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# The Numbered Heads Together Type Cooperative Learning Model on Students' Understanding of Mathematical Concepts in Grade VIII Mts Negeri 1 Polewali Mandar

Muh. Jamil Barambangi[1], Ade Irma Sari[1] and Herna[1]

[1] Mathematics Education Study Program, Faculty of Teacher Training and Education, University of West Sulawesi

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**Author for correspondence:**
Ade Irma Sari
e-mail: sariadeirma76@gmail.com

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**Abstract-** Learning mathematics at school often present difficulty for students, in particular in understand draft material straight line equation. Students tend experience difficulty in understand gradient, error in determine point cut and not capable drawing graphics, especially if the learning process No support. In case This found p use of learning models in schools the Still not enough diverse. Teachers are more often using a learning model conventional with the teacher playing a role as center information. For overcome problem This requires more learning models active and innovative in increase understanding draft mathematics students. The purpose of the study is for now effectiveness of learning models cooperative type Numbered Heads Together (NHT) in increase understanding draft mathematics students on the material straight line equation. Instrument study in study This There is three that is, test understanding draft mathematics, sheets observation implementation learning and questionnaires response students. Data analysis was carried out use analysis descriptive and analytical inferential. Analysis results descriptive show that learning model Numbered Heads Together supports in increase ability understanding draft students and create a learning process more interactive and not monotonous. This study conclude that use of learning media Numbered Heads Together can increase understanding draft student so that impact good on results Study mathematics student.

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## 1. Introduction

Education is business conscious and planned for develop potential students to have intelligence, skills, and good character as listed in Constitution Number 20 of 2003 concerning National Education System. According to Rahman et al. (2022) education it is said as a learning process that students get For can make it understand, understand, and more mature as well as capable make student more critical in think. One of the eye core lessons in very good education influential to development ability thinking and logical student is Mathematics.

Mathematics is one of the eye core lessons in curriculum education plays a role important in development ability think logical and analytical (Marly, et al., 2023). Mathematics can develop pattern think students and use it in life daily for increase source Power the human being, so that make mathematics as one of the eye core lessons in system education. However, in practice learning, mathematics often considered difficult for students Because nature abstract and requires understanding strong concept (John 2020).

The results of the Programme for International Student Assessment (PISA) 2022 show ability mathematics Indonesian students still low, ranked 68th with average score 366, far below the OECD average of 472 points (OECD, 2024). Based on results Ayu et al (2021) research on mathematics considered difficult Because student difficulty understand concept, difficulty in skills counting and difficulties in solve problem. This is show low ability think students, including in matter understanding draft.

Understanding draft is one of the objective important in learning mathematics Because become base for finish problems and develop ability think level high (Radiusman, 2020). Students who have understanding good concept capable connect knowledge that has been owned with draft new as well as apply it in various situation (Jehadus et al., 2020). Learning it is said succeed If student own level understanding good concept. As according to Yani et al. (2022) success from the learning process the can see from levels understanding concept, mastery material and from performance results Study.

Observation results the beginning at MTs Negeri 1 Polewali Mandar showed that understanding draft mathematics VIII students are still low, with average ability only by 48.75% and is in the category less. Difficulty student found in several indicator like state repeat concept, classify, connect concept, as well as apply it in life every day. Material on straight line equations be one of the most difficult material understood students. The low understanding draft mathematics student influenced by the use of inadequate learning models varied. Learning Still Lots use method teacher - centered lectures so student not enough active, less involved in the learning process, and tends to memorize than understand (Gusman and Fitriani, 2023). Therefore that, the teacher as learners in fact No only teach in a way conventional, but expected capable design learning with selecting and using interesting learning models for student.

