



# Amplifying Math Comprehension: Harnessing Numbered Heads Together Cooperative Learning

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**Abstract.** This research highlights how the mathematical understanding of third-grade elementary school students is influenced by the Numbered Heads Together (NHT) collaborative education strategy. The improvement in mathematical understanding among third-grade students has been demonstrated through the NHT cooperative learning strategy. The study utilized a pre-experimental approach employing a single-group pre-test post-test design and quantitative analysis with Saturated Sampling to select 24 students. Data were collected through pre-tests and post-tests consisting of 10 questions, which were then analyzed using IBM SPSS Statistics 23 for Windows. The findings indicate a significant rise in the pre-test score (92.9167) to the post-test score (83.1250). The validity of this increase has been confirmed through matched Samples T-Test (significance  $0.000 < 0.05$ ) and also through the Chi-Square test ( $0.16 > 0.14$ ). This suggests that cooperative learning with the NHT method has a valuable effect on the mathematical understanding of third-grade students. The implication of these findings is the necessity for enhanced pedagogical tactics at the elementary level to maximize the benefits of NHT cooperative learning in improving students' mathematical understanding.

**Keywords:** learning model, numbered head together, understanding of mathematical concepts

## 1 Introduction

To ensure the country's sustainable growth and progress, it is essential to improve the quality of Human Resources (HR). To face the era of globalization, it is very important to improve the quality of HR services. Therefore, improving the quality of human resources must be considered from the beginning. In the continuity of a nation, education is very important, so the level of education in the quality of life of a nation is very close. [1]. Educational reform in a structured, directed and sustainable manner is one of the immediate efforts made to address these issues. In the educational journey, the strategy of improving the quality of education aims to improve teacher education. The approach and consequence of student learning will improve if the teacher uses the right learning strategy; conversely, if the teacher uses the wrong strategy, the approach and consequence of student learning will be poor or low.

In education, schools are the institutions responsible for achieving educational goals. Primary school is where students learn to write, read and count for the first time. It also teaches students many things, such as giving them a strong numeracy foundation for learning math in primary school. [2]. Mathematics is a domain of science that has an major position in the

development of the world of education, because mathematics is the main subject that must be taught starting from elementary school (SD), secondary school to college. In the world of education, mathematics is often discussed that mathematics is not a foreign thing anymore, because indirectly or inevitably almost every part of human life contains mathematics so that every day humans will deal with problems in mathematics.

According to William Brownell, learning is essentially a meaningful process. Learning Mathematics is meaningful learning, understanding, and comprehension. William Brownell put forward what is called "*Meaning Theory*" as an alternative to "*Drill Theory*". [3]. One of the most important main objectives in the workflow of insight mathematics is the understanding of mathematical concepts related to number operations. Understanding this concept is very important to improve students' ability and knowledge in counting, because these concepts are interconnected and will be the basis for future concepts. Therefore, to achieve the objectives of Mathematics, namely a) understand mathematical concepts, where the ability can explain how concepts relate to each other and use ideas and algorithms consistently, accurately, efficiently, and appropriately to solve problems; b) use patterns as conjectures in order to solve problems, and be able to make generalizations based on existing phenomena or data; c) use reasoning on properties, perform simple mathematical manipulations and analyze existing components to sort out challenge in the circumstance of mathematics and beyond of mathematics, which includes the ability to understand problems, create mathematical models, solve patterns, and explain the solutions obtained, including in the context of solving everyday problems; d) express ideas, reason, and be able to make mathematical proofs by clarifying problems using sentences, symbols, tables, diagrams, or others; e) have an attitude of appreciating the usefulness of mathematics in life, where students have curiosity, attention, interest in mathematics, and the ability to solve problems with tenacity and confidence; f) have attitudes and behaviors that are in accordance with the values in mathematics and its learning, such as obeying the rules, respecting agreements, mutual cooperation, honesty, fairness, opinion, polite, democracy, tenacity, creativity, and strength.g) achieve motor tasks that require mathematical awareness, and h) use simple props or the results of technology to perform mathematical activities. [4]. So it can be established, that the formulation of mathematics learning objectives in elementary schools can provide clarity for teachers to maximize the realization of the purposes of the Mathematics study process.

The theory developed by Edward Lee Thorndike is known as the Thorndike theory. This theory has a relationship between stimulus (question) and *response* (answer). This is done by students in the form of tests (*drills*) or through memorization that students can get. The theory of "*trial and error*" is often mentioned in this theory. People who are successful in learning can be said to be those who can master as much as possible on the stimulus and *response* relationship. [5]. In this case, it can be inferred that study mathematics in elementary school is one of the important studies to be given to all students to supply students with the ability to calculate, process data, utilize information, and for means in problem solving. And provide clarity for teachers to be as much as possible for the realization of the objectives of the Mathematics study process.

