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# Students' Mathematical Communication Ability In View From The Numbered Heads Together (NHT) Cooperative Learning Model Using The Open Ended Approach

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**Abstract :** Problem learning mathematics at MTs NW Karang Bata is that it still uses a conventional learning model where the teacher tells more stories and talks in informing all the facts and concepts of a lesson, the low motivation and mathematical communication of students is caused by the learning techniques used by the teacher because it does not facilitate students more active in accepting the material presented by the teacher, in this case it affects students' mathematical communication abilities, to overcome this problem the Numbered Heads Together (NHT) cooperative learning model with the Open Ended approach is used. The purpose of this study was to find out the effect of the Numbered Heads Together (NHT) cooperative learning model with an open ended approach on students' mathematical communication skills. This research is an experimental research with a post-test only control group design, which aims to determine the cooperative learning model of the Numbered Heads Together (NHT) type with the Open Ended approach to the mathematical communication skills of class VIII students at MTs NW Karang Bata with a total of 38 students. sampling using random cluster technique, with VIIIA as the experimental class and class VIIIB as the control class. The independent variable in this study is the Numbered Heads Together (NHT) cooperative learning model with the Open Ended approach and the dependent variable is students' mathematical communication skills. Data on student learning outcomes were analyzed using the Polled Variance t test. At a significant level of 5% and obtained T count > T table = t2.543 > t1.690, then accepted and rejected. From the results of the analysis it can be concluded that there is an influence of the Numbered Heads Together (NHT) type cooperative learning model with the Open Ended approach to the mathematical communication skills of class VIII students of MTs.

**Keywords :** Mathematical communication skills, Model (NHT), Open Ended Approach.

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## INTRODUCTION

Mathematics is a tool for developing logical thinking and being able to explain concepts scientifically. Mathematics is very necessary in everyday life. Therefore, mathematics is one of the important sciences to be taught in schools (Masdewani lubis, Eva Yanti Siregar, 2020). In learning mathematics at school basically aims to have all mathematical abilities to achieve optimal learning results, and these abilities can be used to solve problems in everyday life (Mega & Subhanadri, 2019). As stated in Permendiknas No. 22 of 2006 concerning Content Standards, states that the purpose of learning mathematics is for students to be able to: (1) understand mathematical concepts; (2) using reasoning on patterns and characteristics; (3) solving math problems; (4) communicating ideas with symbols, tables, diagrams, or other media to clarify conditions or problems; (5) have an attitude of appreciating the usefulness of mathematics in life. In developing communication skills, people can convey information in mathematical language, for example presenting problems or problems to students in mathematical models in the form of diagrams, mathematical equations, graphs, or el tables . Communicating ideas with language mathematics is actually more practical, systematic, and efficient (Dewi et al., 2016).

Therefore, the ability to communicate is needed. Communication skills which are one of the goals of learning mathematics are very important and need to be improved in learning mathematics (Sutisna & Nanang, 2013). The importance of mathematical communication can help a person's way of thinking, as a tool to assess understanding, help organize mathematical knowledge, build mathematical knowledge, improve mathematical problem solving abilities, advance reasoning, build self-ability, improve social skills, and be useful in establishing a mathematical community (Yanti, 2018). Facts on the ground show that students' mathematical communication skills are still relatively low. This can be known based on interviews conducted by researchers with mathematics teachers at MTs NW Karang Bata. From interviews, the authors obtained information that students' mathematical communication skills were still far from what was expected, things that indicated that students' mathematical communication skills were low, namely: 1) Students lack confidence and are hesitant in communicating ideas and answer when asked by the teacher. 2) Students are still confused about how to solve problems when presented in the form of word problems, they have difficulty making mathematical models of these questions. 3) Learning process still teacher centered.