One of solution for increase understanding draft mathematics is use of learning models cooperative. According to Komalasari, the NHT model is a learning model Where every student given number Then made something group then the teacher called number head student in a way random (Zativalen & Humairah, 2021). Learning model NHT is capable make atmosphere class become more interactive and active so that can be implemented in accordance the above problems. As opinion from Dadri that the learning model in groups This designed with give number head to every child in each group (Anisa et al., 2022; Suwarti, 2021). With the learning model this, in a way explicit give student more Lots time think, each other answer One each other and involving student in examine material learning.

The application of the NHT model requires student for responsible answer to activity Study member his group, so that all over member group can understand material with good. Summoning number in a way random, make student for always ready and understanding material lesson. Condition the create pattern Study as well as habituation student For Keep going learning. The Numbered Head Together (NHT) model has steps as Tara expressed as following: (1) numbering, the teacher divides student in 4-5 groups; (2) the teacher gives tasks on each group; (3) group discuss for finish task; (4) one of group called to front for report results discussion; (5) other groups provide response; (6) give conclusion (Nourhasanah & Aslam, 2022). In line with Trianto that Implementation of the NHT model consists of 6 easy steps carried out, namely: (1) students shared in group, each student in group given number, (2) the teacher gives

tasks on each group, (3) each group discuss answers and ensure its members do, (4) in a way random, the teacher calls number student For report results discussion, (5) other groups provide response then the teacher pointed other numbers in random, (6) teachers and students together take conclusion ( Zivalen & Humairah, 2021).

A number of study previously more Lots study the influence of learning models cooperative NHT type. In the study This focus on the effectiveness of the model in increase understanding draft mathematics students. In addition, some big the above research implemented in high school/junior high school/elementary school, while study This will test the effectiveness of the NHT model in class VIII MTs, so that study This give perspective new because not yet many are studying effectiveness NHT type in the madrasa environment. Then, the research previously combines NHT type with learning media or factor others, whereas in study This test effectiveness of the NHT model in general directly. In addition, research This focus on one material in mathematics that has not been Lots investigated previously. With Thus, researchers interested do study with title effectiveness of learning models cooperative type Numbered Heads Together against understanding draft mathematics student Class VIII MTs 1 Polewali Mandar. The material studied in study This is material straight line equation in even semester junior high school/Islamic junior high school level or equivalent.

## 2. Methods

This research is quantitative with a quasi-experimental approach. The research design used is a nonequivalent control group design. This design provides treatment to the experimental group and compares the posttest results with the control group, after both groups were previously given a pretest (Wada et al. 2024).

This research was conducted in the even semester of the 2024/2025 academic year at MTs Negeri 1 Polewali Mandar. The population used in this study were all students of class VIII MTs Negeri 1 Polewali Mandar. The sample used was class VIII A and class VIII B, with the sampling technique used was cluster random sampling. Author choose technique this, because population consisting of of 9 classes and have characteristics similar in matter level understanding draft students and the application of learning models in the classroom. The use of technique This done with method drawing ninth class VIII of MTs Negeri 1 Polewali Mandar. Next, the procedure study done with 4 stages, namely preparation, implementation, analysis and compilation results.

Instrument research used There is three that is test understanding draft mathematics consisting of from pretest and posttest with each consisting of of 3 grains questions, sheets observation implementation learning class experiments and classes control as well as questionnaire response student with 6 question items. The data analysis used is descriptive analysis and inferential analysis consisting of normality test, homogeneity test, calculation of N-gain value, and hypothesis testing of t-test (Independent Sample T-test) using SPSS Statistics 20.

## 3. Results and Discussion

### (a) Results of Understanding Mathematical Concepts

The research data was obtained in the form of quantitative data, details of the results of the mathematical concept understanding test of students in the experimental class are presented in Table 1.

