EXPERIMENTATION OF MATHEMATICS LEARNING BY USING COOPERATIVE MODEL TYPE *TWO STAY TWO STRAY (*TSTS) ON THE SUBJECT OF A CIRCLE VIEWED FROM STUDENT'S CRITICAL THINKING ABILITY IN GRADE VIII OF SMP N 1 SURAKARTA

PUBLICATION ARTICLE

Submitted as a Partial Fulfillment of the Requirements

for Getting Bachelor Degree of Education

In Mathematics Department

by

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2013

UNIVERSITAS MUHAMMADIYAH SURAKARTA
FAKULTAS KEGURUAN DAN ILMU PENDIDIKAN

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Judul Skripsi   : **EXPERIMENTATION OF MATHEMATICS LEARNING BY USING COOPERATIVE MODEL TYPE *TWO STAY TWO STRAY* (TSTS) ON THE SUBJECT OF A CIRCLE VIEWED FROM STUDENT'S CRITICAL THINKING ABILITY IN GRADE VIII OF SMP N 1 SURAKARTA**

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Surakarta,   Maret 2013

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ABSTRACT

The purpose of this study are : (1) to analyze and examine the difference effect of using cooperative learning model type TSTS and conventional learning model to student's mathematics achievement, (2) to analyze and examine the difference effect of student's critical thinking ability to the student's mathematics achievement, (3) to analyze and examine interaction effect of using learning model and critical thinking ability of students to student's mathematics achievement .The population in this study is all students in VIII grade in SMP N 1 SURAKARTA 2011/2012 school year. Samples taken in this study are VIII G as experiment class that given cooperative learning model type TSTS and VIII H as control class that given conventional learning model. The sampling technique used in this study is cluster random sampling. Collecting data method are used test method, questionnaire method, and documentation method. Data analysis technique using two-way analysis variance with unequal cells, a perquisite are need before, using the Liliefors test analysis method to test normality and Barlet method to test the homogeneity. From the analysis of the data with significance level 5% satisfied that: (1) There is no difference effect of using cooperative learning model type TSTS and conventional learning model to student's mathematics achievement with $F_A=1,51$, (2) there is difference effect of student's critical thinking ability to student's mathematics achievement with $F_B=8,18$, and (3) there is no interaction effect between learning model and student's critical thinking ability with $F_{AB}=0,46$.
Keywords: TSTS, learning activity, students' critical thinking ability, mathematics achievement.

Introduction

Mathematics is mother of science, mathematics is very important in learning and daily activity. Mathematics given to student in the form of subject that can be related daily activity.

Man is a being who thinks , Sitti Hartinah (2008: 12-13), says that man is a being who thinks, or *homo sapiens*, a being which is shaped or *homo faber*, a being who can be educated or *homo educandum*. Student must be can think and active in the learning process.

Student's active in learning process is effect by internal factor and external factor. Internal factor of student are the talking ability, problem solving ability and brave to give the opinion. Those abilities can appear when student have critical thinking ability. Radno Harsanto (2005: 43), says that critical thinking is a model of thinking that is not receiving any data without evidence or obvious. A critical thinking should be able to give reasons for the selection decision taken. This means, a critical thinking must already have logical answers for any of his thinks.

Children until old men need education to be shaped and can think. While the education itself has the sense of conscious effort and planned to bring about condition of learning and the learning process so that students actively develop the potential to have a religious spiritual strength, self-control, personality, intelligence, morals, as well as the necessary skills they need in society.

Education can be given to children though home education and school education. Education at school can't be removed from the process of learning and interaction between teachers and students. Usually, in learning activities the teacher is more dominant than students. Teacher giving material to students and students just listen to the teacher at the seat. Conventional model like this should not be continued, because it will make the distance between teacher and students.

Teacher can use cooperative model as the alternative. Cooperative model has many types and development. Teacher can apply this model in the teaching and learning activities.

One type of cooperative learning model is *Two Stay Two Stray* (TSTS). Cooperative learning model type TSTS is cooperative learning model that given opportunity for group to share information with other group. It can be

said that cooperative learning model type demanding students active in learning process.