Realizing this fact, we need a learning model that is able to provide stimulation to students to be more active. One of the learning models that can improve students' mathematical

communication skills is the Numbered Heads Together (NHT) cooperative learning model. This is proven based on research conducted by Rabiyatul Adawiyah Siregar, et al., it was found that there was a significant influence between the use of the NHT type cooperative learning model on the mathematical communication abilities of students in class XI SMA Negeri 1 Angkola Selatan with the average value obtained in the control class being of 1.86 with a median of 2.00 and a mode of 1.00. Then the average obtained in the experimental class was 2.78 with a median of 2.00 and a mode of 2.00. It is proved that the significant value is 0.666 > 0.05, which means that the enforced hypothesis is accepted. Thus, the defender model NHT type cooperative learning can be used as an alternative to improve the learning process and improve students' mathematical abilities, especially students' mathematical communication abilities. The Numbered Heads Together (NHT) cooperative learning model is a learning model that divides students into several groups which provide opportunities for members to share ideas with each other. solve problems given by the teacher about related material and consider the most appropriate answer.

The advantage of this learning is that it deepens students' understanding and is able to improve student learning achievement (Widyastuti, 2016). In the learning process using the Numbered Heads Together (NHT) cooperative learning model, each student is given a number to communicate his own ideas and each student has equal opportunity to communicate his ideas. Another thing that must be considered in learning mathematics is the approach used, so that learning can help students to obtain the expected goals. One approach that can fulfill the objectives of learning mathematics is the Open Ended approach (Widyasari, 2020) . The Open Ended approach is an approach that can direct students to solve problems with various strategies based on previous learning experiences. The main purpose of students being given Open Ended problems is not only to get answers but how students arrive at these answers (Lusiyana et al., 2017). The Open Ended approach can provide opportunities for students to acquire knowledge, discover, recognize, and solve problems with several techniques, so that students' mathematical thinking skills can develop optimally and at the same time the creative activities of each student are communicated through the learning process (Azizah, 2016).

The Open Ended approach to the implementation of the Number Head Together learning model means that the teacher gives questions to students. Through these questions students are required to work on questions using two or more ways. The application of the Number Head Together learning model with the Open Ended approach can foster students' mathematical communication skills in student learning trying to solve problems faced and trying to exchange

ideas or thoughts with group members (Widyastuti, 2016). from the results of research conducted by (Putra, 2021) regarding the implementation of cooperative learning models with the approach open ended learning to improve learning outcomes mathematics of class iii students of SD Negeri 110 Pekanbaru shows that the use of cooperative learning models with an open ended learning approach can improve student learning outcomes in mathematics. (Permana, 2016) As for this study, it focuses on students' mathematical communication ability in view from the application of the numbered heads together (NHT) cooperative learning model using the open ended approach.

Based on the results of a preliminary study conducted in class X public high schools in the city of Mataram, with a total of 9 classes consisting of 3 experimental classes I, 3 experimental classes II, and 3 control classes. from the research results show that: 1). student achievement using the NHT learning model with an open ended approach is better than student achievement using the NHT model and conventional models. 2). students with the type of climbers and types of campres have the same learning achievement, students of the type of campers and types of quitters have the same learning achievement and students of the climbers type have better learning achievement than the quitters type. 3). for each type of AQ (climbers, campers, and quitters), using the NHT learning model with an open ended approach results in better learning achievement than NHT or conventional (Azizah, 2013). So that in this case the researcher is interested in conducting research with the title: The Effect of the Number Head Together (NHT) Cooperative Learning Model with the Open Ended Approach on Students' Mathematical Abilities.

## RESEARCH METHODS

The type of research used in this research is quasi-experimental (quasi-experimental), namely research conducted to determine the consequences of a treatment given intentionally by the researcher. The design used in this study is the Post-test Only Control Group Design. This design has a control class, but does not fully function to control the variables that affect the implementation of the experiment (Ayu et al., 2013). In this design the two classes were not given a pre-test, the experimental group in this study was treated using the Numbered Heads Together (NHT) cooperative learning model with the Open Ended (X) approach, while the control group was treated using the traditional method or also called the lecture method (conventional). Both groups were given the test as a final test. Final test for the experimental class (O1) and final test for the control class (O2). The results of the final test were analyzed to

see whether the Numbered Heads Together (NHT) type cooperative learning model with the Open Ended approach had more influence on students' mathematical communication skills from the treatment given, the research design can be seen in Table 1.