Understanding mathematical concepts related to number operations is the most important goal in the course of study mathematics. Understanding this concept is very important to improve students' ability and knowledge in counting, because these concepts are interconnected and will be the basis for future concepts. Therefore, understanding of Mathematics concepts requirement to be refined in order to achieve the objectives of Mathematics. Students need supporting resources to improve their understanding of abstract math concepts. According to Kilpatrick, indicators of concept understanding include: a) Restate concepts; b) Clarify certain

objects according to certain properties; c) Provide examples and non-examples; d) Present a concept in a form of mathematical representation; e) State the necessary or sufficient conditions of a concept; f) Use and utilize and select a procedure; and g) Apply concepts in solving problems [6]. Wrong mathematical concepts can lead to misconceptions in students, so that the learning process is only limited to results. This can cause students to lack understanding of Mathematics concepts.

Understanding the concept of Mathematics still exists and must be done with updates (innovations) that make students active and able to think clearly, logically and be able to conduct their own research which is very here. Because the study practice is the general behavior of teachers and students in activities to realize learning activities, teachers must plan so that students can learn effectively and efficiently in accordance with the expected goals. In addition, in teaching and learning interactions, the selection of methods, strategies, and approaches in designing learning models is also very influential on the development of students' understanding of mathematics concepts, teachers or students who are good at their groups can provide individual assistance to students so that students who are having difficulty in understanding mathematics concepts understand mathematics concepts. This is in line with the opinion of Robert E. Slavin, that providing students with the knowledge, concepts, abilities, and understanding they need to be happy and contributing students is the most important goal in cooperative learning [7].

Indonesian students are still classified as learning math with a low level of concept understanding. Minister of Education and Culture (Mendikbud) Nadiem Anwar Makarim stated that the *Organization for Economic Co-operation and Development* (OECD) organizes the *International Programme for International Student Assessment* (PISA) every three years for 15-year-old students. This survey assesses the extent to which students have acquired the essential knowledge and skills needed to participate fully in society. In 2018 PISA released its results simultaneously on Tuesday, December 3, 2019. About 600,000 students completed the study, representing about 23 million 15-year-old students from 79 countries. Below is the Portrait Report of PISA and OECD Mathematics performance in Indonesia in 2018 in Figure 1 and the Report of Average PISA Mathematics Results in Indonesia from 2003 to 2018 in Figure 2 below:

Figure 1. 2018 PISA and OECD Mathematics Performance Portrait Report in Indonesia [7]. Based on the PISA and OECD Mathematics performance snapshot report in Indonesia in 2018 depicted in Figure 1 above, it can be concluded that, the average PISA Mathematics result report in Indonesia, which is 379, is lower than the OECD Mathematics average in Indonesia, which is ranked 72 out of 79 participating countries.

Average PISA Mathematics Results Report in Indonesia from 2003 to 2018 [8]. Based on the report of the average results of PISA Mathematics in Indonesia from 2003 to 2018 depicted in Figure 1 above, it can be concluded that, the average PISA in Indonesia in 2003 had a score of 360, in 2006 had a score up to 391, in 2009 had a score down to 371, in 2012 had a score up to 375, in 2015 had a score up to 386, while in 2018 had a score down to 379. It can be concluded that the average results of PISA Mathematics in Indonesia described above are not much different from the average results of PISA Mathematics in Indonesia in previous years, namely the rankings obtained by Indonesia are always in the bottom 10.

The Indonesian government took the PISA results seriously, and the ministry of education and culture made new education policies, including revisions to the current curriculum. Through her writing on the impact of the PISA program on the curriculum in Indonesia, Pratiwi said that the PISA assessment results led to curriculum changes in Indonesia. This explains that the curriculum is the core of the education system as a whole, and curriculum changes mean that

teachers, students and school governance must change to meet the demands of society and the parties involved. [9]. It further explains that the PISA 2018 results should not be packaged or promoted as good results; instead, they should be viewed objectively, meaning that good results should be said to be good, but bad results should be talked about and addressed honestly.

This is in line with the results of observations made by researchers at SDN Jimbaran Kulon Wonoayu. The yield of reconnaissance and interactions show that one of the causes of disinterest in mathematics from many students causes students to lack interest in learning. This can result in student interest in learning still tends to be low. Students do not have enough interest in learning to achieve the learning objectives of Mathematics, one of which is understanding mathematical concepts. Where the focus of learning shifts to the teacher rather than the students. Because they only receive material from the teacher, students are not involved in constructing their own knowledge. As a result, they tend to imitate the teacher's steps without actively participating in building their own understanding. The wrong concept of mathematics can lead to misconceptions in students, so that the learning process is only limited to results. This can cause students to lack understanding of Mathematics concepts.

