NUMBERED HEADS TOGETHER (NHT) COOPERATIVE LEARNING MODEL ON STUDENTS' MATHEMATIC PROBLEM SOLVING ABILITY STUDY ON CLASS VIII STUDENTS OF GOLDEN STAR INFORMATICS SMP

Ria Irawati[1*)], Sri Wahyuni[2)]
[1,2]*Mathematical Education, Metro State Islamic Institute, Lampung*
[1*)]riairawati012arifin@gmail.com

Received: 26-07-2022; **Accepted**: 31-09-2022; **Published**: 31-10-2022

Abstract. This research is motivated by the low mathematical problem solving ability of students at the Golden Star Informatics Junior High School. This study aims to determine the effect of the *Numbered Heads Together* (NHT) cooperative learning model on the mathematical problem solving ability of the students of class VIII SMP Informatika Golden Star. The research method used is *quasi-experimental* with *posttest only control design.* The population of this study were all eighth grade students of Golden Star Informatics Junior High School which consisted of two classes. Sampling was done by saturated sampling technique. Class VIII A as the control class and class VIII B as the experimental class. The instrument used to determine the mathematical problem solving ability is the *post test results* of six questions. Data analysis for students' mathematical problem solving ability was carried out using the t' test. Based on the results of the data analysis of students' mathematical problem solving abilities, the results of hypothesis testing using the t' test were obtained $t_{hitung} = 3{,}122$ compared to $t_{tabel} = 2{,}03$at a significant level of 0.05 . Because $t_{hitung} > t_{tabel}$, it H_0 was rejected. This shows that the average mathematical problem solving ability of students from the two groups is not the same. Then there is the effect of the application of the NHT cooperative learning model on the mathematical problem solving abilities of eighth grade students of Golden Star Informatics Junior High School.
Keywords: *NHT, Mathematical Problem Solving Ability, Statistics*

1. INTRODUCTION

Education is the basis of the progress of civilization and human culture. There is no great civilization in this world that did not start with education. Persian civilization, Greek civilization, Arab civilization, Chinese civilization, and Western civilization departed from a proposition that education was the main locomotive of the progress of their civilization.

Education has a very decisive role for the development and self-realization of individuals, especially for the development of the nation and the country. The progress of a culture depends on the way the culture recognizes, appreciates, and utilizes human resources. This is closely related to the quality of education provided to the community and students. So the quality of education needs to be taken seriously by the government. In the Qur'an,

ISSN: 2620-4129
E-ISSN: 2621-3885

Allah SWT said, "Surely Allah will raise the ranks of those who believe among you and those who seek knowledge" (QS. Al-Mujadalah [58]:11).

Schools are a place for educational activities that function as creators of human resources [1]. One of the subjects taught at school is mathematics. Mathematics has a significant role in providing various abilities to students such as thinking skills and problem solving skills in everyday life[2].

Cooperative learning accommodates how students can work together in groups, group goals are common goals [3]. The *Numbered Heads Together* learning model can show how well each group works. Positive interactions between students through groups that have been created are able to train each student's ability to solve problems.[4] NHT type cooperative learning students must be able to express opinions and accept opinions from other friends so that students can solve problems well [5].

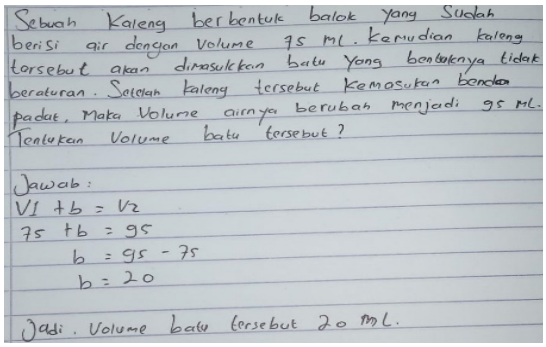
Based on the Regulation of the Minister of National Education (Permendiknas) RI Number 22 of 2006, it is explained that the purpose of learning mathematics in schools is that students have the ability to understand mathematical concepts, use reasoning on patterns and characteristics, solve mathematical problems, communicate ideas with symbols, tables and diagrams and have an attitude of appreciating the usefulness of mathematics in life.

Based on the statement above, it can be seen that one of the students' goals in learning mathematics is the ability to mathematical problem solving which includes the ability to understand problems, designing mathematical models, completing mathematical models and interpret the obtained solution. It has even been reflected in the curriculum concept competency based. Demands for problem solving skills explicitly emphasized in the curriculum that is, as a competency basis that must be developed and integrated into a number of materials that in accordance.