Based on explanation above, the objectives to be achieved from this study to analyze (1) effect of using cooperative learning model type *Two Stay Two Stray* (TSTS) to student's mathematics achievement, (2) effect of student's critical thinking ability that divided into three groups: high, medium, and low to student's mathematics achievement, (3) the interaction effect between cooperative learning model type TSTS and student's critical thinking ability (high, medium, and low) to students' mathematics achievement.

Research Method

This research was carried out in Grade VIII Junior High School 1 Surakarta in the even semester, 2012/2013 academic year. The type of this research is experimental research. The dependent variable is mathematics student's achievement, and the independent variable are learning model and student's critical thinking ability. Learning model that use are conventional learning model given to control class and cooperative learning model type *Two Stay Two Stray* (TSTS) given to experimental class. This study will look at the effect of the cooperative learning model type *Two Stay Two Stray* (TSTS) to student's mathematics achievement viewed from student's critical thinking ability. The sample of this research using two classes, VIII-G as experimental class and VIII-H as control class.

In this study used *probability sampling* techniques. *Probability sampling* is sampling techniques that give the same opportunities for each element (members) of the population to choose a member of sampling (Sugiyono, 2010: 63). The type that is used is the *cluster random sampling*. Before giving a treatment, both groups should be used to test whether the experimental group and the control group in a state of balance. To compare before and after treatment or to compare experimental and control groups, researcher used t-test.

The methods used to collecting data in this research are test method, questionnaire method, and documentation method. Model of a questionnaire in

this study is used to measure the criteria of critical thinking ability of students. Test method in this study is used to collect achievement data of students. In this study the documentation method will be used to balance test, knowing the capabilities of early students as well as the evidence of the study.

Before questionnaire and test used to retrieve the research data, research instrument in the form of questions to mathematics learning achievement tests and questionnaires of student's critical thinking ability tested first to see its reliability and validity. To calculate the validity of instrument items, use the formula of *the product moment correlation* and to calculate the reliability index of essay tests used *Alpha Cronbach* formula.

The technique of data analysis used analysis of variance two ways with unequal cells. Before doing analysis of variance two ways with unequal cells, prerequisite test analysis must be done, consists of normality test uses *Liliefors* formula and homogeneity tests uses *Bartlett* formula.

The Result of Research and Discussion

Before the sample is given treatment, researcher does the balance test to determine whether experiment and control class are balance. The data source of the balance test is taken from the final score mathematics in odd semester. From the result of calculation using $?$-test is obtained $?_{???} ? ??????$ and $?_{????\ ??} ? ????$. Because $?_{???} ? ?_{?????}$ then $?_?$ is accepted. So, experiment class and control class in the state of balance or they have the same ability.

Instrument in this study include achievement test on the subject of circle and questionnaire of student's critical thinking ability. There are 35 items for multiple choice test and 30 items for questionnaire. The score of each item is compared to the value of coefficient table at N = 27 and at 5% of level significance. From 35 items for multiple choice test that given there are 23 items valid and 12 items invalid can be seen from the value $?_{??} ? ?_{?????}$. So, 23 items are used to collect data in this study. From the result of reliability test obtained $?_{??} ? ?₲???$. So, achievement test try out for multiple choice items on subject of circle are reliable.

From the validity test of 30 items student's critical thinking ability questionnaire, 19 items are valid and 11 items are invalid. So, 19 valid items can be seen from the value $?_{??}$? $?_{?????}$ are used to collect data of student's critical thinking ability. From the result of reliability test obtained $?_{??}$? $??????$. So, the items of student's critical thinking ability questionnaire are reliable.

After doing treatment between experiment and control class, is obtained the average experiment class is 84,85 and control class is 76,56. Based on the data that has been collect of student's critical thinking ability for experiment class there are 10 students including high category, 13 students including medium category, and 4 students including low category. While for control class there are 7 students including high category, 8 students including medium category, and 12 students including low category. The results of cooperative learning model type *Two Stay Two Stray* (TSTS) and conventional learning model as follow the figure:

Figure 1

The Average of Mathematics Achievement
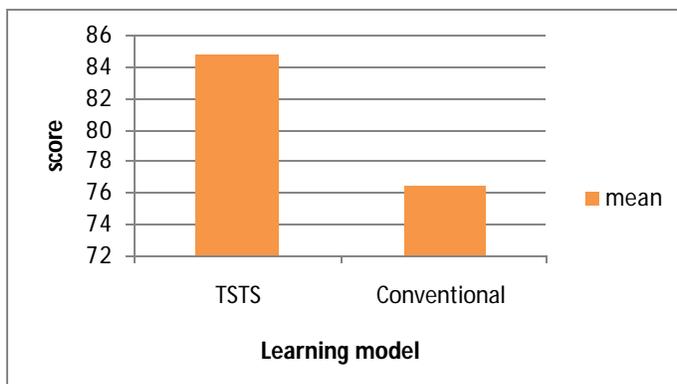
Based on deviation standard of control class and experimental class, the criteria of critical thinking ability of students can be grouped into three

categories, high, middle, and low. The value of criteria for class control and experimental control are as follows:
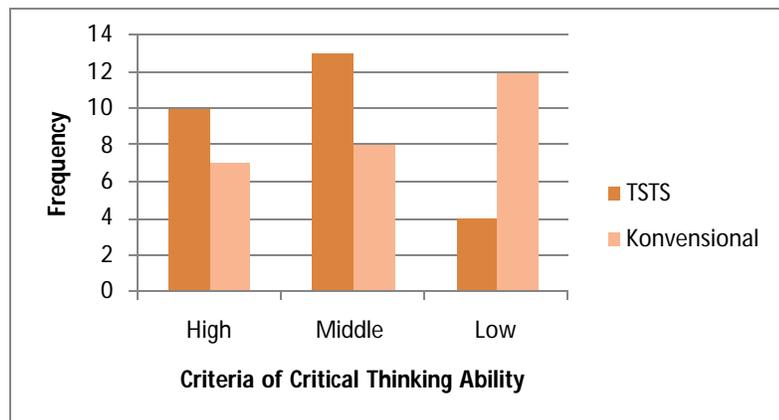
High critical thinking : $x > \overline{x} + \frac{?}{?}SD \iff x > 50,61$

Middle critical thinking: $\overline{x} - \frac{?}{?}SD < x < \overline{x} + \frac{?}{?}SD \iff 45,2 < x < 50,61$

Low critical thinking : $x < \overline{x} - \frac{?}{?}SD \iff x < 45,2$

Figure 2

Histogram of Data of Critical Thinking Ability Based On Criteria

With the fulfillment the properties of normality and homogeneity, that is normality test uses *Liliefors* method at significance level 5% obtained $L_{calculate} < L_{table}$ so conclude that H_0 accepted it means that the sample is from population that have normal distribution . From homogeneity test uses *Bartlett* method at significant level 5% between experiment class and control class obtained the value test statistics $?^?{}_{???} ? ?^?{}_{?????}$. It means that the independent variables come from the same population or homogeneous. After the normality and homogeneity test fulfilled then analysis of variance two ways with difference cell can be done. The results of the analysis of variance two ways with unequalcells are presented in the following table:

Table 1

Summary of Two Way Variance with Unequal Cells

Source	JK	Dk	RK	$?_{???}$	$?_{?????}$	Conclution
Learning model (A)	??????	1	??????	???	4,05	$?_{??}$??????ed
Critical thinking (B)	??????	2	??????	???	3,198	$?_{??}$????????
Interaction (AB)	??????	2	????	???	3,198	$?_{???}$????????
Error	??????	48	??????			
Total	??????	53				

Based on the summary of analysis of variance two ways with unequal cells with 5% of significant levelare presented in the table above, shows that:

1. In the main effects row (A)

The result of two way variance with unequal cells analysis with significant level 5% is obtain $F_A = 1{,}51$ and $F_{table} = 4{,}05$. Since $F_A < F_{table}$ then H_{0A} is accepted, it means there is no difference effect using cooperative learning model type TSTS and conventional learning model to mathematics students' achievement.

In Emzir (2012:70), "Setelah kedua kelompok diberi perlakuan tertentu selama periode waktu tertentu, peneliti melakukan suatu tes pada variabel terikat dan kemudian menentukan apakah ada perbedaan signifikan". In this study, researcher is applying the treatment at twice meetings. Twice meetings is unable to cause there is no difference effect using learning model to mathematics students' achievement.