One way to measure the workflow of the student learning process is to choose the right learning model. Cooperative learning model is one of the models that can be used in the learning process. Teachers can use this model to help students achieve learning objectives. Students can use other student learning resources besides teachers and other learning resources. In addition, this research shows that cooperative learning has a positive effect on students who had low learning outcomes before. It can be concluded that, innovative cooperative learning is a way to improve students' learning outcomes, give them motivation to share opinions and socialize with friends, and create an environment that supports their creativity and reasoning power.

To solve the problem of students' understanding of mathematical concepts described by previous researchers, one of the alternative solutions is learning through the *Numbered Heads Together* (NHT) type cooperative learning model, which aims to solve math problems and is expected to improve students' ability to understand mathematical concepts. NHT type cooperative learning model to encourage more students to better understand what is taught in class, which can have an impact on interaction patterns. [10]. The NHT-type cooperative learning model can increase students' creativity, encourage individual responsibility for the group, and encourage all students to complete the task [11]. The NHT cooperative learning model can be applied to all subjects and grade levels.

To improve learning outcomes, the NHT cooperative learning model utilizes cooperation skills and positive interactions in groups of 4-5 students. The opportunity for students to share ideas and consider the right answer is the purpose of the NHT cooperative learning model, in addition to improving students' cooperation. Teachers use a four-phase structure as the syntax of the NHT cooperative learning model, namely: a) The first phase is numbering, the teacher divides students into groups of 3-5, with numbers 1-5 for each group; b) The second phase is asking questions, the teacher asks varied and specific questions to students in the form of interrogative sentences; c) The third phase is thinking together, students make sure all team members know the team's answer and unite their opinions on the answer to the question; and d) The fourth phase is answering, the teacher takes a random number and calls it quickly. Then, students check the number of each group and raise their hands to answer the question in front of the class. [12].

Compared to other cooperative learning models, the NHT cooperative learning model has many features. In terms of process, the implementation of the NHT-type cooperative learning model is easier to do compared to other types of cooperative learning models. The application of the NHT-type cooperative learning model not only requires students to be active in the

learning process, but also expects students to be independent, improve their thinking skills, be creative, increase self-confidence, be able to work together, easily accept others, reduce conflict behavior, reduce interpersonal conflicts, improve character, tolerance, gain a deeper understanding, and better learning outcomes [13].

The NHT learning model is supported by learning theories such as Constructivism, Vygotsky on Social Learning, and Piaget's Cognitive Development. Students can build mindset in discussion and group, which is supported by constructivism learning theory, thanks to NHT learning model. Each group will talk, give ideas or opinions, and help each other solve problems. This discussion activity, helps students increase their knowledge from various sources and construct their own knowledge, which makes learning more important. Vygotsky's Social Learning Theory also says that students are put into heterogeneous groups to give them the opportunity to interact more actively with their environment. This theory supports the NHT-type model.

This shows that all indicators of the achievement of students' understanding of mathematical concepts can be included in the stages of the NHT type cooperative learning model, based on the relationship between these stages and indicators of students' understanding of mathematical concepts. To ensure that students understand mathematical concepts correctly, the four syntaxes of the learning model are interconnected. It is expected to improve students' understanding of mathematical concepts. In this case, it means that they not only take notes and listen to what the teacher says, but they also talk, ask questions, and participate in active learning. During the discussion, students should make sure that they can solve the problem proposed by the teacher.

Based on the description above, the purpose of this study is to determine whether there is an Effect of *Numbered Heads Together* (NHT) Type Cooperative Learning Model on Understanding Mathematics Concepts of Grade III Elementary School Students.

## 2 Research Methods

In this study, the type of experimental research used by researchers is using *Pre-Experimental Design (Nondesigns)*. This type of research is used because it uses data in the form of numbers and data processing is carried out by statistical calculations.

Research variables are the subject of research or what is the focal point of research [14]. The research design taken by researchers in collecting data using quantitative research conducted using experimental methods. It aims to influence certain treatments on controlled conditions. The research design used is using *One Group Pre-test Post-test Design*. In this study only conducted in one class, in one class the subject will be given action and treatment in the form of an initial test (*pre-test*) and *post-test* (final test). The following is the form of the *One Group Pre-test Post-test Design* design in this study which is described in Table 1 below:

**Table 1.** One Group Pre-test Post-test Design [18]

O <sub>1</sub>	X	O <sub>2</sub>
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Description:

- O<sub>1</sub> = *Pre-test* score (test given to students before students get treatment)  
 O<sub>2</sub> = *Post-test* score (test given to students after students get treatment)

X = Treatment given in the form of cooperative learning model type *Numbered Heads Together* (NHT)

The population is determined by researchers to study and draw conclusions, consisting of subjects with certain qualities and characteristics. [15]. The population in this study used one class or all students who were the research subjects given action and treatment, namely all third grade students at SDN Jimbaran Kulon Wonoayu, totaling 24 students.

