THE IMPLEMENTATION OF PROBLEM SOLVING MODEL USING NUMBERED HEADS TOGETHER IN THE TEACHING CIRCLE SUBJECT VIEWED FROM STUDENT'S ADAPTIVE REASONING IN SMP NEGERI 1 SURAKARTA

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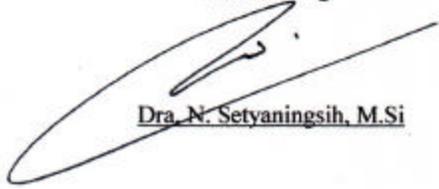NIM   : A410090209

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ABSTRACT

The purpose of this research is to analyze: 1) the effect of learning model of Problem Solving model using Numbered Heads Together (NHT) and the conventional learning model for student's mathematics achievement, 2) the effects of low, medium, and high adaptive reasoning to student's mathematics achievement, 3) the interaction of learning model and student's adaptive reasoning to student's mathematics achievement. The populations are all students of grade VIII in SMP Negeri 1 Surakarta (8 classes). Sample in this research consist of 2 classes, there are class C as control class with 27 students and class D as experiment class with 25 studen ts. The sampling technique use in this research is cluster random sampling. In effort to obtain the necessary data in this research, researchers use the test method there are questionnaire method and auxiliary method. Technique of data analysis uses two ways variance analysis test with unequal cell, a prerequisite using Liliefors test to analysis normality test and Bartlett test to analysis homogeneity test. The result of data analysis with significant level 5% satisfied that: 1) there is no significant effect of students that are given problem solving model using numbered heads together with students that given conventional model to the student's mathematics achievement. This is based on analysis of data with F_a =?????< F_{table} =4,056. 2) There is significant effect of adaptive reasoning of students to the student's mathematics achievement. This is based on analysis of data with F_b =????? > F_{table} =3,206. 3) There is no significant effect of interaction solving model using numbered heads together and conventional model viewed from student's adaptive reasoning to the student's mathematics achievement. This is based on analysis of data with F_{ab} = ????? F_{table} =3,206.

Keywords: problem solving, numbered heads together, adaptive reasoning, student's mathematics achievement

1. Introduction

Since childhood we have been introduced to mathematics lesson which is one of the important sciences for life. However, many children feel that mathematic are a difficult subject. The assumption that mathematics is difficult subject because there are several factors behind the background, such as students who are lazy to learn Mathematics, material that is considered difficult, and less accuracy in using model of learning by teachers. The three factor causes some students tend to have less understanding causing less satisfactory achievement.

Concept understanding of students will affect the student's reasoning in solving mathematical problem. Adaptive reasoning is one of the reasoning that needs to develop in solving a mathematic problem. Adaptive reasoning refers to the capacity to think logically about the relationships between concepts and situations, the ability for reflective thinking, the ability to explain and the ability to provide justification (Djamilah, 2011:3).

Many students are afraid to solve mathematics problems, so teachers should guide students to solve a mathematic problem. It makes students' understanding relatively low. That condition also supported by the results of TIMSS (*Trends in International Mathematics and Science Study*). In TIMSS (Ina et.al. 2011: 6) International Results in Mathematics, the average overall grade 8 in Indonesia is 386; far from the midpoint of TIMSS are 500. Beside that TIMSS (Ina et.al. 2011: 162) says that Mathematical average in term of cognitive dimensions that include understanding 378 (31%), application 384 (23%) and reasoning 388 (17%). Cognitive aspects of the TIMSS showed average of understanding 35%, application 40% and reasoning 25%.

According to Achmad Nizar (2007:75), reasoning and communication as one of the major scoring aspects in learning mathematics. The aspect of understanding concepts and problem solving are still contributing to report the accurate mathematics learning results.

The power of students to reason can be reduced the students pressure in mathematics problem solving that procedural.

Student's reasoning can develop if they are active during the learning process. In this case teacher's role in learning can affect the student's reasoning. One of them is used an appropriate learning model, so it makes students more active and strengthens understanding of material. The teacher use of inappropriate models of learning will affect student's mathematics achievement.

Problem Solving model using Numbered Heads Together (NHT) is a learning model that can be used in learning mathematics. This model engages students to solve a problem together and draw conclusions from it. According to Andrea (2004:11) a problem solving model is a systematic approach that reviews student strengths and weaknesses, identifies evidence-based instructional interventions, frequently collects data to monitor student progress, and evaluates the effectiveness of interventions implemented with the student.