Based on the PTS score data for the VIII grade students of the Golden Star Informatics Middle School, it was found that of the 44 students who completed mathematics, there were 19 students, while the 25 students who did not complete the subject were. This shows that the ability to solve mathematical problems at the Golden Star Way Jepara Informatics Junior High School is still low. When the teacher gives a question in the form of a story, there are still many students who cannot solve the problem and some students cannot make a mathematical model. An example of a student's written answer on a mathematical problem-

ISSN: 2620-4129
E-ISSN: 2621-3885

solving ability test which includes understanding the problem, planning problem-solving strategies and implementing problem-solving strategies can be seen in the image below.


Sebuah kaleng berbentuk balok yang sudah berisi air dengan volume 75 ml. kemudian kaleng tersebut akan dimasukkan batu yang bentuknya tidak beraturan. Setelah kaleng tersebut kemasukan benda padat, maka volume airnya berubah menjadi 95 ml. Tentukan volume batu tersebut ?

Jawab :
V1 + b = V2
75 + b = 95
b = 95 - 75
b = 20

Jadi. Volume batu tersebut 20 ml.

Figure 1. Student Work

From the results of student work above, it shows that students do not at all precede answers by writing down information that is known and asked in the question. So that students have not been able to write an explanation of the answer to the problem clearly and arranged according to the known elements. Therefore, the writer concludes that the mathematical problem solving ability of the eighth grade students of the Golden Star Informatics Junior High School is still relatively low.

The problems that occur in the Golden Star Informatics Junior High School students above, from the results of Rofikoh's research, can be overcome by using the right learning model so that students' mathematical problem solving abilities increase. Therefore, the researcher tried to apply the *Numbered Heads Together* (NHT) cooperative learning model in the hope that it could be used to meet the needs of students in improving their mathematical problem solving skills .

Numbered Heads Together (NHT) type of cooperative learning model because it sees from several advantages, namely students actively study together in small heterogeneous groups and work together to solve a problem to achieve a common goal , students have the freedom to submit ideas, questions and problems so that learning mathematics can be more effective.

The cooperative learning model with the *Numbered Heads Together* (NHT) type developed by Spencer Kagan is a cooperative learning model consisting of four to five people and given a number, so that each student in the group has a different number. At the stage of thinking together students discuss in groups to find answers and explain answers to members in their team so that all members know the answers to each question.

ISSN: 2620-4129
E-ISSN: 2621-3885

Based on the above background, the authors conducted a study entitled "The Effect of *Numbered Heads Together* (NHT) Cooperative Learning Model on the Mathematical Problem Solving Ability of Study Students in Class VIII SMP Informatics Golden Star.

2. RESEARCH METHOD

This research was implemented at State Junior High School of Informatics Golden Star. The research type was quasi experimental with the posttest only control group design. The first group is the experimental class and the second group is the control class. The practical class is treated with NHT, and the control class is treated with conventional learning. The research design is described as follows:

Table 1. Research Design

Class	Treatment	Posttest
Experiment	X	O_1
Control	-	O_2

Description:
X : Treatment with NHT model
- : Treatment with conventional learning
O_1 : Posttest given to the experimental class
O_2 : Posttest given to the control class

The population in this sample are students at SMP Informatika Golden Star and the research sample used in this study can pay attention to the students mathematical problem solving ability in two different classes, where class VIII A consists of 22 students and class VIII B consists of 22 students. In the experimental and control classes to compare were the best to increase the learning results.

Research at SMP Informatika Golden Star was carried out in class VIII. All students of class VIII in this school were made into a population and the sample was representative of the populations studied. The technique used is total sampling. The variables in this study are the independent variable, the dependent variable. In this case, the independent variable is the Numbered Heads Together (NHT) model while the dependent variable is the students mathematical problem solving ability.

The instrument used in this study was taken from 6 essay test questions. Trial test are carried out starting from the analysis of validity, to the level of difficulty items. Data on the students mathematical problem solving ability are collected throught the last meeting essay

test (posttest). The next step is the answer sheet is collected and checked. The study consisted of four stages: the numbering, question, heads together, and final answering.

The data analysis technique was performed by t', to find out the results of students mathematical problem solving abilities in the experimental class that were very different from the control class. The t' there are two conditions, sample from normal populations and not homogeneus variances The t' formula is as follows:

$$t' = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{\left|\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right|}}$$

With

$$df = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2 - 1}}$$

3. RESULTS AND DISCUSSION

A. RESULTS

Students' mathematical problem solving ability was measured using an instrument in the form of a test question in the form of a description of six questions. The students' mathematical problem solving ability test was given once, namely after the implementation of the *Numbered Heads Together* (NHT) cooperative learning model. This study used two classes, namely class VIII A as a control class using conventional learning and class VIII B as an experimental class using a *Number Heads Together* (NHT) cooperative learning model. The following table presents statistics for data on mathematical problem solving abilities in the experimental class and control class.

