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The Influence of the Numbered Head Together Learning Model on Improving Students' Mathematical Concept Understanding Ability

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Abstract— The Numbered Heads Together (NHT) learning model is designed to provide opportunities for students to work collaboratively and support interpersonal interactions between students. A very important aspect in learning mathematics is understanding concepts. Understanding mathematical concepts is understanding mathematical concepts correctly, namely students can translate, interpret, and conclude a mathematical concept based on the formation of their own knowledge, not just memorizing. Understanding concepts, students in the learning process can develop their abilities, simple to complex problems can be solved by students by applying the concepts they have learned. One of the characteristics of students who are considered to understand a concept is students who are able to understand a concept and are able to explain it again using their own grammar. This type of research is a quasi-experimental with a pretest-posttest design with Simple Random Sampling. The sample in this study was 67 students in grades VII B and VII C. The hypothesis testing technique used the t-test (Independent Sample T-Test) with a significance level of 0.05. The results of data analysis and discussion that have been carried out, it can be concluded that the Numbered Heads Together (NHT) learning model has an influence in improving students' mathematical concept understanding abilities in the mathematics learning process.

Keywords— Numbered Head Together, Understanding Mathematical Concepts.

I. INTRODUCTION

Education is a medium that has an influence in determining the direction of a country's success. Mathematics is one of the subjects that plays an important role in the world of education. This is proven by the fact that all students need to be given mathematics subjects starting from elementary school. One of the fields of study that students must know is mathematics. The use of the right learning model can encourage students to enjoy the lesson and be able to achieve good learning objectives (Aunurrahman, 2013). The right learning model can make students more active and able to solve mathematical problems so that learning objectives can be achieved. One possible cause of the low achievement of Indonesian students in mathematics learning is the inappropriate learning model due to the mathematics learning process (Prahmana et, al.2017).

According to Spence (2003), there are several interventions that can be used to improve social skills and one of them is cooperative learning. Cooperative learning is an approach with group work access to minimize the occurrence of unpleasant situations but maximize learning experiences through satisfying results in working in a high-performance team. Johnson (2002) explains that in cooperative learning, students will benefit or benefit both academically and socially when students interact with each other to jointly complete learning objectives.

The use of cooperative learning in the classroom can create certain opportunities that are lacking when students learn competitively or individually. In cooperative learning, students will be involved in discussions that will expand and build students'

understanding of mathematical concepts. The cooperative learning model in practice is centered on students so that it can activate students' cognitive activities. Cooperative learning involves many activities, so that it can increase interaction between students. Cooperative learning involves many activities, such as communication, observation, and support. In addition, students change their learning behavior, stimulate their cognitive activities, and improve relationships between students (Otham et, al 2012). In addition, cooperative mathematics learning can provide a significant contribution to student achievement and attitudes. Cooperative learning has a significant effect on mathematics achievement and attitudes towards mathematics.

The learning model is a set of actions designed to support the learning process of students in teaching and learning activities. Learning is also a process consisting of a combination of two aspects, namely: learning is directed at what students should do, teaching is oriented to what teachers should do as teachers (Jihad, 2013). According to Hanaflah (2016) the learning model is closely related to the learning style of students (learning style) and the teaching style of teachers (teaching style), both of which are abbreviated as SOLAT (style of learning and teaching). The learning model has a very important role in learning Mathematics because it is able to involve each student to help efficiently in gaining knowledge. Of course, a teacher as a professional educator with the main task of educating, teaching, guiding, directing, training, assessing, and evaluating, students in formal educators, elementary educators and secondary educators, are required to be able to advance and apply it to the assessment method.

The cooperative learning model that can be applied in mathematics learning is the Numbered Heads Together (NHT) cooperative learning model. Numbered Heads Together (NHT) provides opportunities for students to convey their ideas and determine the correct answer. The use of Numbered Heads Together (NHT) can increase student activity, social skills, and cooperative skills while reducing disruptive behavior (Maheady L. & Hunter W. 2010). Numbered Heads Together NHT is based on four basic principles: (1) positive interdependence, (2) individual accountability, (3) equal participation, and (4) simultaneous interaction. NHT is designed to provide opportunities for students to work collaboratively and support interpersonal interactions between students. Numbered Heads Together (NHT) requires students to be divided into small heterogeneous groups that work collaboratively and provide support to improve their academic performance (Maheady et al., 2006). This learning model aims to encourage students to be more courageous in expressing other people's opinions, help students to interact more with their friends, activate students, and to make students more enjoyable in the learning process. So that it can make students follow the learning from the beginning very well and can increase students' interest in learning.

