J. Pijar MIPA, Vol. 17 No.3, May 2022: 331-336 ISSN 1907-1744 (Print)
DOI: 10.29303/jpm.v17i3.3468 ISSN 2460-1500 (Online)

ENHANCING METACOGNITIVE SKILLS IN THE CLASSROOM: THE EFFECT OF NUMBER HEAD TOGETHER COOPERATIVE LEARNING MODEL

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Received: April 11, 2022. Accepted: May 14, 2022. Published: May 27, 2022

Abstract: This study aims to study the effect of the number head together NHT type cooperative learning model on the activities of students and metacognitive skills. The research subjects came from students of class eleventh Science Senior High School of 19 Surabaya, 35 students using a one pretest-posttest control group design. The results obtained were 1) the percentage of implementation of the NHT cooperative learning model at meetings 1 and 2 was 94.4% and 95.8%, which were categorized as very good. 2) The percentage of student activity at the relevant 1 and 2 meetings is 95.97% and 97.20%, respectively. 3) Increased N-gain on students' metacognitive skills through post-test, including planning skills of 0.6; monitoring skills of 0.5; and evaluating skills of 0.5.

Keywords: *Cooperative Learning Model, Metacognitive Skills, NHT, Reaction Rate*

INTRODUCTION

Indonesia is a country that has multiple human resources with diverse backgrounds. Education is one way that can be taken so that human resources have competencies as provisions to compete in the outside world. In education, human resources will gain theoretical and practical experience. It becomes an impetus to create superior human resources and not become a backward generation.

The purpose of Indonesian education in the opening of the 1945 Constitution of the Republic of Indonesia is to educate the nation's life. The Indonesian people's ideal is to generalize education throughout Indonesia to achieve an intelligent generation. In addition, based on Law No. 20 of 2003, article 3, national education functions to develop capabilities and shape the character and civilization of a dignified nation by educating the country. That aims to develop the potential of students to become human beings who believe in God Almighty, have a noble character, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens [1].

However, the reality today is different from the situation two years earlier. Indonesia is being hit by the Covid-19 pandemic, which causes the Indonesian education system to have positive and negative impacts simultaneously. This negative impact is evidenced by the limited face-to-face learning process between teachers and students. To hinder the delivery of theoretical and practical material (especially science subjects), thus requiring teachers to create innovations in the learning process, such as the media used to increase the quality of education.

According to the Knowledge Core Competence, efforts to improve the quality of education today must be carried out to achieve equivalent high school graduates. They must have factual, conceptual, procedural, and metacognitive knowledge of science, technology, art, and culture. That can use insight into humanity, nationality, state, and civilization-related causes and impacts of phenomena and events [2]. So, it can be done with a learning plan so that the learning process runs to be directed and effective. Teachers must plan to learn before carrying out the learning process and evaluate student learning outcomes to achieve graduate competencies according to national education goals. Teachers' learning planning can be designed in the form and Learning Implementation Plan, which refer to the Content Standards [3]. The success of learning activities lies in implementing all procedures from a syntax because there are still teachers who do not understand the learning procedures following the syntax in the learning model.

Chemistry is one of the subjects that aims to develop students' attitude competence, knowledge competence, and skill competence according to interests, talents, and intellectual abilities in a group of scientific subjects [4]. According to the Ministry of Education and Culture (2014), chemistry is a part of a scientific discipline that is inseparable from the nature of science, namely, products, processes, and attitudes [5]. A scientific product is categorized if it contains facts, concepts, principles, laws, and theories. The process is classified if it has science process skills, methods, procedures, or learning strategies to gain knowledge or seek explanations. Categorized attitude if able to develop scientific attitude and cooperation. Based on the pre-research results obtained at Senior High School of 19 Surabaya in November 2021, 70.8% of the 24 students stated that chemistry lessons had difficulty.

One of the materials in chemistry is the rate of reaction with Basic Competence, namely analyzing the factors that affect the reaction rate and

determining the order of the response based on the experimental results. Chemists think that reaction rates are a contextual matter with much emphasis on concepts, calculations, and analyzing experimental data on reaction rates. Therefore, a careful, tenacious, thorough, and skilled attitude is needed in solving these problems [6]. In addition, the reaction rate material requires students to understand concepts and theories by designing, implementing, concluding, and presenting experimental results about the factors that affect the reaction rate [7]. So that this can combine knowledge and metacognition to control the way students learn. Based on the interview results with the chemistry teacher at Senior High School of 19 Surabaya in November 2021, student learning outcomes in the reaction rate material were low. Students find it difficult to understand concepts and calculations on reaction rates. In addition, the teaching methods used by the teacher do not vary. So, it can be said that learning chemistry at the Senior High School of 19 Surabaya is a product, not a process. If it is consistently applied, students will find it challenging to develop their knowledge and metacognitive skills in learning.

