



Improving Students' Attitudes Toward Mathematics Through Numbered Heads Together Cooperative Learning Models with Scientific Approach

Megita Dwi Pamungkas

Mathematics Education Study Program, Universitas Tidar, Magelang, 56116, Indonesia
megitadwip@untidar.ac.id

Received: 26 February 2019

Revised: 10 April 2019

Accepted: 23 April 2019

Abstract

Schools in Indonesia are supposed to carry out mathematical learning well. However, in reality, mathematics learning process is, in many ways, simply delivering information without involving students to be able to build their own understanding and knowledge. Based on the observation, during the mathematics learning activities it was found that some students paid less attention, disturbed friends, did not do tasks, and did not focus on the learning processes. This study aims to improve students' attitudes towards learning mathematics by applying the Numbered Heads Together (NHT) cooperative learning method with a scientific approach. This research was a Classroom Action Research (CAR) which was conducted collaboratively and carried out in class VIII A one of junior high school in Depok, Sleman, Yogyakarta which consists of 21 male and 15 female students. The procedure is in the form of cycles. Each cycle consists of four stages namely: planning, implementation, action, observation, and reflection. The techniques of collecting data were observation, notes, field notes, documentation, non-test instruments (attitude questionnaire), and tests. The results showed that students' attitudes toward mathematics increased. The final results of the questionnaire on students' attitudes toward mathematics showed a good category (77.78%) with an average score of 110.44. Then, for mathematics learning outcomes, students got an average score of 72.22. The number of students who were scored above 75 increased to 63.89%.

Keywords: numbered heads together, scientific approach, students' attitude

INTRODUCTION

Education is an effort and planned in creating a learning atmosphere and learning process so that students develop actively their potential to have strength of religious spiritual, self-control, personality, intelligence, noble character, and skills needed by themselves, society, nation and state (Law No. 20 of 2003 on the National Education System). In the national education system, it is also stated that the aim of national education is to educate the life of the nation and develop whole people. The purpose of national education is to guide all educational activities in Indonesia. Mathematics is known as

basic science and an important requirement that is needed in daily life. Mathematics is a universal science that underlies the development of modern technology.

The importance of mastering Mathematics is also emphasized by National Council of Teacher of Mathematics (NCTM) (2000) which states that those who understand and can use "mathematics" will have significant opportunities and choices to emphasize their future because mathematical competence opens the door to a productive future. In the attachment of Regulation of Minister of Education and

Culture number 58 of 2014, it was also stated that mathematics subjects need to be given to all students from elementary school, to equip students with the ability to think logically, analytically, systematically, critically, innovative and creatively, and the ability to cooperate. These competencies are needed so that students can have the ability to obtain, manage, and use the information to live better in conditions that are always changing, uncertain, and very competitive.

Schools in Indonesia are required to carry out mathematical learning well. However, in reality, most mathematics learning is simply delivering information without involving students to be able to build their own understanding and knowledge. The measurement of the success of learning mathematics is only limited to the knowledge aspect (achievement), even it must also include attitudes and skills competencies in an integrated manner. These three aspects can be obtained optimally by students with meaningful mathematics learning so that they can achieve the expected learning achievement. Learning achievement will be achieved optimally if students are involved actively in learning, thinking, and communicating with others.

Students' attitudes towards learning mathematics expect students to be able to respond in the form of good attitudes towards mathematics. Myers (2007) stated that "Attitudes are beliefs and feelings that can influence our reaction". It means that attitudes are beliefs and feelings that can affect us. Lahey (2009) added, "*attitudes as evaluations that predispose us to act and feel in certain ways*" which means attitudes such as evaluations that affect us to act and feel in a certain way.

Based on observation, it is found that the mathematics learning process in class VIII A, one of junior high school in Depok was not yet optimal and the students' attitudes towards mathematics were low. The learning was

monotonous and tended to be boring. Mathematics learning is only limited to delivering the information so that it is unable to develop students' thinking skills. As a result, students felt happy if the math teacher was unable to attend. Students were also lack of interaction, communication, and participation during the learning process.

Besides making an observation, the researcher also did pre-research on the affective aspects of class VIII A, one of junior high school in Depok, such as students' attitudes towards mathematics. Pre-research was conducted by giving a questionnaire to 36 students. The questionnaire is in the form of statements relating to student attitudes toward mathematics with five ranges of answers, namely are strongly agree, agree, slightly agree, disagree, and strongly disagree. Based on the results of the questionnaire, it was found that there were several students who showed negative attitudes towards mathematics. These observations were also supported with interviews with mathematics' teacher. The teacher said that in mathematics learning activities there were some students who paid less attention to learning activities, disturbed friends, did not do tasks, did not focus on learning.

