The Effect of Numbered Heads Together Learning Model on Mathematics Concept Understanding Reviewed From The Initial Ability and School Level

Liza Wulandari, I Made Arnawa, Ali Asmar

Abstract: This research aimed to find out the differences in understanding of mathematical concepts between students who use the Numbered Heads Together (NHT) learning model and students who use conventional learning models in terms of initial abilities (high, medium or low) and school level (high, low) State Junior High School students in Pekanbaru City. The research model is an experimental and the research design usesPosttest-Only Control Group Design with the independent variables of NHTand conventional learning model, dependent variables understanding mathematical concepts and moderating variables of initial ability and school level. The subjects of the research are the eighth grade students of middle school. To discover the results of the research, a t-test is carried out to find out the differences between the two classes of students with high, medium and low initial ability at the high and low school levels, while to see the interaction is conducted with 2-way ANOVA test. The result of this research indicates that: (1) there is no interaction between the learning model and the initial ability of understanding mathematical concepts, (2) there is no interaction between the learning model and school level on understanding mathematical concepts, (3) there is an effect of the NHT model with the capable students initial high, medium and low on understanding mathematical concepts,(4) there is effect of the NHT model with the school level on understanding mathematical concepts.

Index Terms —Initial Ability, Numbered Heads Together (NHT), School Level, Understanding Mathematical Concepts .

1. INTRODUCTION

The purpose of the school curriculum is students must have mathematical abilities in learning mathematics, namely the ability of mathematical communication. Mathematical communication is very essential because mathematics is not only a tool for thinking and counting, but also as a tool for communicating ideas, ideas and concepts clearly [1]. This is in accordance with the *National Council of Teachers of Mathematics* (NCTM) which asserts that learning mathematics must be able to meet the ability standards that must be recommended in the book of*Principles and Standards for School Mathematics,* namely understanding mathematical concepts [2]. In line with the competence of understanding mathematical conceptsmust be achieved by students, namely students must have the ability to understand the concept of learning [3]. Tribowo et al mentions that there is an understanding of mathematical concepts in students if students are able to understand concepts have been learned and are able to use these concepts in accordance with mathematical problems, and students are able to develop other concepts from concepts are already known [4].

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Risnawati reveals that if students 'understanding of concepts subject matter is good so then student learning outcomes will also increase [5].

Yunita also mentions that in the process of learning mathematics, students' understanding on the concept of a lesson is very important, because with students can understand a concept then it will interrelation between one and the other concepts. [6]. Based on expert opinion, understanding the concept is very essential, the concept as a pillar of development for higher thinking. However, in fact occurs in Indonesia dealing with understanding students' mathematical concepts do not meet the expected indicators. Students do not understand problems in the question of mathematic as well, then students only memorize the processmust be done without understanding the intent of the concept [7]. Students know the formulas and procedures for solving problems, but students do not understand and know in what context mathematical formulas and procedures are used. Moreover, if the questions given by the teacher are different from those exemplified by the teacher in the previous, the students have difficulty and do not understand how to solve the problem regarding with the question.It indicates that the stronger understanding of mathematical concepts of students classified as low and not good.

The low understanding of students' mathematical concepts from the results of the PISA survey and some research from research experts can also be seen from the observations conducted at one of the Pekanbaru City Junior High Schools which are pilot schools (high level) based on data from the Pekanbaru City Education Office. This

observation is carried out by giving 3 questions according to the indicators of understanding mathematical concepts obtained that students who answered the question only 17 people out of 32 students, 15 others do not answer at all and 7 others answerincorrectly, so that only 10 people answer right. Referring to the results of these students' answers, it seems that the understanding of the mathematical concepts of Pekanbaru city students is still relatively low.

Dealing with the issue, it is necessary to implement learning in the form of models that involve students in learning. Jufri states that how cooperative learning can make students learn together in heterogeneous groups both from the initial ability of academics and associations to overcome problems related to the learning process [8]. In addition Nursyamsim reveals that the learning process carried out in schools is still teacher center and the teacher has a more active role in students. The teacher considers that using the lecture method can stimulate students to think by sitting and listening.As the result, learning outcomes do not last long in students' memories [9]. The Cooperative *Model Numbered Heads Together* (NHT) as an alternative model of mathematics learning that is in accordance with the 2013 curriculum and it is assumed to be able to solve problems that occur of Junior High School in Pekanbaru City.

The learning model of NHT is this learning modelcan improve understanding of concepts and mathematical communication skills. This is supported by Slavin's opinion that by numbering and calling one student at random it can make a total involvement of all in understanding the material [10]. The use of numbers on students can provoke the involvement of students to be responsible for solving problems of the specified number.Thelearning model of NHTassists to create student-centered learning that is conducive and active [11]. Students are more encouraged to understand the material since all group members are responsible for the task. Students who are slow will be more enthusiastic to ask others who are better at understanding the material so that their potential can be developed maximally. Students are asked to work together and provide opportunities to distribute information to improve understanding of mathematical concepts. In addition, the impleementation learning model of NHT can increase activitiesare suitable for learning and have a significant influence on student learning outcomes [12].