**Table 1.** Pretest and Posttest Data on Students' Understanding of Mathematical Concepts on the Material of Straight Line Equations in the Experimental Class.

| | Pretest Score | Posttest Score |
|---|---|---|
| The highest score | 50 | 94 |
| Lowest Value | 11 | 50 |
| Average | 30.00 | 76.79 |
| Median | 30.50 | 78 |
| Mode | 33 | 72 |
| Standard Deviation | 8.44 | 11.60 |
| Variance | 71.30 | 134.69 |

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Based on the data in Table 1, it can be seen that the average posttest score is higher than the average pretest. For the pretest results, the highest score obtained was 50 and the lowest score was 11, with an average of 30.00, median of 30.50, mode of 33, standard deviation of 8.44 and variance of 71.30. Meanwhile, in the posttest score, the highest score was 94, the lowest score was 50, the average was 76.79, median of 78, mode of 72, standard deviation of 11.60 and variance of 134.69.
The pretest and posttest data on the results of the control class students' understanding of mathematical concepts can be seen in Table 2.

**Table 2.** Pretest and Posttest Data on Students' Understanding of Mathematical Concepts on the Material of Straight Line Equations in the Control Class.

| | **Pretest Score** | **Posttest Score** |
|---|---|---|
| The highest score | 50 | 61 |
| Lowest Value | 6 | 17 |
| Average | 28.20 | 45.80 |
| Median | 28 | 50 |
| Mode | 28 | 50 |
| Standard Deviation | 9.18 | 11.42 |
| Variance | 84.41 | 130.58 |

Based on the data contained in Table 2, it can be seen that there was an increase in the average posttest score in the control class, although the difference between the pretest and posttest scores was not very significant. In the pretest, the highest score was 50 and the lowest score was 6. The average pretest score was 28.20, median 28, mode 28, standard deviation 9.18, and variance 84.41. Meanwhile, in the posttest score, the highest score obtained was 61, and the lowest score was 17. The average posttest score was 45.80 , with a median of 50, mode 50, standard deviation 11.42, and variance 130.58.
After the pretest and posttest data were analyzed, the N-gain value of the students' understanding of mathematical concepts in the experimental and control classes on the linear equation material was calculated, as shown in Table 3.

**Table 3.** Interpretation of N-gain Effectiveness of Experimental and Control Class Students.

| Class | Average N-gain | Average N-gain Percent (%) | Interpretation |
|---|---|---|---|
| Experiment | 0.67 | 67.23 | Effective |
| Control | 0.24 | 24.18 | Less Effective |

Based on Table 3, the average N-gain value in the experimental class was 0.67, which is in the moderate category. Meanwhile, the control class obtained an average N-gain value of 0.24, which is in the low category. Furthermore, it can be seen that learning in the experimental class using the NHT type cooperative learning model is classified as effective (67.23%). Meanwhile, learning in the control class using the conventional learning model is classified as less effective (24.18%).

## (b) Observation Sheet Results

The implementation of learning consists of two data, namely student activities and teacher activities. Data analysis regarding the implementation of learning by teacher activities was carried out descriptively. This assessment is based on teacher evaluation of the implementation of NHT type learning in the experimental class and the conventional model in the control class. Can be seen in Table 4.

**Table 4.** Results of Observations on the Implementation of Learning by Teachers

| Class | Meeting | | | Average | Category |
|---|---|---|---|---|---|
| | I | II | III | | |
| Experiment | 100% | 100% | 100% | 100% | Very good |
| Control | 100% | 100% | 93% | 97.67% | Very good |

Based on Table 4, the implementation of learning by teachers in the experimental class obtained an

average score of 100%, while in the control class it was 97.67 %. Both are included in the very good category, which indicates that the implementation of learning in both classes ran optimally without significant differences. Furthermore, the implementation of learning by student activities was analyzed descriptively based on observations during the learning process, which can be seen in Table 5.