Table 1. Post-Test Treatment Only Control Group Design

| Class | treat | Posttest |
|---|---|---|
| Experiment | X | $O_1$ |
| Control | | $O_2$ |

This research was conducted on class VIII students of MTs NW Karang Bata totaling 36 students. The samples in this study were 2 classes consisting of an experimental class and a control class, namely class VIII A and class VIII B. Data collection techniques were carried out by researchers to obtain and collect 49 data or information in the most relevant way to the problem. appointed and can be held responsible for the data. The data collection techniques used in the research include: (1) Tests; The test as a data collection instrument is a series of questions or exercises used to measure knowledge, intelligence, abilities or talents possessed by individuals or groups. The test instrument used was an instrument of students' mathematical communication abilities in the form of a description of the circle material which was compiled based on the concept of students' mathematical communication ability tests that met the indicators of mathematical communication abilities, namely drawing, making mathematical expressions, and writing answers with own language (written text). The test is carried out after carrying out the learning process, namely at the end of the learning process (posttest). (2) Observation; observation is used to determine the implementation of learning during the learning process takes place. This method is carried out during processing teaching and learning takes place with the aim of observing the strengths and weaknesses.

## RESULTS AND DISCUSSION

The research was conducted on July 24 to August 24, 20 21 at MTs NW Karang Bata. Study lasts for a month as long as the researcher gets permission from the school. At the time of the study, researchers were given full opportunity during the first to last class hours. The research was conducted in four meetings, two meetings using the Numbered Heads Together (NHT) type cooperative learning model with an Open Ended approach in the experimental class with number pattern material with 20 students and two subsequent meetings in the control class without using a learning model. cooperative type Numbered Heads Together (NHT) with an Open Ended approach with number pattern material with 16 students. And then in the last

meeting, namely giving a post test to measure students' mathematical communication skills after being given treatment.

In the experimental class, students were given treatment with specified learning steps, namely at the beginning of the learning process, students were given a problem to solve. Students look more enthusiastic and active in finding solutions to the problems that have been given. In the learning process, students are divided into several groups consisting of 3-5 people who are required to work together to find the best solution to the problems given. Likewise the control class which was given treatment using conventional methods also ran smoothly as it should. The learning process is focused on delivering material delivered by researchers and students are given exercises that must be completed and guided and directed by researchers who deliver material, and at the end of the meeting the researchers provide assignments that must be done at home by students. The pre-research data from the results of the odd semester students in class VIII A as the experimental class and VIII B as the control class at MTs can be seen in table 2 follows.

Table 2. Exposure to Pre-Research Data from the Results of Odd Semester Examinations for Experiment Class and Control Class MTs NW Karang Bat a

| NO | Data | Experiment | Control |
|---|---|---|---|
| 1 | Total value | 1563 | 1200 |
| 2 | Lots of data | 20 | 16 |
| 3 | Minimum data | 65 | 65 |
| 4 | Maximum data | 84 | 84 |
| 5 | Average (Mean) | 78.15 | 75 |
| 6 | Standard deviation | 4.91534 | 6.33246 |
| 7 | Variance | 24.1605 | 40,1 |

From the results of the mathematical ability test given to students of the experimental class and control class obtained data on the test scores of students who were given treatment and without treatment, in this case it can be seen in Table 3 following.