In Haditono (2006:9), "setiap anak memiliki bakat yang dibawa sejak lahir, pengaruh lingkungan hanya menyediakan kesempatan yang baik". In this study, TSTS is new learning area. There is no effect of using TSTS learning model can be caused students in SMP N 1 SURAKARTA is children that have high academic.

Haditono (2006: 18),), "Hasil interaksi genotip-lingkungan bersifat pasif, timbul karena orang tua memberikan lingkungan sesuai dengan bakat anak". In this study students are have ability about the subject of circle.

2. In the main effects column (B)

The result of two way variance with unequal cell analysis with significant level 5% obtains $F_B = 8,18$ and $F_{table} = 3,198$. Since $F_B > F_{tabel}$ then H_{0B} is rejected, it means there is difference effect of student's critical thinking ability to mathematics student's achievement. The different criteria of student's critical thinking ability (high, middle and low) causes different understanding level of mathematics learning material that's given.

Table 2

The summary of Comparison Test Analysis Whether Column

H_0	F_{obs}	$(q-1)F_{0.05;2;48}$	Conclusion
$?_{?_?}$ $?$ $?_{?_?}$	0,21	6,396	H_0 Accepted
$?_{?_?}$ $?$ $?_{?_?}$	14,55	6,396	H_0 Rejected
$?_{?_?}$ $?$ $?_{?_?}$	12,65	6,396	H_0 Rejected

Amiroh (2011: 88), says critical thinking is give positive effect to student's achievement. This condition is supported by the fact that critical thinking ability of every student is different. Students who have high and middle critical thinking ability are more critic to ask, more quick to solve the problem that given. Students who have low critical thinking ability are less critic, and less quick to solve the problem that given.

3. In the main effects interaction (AB)

The result of two way variance with unequal cell analysis with significant level 5% obtains $F_{AB} = 0,46$ and $F_{table} = 3,198$. Since $F_{AB} < F_{table}$ then H_{0A} is accepted, it means there is no interaction between learning

model and critical thinking ability of students to students' mathematics achievement.

Figure 2

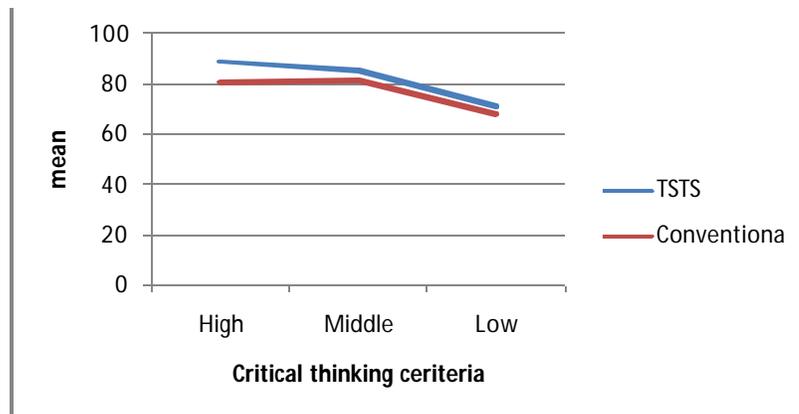Interaction of Learning Model and Student's Critical Ability

Figure 2 shows that mean of experiment class' achievement is greater than control class. This condition is caused by motivation factor that have of every student.Haditono (2006: 9), "Motivasi intrisik adalah sesuat perbuatan memang diinginkan karena seseorang senang melakukannya". In this study can be said that experimental class enjoying the given activity, then have better student's mathematics achievement. It can be concluded that no systematic interaction between learning model and student's critical thinking ability effects of student's mathematics achievement

Conclusion

Based on the result of analysis and the discussion that have been done in previous chapter with a = 5%, researcher concludes that:

1. There is no difference effect of using TSTS *(Two Stay Two Stray)* learning model and conventional learning model to mathematics students' achievement with $F_{obs}=1,51$.

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2. There is difference effect of student's critical thinking ability criteria to mathematics student's achievement in the subject of circle, with $F_{obs}=8,18$. Students who have high and middle critical thinking ability have better achievement than those who have low critical thinking ability.

3. There is no interaction effect between learning model and student's critical thinking ability in the subject of circle with $F_{obs}=0,46$.

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