**Table 5.** Results of Observations on the Implementation of Learning by Students

| Class | Meeting | | | Average | Category |
|---|---|---|---|---|---|
| | I | II | III | | |
| Experiment | 95.29% | 91.76% | 95.29% | 94.11% | Very good |
| Control | 92% | 90.67% | 85.33% | 89.33% | Very good |

Based on Table 5, the results of the descriptive analysis show that the average student activity in the experimental class was 94.11%, while in the control class it was 89.33%. Both values are in the excellent category. This indicates that student activity during the learning process in both classes was at an equivalent level without showing any significant differences.

## (c) Response Questionnaire Results

The data analysis of the results of the student response questionnaire was analyzed descriptively, the results of student responses to the learning provided in 3 meetings in the experimental class and the control class can be seen in Table 6.

**Table 6.** Results of Student Response Questionnaire Analysis

| Class | Number of Students | Average Score | Percentage Score | Category |
|---|---|---|---|---|
| Experiment | 24 | 41 | 84.74% | Very Positive |
| Control | 25 | 32 | 70.17% | Positive |

Based on Table 6, the average percentage of student responses in the experimental class that received learning using the NHT type was 84.74%, with a positive category. Meanwhile, in the control class that received learning using the conventional model, the average percentage was 70.17%, with a positive category.

## (d) Prerequisite Test Results

To analyze the effectiveness of the NHT type cooperative learning model on students' understanding of mathematical concepts, prerequisite tests were first carried out in the form of normality tests and homogeneity tests. The results of the normality test can be seen in Table 7.

**Table 7.** Results of the N-gain Data Normality Test for Students in the Experimental and Control Classes

| | Class | Number of Samples | Significance | Conclusion |
|---|---|---|---|---|
| N-gain value | Experiment | 24 | 0.802 | Normal |
| | Control | 25 | 0.710 | Normal |

Based on Table 7, the significance value of N-gain understanding of mathematical concepts on the material of linear equations of experimental class students is 0.802 and the control class is 0.710. With a significance level of $\alpha$ = 0,05, both values are greater than $\alpha$ (0,802>0,05and 0,710>0,05). Thus, it can be concluded that the N-gain data in both classes are normally distributed. After obtaining that the students' N-gain value data is normally distributed, the next stage is to conduct a homogeneity test. The results of the homogeneity test are presented in Table 8.

**Table 8.** Results of the N-gain Data Homogeneity Test for Students in the Experimental and Control Classes

| Mark | Significance | Conclusion |
|---|---|---|
| N-gain | 0.837 | Homogeneous |

Based on Table 8, the significance value of N-gain understanding of mathematical concepts on the linear equation material of students in the experimental and control classes is 0.837. Referring to the significance value $\alpha$ = 0,05, the value is greater than $\alpha$ (0,837>0,05). Thus, it can be concluded that the variance of N-gain data on students' understanding of mathematical concepts on the linear equation material is homogeneous.

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## (e) Hypothesis Test Results

Hypothesis testing was conducted after obtaining the results of normality and homogeneity tests which showed that the data were normally distributed and the variance between groups was homogeneous. To test the hypothesis, an Independent Sample t-Test was used on the N-gain value in the experimental and control classes. The results of the hypothesis test can be seen in Table 9.

**Table 9.** Results of Hypothesis Test Calculation

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | |
|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) |
| N-gain score value | Equal variances assumed | .043 | .837 | 10,479 | 47 | .000 |

Based on Table 9, the value t_hitung (10,479)>t_tabel(1.678) obtained shows that H_0it is rejected and H_1accepted. This means that students' understanding of mathematical concepts on the material on linear equations taught using the NHT type cooperative learning model is significantly higher than that of students taught using the conventional learning model.

The results of the study showed that the NHT type of cooperative learning model had a significant effect on improving students' mathematical concepts in the linear equation material. This can be seen from the relatively similar average pretest scores of both classes, namely 30.00 in the experimental class and 28.20 in the control class, which indicates that students' initial abilities were in the low category. After the treatment, the average posttest score of the experimental class increased to 76.79 in the high category, while the control class only reached 45.80 in the medium category. This indicates that learning using the NHT type is more effective than conventional learning.

