT model is better than student's Mathematics achievement taught using direct learning model while student's Mathematics achievement taught using TTW model is as good as Student's Mathematics achievement taught using NHT model.

Learning model of TTW and NHT can be used by teacher as alternative in selecting learning model to increase the student's Mathematics achievement especially on Relations and Functions subject. The other researchers are expected to develop this research in broader scope with related studies or more attractive learning model so that this research can be used widely.

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