To solve the above problems, the teacher must be able to develop and combine various methods and strategies of mathematics learning. Teacher learning methods and approaches which are not good will affect student learning. The choice of methods, approaches, and strategies in learning become very important when the teacher prepares the teaching process. One of the alternatives that can create an atmosphere of active learning and interaction in the classroom is the scientific approach. The scientific approach in mathematics learning includes observing, asking, gathering information, reasoning, and communicating. Quinn (2011) stated that "*the science-of-learning methodology described here is compatible with modern*

mathematics, and advanced course work would be relevant to teaching based on this approach".

To be able to produce more optimal mathematics learning, teachers should combine the scientific approach that has been implemented with the cooperative learning model. Chianson et al. (2011) in their study said that the cooperative learning approach can capture students' attention in class activities and give them the enthusiasm to work tirelessly in math class. Among many cooperative learning models, the Numbered Heads Together (NHT) cooperative learning model provides opportunities for students to be able to help each other in understanding lessons, cooperation, and instilling a sense of responsibility for the success of the group or team.

Based on the description above, to reach the goal of this study which is, improving students' attitudes towards mathematics learning, the researcher collaborated with the teacher to conduct classroom action research with a research entitled "Improving Students' Attitudes toward Mathematics through Cooperative Learning Models Numbered Heads Together with Scientific Approach".

METHOD

The type of research is Classroom Action Research (CAR) which is done collaboratively. It means that the researchers collaborated with a teacher who taught mathematics. There are four stages in this research, i.e. planning, implementing, observing, and reflecting. This class action research was conducted in the first semester of the school year 2014/2015 at one of junior high school in Depok. This CAR was carried out in class VIII A through several cycles, starting from the Pythagorean theorem topic.

The subjects in this study were students of class VIII A, one of junior high school in Depok. This class has heterogeneous characteristics of students and who come from different family

backgrounds. There are 36 students in this class which consist of 21 male and 15 female students. This action research was carried out in several cycles. Each cycle consists of 1) planning, 2) implementation, 3) observation, and 4) reflection.

At the planning stage researcher conducted the following activities: 1) Arranging the activities of teachers and students in accordance with the steps of learning using NHT cooperative learning model with scientific approach as a guidance in preparing lesson plans; 2) Making learning instruments in the form of lesson plan; 3) Making student worksheets; 4) Arranging the learning implementation observation sheet; 5) Arranging instruments for pretest and post-test for cycle I; and 6) Coordinating and discussing the learning tools that have been prepared with collaborator.

In the action stage, the planned lesson plan in the previous stage was carried out. During the learning process, the researcher was assisted by other observers who made observations. The observation was monitoring and documenting activities in the ongoing learning activities. After the action and observation stages, the results were analyzed to be used as a reflection on whether the learning has been done as planned and expected. It was also used to see if there is an improvement from the condition before the action was done. In the reflection, the researcher was expected to improve the lesson plan in the next cycle.

The activity carried out in the cycle II was an activity carried out as an improvement from the cycle I. It means that if there is an indicator of observation in the cycle I which has not reached an improvement yet, it will be corrected in this cycle. The stages in cycle II are the same as cycle I. If the research target which is an indicator of success in implementing the learning model has not been achieved, then the research activities continue in the next cycle. Activities carried out in this cycle are an improvement for

the cycle I and cycle II. Data collection techniques and instruments used in this study were:

1. Observation

Observation aims to observe the process of implementing mathematics learning using the cooperative learning model NHT with a scientific approach and observe the attitude of students and teachers during the learning process. The instruments used in this observation were the learning observation sheet. The observation of the implementation of the learning process was to describe percentage achievement of the learning process that will be implemented.

2. Field Notes

These field notes are used to facilitate reflection to be carried out. Field notes are used to record things that occur during the learning process in the classroom when the researcher observes and constrains the obstacles faced by students and teachers.

3. Documentation

Documentation is used to strengthen data obtained from observation, questionnaire, and test. Documentation is done to see the records or archives carried out in the research. These documents include archives of the lesson plan, observations, students' worksheets which provide information about data, assignments, test results. In addition, documents are used to provide a visual picture of student activities. Documentation of photographs was taken during the learning process of the NHT cooperative learning model with the scientific approach.