According to Kagan's in Luu Trong (2010) numbered heads together as structural approaches which is based on using content-free ways of managing classroom interaction called structures. Students number off within teams. After the teacher asks the question, the groups huddle to determine the answer. The teacher calls a number random and the students with that number respond.

From explanation above, this research has purpose to know (1) differences between the effects of learning model to students' mathematics achievement, (2) difference between the effects of student's adaptive reasoning to student's mathematics achievement, (3) an interaction between learning model and student's adaptive reasoning to student's mathematics achievement.

2. Research Method

The type of this research as experiment research that is research procedures are performed to know a causal link of two or more variables to control the influence of other variables. In this case the model is the application of problem solving model using numbered heads together will be controlled and viewed its effects on other variables student's mathematics achievement.

This research doing in SMP N 1 Surakarta located at MT. Haryono No. 4 Surakarta. The population in this research is all of students in VIII class that contains 8 classes. The samples of this research are two classes, which are class C as a control class and class D as experiment class. On the experiment class is given Problem Solving model using Numbered Heads Together (NHT) treatment and the control class is the treatment with conventional models. Two classes then compared and seen the difference of their mathematic achievements.

According to Sutama (2012: 123) sampling is the determination of samples from a population that aims to improve the usefulness of the information obtained from a sample. The technique of sampling was the technique of the sample. Sampling technique is the selection process or the recruitment of individuals from a population, which is done in a certain way to be able to represent the larger group (Sutama, 2012:108).

Two classes out of 8 classes are taken. First class using a problem solving model using numbered heads together as experiment class and other using conventional model control class. Before it class given treatment, both classes must be balance test between experiment class and control class. To compare the experiment and control classes, researcher used t-test sample.

To obtain the necessary data in this research, researchers used the test method, questionnaire method and auxiliary method. But, before being used as test questions, the question must be tested are worthy used in research or not. Testing is used to check the questions are validity and

reliability test. To know validity for each instrument item, it will be used product moment formula and to know the reliability test of question used *Alpha Cronbach* formula. In addition the auxiliary method uses data measurements by taking an existing document or documentation data during the procces of learning.

The technique of data analysis used to two ways variance analysis with unequal cells. Before doing analysis of variance, prerequisites test analysis must be conducted. It is consisting of normality test uses the Liliefors and homogeneity test uses Bartlett.

3. The Result of Research and Discussions

The implementation of research that means collecting data. The balance test must be done before giving treatment to the sample, balance test use to measure the condition of experiment and control class are balance. The data of the balance test are taken from the final score mathematics in odd semester. From the result of calculation is obtained t $_{calculation}$ = $?\ ??\mathbf{?}?$ then t $_{table}$= $t_{0,05:53}$=1,645, because t $_{calculation}$ < t $_{table}$, then H_0 is accepted. So that two classes are in balance condition or same ability.

Instrument in this research consist of essay test of student's mathematics achievement and questionnaire of student's adaptive reasoning. Item that used to get data from respondent is valid and reliable item, while invalid an unreliable item are not used. There are 7 questions for essay test and 30 questions of questionnaire. For the essay questions, score of each question item test compare with the coefficient table value at N=27 and significant level 5% obtained six valid items. Criteria of research instrument says reliable when the coefficient of reliability r_{11} > 0,6. Because $?_{??}\ ?\ ???\ ?\ ???$, it can be concluded that the questions are reliable.

The questionnaire consists of 30 questions that have been adapted to grating. From the calculation of validity test at significant level 5%, are

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obtained 22 valid item because $r_{xy} > r_{table}$ and 8 invalid questions. From the calculation of reliability test obtained $?_{??}$ $?$ $???$ $?$ $???$, so it can be concluded that the questionnaire are reliable.

After doing treatment there are two data, firstly the data of student's mathematics achievement of experiment and control class. Secondly, the data of student's adaptive reasoning of experiment and control class. In control class the maximum score of achievement is 8,83 and minimum score is 0,5. In experiment class maximum score of student's achievement is 9,00 and the minimum score is 0,5. And then the data of student's adaptive reasoning of control class, there are 8 students that have high adaptive reasoning, 11 students that have medium adaptive reasoning and 8 students that have low adaptive reasoning. For experiment class 7 students that have high adaptive reasoning, 11 students that have medium adaptive reasoning, and 7 students that have low adaptive reasoning.

The data of each variable is used to do hypothesis test. Prerequisite test analysis is a requisite to do the two ways variance analysis with unequal cells. Prerequisite test analysis consist of two parts, there are normality test and homogeneity test. Firstly, normality test is testing to determine whether the data analyze are in normal distribution. The normality test uses Liliefors method at significant level 5% and says normal if $L_{max} < L_{table}$. From calculation conclude that H_o is accepted, so the sample came from normal distribution population.