The learning model has a very important role in learning Mathematics because it is able to involve each student to help efficiently in gaining knowledge. Of course, a teacher as a professional educator with the main task of educating, teaching, guiding, directing, training, assessing, and evaluating, students in formal education, elementary education and secondary education, are required to be able to advance and apply it to the assessment method. The guided discovery learning model is an inquiry approach where the teacher guides students to carry out activities by giving initial questions and directing them to a discussion, the teacher has an active role in determining the problems and stages of their solution (Sanjaya, 2013).

Mathematical concept understanding is an important goal of mathematics learning. Concept understanding is the initial provision and an important step to influence or learn mathematics (Nudiya, 2019). A student who cannot explain a mathematical problem has at least two possibilities: first, the student does not understand the solution to the problem given so that the student cannot communicate it. Second, the student actually understands the solution to the mathematical problem but the student cannot communicate it well. So from this case, the first is that the student's mathematical understanding must be improved so that the student can communicate it well. The second is that students must develop mathematical connection skills so that students can communicate it correctly (Farida, 2015). A very important aspect in mathematics learning is conceptual understanding. Mathematical concept understanding is understanding mathematical concepts correctly, namely students can translate, interpret, and conclude a mathematical concept based on the formation of their own knowledge, not just memorizing. Understanding the concept, students in the learning process can develop their abilities, simple to complex problems can be solved by students by applying the concepts they have learned. Factors that influence students' low understanding of mathematical concepts are that students want to quickly complete procedures without understanding the concept (Machaba, F., 2019). This is what often happens, namely students assume that mathematical concepts are too difficult so they want a faster way without having to understand the concept.

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Factors that influence learning success, namely internal factors and external factors. One of the internal factors that influence learning success is student interest in learning. Interest is something or activity without anyone telling you but based on a sense of preference and interest. Interest has a big influence on learning, students will not learn as well as possible, if the material being studied is not in the interests of the students, because there is no attraction for it. Students who have an interest in a particular subject tend to pay more attention to the subject. Lack of student interest in learning makes students less focused on learning which results in low mathematical concept understanding abilities. Basically, students have different mathematical abilities, some have very high mathematical abilities and some have very low mathematical abilities so that students have difficulty answering daily test questions given by educators. In learning mathematics, students have difficulty understanding the lessons explained by the teacher so that many students only memorize the formulas without understanding the solution flow. Especially in the material, students do not understand the concept of the material but memorize how to solve the example questions given on the board. So, when given different questions, students experience difficulties.

Another problem was expressed by Bernard, et al. (2019) that students choose to memorize a mathematical concept rather than understand it. The impact is that students are unable to restate a mathematical concept in their own language, because they do not understand it. One of the characteristics of students who are considered to understand a concept is students who are able to understand a concept and are able to explain it again using their own grammar. Conceptual understanding is a cognitive ability that includes restating a concept using their own language, classifying an object in a concept and making examples or non-examples of a concept. There needs to be improvement in the learning process in the classroom, namely by using a learning model that involves and pleases students in the teaching process, and which can invite students to be active in learning in order to improve students' mathematical concept understanding abilities. Cooperative learning is a learning process that trains students to be able and willing to work together in groups to meet learning objectives by involving students in learning.

This study is supported by several studies related to the Numbered Heads Together (NHT) cooperative learning model, research on the Numbered Heads Together (NHT) learning model conducted by Ratna Dwi Herwiyanti et al. (2019) this study shows that the Numbered Heads Together (NHT) learning model can improve student learning achievement, the difference with this study is in the ability measured, namely the ability to understand mathematical concepts. Another study conducted by Dwi Indart et al., (2017) showed that mathematics learning using the Numbered Head Together (NHT) learning model with a scientific approach improves students' mathematics learning achievement compared to direct learning models, especially in learning rectangular objects. The difference with this study lies in the ability measured and the approach, namely using a scientific approach. While other studies conducted by Shemae M. De Vera. (2021) showed that the application of Numbered Heads Together (NHT) can improve student performance. The difference with this study is that the ability measured in this study is student performance while this study is the ability to understand mathematical concepts.