4. Non-test

Data collection was using a non-test technique which is intended to see an improvement of affective aspects as expected of the research target. The instrument used in this non-test data collection is the questionnaire of students' attitudes towards mathematics. Questionnaires of students'

attitudes toward mathematics were using a Likert scale consisting of five choices of answers, i.e. strongly agree, agree, slightly agree, disagree, and strongly disagree. The statements were 30 items which consist of 16 positive statements and 14 negative statements. Grids and questionnaires of students' attitudes towards mathematics are attached. Scoring guidelines for questionnaires are stated in the following table.

Table 1. Scoring Guidelines for Questionnaire of Attitude

Statement	Choice of answers				
	Strongly Agree	Agree	Slightly Agree	Disagree	Strongly Disagree
Positive	5	4	3	2	1
Negative	1	2	3	4	5

The data analyses for the questionnaires are as follows.

- Give a score to each statement filled by students. This score is distinguished based on negative and positive statements, then summed up for each student.
- The total scores of each student are categorized based on criteria of questionnaire results according to Azwar (2011) as follows.

Table 2. Students' Attitude Criteria

Interval	Criterion
$120 < X \leq 150$	Very good
$100 < X \leq 120$	Good
$80 < X \leq 100$	Fair
$60 < X \leq 80$	Poor
$30 \leq X \leq 60$	Very Poor

- Calculate the percentage of each criterion to see the percentage of each category/criterion, with the following formula:

$$\text{percentage} = \frac{\text{students belong criteria}}{\text{total of students}} \times 100\%$$

5. Tests

The technique of collecting data was conducted to describe the achievement of the Minimum Criteria of Learning or *Kriteria Ketuntasan Minimum* (KKM) achieved by students after the learning process. The test in each cycle was pre-test and post-test. This test is to measure whether there is an increase in learning results after the learning process is carried out. The tests are student's learning achievement which is prepared based on basic competencies and indicators to be studied. The test instrument is in the form of multiple choice based on indicators of each basic competency. The correct answer is given 1 score and the wrong answer is given 0 score.

The data analysis technique was using the class average system, which is using the following formula:

$$\text{Mean ideal} = \frac{\text{Total score of all students}}{\text{Total of students}}$$

From the above test results, then it was qualified according to the category according to Azwar (2011) as follows.

Table 3. Criteria for Average Score of Learning Achievement Test

Interval	Criterion
$Mi+1,5Sdi < X \leq Mi+3Sdi$	very high
$Mi+0,5Sdi < X \leq Mi+1,5Sdi$	High
$Mi-0,5Sdi < X \leq Mi+0,5Sdi$	Medium
$Mi-1,5Sdi < X \leq Mi-0,5Sdi$	Low
$Mi-3Sdi < X \leq Mi-1,5Sdi$	Very low

Note:

$$\text{Mean Ideal (MI)} = \frac{1}{2} (\text{ideal maximum score} + \text{ideal minimum score})$$

$$\text{Standard Deviation Ideal (SDI)} = \frac{1}{6} (\text{ideal maximum score} - \text{ideal minimum score})$$

X = total actual score

Next, the data on the post-test of learning achievement was calculated with the percentage of Minimum Criteria of Learning (KKM) by class VIII A, one of junior high school in Depok. The Minimum Criteria of Learning (KKM) has been set as 75 on a scale of 100. The calculation was using the formula:

$$\text{percentage of KKM} = \frac{\text{Students achieve KKM}}{\text{Total of students}} \times 100\%$$

The success of this CAR was characterized by improvement in student learning motivation during the learning process. The indicators are as follows.

1. The implementation of mathematics learning with the steps of the NHT cooperative learning model with a scientific approach was 85%.
2. The improving of students' attitudes toward mathematics for class VIII A, one of junior high school in Depok was seen as the target for each criterion as shown in the following table.

Table 4. Target CAR Results

Criterion	Initial conditions	Target
very high	0%	20%
High	48.57%	60%
Medium	45.71%	20%
Low	5.71%	0%
Very low	0%	0%

3. The number of students who achieved the Minimum Criteria of Learning (KKM) was more than 75% and the class average based on student test scores increased from cycle I to cycle II.

RESULTS

The learning implementation in this study was 87.5%. These results have reached the implementation target of at least 85%. Learning activities during the implementation process are

carried out based on the objectives of the NHT cooperative learning model with a scientific approach. By using this model, the teacher can increase a positive attitude towards mathematics. The following table presents the improvement of positive attitudes towards mathematics which is obtained from the results of student questionnaires in the pre-cycle, end of cycle I, and end of cycle II.