Sampling technique is a technique for taking samples used for research. The sample is part of the population based on its number and characteristics [16]. The technique in this study uses *Non Probability Sampling* sampling technique. Where, a sampling method that does not give each member of the population the same opportunity to be selected as a research sample. Because the population of this study is relatively small, less than 30 individuals. Therefore, researchers use a type of sampling technique in the form of *Saturated Sampling*, that is, if the entire population is used as a sample.

The most important step related to research objectives is obtaining data called data collection techniques. Researchers will not obtain data that meets predetermined data standards without knowing the data collection techniques. [17]. This data collection technique uses test techniques. Before the test is tested, the most important thing is very important to prepare the test instrument.

The tools used to measure natural and social factors are research instruments. [18]. In this study, test instruments were used to measure students' understanding of mathematical concepts. This objective test consists of 10 short fill-in questions given in accordance with 7 indicators of understanding of mathematical concepts. This is used because it is adapted to the characteristics of thinking of third grade elementary school students who are still relatively low. In this study, the test sheet that will be carried out is in the form of a *pre-test* (before students are given treatment) and *post-test* (after students are given treatment).

Documentation is used to obtain the necessary data. In this study, documentation was carried out to obtain data on student names, student grades, the number of students and student activities in the learning process. Statistical data analysis techniques in this study used IBM SPSS *Statistics 23 for windows* by performing calculations using the *Paired Samples T-Test* and *Chi Square Test*. Using this formula aims to determine the quality of differences in understanding of mathematical concepts obtained from *pre-test* scores and *post-test* scores of each third grade student of SDN Jimbaran Kulon Wonoayu.

### 3 Results and Discussion

#### 3.1 Results

In this sub-chapter of the research, the data analysis used is the learning outcomes from the giving of mathematical concept understanding tests in the form of *pre-test* and *post-test* that have been produced from the research results. This aims to determine the quality of differences in understanding of mathematical concepts before and after students get treatment in the form of a cooperative learning model of the *Numbered Heads Together* (NHT) type. After the third grade students at SDN Jimbaran Kulon Wonoayu took the test on understanding the concept of mathematics and had a *pre-test* value and a *post-test* value. Then the results of these values will produce results that will be compared using calculations through Microsot Excel 2010. The following is a bar chart of *pre-test scores* and *post-test* scores of understanding of mathematical concepts using calculations through Microsot Excel 2010 which is depicted in Figure 3 below:

Figure 3: Bar Diagram of *Pre-Test* and *Post-Test* Scores of Understanding Mathematical Concepts. Based on the results of the bar chart of *pre-test* scores and *post-test* scores of understanding of mathematical concepts in Figure 3 above, it can be concluded that, the *pre-test* scores and *post-test* scores show that before and after students get treatment in the form of a cooperative learning model of the *Numbered Heads Together* (NHT) type there are different values in understanding mathematical concepts. Before being given treatment at the lowest *pre-test* value was a value of 75 and the highest was a value of 90. Whereas after being given treatment at the *post-test* value the lowest was a value of 80 and the highest was a value of 100. This shows that students' understanding of mathematical concepts is influential when using the *Numbered Heads Together* (NHT) type cooperative learning model. If students have a good understanding of math concepts, the improvement is not significant, but if students have a lower understanding of math concepts, the improvement is quite significant.

To answer the first problem formulation. From the results of the *pre-test* and *post-test* scores obtained by students, the researchers then compared the average *pre-test* and *post-test* scores using calculations through IBM SPSS *Statistics 23 for windows* which are explained in Table 2 below:

**Table 2.** Comparison Results of Average *Pre-Test* and *Post-Test* Values

	N	Descriptive Statistics			
		Minimum	Maximum	Mean	Std. Deviation
<b>Pre_Test</b>	24	75.00	90.00	83.1250	5.47971
<b>Post_Test</b>	24	80.00	100.00	92.9167	6.06427
<b>Valid N (listwise)</b>	24				

Based on the results of the comparison of the average *pre-test* and *post-test* scores in Table 2 above, it can be concluded that, to find out the average *pre-test* and *post-test* scores before students are given treatment shows a value of 83.1250 while the average *post-test* score after students are given treatment shows a value of 92.9167 students. So it can be interpreted that  $92.9167 > 83.1250$ . It can be concluded that the effect of the *Numbered Heads Together* (NHT) type cooperative learning model has a significant effect on the understanding of mathematical concepts of third grade elementary school students.