II. RESEARCH METHODOLOGY

This type of research is a quasi-experimental with a pretest-posttest design with Simple Random Sampling. This research was conducted in the even semester at a Junior High School in Yogyakarta that was accredited A using the Merdeka curriculum. The population in this study were 68 students in grades VII B and VII C. There are two variables in this study, namely the independent variable is the Numbered Heads Together (NHT) learning model in the mathematics learning process with the symbol (X) and the dependent variable in this study is the ability to understand mathematical concepts, which is symbolized (Y). The experimental class was given treatment in the form of the Numbered Heads Together (NHT) learning model while the control class used a conventional learning model. Before the learning activities were carried out, both students in the experimental class and the control class were given a Pretest and after the learning activities were given a test to determine students' understanding of mathematical concepts by giving a Posttest to students.

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III. RESULTS AND DISCUSSION

A. RESULTS

The results of the instrument trial analysis that have been obtained in this study are tests of mathematical concept understanding abilities, the results of the instrument trial on mathematical concept understanding abilities using 2 essay questions with flat shape material with a total of 34 students, to obtain good trial data with that we can find out the characteristics of each question item which includes the validity test and the reliability test of the instrument.

The validity test on the mathematical concept understanding ability test in this study uses the help of the Microsoft Excel application to determine whether the mathematical concept understanding ability test instrument is valid or not, which can be seen using the following criteria:

1. 1. If the value of $R_{Count} > R_{Table}$ = Valid
2. 2. If the value of $R_{Count} < R_{Table}$ = Invalid

The validity test in this study used the Product Moment correlation using a significance level of 0.05%. The results of the validity test of the mathematical concept understanding test items can be seen in the table below.

Table 1. Results of the Validity Test of Test Questions

Question Number	R_{Count}	R_{Count}	Criteria
1	0,926	0,339	Valid
2	0,915	0,339	Valid

Based on the results of the table above, it can be seen that the RCount value is greater than RTable with N = 34 at a significance level of 0.05%. So it can be concluded that the results of the validity test of the question items from the 2 essay questions that were tested were declared valid because the $R_{Count\ value} > R_{Table}$ or 0.926 > 0.339.

The reliability test in this study uses the results of calculations from 2 trial questions of the mathematical concept understanding ability test to determine whether the instrument is reliable or not, then it can be seen from the Crombach alpha value > 0.70 then the data can be stated as reliable, more details can be seen in the table below.

Table 2. Reliability Test Results

Usage Criteria		
Reference	**Cronbach Alpha Value**	**Conclusion**
> 0,70	0,820	Reliabel

Based on the table above, it can be seen that the test instrument for students' mathematical concept understanding ability is said to be reliable because the Crombach Alpha value is 0.820 > 0.70, so it can be concluded that the test instrument is consistent in measuring samples and can be used to obtain data on students' mathematical concept understanding ability or it can also be said that the instrument data is reliable.

After conducting an analysis of the instrument trial on students' mathematical concept understanding abilities, it was continued with hypothesis testing. However, before conducting a hypothesis test, a prerequisite test was first carried out, namely a normality test and a homogeneity test. Before the learning process took place in both classes, a pretest was held to collect initial data. Initial data was collected from the experimental class and the control class and after the final data was collected, a normality test and a homogeneity test could be carried out. After the normality and homogeneity tests were met, it was continued with a hypothesis test

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using the Independent sample T test to determine whether there was an effect of the Numbered Head Together (NHT) learning model on improving students' mathematical concept understanding abilities. The normality test in this study used Kolmogorov Smirnov with the help of SPSS 25 which can be presented in the following table.

Table 3. Normality Test

Data	Class	Kolmogrov-Smirnov	*Sig.*	Decision
Pretest	Eksperimen	0,188	0,05	Normal
	Kontrol	0,064	0,05	Normal
Posttest	Eksperimen	0,074	0,05	Normal
	Kontrol	0,200	0,05	Normal

Based on the table above, it can be seen that in the pretest normality test data, the ability to understand mathematical concepts in each class, namely in the experimental class, shows a Kolmogorov Smirnov value > Sig. or 0.188 > 0.05 and in the control class shows a Kolmogorov Smirnov value > sig. or 0.064 > 0.05. While in the posttest data, the ability to understand mathematical concepts in each class, namely in the experimental class, obtained a Kolmogorov Smirnov value of 0.074 and in the control class obtained a Kolmogorov Smirnov value of 0.200. So it can be concluded that the pretest data and posttest data in each class are greater than the significance value of 0.05, so it is said that the data is normally distributed.