Table 5. The Results of Increasing Student Attitudes towards Mathematics

Pre-cycle	Target	End Cycle I	End Cycle II
0%	20%	11.11%	13.89%
47.22%	60%	72.22%	77.78%
44.44%	20%	16.67%	8.33%
8.33%	0%	0%	0%
0%	0%	0%	0%
99.88		109.005	110.44

The distribution of attitude questionnaires towards mathematics is done at the end of the cycle, in order to obtain data about students' attitudes towards mathematics during the previous cycle. Data from questionnaires indicate that student attitudes toward mathematics have increased. The final results of the questionnaire on students' attitudes toward mathematics showed good categories with an average score of 110.44. Students who are in good criteria are 77.78%. The improvement was almost 30% compared with the students' attitude before the treatment. These results have reached the expected target, i.e. students who get a good category at least achieved 60% although the target for this criterion has not been achieved yet. This showed that the implementation of the NHT cooperative learning model with a scientific approach can improve students' positive attitudes towards mathematics.

Furthermore, according to the results of tests conducted at the end of each cycle, it can be said that students' cognitive abilities are better. The following table presents the improvement of

the cognitive ability test indicated by the average score of the test at the end of cycle I and cycle II.

Table 6. Mathematics Learning Outcome

Description	Tests	
	Pre-test	Post-test
Class average	54.44	72.22
Highest Score	80	100
Lowest score	20	20
Completed	8	23
Not complete	28	13
Percentage of completeness	22.22%	63.89%

Based on Table 6 it can be seen that after being given treatment in cycle II, the class score for the test of mathematics learning outcomes was 72.22. The number of students who scored above 75 increased to 63.89%. These results are less likely to reach the expected target of minimum criteria of learning 75% so that the next cycle needs to be carried out with all improvements. Due to limited time and permission for the research in the school, the action research ends in cycle II. Based on the results of the research that has been done, the cognitive abilities of students in mathematics learning by using the NHT cooperative learning model with scientific approach have increased. Besides the level of attitudes toward mathematics, the cognitive abilities of students also increased, but the percentage of increasing the ability of students' attitudes toward mathematics was greater than the percentage of increasing the cognitive tests of students' mathematics learning.

CONCLUSION

This research is an effort to improve students' attitudes towards mathematics by using an active knowledge sharing strategy with a scientific approach. Based on the results of research, discussion, and reflection, it can be concluded that after the implementation of the NHT cooperative learning model with scientific

approach for 2 cycles, students' attitudes towards mathematics and learning achievement of class VIII A, one of junior high school in Depok, Yogyakarta increased although the increase has not yet achieved the targets that have been set for the achievement of mathematical learning.

The achievement of student mathematics learning outcomes can be seen from cognitive test data which was held at the end of each cycle. The average score of the percentage of completeness tests for students' cognitive abilities increased by 41.67%. At the end of cycle I the percentage of completeness was 22.22%. Then after reflection of learning activities, the percentage of learning completeness increased at the end of cycle II to 63.89%. The score of class average also increased from 54.44 at the end cycle I to 72.22 at the end of cycle II.

REFERENCES

- Azwar, S. (2010). *Penyusunan skala psikologi*. Yogyakarta: Pustaka Pelajar.
- Chianson, M.M., Kurumeh, M.S., & Obida, J.A. (2011). The effect of cooperative learning strategy on students' retention in circle geometry in secondary schools in Benue State, Nigeria. *American Journal of Scientific and Industrial Research*, 2(1): 33-36.
- Depdiknas. (2003). *Law of the Republic of Indonesia Number 20, the year 2003 of the National Education System*.
- Kemdikbud. (2014). *Ministerial Regulation Number 58 the year 2014 of Curriculum 2013*.
- Lahey, B. B. (2009). *Psychology an introduction*. New York, NY: McGraw-Hill.
- Myers, D. G. (2007). *Exploring social psychology*. New York: McGraw-Hill
- NCTM. (2000). *Principles and standards for school mathematics*. USA: The National Council of Teachers of Mathematics, Inc.
- Quinn, F. (2011). A science-of-learning approach to mathematics education. *A co-publication of the AMS and Fields Institute*, 58(9), 1264-1275. Retrieved from <https://www.ams.org/notices/201109/rtx110901264p.pdf>.