Secondly, homogeneity test is test to know whether two independent variables have same variance or not. The homogeneity test in this research uses Bartlett method with significant level 5% and says homogeneous if $?^{?}_{??????????} < ?^{?}_{?????}$. From calculation is obtained $?^{?}_{??????????} < ?^{?}_{?????}$ $?$ it means that between independent variables have same variances or data that analyze come from same population or homogeneous.

After the normality and homogeneity test as a prerequisite test analysis fulfilled then variance analysis can be done. Variance analysis uses two ways variance analysis with unequal cells. Based on result of two ways variance analysis with unequal cells, it's the summary as follows:

Table 1

The Summary variance analysis used two ways with unequal cells

Source	JK	Df	RK	$F_{calculation}$	F_{table}	Decision
Learning Model(A)	??????	1	?????	??????	4,056	Accepted
Adaptive Reasoning (B)	?????	2	?????	??????	3,206	Rejected
Interaction (AB)	????	2	????	????	3,206	Accepted
Error (G)	153,277	46	????			
Total (T)	??????	51				

Based on tables above so the result of two ways variance analyses with unequal cells interpret as follows:

a. Test Between row (A)

The result of variance analysis is obtained F_A = ?????? and F_{table} at significant level 5% is 4,056. Because $F_A < F_{table}$ so H_{OA} is accepted, then can be said that there is no effect between problem solving model using numbered heads together and conventional model to the student's mathematics achievement at VIII class in even semester of SMP Negeri 1 Surakarta at the subject of circle. This fact to be supported in SMP N 1 Surakarta never use problem solving model using numbered heads together. Students tend accustomed to conventional model of learning given by teacher. Lack of time in research cause less to achieve satisfactory result of the study. So, it is less visible the influence of using the problem solving model using numbered heads together to student's adaptive reasoning.

b. Test Between column (B)

The result of variance analysis is obtained F_B = ?????? and F_{table} at significant level 5% is 3,206. Because $F_B > F_{table}$,

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H_{OB} is rejected, then that's mean there is not all of student's adaptive reasoning (low, medium, high) give the same effect to the student's mathematics achievement at VIII class in even semester of SMP N 1 Surakarta at the subject of circle. H_{OB} is rejected, so the next step is doing multiple comparisons to know which one the level of student's adaptive reasoning have significantly different average to student's mathematics achievement. The result of multiple comparison tests, there is difference marginal average of mathematics achievement between low, medium and high adaptive reasoning. Moreover, the high adaptive reasoning groups also have significantly different marginal average of mathematics achievement with the low and medium adaptive reasoning group.

This condition is accordance with Kilpatrick (2011:116) that one of the basic competencies that necessary to be achieved in the learning mathematics is reasoning. Adaptive reasoning has an important role in improving the thinking skills of students in mathematics. Beside that according to Achmad Nizar (2007:75), reasoning and communication as one of the major scoring aspects in learning mathematics. The aspect of understanding concepts and problem solving are still contributing to report the accurate mathematics learning results. The power of students to reason can be reduced the students pressure in mathematics problem solving that procedural. So, the level of student's adaptive reasoning can support the student's mathematics achievement. It can be concluded that the adaptive reasoning effect on the student's mathematics achievement.

c. Test interaction (AB)

The result of calculating variance analysis test is obtained F_{AB} = **????** and F_{table} =3,206 at significant level is 5%. Because $F_{AB} < F_{table}$ so H_o is accepted, then it can be said that there is no effect interaction between learning model with student's adaptive reasoning to the student's mathematics achievement. It means that

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there is different achievement for each learning model give same affect for each criteria adaptive reasoning consistent at learning model, so that between learning model with student's adaptive reasoning. There is no systematic interaction to influence the student's mathematics achievement.

4. Conclusion

Based on the literature review and supported the analysis of the data with 5% significance level can be drawn the following conclusions:

a. There is no significant effect between students that given problem solving model using numbered heads together with students that given conventional model to the student's mathematics achievement. This is based on analysis of data obtained from $F_a = ?????< F_{table} =4{,}056$.

b. There is significant effect between student's adaptive reasoning to the student's mathematics achievement. This is based on analysis of data obtained from $F_b = ????? > F_{table} =3{,}206$.

c. There is no significant effect between interaction problem solving model using numbered heads together and conventional model viewed from student's adaptive reasoning to the student's mathematics achievement. This is based on analysis of data obtained from $F_{ab} = ???? < F_{table} =3{,}206$.

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