The second prerequisite test is the homogeneity test. The homogeneity test is carried out together using Levene's Test with the help of the SPSS 25.0 windows application program. This homogeneity test is carried out to determine whether the samples have different or the same characteristics. A summary of the results of the homogeneity test of the mathematical concept understanding pretest is in the following table.

Table 4. Homogeneity Test Results

Data	*Sig.*	Decision
Pretest	0,296	Homogen
Posttest	0,296	Homogen

Based on the calculation results of the mathematical concept understanding ability data in table 4. Above, it was obtained in the homogeneity test data. The pretest above obtained a sig. value of 0.296. Judging from the significance level value that exceeds , it can be concluded that in the pretest data, the mathematical concept understanding ability is distributed homogeneously. While in the posttest data, the mathematical concept understanding ability obtained a sig. value of 0.296 which exceeds the value, it can be concluded that both data are distributed homogeneously.

After the prerequisite test is carried out, a hypothesis test is carried out. The hypothesis test in this study uses an independent sample T test using the help of the IBM SPSS 25.0 application. The formulation of the hypothesis from the test results on this variable is as follows.

H_0 = There is No Influence of the Numbered Heads Together (NHT) Learning Model on Improving Students' Mathematical Concept Understanding Ability.

H_1 = There is an Influence of the Numbered Heads Together (NHT) Learning Model to Improve Students' Mathematical Concept Understanding Ability.

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The criteria for hypothesis testing in this study are if the sig.(2-tailed) T-test value < 0.05 or if $T_{count} < T_{table}$ then H1 is accepted, while if the sig.(2-tailed) T-test value > 0.05 then H_1 is rejected. The results of the independent sample T-test hypothesis testing can be seen in full as follows.

Table 5. Hypothesis Testing

Independent Samples Test			
Data	**F**	**t**	**Sig. (2-tailed)**
Posttest	1.423	3.110	0,03

Based on the table above, it can be seen that the results of the Independent Sample T-test hypothesis test obtained a sig. (2-tailed) value of 0.03 < sig. 0.05. So it can be concluded that the Independent Sample T-test hypothesis test has an effect on the Numbered Heads Together (NHT) learning model to improve students' mathematical concept understanding abilities.

B. DISCUSSIONS

To see which learning model provides a significant increase in students' mathematical concept understanding ability, an independent sample T-test was conducted using the SPSS 25.0 Windows application.

The results of the independent sample T-test calculation obtained a sig. (2-tailed) value of 0.03 <. So H_0 is rejected, meaning that there is a significant increase in the ability to understand mathematical concepts using the Numbered Heads Together (NHT) learning model. Based on the average results, it can be concluded that the Numbered Heads Together (NHT) learning model is better than the scientific learning model. This is because the class that was given this treatment looked very active, and students felt more interested and enthusiastic during the learning process. Judging from the results of the test, students' mathematical concept understanding ability has also been seen to be very significant where the class that uses the Numbered Heads Together (NHT) learning model has a very high and maximum value, while the class that uses the scientific learning model or scientific approach has a high mathematical concept understanding ability test score but is not yet optimal. The following are the results of the test of students' mathematical concept understanding ability.