After calculating the average *pre-test* and *post-test* scores, then the researchers calculated the hypothesis test, the researchers used the *Paired Samples T-Test test*. The *Paired Sample T-Test* test is used to determine whether or not there is an influence on the value of students' understanding of mathematical concepts. *Paired Samples T-Test* Test. According to Priyatno, the *Paired Samples T-Test* test is used to measure the average difference between two paired data groups. [19]. What is meant by two groups of paired data is to test the difference in student learning outcomes before and after treatment by using *pre-test* and *post-test* results.

The hypothesis tests tested in this study are:  $H_0 : \mu_1 = \mu_2$ , there is no difference between *pre-test* and *post-test* results and  $H_1 : \mu_1 \neq \mu_2$ , there is a difference between *pre-test* and *post-test* results. The interpretation used to determine decision making is the significance value (*2-tailed*)  $< \alpha = 0.05$  indicating that there is a significant difference between the initial variable and the final variable.  $H_0$  is rejected and  $H_1$  is accepted, and the significance value (*2-tailed*)  $> \alpha = 0.05$  indicates that there is no significant difference between the initial variable and the final variable. The *Paired Samples T-Test* test uses calculations through IBM SPSS *Statistics 23 for windows*

described in Table 3 *Paired Samples Statistics Test* and in Table 4 *Paired Samples T-Test Test* below:

**Table 3.** Paired Samples Statistics Test

Paired Samples Statistics					
Pair 1		Mean	N	Std. Deviation	Std. Error Mean
	Pre-Test	83.1250	24	5.47971	1.11854
	Post-Test	92.9167	24	6.06427	1.23786

**Table 4.** Paired Samples T-Test

Paired Samples Test									
Paired Differences									
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)	
				Lower	Upper				
Pair 1	Pre-Test - Post-Test	9.79167	4.53948	.92662	-11.70852	-7.87481	10.567	23	.000

Based on the results of the *Paired Sample T-Test* test in Table 3 and Table 4 above, it can be concluded that, showing the sig value. (*2-tailed*) in Table 4 gets 0.000, if the sig. (*2-tailed*) < sig level ( $\alpha = 0.05$ ). So it can be interpreted that  $0.000 < 0.05$ , indicating that there is a significant difference between the initial variable and the final variable.  $H_0$  is rejected and  $H_1$  is accepted, it can be concluded that there is a difference in the average understanding of mathematical concepts in *pre-test* scores and *post-test* scores. Based on pair 1, it is explained that there is a significant effect of the influence of the *Numbered Heads Together* (NHT) type cooperative learning model on the understanding of mathematical concepts of third grade elementary school students which has been proven in Table 4 above.

Furthermore, to answer the second problem formulation, namely how much influence the *Numbered Heads Together* (NHT) type cooperative learning model has on students' understanding of mathematical concepts, researchers use the *Chi Square* test. The chi-square test is used to determine whether there is a relationship between two variables when the data scales on the two variables are not the same. In the first table, the data scale is nominal, while the second variable is an interval data scale.. In testing *Chi Square*, researchers used calculations through IBM SPSS *Statistics 23 for windows* which were used to calculate the Percentage of *Pre-Test* Values and *Post-Test* Values *Chi Square* in Table 5 and *Chi Square* Test in Table 6 below:

**Table 5.** Percentage of *Pre-Test* Value and *Post-Test* Value *Chi Square*

Pre-Test * Post-Test Crosstabulation						
75.00	Count	Post-Test				Total
		80.00	90.00	95.00	100.00	
		3 <sub>a</sub>	2 <sub>a, b</sub>	0 <sub>b</sub>	0 <sub>b</sub>	5



Pre-Test	80.00	% within Pre-Test	60.0%	40.0%	0.0%	0.0%	100	
		Count	0 <sub>a</sub>	1 <sub>a</sub>	3 <sub>a</sub>	1 <sub>a</sub>	5	
	85.00	% within Pre-Test	0.0%	20.0%	60.0%	20.0%	100	
		Count	0 <sub>a</sub>	3 <sub>a</sub>	4 <sub>a</sub>	1 <sub>a</sub>	8	
	90.00	% within Pre-Test	0.0%	37.5%	50.0%	12.5%	100	
		Count	0 <sub>a, b</sub>	0 <sub>b</sub>	3 <sub>a, b</sub>	3 <sub>a</sub>	6	
	Total	% within Pre-Test	0.0%	0.0%	50.0%	50.0%	100	
		Count	3	6	10	5	24	
			% within Pre-Test	12.5%	25.0%	41.7%	20.8%	100.0%

Each subscript letter denotes a subset of Post-Test categories whose column proportions do not differ significantly from each other at the .05 level.