Table 3. Data on Mathematical Communication Ability Test Results for Experiment Class and Control Class

| NO | Data | Experiment | Control |
|---|---|---|---|
| 1 | Total value | 1625 | 1202.5 |
| 2 | Lots of data | 20 | 16 |
| 3 | Minimum data | 75 | 65 |
| 4 | Maximum data | 87.5 | 87.5 |
| 5 | Average (Mean) | 81.25 | 75.1563 |
| 6 | Standard deviation | 7.09429 | 6.67512 |
| 7 | Variance | 50.3289 | 44.5573 |

In the experimental class for the semester exam results it was found that the lowest score was 65 and the highest score was 84 with an average of 78.15, while for the control class for the semester exam results the lowest score was 65 and the highest score was 84 with an average of 75. So the difference between the control class and the experimental class is 3.15. The average value is obtained from the total score obtained divided by the number of samples for each group.

In the normality test the researcher uses Excel calculations. The normality test used in this research data is the chi square technique ( $\chi^2$ ). In the experimental class for the semester exam results it is known that the lowest score is 65 and the highest score is 84 with an average of 78.15, the standard deviation is 4.91534 and the variance is 24.1605. Based on the degrees of freedom (dk) = 3. The significant level is 0.05 = 7.82 and $\chi^2$ counts are obtained = $\chi^2$ 7.3004 with the test criteria is If $\chi^2$ counts < $\chi^2$ tables , so the data is normally distributed. In other circumstances, the data is not normally distributed. From the analysis it can be concluded that $\chi^2$ count < $\chi^2$ table = $\chi^2$ 7.3004 < $\chi^2$ 7, 82 the data is normally distributed. Test for normality of control class math test results In the experimental class for the semester exam results it is known that it is 65 and the highest score is 84 with an average of 75, the standard deviation is 6.33246 and the variance is 40.1. Based on the degrees of freedom (dk) = 2. The significant level is 0.05 = 5.99 and it is obtained $\chi^2$ counts = $\chi^2$ 2.0863 with the test criteria being If $\chi^2$ counts < $\chi^2$ tables then the data is normally distributed. In other circumstances, the data is not normally distributed .

In the experimental class for the semester exam results it is known that it is 65 and the highest score is 84 with an average of 75, the standard deviation is 6.33246 and the variance is 40.1. Based on the degrees of freedom (dk) = 2. The significant level is 0.05 = 5.99 and it is obtained $\chi^2$ counts = $\chi^2$ 2.0863 with the test criteria being If $\chi^2$ counts < $\chi^2$ tables , the data is normally distributed. In other circumstances, the data is not normally distributed. Based on the test decision it can be concluded that $\chi^2$ count < $\chi^2$ tables = $\chi^2$ 2.0863 < $\chi^2$ 5.99 then the data is normally distributed .

The homogeneity test aims to determine whether the sample is homogeneous or not, with the tester's criteria being to reject Ha if F count < F table and accept Ha if F count < F table . Based on the results of the semester exam scores for the experimental class and the control group, ¯is obtained and for the experimental class while for the control class¯and . The hypothesis to be tested at significant rates, for F count = 1.6597 and F table = 2.345. Based on the results of the data analysis above, it is obtained F count < F table = F 1.6597 < F 2.345 , it can be concluded that the sample variance is homogeneous .

After testing the homogeneity of variance, the sample in this study is homogeneous, then a t-test will be carried out using the Polled Variance formula. From the results of previous calculations obtained the mean, standard deviation and standard deviation for each. Known $n_1 = 20$ , $n_2 = 16$, $x_1 = 78.15$, $x_2 = 75$, $S^2_1 = 24, 1605$ $S^2_1 = 40.1$ obtained $t_{count} = 1.776$ and $t_{table} = 1.690$. Based on the results of calculations using the t test shows that $t_{count} < t_{table}$ or $1.776 < 1.690$, it can be concluded that $H_0$ is rejected and $Ha_{is}$ accepted.