Table 2. Data Description

Statistics	Experiment Class	Control Class
	Posttest	Posttest
Total students	22	22
Average	86.23	76.05
variance	56.565	177,379
Standard deviation	7.5210	13.3184
Reach	30	46
Highest value	100	100
Lowest value	70	54

Mathematics Research and Education Journal, Vol. 6, No.2, October 2022, 1 – 11
ISSN: 2620-4129
E-ISSN: 2621-3885

From the table above, it can be seen that the average *post-test value* of the experimental class's mathematical problem solving ability is higher than the average post-test score for the control class. The difference in the average value is 10.18. In other words, the mathematical problem solving ability in the experimental group and the control group experienced differences. This difference can be seen in the experimental group which gets a higher average score because the learning model uses the *Numbered Heads Together* (NHT) cooperative learning model.

Data about students mathematical problem solving abilities is obtained through mathematics problem solving ability tests. The problem solving ability test data consists of six questions that contain the following three indicators:

Table 3. Achievement Of Problem Solving Capability Indicators

Indicator	Class	
	Experiment	**Control**
Understanding of problem	10,64	10,09
Planning to solve the problem	24,91	21,09
Solving the problem	21,95	19,59

This table explains the indicators of different student abilities. The first indicator obtained the value of the experimental class 10,64 and 10,09 control class. The second indicator obtained the value of experimental class 24,91 and 21,09 control class and the third indicator obtained the experimental class value of 10,64 and 10,09 control class.

From the normality test obtained, it was concluded that both sample classes were normally distributed. T_3 for each sample class is greater than P_{table}. For the problem solving ability of experimental students and control classes are respectively obtained $T_3 = 0{,}96$ and $P_{table} = 0{,}911$ while $T_3 = 0{,}94$ and $P_{table} = 0{,}911$. Homogeneity test is done with the F test, from the calculations obtained $F_{count} = 3{,}1358 > F_{table} = 2{,}0842$ so it can be concluded that the two sample classes equal variences not assumed.

Both classes are assumed to be normal, then proceed with the homogeneity test. The results of the calculation of the homogeneity of variance test for the experimental class with the Numbered Heads Together (NHT) learning model and the control class with conventional learning is equal variences not assumed. Then the calculation of the t'-test about the ability of students is $t_{count} = 3{,}122$ and $t_{table} = 2{,}03$. Based on the results obtained, it appears that $t_{count} > t_{table}$. This shows that there is an average difference in

ISSN: 2620-4129
E-ISSN: 2621-3885

students mathematical problem solving abilities between the experimental class and the control class.

B. DISCUSSION

Experimental research on the effect of the *Numbered Heads Together* (NHT) cooperative learning model on students' mathematical problem solving abilities based on indicators of students' mathematical problem solving abilities can be seen from the students' posttest results as follows:

Understanding M problems

In this indicator students are expected to be able to write down the information contained in the questions, such as what is known, what is being asked and able to write pictures or sketches of the problem. The following is the answer of one of the students in the experimental class and the control class.

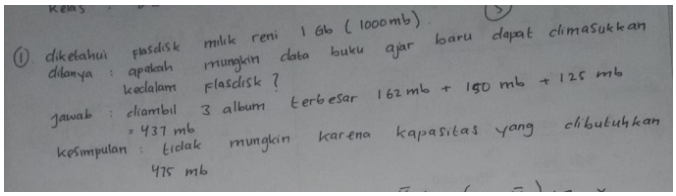


Figure 2. Answer Number 1 Student in the Experimental Class

In the picture, it can be seen that students are able to provide information contained in the questions, so that these students get a score of 2 on the problem-solving ability indicator.

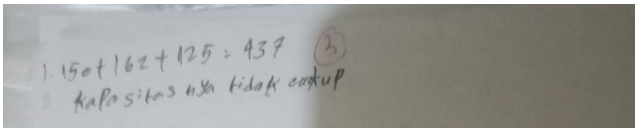


Figure 3. Answer Number 1 Student in the Control Class

In the picture above, it can be seen that students are not at all able to provide the information contained in the questions, so these students do not get scores on indicators of problem solving abilities.