Table 6. Chi Square Test

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	20.380 <sup>a</sup>	9	.016
Likelihood Ratio	22.168	9	.008
Linear-by-Linear Association	11.112	1	.001
N of Valid Cases	24		

a. 16 cells (100.0%) have expected count less than 5. The minimum expected count is .63.

Based on the *Chi Square* test results in **Table 6** above, it can be concluded that, the *Chi Square* percentage gets 0.16 if  $t \geq 0.14$ . So it can be interpreted that  $0.16 > 0.14$ . It can be concluded that there is an influence of the *Numbered Heads Together* (NHT) type cooperative learning model on the understanding of mathematical concepts of third grade elementary school students.

### 3.1 Discussion

Based on observations made by researchers when conducting research in class III which amounted to 28 students. It can be seen that students are required to understand math concepts. In the end, students can answer questions with the help of teachers or peers to develop their concept understanding skills.

Based on the results of data processing, students' *pre-test* and *post-test* scores showed an increase in scores in understanding mathematical concepts, both before and after students received treatment in the form of a cooperative learning model of *Numbered Heads Together* (NHT) type. The results of hypothesis testing with the *Paired Samples T-Test* test show that the sig. (2-tailed) < sig level ( $\alpha = 0.05$ ). So,  $0.000 < 0.05$ , indicating that the initial variable and the final variable have a significant difference. With  $H_0$  rejected and  $H_1$  accepted, it can be concluded that the understanding of mathematical concepts that there is an average difference in *pre-test* scores and post-test scores.

In addition, students also experienced an increase in understanding of mathematical concepts, this can be seen from before being given treatment on the lowest *pre-test score* was 75 and the highest was 90. Whereas after being given treatment on the *post-test score* the lowest was 80 and the highest was 100. This shows that the use of the *Numbered Heads Together* (NHT) type cooperative learning model is influenced by students' understanding of mathematical concepts. For students who have a good understanding of mathematical concepts, the improvement achieved is not significant, but it is quite large for students who have a lower understanding of mathematical concepts.

Therefore, the *post-test* score is higher than the *pre-test* score after being treated. This means that students' understanding of mathematical concepts is influenced by the *Numbered Heads Together* (NHT) type cooperative learning model. Thus, the research on the Effect of *Numbered Heads Together* (NHT) Cooperative Learning Model on the Understanding of Mathematics Concepts of Grade III Elementary School Students.

This is in accordance with research with the title "The Effectiveness of the *Two Stay Two Stray* (TS-TS) Cooperative Model on Mathematical Concept Understanding of Elementary School Students". Where the study concluded that the results showed that: (1) the *Two Stay Two Stray* (TS-TS) cooperative learning model was well implemented in mathematics learning, (2) the average understanding of mathematical concepts of fourth grade students of SD Negeri Kassi Makassar City, which was previously in the low category, increased from 35.18 to 84,14 after applying the *Two Stay Two Stray* (TS-TS) cooperative model, and (3) the results of hypothesis testing at a significant level of 0.05 with a t-test showed that  $H_0$  was rejected and  $H_1$  was accepted so that there was an effectiveness of the *Two Stay Two Stray* (TS-TS) cooperative model on the understanding of elementary school mathematics concepts [20].

This is in accordance with research with the title "The Effectiveness of Cooperative Learning Model Type *Numbered Head Together* (NHT) on Mathematics Learning Outcomes of Elementary School Students". Where the study concluded that the results of the *n-gain score*, stated the mean value of the experimental class obtained a result of 61.248%, which is considered quite effective. Meanwhile, the *mean* value of the control class for the *n-gain score* is 32.02%, which indicates that the class is not effective. The results show that the *Numbered Head Together* (NHT) type cooperative learning model has succeeded in improving student learning outcomes in grade 3 math subjects [2].

This is in accordance with research with the title "The Effect of *Flipped Classroom* Learning Model on Mathematical Concept Understanding Ability of Grade IV Elementary School Students". Where the study concluded that the results of hypothesis testing showed that the *Flipped Classroom* model had an influence of 33.7% on the ability to understand mathematical concepts of students in grade IV elementary schools. The results show that the significant value obtained is  $0.000 < 0.05$ , and the percentage obtained is 33.7%. Thus, it can be concluded that the *Flipped Classroom* model has an influence of 33.7% on students' ability to understand mathematical concepts in grade IV. [21].