The improvement in students' conceptual understanding was also evident from the average N-gain score of the experimental class, which was 0.67 (medium category) and the control class, which was 0.24 (low category). Based on effectiveness criteria, NHT learning was classified as effective (67.23%), while conventional learning was less effective (24.18%). The results of the independent sample t-test on the N-gain score showed that there was a significant difference between the two classes, so that students' mathematical conceptual understanding using the NHT model was significantly better than that of the conventional model.

The success of the NHT model in improving mathematical conceptual understanding is supported by the model's characteristics, which enhance student engagement in understanding the material through group discussions. Each group member is required to think, collaborate, and take responsibility for learning outcomes. This is in line with the research findings of Tukly et al. (2022), Kurniati & Sari (2019), and Jehadus et al. (2020), which concluded that the NHT model significantly improves mathematical conceptual understanding compared to conventional learning. Students' active involvement in the learning process also encourages them to be more critical and confident in solving problems.

The effectiveness of the NHT model in this study was also supported by observations of teacher and student activities, as well as positive student responses to learning. Teacher activity achieved an average score of 100% (very good category), while student activity reached 94.11 % (very good category). Student responses to the implementation of the NHT model were also very positive, with a percentage of 84.74%. This indicates that the NHT model not only improves learning outcomes but also creates an active, enjoyable, and student-centered learning atmosphere.

The effectiveness of this NHT type cooperative model on the understanding of mathematical concepts in the material of linear equations of grade VIII MTs students because at that age they still tend to want to play a lot, while in the NHT type, a learning pattern is applied in the form of play. So, with this model students will be interested, feel happy, and of course give a positive response in participating in learning. With NHT the learning process is not boring, not monotonous, but instead excites students in learning because there is active interaction horizontally among students and there is diagonal interaction with the teacher. This is proven by the results obtained, both the results of understanding mathematical concepts in the material of linear lines, observations, response questionnaires as well as the results of the condition test and hypothesis test showed very significant results.

Referring to the findings and analysis results that have been confirmed above, NHT in its implementation is very significant and effective in improving and developing students' problem-solving or collaborative problem-solving abilities. It improves and deepens understanding, because students

learn together to explore ideas, concepts, and draw conclusions together. This leads to increased cooperation and can build communication and understanding within the group, thus fostering a sense of responsibility and self-confidence. Because students are semi-forced to be active and participate or be actively involved personally in working on or answering questions, which leads to building positive attitudes and social skills.

This means that if the NHT cooperative model is implemented proportionally in the learning process, it will be very effective in improving students' conceptual understanding and the quality of cooperation and teamwork within groups. NHT can create a more interactive and collaborative learning atmosphere while transforming a conventional learning environment into a more participatory, dynamic, and stimulating one. In this section the authors describe data or models obtained from the results of the study. Describe the data that has been obtained clearly and concisely, can be in the form of formulas, tables, pictures or diagrams. Furthermore, the discussion must not be separate from the results. The discussion is a review of the results associated with the theory for both relevant and contradicts to the results of the study.

## 4. Conclusion

Thus, it can be concluded that the Numbered Heads Together cooperative learning model is effective in improving students' understanding of mathematical concepts, especially on linear equations in grade VIII, especially at MTs Negeri 1 Polewali Mandar. This model can be used as an alternative learning method to improve the quality of students' understanding of mathematical concepts proportionally.

Teachers in general, and specifically teachers at MTs Negeri I Polewali Mandar, are recommended to continually improve their understanding of learning management to achieve learning objectives effectively. One way to improve this understanding of learning management is to study and apply the NHT cooperative learning model in other subjects to make learning more productive.

Researchers are expected to be able to develop this NHT type of cooperative learning model in other research, so that it is truly more effective and can be used in every subject in the learning process, not only at the Junior High School or Madrasah Tsanawiyah level, but this NHT model can be applied at all levels.

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