Planning a problem-solving strategy

In this indicator students are expected to be able to estimate or choose a strategy to be used in problem solving. The following is the answer of one of the students in the experimental class and the control class.

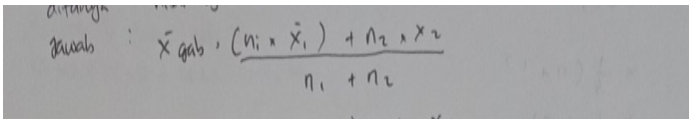


Figure 4. Answer Number 2 Students in the Experimental Class

ISSN: 2620-4129
E-ISSN: 2621-3885

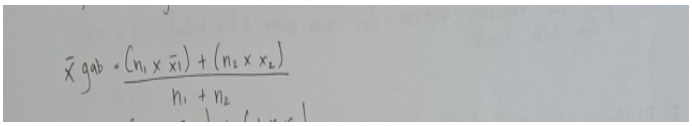


Figure 5. Answer Number 2 Students in the Control Class

In the picture above, it can be seen that the ability to plan problem solving strategies in the experimental class and control class is correct, so that the student gets a score of 4 for the indicator of problem solving ability.

Implement Problem Solving Strategies

In this step students are able to solve problems with the plan or strategy that has been chosen and are able to take decisions and actions by determining the final conclusion.

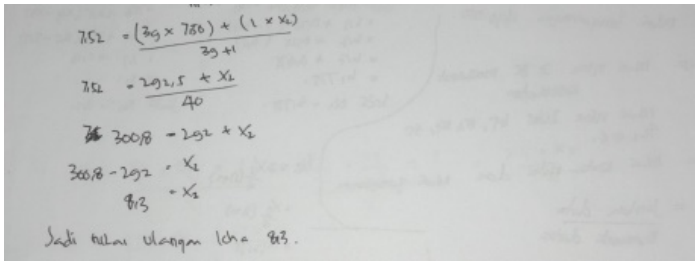


Figure 6. Answer Number 2 Students in the Experimental Class

In the picture above, it can be seen that students in the experimental class have been able to implement problem-solving strategies properly and correctly, so that these students get a score of 3 for indicators of problem-solving abilities.

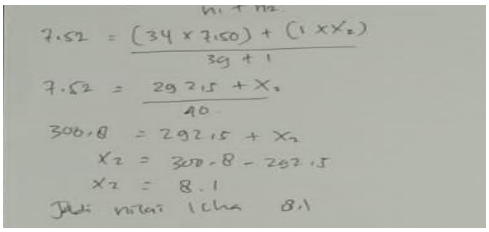


Figure 7. Answer Number 2 Students in the Control Class

In the picture, it can be seen that students in the control class have not been able to implement problem solving strategies properly and correctly, so that students get a score of 2 for indicators of problem solving abilities. Students who learn to use the *Numbered Heads Together* (NHT) learning model have been able to solve problems based on indicators of students' mathematical problem solving abilities, although there are still errors in understanding problems and implementing problem solving strategies.

This research was conducted on April 7, 2022 at the Golden Star Way Jepara Informatics Junior High School. The experimental class was treated using a cooperative

ISSN: 2620-4129
E-ISSN: 2621-3885

learning model of the *Numbered Heads Together* (NHT) type, while the control class used a conventional learning model for statistical material. Before this research was carried out, it was necessary to prepare a research instrument in the form of a mathematical problem solving ability test question and then be tested first on students who had studied statistical material to see the validity, reliability, level of difficulty and discriminating power of the questions, so that the appropriate research instrument was obtained to measure the ability students' mathematical problem solving.

After being tested, the data obtained that the six instrument questions are said to be very valid and have high reliability. In addition, there are three criteria for the level of difficulty, namely easy, medium and difficult and three criteria for different power tests, namely sufficient, moderate and good.

Numbered Heads Together (NHT) cooperative learning model on statistical material and are equipped with group worksheets. The researcher used the steps of the NHT type of cooperative learning model. In the first stage, the teacher explains the goals to be achieved. At the beginning of the lesson the teacher explains the material then divides the students into several heterogeneous groups. In the second step, the teacher distributes group worksheets to be worked on with the group. The third step, each group thinks together to solve the problems given. In the fourth step, after thinking together and solving the problems given, the teacher calls a number to present the results of their group discussions to be discussed with other groups. Then the teacher discusses and directs the students.