This is in accordance with research with the title "The Effect of *Numbered Head Together* Type Cooperative Learning Model on Student Mathematics Learning Outcomes". Where the study concluded that the results of inferential statistical analysis carried out by hypothesis testing using the *paired sample t-test* that  $\text{Sig (2-tailed)} < 0.005$ , which means  $0.000 < 0.05$ . The results show that the *Numbered Head Together* learning model has a positive effect on student learning outcomes. The results showed that the *Numbered Head Together learning* model had an effect on the math learning outcomes of third grade students of UPT SD Negeri 148 Ketulungan North Luwu, with an average *pretest* learning outcome of 57.11 and *posttest* of 75.50 [22].

This is in accordance with research with the title "*Numbered Head Together Learning Model to Improve Learning Outcomes of Elementary School Students*". Where the study concluded that the results showed that the group of students who used NHT learning obtained an average learning outcome of 78.50 while the group of students who used conventional learning obtained an average learning outcome of 73.12. The learning outcomes of student groups using NHT learning are better than student groups using conventional learning. Based on the calculation of testing the average difference of two samples (t-test), it is known that the learning outcomes of students in classes that use both the NHT learning model and the conventional learning model are the same. By considering the averages obtained, student learning outcomes in the class using the NHT learning model are better than the conventional learning model. Therefore, this study found that the *Numbered Head Together* (NHT) Learning Model can improve the social studies learning outcomes of elementary school students [23].

#### 4 Conclusions

Based on the results of research and discussion that has been carried out collaboratively between researchers and third grade homeroom teachers at SDN Jimbaran Kulon Wonoayu, it can be concluded that the process of learning mathematics using the *Numbered Head Together* (NHT) type Learning Model can improve students' understanding of concepts. It can be seen from the *pre-test* scores and *post-test* scores that there are differences in the understanding of mathematical concepts, so that it can affect the *Numbered Heads Together* (NHT) type cooperative learning model. Students' responses to the application of the *Numbered Heads Together* (NHT) type Learning Model show a very good response and are very fun, making students motivated in learning. This can be proven from the hypothesis test using the *Paired Samples T-Test* test which states if the sig value. (*2-tailed*) < sig level ( $\alpha = 0.05$ ). So it can be interpreted that  $0.000 < 0.05$ , indicating that there is a significant difference between the initial variable and the final variable.  $H_0$  is rejected and  $H_1$  is accepted, it can be concluded that there is a difference in the average understanding of mathematical concepts in the *pre-test* and *post-test* scores.

The magnitude of the influence of the *Numbered Heads Together* (NHT) type cooperative learning model on the understanding of mathematical concepts can be seen from the calculation results using the *Chi Square* percentage to get 0.16 if  $t \geq 0.14$ . So it can be interpreted that  $0.16 > 0.14$ . It can be concluded that there is an effect of *Numbered Heads Together* (NHT) type cooperative learning model on the understanding of mathematical concepts of third grade elementary school students.

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## References

- [1] L. Wildani, P. Yolanda, S. A. Laksana, and E. Supriyadi, "Analysis of Ability in Matrix Implementation in Vocational High School," *Papanda J. Math. Sci. Res. (PJMS)*, vol. 1, no. 2, pp. 69–79, 2022, [Online]. Available: <https://ejournal.papanda.org/index.php/pjmsr/article/view/257>.
- [2] F. Y. Nourhasanah and Aslam, "The Effectiveness of Numbered Head Together (NHT) Cooperative Learning Model on Mathematics Learning Outcomes of Elementary School Students," *Basicedu J.*, vol. 6, no. 3, pp. 5124–5129, 2022, doi: 10.31004/basicedu.v6i3.3050.
- [3] Y. Wahyudi, "Elementary School Mathematics Learning Guide (For Elementary Teachers and Prospective Teachers." UNS Press, p. 7, 2015. [Online]. Available: <https://spada.uns.ac.id/mod/resource/view.php?id=16821>.
- [4] Pujiadi, "Mathematics Curriculum 2 and the Utilization of Learning Media." pp. 9–13, 2016.
- [5] I. Firliani, N. Ibad, N. DH, and I. Nurhikmayati, "Throndike Theory and its Implication in Mathematics Learning," in *Proceedings of the National Seminar on Education*, 2019, p. 834.
- [6] F. E. Giriansyah and Pujiastuti, "Analysis of Students' Mathematical Concept Understanding Ability Based on Skemp's Theory," in *Proceedings of Galuh Mathematics National Conference (GAMMA NC)*, 2022, p. 152.
- [7] Y. A. Kawakib, "The Effect of Team Assisted Individualization (TAI) Cooperative Learning Model on Mathematics Learning Outcomes with Polynomial Subject Matter in Class XI Students of SMA N 1 Dander Even Semester 2018/2019," *Prog. Retin. Eye Res.*, vol. 561, no. 5, pp.5,2019.[Online].Available:<http://repository.ikipgribojonegoro.ac.id/77/1/BAB%201%2C%202%2C%203.pdf>, 2019.
- [8] W. F. McComas, "Program for International Student Assessment (PISA)," *Lang. Sci. Educ.*, pp. 1–3, 2019, doi: 10.1007/978-94-6209-497-0\_69.
- [9] I. Pratiwi, "The Effects of the PISA Program on the Curriculum in Indonesia," *J. Educ. Cult.*, vol. 4, no. 1, pp. 51–71, 2019, doi: 10.24832/jpnk.v4i1.1157.
- [10] A. Pandy and H. M. Mbagho, "Numbered Head Together (NHT) Learning Model on the Subject Matter of Relation and Function," *Basicedu J.*, vol. 5, no. 1, pp. 169–177, 2021, [Online]. Available: <https://jbasic.org/index.php/basicedu/article/download/542/422>.
- [11] R. P. Siahaan, M. Ario, and Nurrahmawati, "The Effect of Cooperative Learning Model Type Number Heads Together (NHT) on Mathematical Representation Ability of Class VII Students of SMPN 3 Ujungbatu," *J. Math. Educ.*, p. 125, 2016.
- [12] H. Pagarra, T. J. Raharjo, and A. Widodo, "Development of Learning Tools through Lesson