Figure 1. Experimental Class Test Results

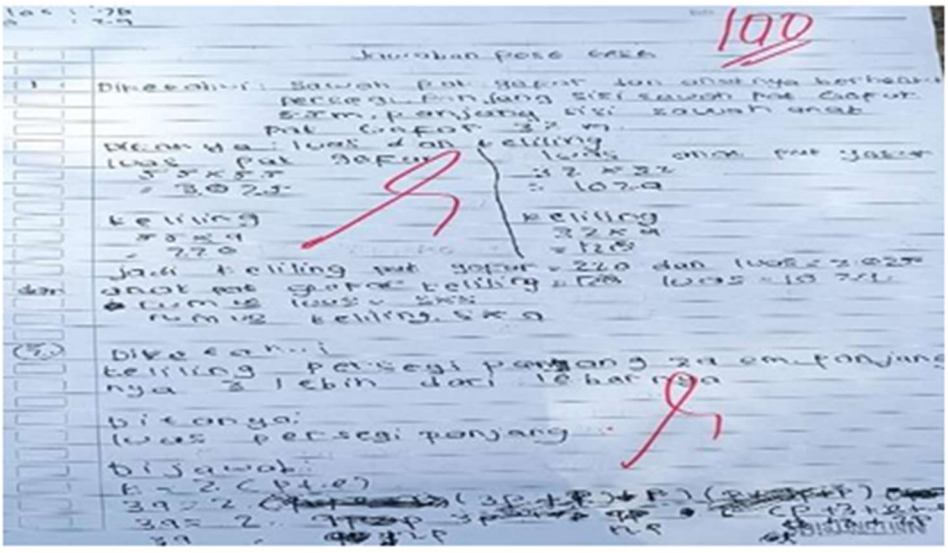

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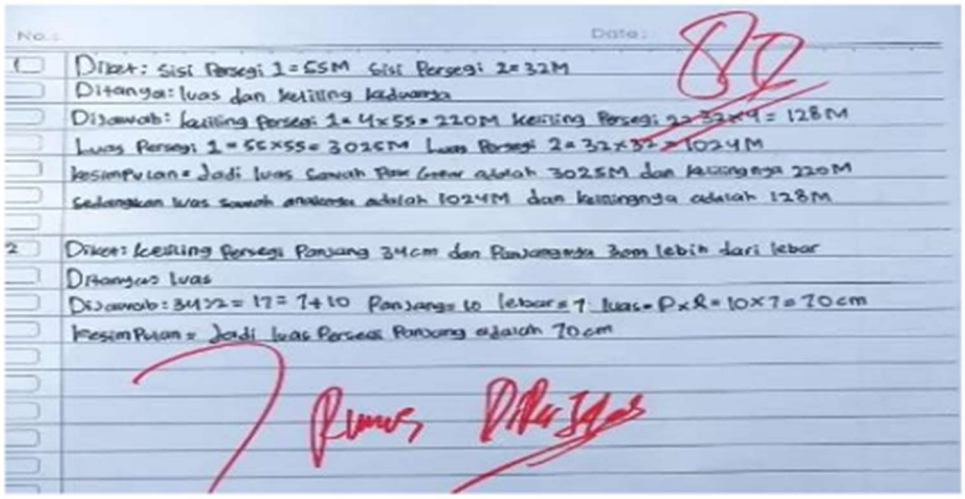
Figure 2. Control Class Test Results



This is in line with Spenser Kagan's opinion about the advantages of the Numbered Heads Together (NHT) learning model, namely: The Numbered Heads Together (NHT) learning model (1) Can foster student learning outcomes, (2) Can deepen students' understanding of concepts, (3) Makes students happy in learning, (4) Develops students' positive attitudes and leadership attitudes, (5) Develops students' curiosity, (6) Develops a sense of belonging, and (7) Increases students' self-confidence. The Numbered Heads Together (NHT) learning model can provide better results than scientific learning, because in the research of Eka Rahmawati and Yesi Gusmaina, it was stated that students' mathematical concept understanding abilities in experimental classes using the Numbered Heads Together (NHT) learning model were higher compared to the scientific learning model.

Research conducted by Sonni states that there are supporting factors in understanding mathematical concepts using the Numbered Heads Together (NHT) learning model, including: (1) students become more enthusiastic because learning is in the form of group discussions. During the learning process, students are motivated to understand the learning material presented by the teacher who will later be given questions to discuss, (2) students who become group representatives or head numbers appointed by the teacher to provide answers and present them in front of the class and each group member must know and understand the answers to be presented, then representatives of other groups with other head numbers will provide answers or present their answers as well. If there is a wrong or inappropriate answer, the teacher will direct and provide input or the correct answer, (3) students' understanding of mathematical concepts will increase in a relatively short time, because students try to answer every question given, (4) students can socialize with other people, both in their own group or with other groups.

IV. CONCLUSIONS AND RECOMENDATIONS

A. CONCLUSIONS

Based on the results of data analysis and hypothesis testing that have been carried out, it can be concluded that there is an influence of the Numbered Heads Together (NHT) learning model to improve students' mathematical concept understanding abilities which is better than the scientific learning model.

B. RECOMMENDATIONS

The suggestions that the author provides in this research are as follows:

1. Teacher

   The Numbered Heads Together (NHT) learning model is an alternative choice that must be used so that students are more active and enthusiastic in the learning process so that students' ability to understand mathematical concepts can be even better.

2. Student

   It is better if students do not have to feel inferior, doubtful and not afraid to try to express opinions during the learning process in solving mathematics problems.

3. School

   Able to inform mathematics subject teachers about the learning model that researchers use.

4. Researcher

   It is hoped that future researchers will be more creative and innovative in using the Numbered Heads Together (NHT) learning model and hopefully other researchers can continue this research with broader research and what is being researched can provide ideas and benefits for educators in general.

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