Besides, Lince points out that the NHT model is able to deepen student understanding and develop a sense of belonging and cooperation, this model requires students to be active throughout, train students' responsibilities, and communicate its understanding [13]. Thus the NHT model is a learning model that is suitable for improving mathematical communication skills. Another factorinfluences understanding of mathematical concepts is the student's initial ability. The NHT learning model can be implemented at every level of student age but every student of the same age may not have the same initial ability [14]. The NHT learning model is implemented in heterogeneous classes where students have different initial abilities consisting of high, medium and low initial abilities. Initial ability is a prerequisite ability students must possess for further learning [15]. Besides, Uno mentions that initial ability is very important in learning [16]. Therefore the initial ability aspect needs to be a concern in learning mathematics especially towards mathematical understanding. Other efforts can effect mathematical communication skills with thelearning model of NHT is viewed based on the initial ability need to be considered at the school level.

School levels are classified into high and low levels based on data from the Pekanbaru City Education Office which are divided into two categories: pilot schools (high level) and non pilot schools (low level). Mumun in developing the mathematical power and disposition of students with in addition to the cognitive style of students, it is also necessary to consider factors at the school level, namely schools have good levels and schoolshave low levels [17]. In line with this, research conducted by Nufus states there are interactions of learning and school level on students' mathematical abilities [18]. Fachrurazi points out that students from high-level schools receive better improvement than students from low-level schools. Based on this, the learning model of NHT is suitable to be implemented at each school level [19]. The researcher of this research examine mathematics learning using the learning model of NHT and find out its effect on understanding mathematical concepts in terms of initial ability and school level. Based on the description above, the purpose of this research is to discover whether or not there are differences in mathematical communication skills between students who use the NHT model and students who use conventional learning in terms of the initial ability and school level of junior high school students in Pekanbaru City.

2. METHODOLOGY

The design used in this research was Posstest-Only Control Design. This research was an experimental study conducted at SMP Negeri 1 Pekanbaru as a high level school and SMP Negeri 25 as a low level school. This research was conducted in the even semester of the academic year 2019/2020. The method of population was obtained through*purposive sampling* by selecting 1 school from 40 state junior high schools in Pekanbaru in a pilot school was used as a high level and non piloted schools as a low level. Considering with the phenomenon, the subject chosen was SMP Negeri 1 and SMP Negeri 25 Pekanbaru were students of class VIII totaling 346 people. The sampling technique was conducted after the data was declared homogeneous normal contribution and had an average similarity then the experimental class and the control class were taken by *Purposive sampling.*

Based on consideration of teaching time in two schools and school mileage, Class VIII HJ was chosen with a total of 30 students as an experimental class and VIII HT with a total of 30 students as a control class for SMP N 1 Pekanbaru. For SMP 25 Pekanbaru selected VIII 1 class with

31 students as the control class and VIII 4 with 34 students as the control class. The mathematical communication ability instrument used essay tests with 12 questions divided into two validated posttests. To classify students as high, medium and low initial abilities, an initial ability test in the form of prerequisite material / which had been studied by students totaling 5 essay questions.Another way how to classify the initial abilities of students according to Suharsimi as follows, namely (1) add up the entire score of each student's score, (2) find out the average (mean) and standard deviation (SD), (3) determine the boundaries of groups for initial ability is high, medium and low [20]. Based on the student grouping, it was found that students at the high school level for high initial ability were 16 students, moderate initial ability with totaling 31 students and low initial ability totaling 14 students, whereas for the low school level it is attained 20 students with high initial ability, 27 students with low initial ability and 17 students with low initial ability. After conducting the final test / posttest twice, the data was analyzed using the *SPSS 21* application. Data analysis was carried out using descriptive analysis with data requirements testing including normality test, homogeneity test then the two-way ANOVA test was conducted.

3. RESULTS AND DISCUSSION

After grouping the data based on the experimental class taught by the NHT model, the control class is taught with the conventional model and grouping according to the category of initial ability and school level, then students are given a test to find out mathematical communication skills. The test given in the form of essays is 12 questions with two tests that the two test results combined have been tested for validity and reliability. The description of mathematical communication ability data can be seen in the following table

Table 1. Descriptive Statistics of the Experimental Class and the Control Class

	n	$\bar{x}$	Std. deviation	Max	Min
Experiment	61	69,83	15,05	100	35,00
Control	64	61,48	15,45	85	35,00

The results of the descriptive statistical analysis in Table 1 show that the average results of the experimental class posttest are higher than the control class. The average difference in the posttest results of the experimental class and the control class is 8.35. It shows that the results of understanding the mathematical concepts of experimental class students are better in the control class. In this research, it is seen the level of understanding of mathematical concepts of students who have high initial ability, medium and low and high and low school levels. From the results of these calculations, the highest average value of students' understanding of concepts is obtained by the experimental group with high initial ability. The worst results are obtained by the control group with low initial ability. Before the data is analyzed, a data analysis requirements test was carried out, namely the normality test and the homogeneity test for the data of understanding mathematical concepts in each data group. The normality test is presented in the table. Based on the table, it can be seen that the sample from each data group has a symp value. Sig> 0.05, Thus, it can be concluded that the five data are not normally distributed.