- Study with Cooperative Model Type Numbered Heads Together Assisted by Manipulative Media in Elementary School,” *Innov. J. Curric. Educ. Technol.*, vol. 4, no. 1, pp.25,2015.[Online]. Available: <https://journal.unnes.ac.id/sju/index.php/ujet/article/download/9831/6283>, 2015.
- [13] L. Usaha, E. N. Inah, and F. Kadir, “Improving Science Learning Outcomes Through the Number Head Together Cooperative Model for Class IIIB Students of Madrasah Ibtidaiyah Negeri 2 South Konawe,” *J. Al-Ta’dib*, vol. 11, no. 2, p. 149, 2018, [Online]. Available: <https://core.ac.uk/download/pdf/231136747.pdf>.
- [14] W. Lidia, “The Effect of Numbered Head Together and Talking Stick Learning on Social Studies Learning Outcomes,” *Inspirasi J. Soc. Sci.*, vol. 15, no. 2, pp. 15–32, 2018, doi: 10.29100/insp.v15i2.898.
- [15] Sugiyono, *Quantitative, Qualitative, and R&D Research Methods*. Bandung: Alfabeta, 2017.
- [16] Sugiyono, *Quantitative, Qualitative, and R&D Research Methods*. Bandung: Alfabeta, 2018.
- [17] Sugiyono, *Quantitative, Qualitative and R&D Research Methods*. Bandung: Alfabeta, 2013.
- [18] Sugiyono, *Quantitative, Qualitative, and R&D Research Methods*. Bandung: Alfabeta, 2019.
- [19] D. Priyatno, *Practical Guide to Data Processing Using SPSS*. Yogyakarta: Andi, 2017.
- [20] Jusmawati, “The Effectiveness of the Two Stay Two Stray (TS-TS) Cooperative Model on Mathematical Concept Understanding of Elementary School Students,” *J. Islam. Basic Educ.*, vol. 6, no. 2, pp. 16–172, 2019, doi: 10.24252/auladuna.v6i2a7.2019.
- [21] S. Imawati, D. Meliyana, N. Yusuf, and G. Santoso, “The Effect of Flipped Classroom Learning Model on Mathematical Concept Understanding Ability of Grade IV Elementary School Students,” *J. Educ. Res. Artic.*, vol. 14, no. 22, pp. 111–120, 2022, doi: 10.31603/edukasi.v14i2.8060.
- [22] L. Muslimin, Y. S. Passinggi, and N. Nirmalasari, “The Effect of Cooperative Learning Model Type Numbered Head Together (NHT) on Student Mathematics Learning Outcomes,” *J. Math. Learn.*, vol. 8, no. 1, pp. 99–108, 2023, doi: 10.56013/axi.v8i1.1563.
- [23] D. Kusnaeni, L. H. Affandi, and I. Oktavianti, “Numbered Head Together Learning Model to Improve Learning Outcomes of Elementary School Students,” *J. Educ.*, vol. 9, no. 2, pp. 1017–1023, 2023, doi: 10.31949/educatio.v9i2.4780.

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