Before carrying out the t test, the data obtained during the study will be examined using Experimental class normality test date. The data normality test is a prerequisite test before knowing what type of statistics to use, whether parametric statistics or non-parametric statistics. The normality test of learning test results uses Application of Numbered Heads Together (NHT) Cooperative Learning Model using Open Ended for Students Mathematical Communication Ability. The results of the normality test can be seen in Table 4 following.

Table 4. Normality Test in Experimental Class and Control Class

| Kartrikstik | Experiment Class | Control Class | Conclusion |
|---|---|---|---|
| $X^2_{count}$ | 6,287 | 2,505 | Normal distribution |
| $X^2_{table}$ | 7,82 | 5.99 | $X^2_{count} < X^2_{table}$ |
| Significance Level ( α ) | 5% | | |

Based on table above normality test in the experimental class obtained $X^2_{count} = 6.287$ and the value of $X^2_{tables}$ at a significant level of 5% and dk = many classes -3 = 6 – 3 = 3 is $X^2_{tables\ (0.05;\ 3)} = 7.82$. Because $X^2_{counts} < X^2_{tables}$ , the learning data using the Numbered Heads Together (NHT) type cooperative learning model with an Open Ended Approach to Students' Mathematical Communication Ability in the matter of number patterns in the experimental class is declared normal. While the normality test in the control class based on the table above obtained $X^2_{count} = 2.505$ and the value of $X^2_{tables}$ at a significant level of 5% and dk = many classes is -3 = 5 – 3 = 2 is $X^2_{tables\ (0.05;\ 2)} = 5.99$. Because $X^2_{counts} < X^2_{tables}$ , the mathematics learning data without using the Numbered Heads Together (NHT) cooperative learning model with the Open Ended Approach to Mathematical Communication Ability of students in the control class is declared to be normally distributed.

Homogeneity test is used to prove two homogeneous samples. Test the homogeneity of student learning outcomes data using the F test .

$$F = \frac{Varians\ terbesar}{varians\ terkecil}$$

$$F = \frac{50,3289}{44,5573} = 1.129$$

Table 5. Homogeneity Test in Experimental Class and Control Class

| **Kartrikstik** | **Experiment Class / Control Class** | **Conclusion** |
|---|---|---|
| *S* F $_{count}$ | 1.129 | Normal |
| F $_{table}$ | 2,345 | distribution |
| Significance | 5% | $X^2_{count} < X^2_{table}$ |
| Level ( α ) | | 5.99 |

Based on the calculation results in the table above, both experimental and control class data at a significant level of 5% show F $_{count\ data}$ (1.129) < F $_{tabe}$ (2.345) means that the sample has a homogeneous variant.

Based on the prerequisite tests that have been carried out, the pooled variant formula will be used. This test is carried out to find out whether the provisional assumptions or temporary answers formulated in the research hypothesis are rejected or accepted. For more details, the results of the hypothesis test calculations can be seen in table 6 following.

Table 6. t Test on Experimental Class and Control Class l

| Characteristics | | | Ha |
|---|---|---|---|
| T $_{count}$ | T $_{table}$ | Interpretation | accepted |
| 2,543 | 1,690 | T $_{count}$ < T $_{table}$ | |

From the results above the results of the analysis of the Pooled Variant t-test test show that the T $_{count}$ obtained for the experimental class and control class learning test value data is 2.543, the T $_{count}$ is then converted to the value of T $_{table}$ = T $_{(0.05,34)}$ = 1.690 . With the provision that if T $_{count}$ < T $_{table}$ then the hypothesis Ha $_{is}$ rejected and H $_0$ is accepted and if T $_{count}$ < T $_{table}$ then the hypothesis Ha $_{is}$ rejected and H $_0$ is accepted with a significant level ( α ) of 5%. This shows $_{that}$ Tcount $_{<}$ Ttable or T $_{2.543}$ < T $_{1.690}$ , it can be concluded that the hypothesis H $_a$ accepted and H $_0$ rejected, this means that the model cooperative learning type Numbered Heads Together (NHT) with the Open Ended approach has an effect on the mathematical communication skills of class VIII students of MTs NW Karang Bata