Table 2. Normality Test for Experiment Classes and Control Classes

	Mathematics Concept Understanding				
	KAM T	KAM S	KAM R	LS T	LS R
Experiment	0,198	0,008	0,200	0,357	0,049
Control	0,001	0,114	0,007	0,004	0,005

After normality test has been obtained, it is found that all the variables are not normally distributed, so the homegenity testing is not necessary. Furthermore, to answer the research objectives, the whitney u-mann test was performed, then the analytical test was carried out with the mann whitney test and Anova two-way test to determine the interaction between variables.

Table 3. U-Mann Whitey Test Experimental Class and Control Class

	Mathematics Concept Understanding				
	KAM T	KAM S	KAM R	LS T	LS R
Sig	0,000	0,003	0,002	0,030	0,036

Table 3 shows that the significance value at the high school level is 0.030 <0.05 and for the low school level is 0.0036 < 0.05, it can be concluded that there are differences in the value of understanding mathematical concepts of students who are taught with NHT and conventional learning model in high and low level schools. This is supported by the average value of understanding the mathematical concepts of high school students who learn using the learning model of NHT is better than students who learn with conventionally. In addition, to the high initial ability obtained a value is 0,000 <0.05 and for the initial abilityobtained is 0.003 <0.05 and for the low initial ability obtained is 0.003 <0.05, it can be concluded that there are differences in the value of understanding the mathematical concepts of students who are taught with NHT and conventional learning modelin high, medium and low initial abilities. Whereas, to see whether there is an interaction between learning modeland mathematical initial ability in influencing mathematical communication skills can be known with the test conducted for this hypothesis is a two-way Anova. The following table shows the result of two-way ANOVA test. The presence or absence of interaction between learning models and mathematical initial abilities in influencing understanding of mathematical concepts can be seen with two-way Anova as shown in the following table.

Table 4. Anova 2 DirectionsTest for Experiment Classand Control Class

Variable	Total Square	*Df*	*F*	Sig.
Learning Model	3237,458	1	38,324	0,000
KAM	24225,588	2	143,387	0,000
Model*KAM	80,229	2	**0,475**	**0,623**

Based on the table, it can be seen that the value of significance is greater than 0,05 or Fcount < Ftable (0,623 > 0, 05) thus it can be concluded that H0 is accepted, namely there is no interaction between the learning model and the initial ability in influencing students' understanding of mathematical concepts. Finally, to see whether there is interaction between school-level learning models in influencing understanding of mathematical concepts can be seen from the following graphic image. In accordance with the picture, it is discovered that there is no interaction between the school level and the learning model in influencing students' understanding of mathematical concepts. This can be seen from the absence of intersecting lines shown by the graph. In addition, the graph also shows that in terms of understanding mathematical concepts students who learn with the learning model of NHT in pilot schools (high level) are more effective than conventional learning in non-pilot schools (low level).

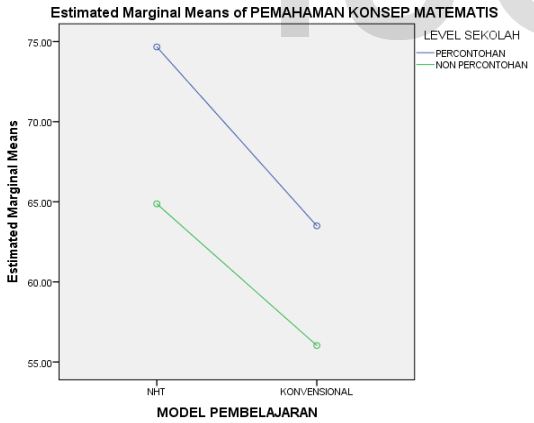

Figure 1.Understanding of Mathematical Concepts Students are reviewed from School Level and Learning Model.

Based on the data analysis has been done, it can be seen that the use of the NHT model is better than the conventional learning model in improving the understanding of mathematical concepts of Grade VIII students in SMP N Pekanbaru City.

4. CONCLUSION

Understanding of the mathematical concepts of students who learn with the learning model of NHT is higher rather than those who learn with conventional models in high and low level schools. In addition, understanding the mathematical concepts of capable students with initial high, medium and lowwho learn with the NHT learning model are also higher than those learning with conventional models. However, on the other hand, there is no interaction between learning models and initial abilities in influencing students' understanding of mathematical concepts aswell as the school level.

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