Numbered Heads Together (NHT) learning model has a positive influence, namely students will be more interested in learning because students are free to express their opinions and work together with their groups, students have the same opportunities to be more prepared and responsible for their groups when the number is called to conclude to other students and smart students can teach less intelligent students [6], [7]. Meanwhile, in the control class who learned to use the conventional model, students listened more to the teacher's explanation and carried out tasks when the teacher gave practice questions without any interaction among students in solving problems [4], [8], [9].

Based on the final results of the mathematical problem solving ability test, the average value in the experimental class was higher than the control class, namely 86.23 for the experimental class and 76.05 for the control class. It can also be seen in Table 3 that the average value of students' mathematical problem solving ability indicators on indicators of

ISSN: 2620-4129
E-ISSN: 2621-3885

understanding problems, planning problem solving strategies and implementing problem solving strategies is higher in the experimental class than the control class. Apart from the above calculations, it can also be seen in the hypothesis test using the t' test. After testing the data on the results of the *post-test* mathematical problem solving ability was obtained $t_{hitung} > t_{tabel}$. This proves that there is an effect on the mathematical problem solving ability of students who are taught using the *Numbered Heads Together* (NHT) cooperative learning model in class VIII of SMP Informatika Golden Star.

4. CONCLUSION

Based on the result of research and data analysis that has been carried out, it can be concluded that there is an effect of the Numbered Heads Together (NHT) learning model on the ability to solve mathematical problems of class VIII students of State Junior High School, from the posttest analysis obtained it can be seen that the average experimental class is 86,23 and the average control class is 76,05. Based on the results of inferential statistical analysis, the posttest value was obtained that $t_{count} = 3{,}12 > t_{table} = 2{,}03$ so that H_0 was rejected and H_1 was accepted. This means that there is a significant effect of the Numbered Heads Together (NHT) learning model on the ability to solve mathematical problems of students of State Junior High Schools Informatika Golden Star.

REFERENCES

[1] G. Biesta, "What is education for? On Good education, teacher judgement, and educational professionalism," *Eur J Educ*, vol. 50, no. 1, pp. 75–87, 2015, doi: 10.1111/ejed.12109.

[2] M. N. Gavareshki, F. Haddadian, and Mc. HassanzadehKalleh, "The Role of Education, Educational Processes, and Education Culture on the Development of Virtual Learning in Iran," *Procedia Soc Behav Sci*, vol. 46, no. Bruner 1996, pp. 5379–5381, 2012, doi: 10.1016/j.sbspro.2012.06.442.

[3] Z. Amir, Risnawati, E. Nurdin, M. Azmi, and D. Andrian, "The Increasing of Math Adversity Quotient in Mathematics Cooperative Learning Through Metacognitive,"

ISSN: 2620-4129
E-ISSN: 2621-3885

International journal of instruction, vol. 14, no. 4, pp. 841–856, 2021, doi: https://doi.org/10.29333/iji.2021.14448a.

[4] A. M. Walad, A. Razak, Lufri, and D. H. Putri, "Implementing Jigsaw Type of Cooperative Learning Model to Improve Students' Cognitive, Affective and Psychomotor Domains in Learning Natural Science at Grade IX.1 Smp Negeri 7 Sawahlunto," *International Journals of Sciences and High Technologies*, vol. 14, no. 2, pp. 329–337, 2019, doi: http://dx.doi.org/10.52155/ijpsat.v14.2.928.

[5] Ç. BektaŞ and G. Tayauova, "A Model Suggestion for Improving the Efficiency of Higher Education : University – Industry Cooperation," in *Procedia - Social and Behavioral*, 2014, vol. 116, pp. 2270–2274. doi: 10.1016/j.sbspro.2014.01.558.

[6] A. Casey and M. Quennerstedt, "Cooperative learning in physical education encountering Dewey's educational theory," *Eur Phy Educ Rev*, vol. 26, no. 4, pp. 1023–1037, Nov. 2020, doi: 10.1177/1356336X20904075.

[7] V. D. Tran, "The Effects of Cooperative Learning on the Academic Achievement and Knowledge Retention," *International Journal of Higher Education*, vol. 3, no. 2, May 2014, doi: 10.5430/ijhe.v3n2p131.

[8] K. J. Herrmann, "The impact of cooperative learning on student engagement: Results from an intervention," *Active Learning in Higher Education*, vol. 14, no. 3, pp. 175–187, Nov. 2013, doi: 10.1177/1469787413498035.

[9] N. Davidson and C. H. Major, "Boundary cross-ings: Cooperative learning, collaborative learning, and problem-based learning," *J Excell Coll Teach*, vol. 25, no. 4, pp. 7–55, 2014.

ISSN: 2620-4129
E-ISSN: 2621-3885