Data collection techniques used in this study were tests and observations. Likewise, the tests used have been validated and said to be valid by the validator before being submitted to students. The number of questions given is in the form of essay questions or descriptions of 5 questions. Before carrying out the analysis using the t-test or hypothesis testing, the researcher first conducted a prerequisite test. The prerequisite tests carried out in this study were normality and homogeneity tests. The normality test was carried out to find out whether the data is normal or not. While the homogeneity test is carried out to find out the data is in the form of homogeneous data homogeneous or not. The normality and homogeneity tests were taken from

the data on student learning posttest results. To test the normality and homogeneity of the data, the researchers used manually and Excel. Where, the results obtained using the manual method or Excel data are normally distributed and homogeneous.

After the normality test was carried out, the data were normally distributed and the homogeneity test was also carried out, the data was homogeneous. So the next step is that the researcher tests the hypothesis. And based on the results of the student posttest data hypothesis test conducted with dk = n1 + n2 – 2 = 20 + 16 – 2 = 34, and with an error or significance level of 5%, then T table = 1.690 and T count = 2.543 , $_{it}$ can be $_{seen}$ that $T_{count} = 2.543 > T_{table} = 1.690$ so that the alternative hypothesis or Ha in this study is accepted and Ho is rejected. This means that there is or there is an influence of the Numbered Heads Together (NHT) cooperative learning model with the Open Ended approach on students' mathematical communication abilities. This research is in line with the research conducted by Eva Novia Sutisna, et al, with the title of the effect of the NHT learning model on students' mathematical communication skills in 2013. 45 Furthermore, it is in line with the research found by Eka Nur Azizah, et al, with the title the effectiveness of the NHT cooperative learning model with the Open Ended approach to learning mathematics in terms of the IQ of state students in the city of Mataram 2011 (Azizah, 2016).

The combination of the NHT learning model with the Open Ended approach is considered to be able to minimize the weaknesses of NHT, this is because the Open Ended approach is a learning approach that presents a problem that has more than one correct method or solution and can provide opportunities for students to gain knowledge/experience discovering , recognize, solve problems with several techniques. One of the advantages of the Open Ended approach is that students with low abilities can react to problems in several ways in their own way so that by combining the NHT learning model with the Open Ended approach, low ability students solve problems in discussions in several ways with their own way. themselves, so as not to cause inferiority and passivity during the discussion.

This shows that the mathematical communication skills of students who are taught using the Numbered Heads Together (NHT) cooperative learning model with the Open Ended approach are better than students who are taught by conventional learning. By using the Numbered Heads Together (NHT) cooperative learning model with the Open Ended approach students are more motivated to learn and solve the math problems they face. The conclusion drawn from the description above is that the use of the Numbered Heads Together (NHT) type cooperative learning model with the Open Ended approach can have a positive influence on

students' mathematical communication abilities, because it can influence the creation of self-enthusiasm for learning, training in mutual cooperation and being able to express mathematical ideas in ongoing learning, as well as the impact of the NHT model with the Open Ended approach is an increase in mathematical communication skills and learning outcomes increase from before. Thus, it shows that in general mathematics learning using the Numbered Heads Together (NHT) type cooperative learning model with the Open Ended approach effect on the mathematical communication skills of class VIII students of MTs NW Karang Bata.

## CONCLUSION

Based on the results of research and discussion, it can be concluded that there is the influence of the cooperative learning model of the Numbered Heads Together (NHT) type with the Open Ended approach to the mathematical communication skills of class VIII students of MTs NW Karang Bata. This can be proven through t- test Polled Variant data analysis obtained the value of $T_{count} = 2.534$ greater than $T_{table} = 1.690$ in the experimental class, this means that the mathematical communication skills of students who were treated (experimental class) were better than the learning outcomes of students who were not given treatment (control class).

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