Metacognition is divided into two components, namely cognitive knowledge and skills. The researchers direct into two components: metacognitive knowledge and metacognitive skills [8]. Metacognitive skills are defined as the scientific process of students, including planning (planning skills), monitoring (monitoring skills), and evaluating (evaluating skills) in the learning process. So that independently, students can measure and control their abilities by looking at the learning process carried out [9]. Therefore, metacognitive skills can support student-centered learning. Based on the pre-research results obtained at Senior High School of 19 Surabaya in November 2021, 45.7% of the 35 students thought about learning objectives and strategies in completing the reaction rate task. As many as 47.1% of students studied the reaction rate material to understand the material. Previously, as many as 55.8% of students evaluated learning achievement following their learning objectives. Therefore, the metacognitive aspect is still relatively low. The process of students controlling their abilities will feel easy if it is done by way of interaction with friends (discussion) to produce a strengthening of the concepts obtained previously. Thus, the learning model used to train metacognitive skills is cooperative.

Cooperative learning is a teaching method in which students work together in small groups to help each other learn a material. Students are expected to be able to help each other, discuss and argue with each other to hone their current knowledge and close the gaps in each other's understanding. If properly organized, students in cooperative groups will work together to ensure that everyone in the group has mastered the concepts thought out [10]. One type of cooperative learning model is Numbered Heads Together (NHT). The NHT-type cooperative learning model can train students' metacognitive skills, which can be done by conditioning students to share their opinions or thoughts and take responsibility for achieving individual and group learning outcomes with student learning strategies. This type also makes it easier for students in the long-term learning process because the discussion method makes students' thinking process able to explore it themselves [11]. In cooperative learning, the NHT type makes students have an attitude of interdependence with each other in groups so that the giving of rewards is not done individually [12].

Therefore, this study focus on obtaining the effect of the NHT-type cooperative learning model to train students' metacognitive skills on the reaction rate material.

RESEARCH METHOD

This research was conducted at the Senior High School of 19 Surabaya in the November odd semester of 2021/2022. This type of research is pre-experimental research with a research design using one pretest-posttest control group design to obtain information on the results of students' metacognitive skills. Observations were made twice, namely pre-test and post-test. The pre-test and post-test are assumed to be the treatment effect, namely the NHT type of cooperative learning model.

The subjects of this limited research were 35 students of class XI IPA 7 who were selected heterogeneously. The research procedure consists of three stages: (1) The preparation stage includes interviews with chemistry teachers at the Senior High School of 19 Surabaya, distributing pre-research questionnaires to students, and selecting samples (classes) randomly by the chemistry teacher class XI IPA. Moreover, making tools (syllabus, lesson plans, and worksheet) and instruments (sheets for implementing the NHT cooperative learning model, pre-test and post-test sheets, student activity observation sheets, and inventory sheets as supporting data) learning. (2) The implementation stage includes conducting a pre-test on students, implementing the NHT type cooperative learning model to train metacognitive skills by being given worksheet, and conducting a post-test for students. (3) The final stages include collecting, processing, and analyzing the gata results obtained.

A scoring scale was used to analyze the NHT cooperative learning model's implementation. The following are the syntax scoring criteria for implementing the NHT cooperative learning model following Table 1.

ISSN 1907-1744 (Print)
ISSN 2460-1500 (Online)

Table 1. Score Criteria for the Implementation of the NHT Cooperative Learning Model

Score	Description
0	The teacher does not carry out learning activities.
1	The teacher carries out learning activities incompletely but coherently in each phase.
2	Teachers carry out learning activities ultimately but not coherently in each phase.
3	The teacher carries out learning activities completely and coherently in each phase.

The total score obtained is used to get scores using the formula:

$$\text{Value} = \frac{\Sigma \text{ score earned}}{\Sigma \text{ maximum score}} \text{ x } 4$$

[13]

The value of the implementation of the NHT type cooperative learning model is converted to the formula as follows:

$$\text{Value} = \frac{\text{score earned}}{\text{maximum score}} \text{ x } 100\%$$

[14]

Then the percentage values are analyzed according to the conversion category as follows:

Table 2. Conversion Percentage of Learning Implementation

Boundary	Category
1%-20%	Very not good
21%-40%	Not good
41%-60%	Enough
61%-80%	Good
81%-100%	Very good

[15]

Implementing the NHT type of cooperative learning model is successful in good and very good categories if the percentage value is 61 %.

To analyze of student activities is done by taking the average results of observations of dominant student activities by three observers using the following formula:

$$\text{Percentage value} = \frac{\text{The frequency of the activity that appears}}{\text{Overall activity frequency}} \boldsymbol{x\ 100}\%$$

[16]

Student activities in groups are successful if the relevant activities are 75 % and more significant than the percentage of irrelevant activities.

The students' metacognitive skills were obtained with the pre-test and post-test scores. The metacognitive inventory questionnaire included planning, monitoring, and evaluating. Scoring criteria for pre-test and post-test of each metacognitive aspect (planning, monitoring, and evaluating) according to Table 3.

Table 3. Criteria Pre-test and Post-test

Metacognitive Aspects	Score	Description
Planning, monitoring, and evaluating	0	Not writing down answers
	1	Write answers but not correct (do not contain two keywords).
	2	Write answers with two keywords, but they are not related.
	3	Write complete answers by connecting two keywords.

The score obtained is used to get the value of the metacognitive skills of students calculated by the following formula:

$$\text{Percentage value} = \frac{\Sigma \text{ value earned}}{\Sigma \text{ maximum value}} \text{ x } 100\%$$

[14]

The value obtained is then processed using SPSS 25 to determine the normal distribution of the data to be continued with data testing using a paired sample T-test. This test takes a sig (2-tailed) value of less than 0.05, which indicates a significant difference between the pre-test and post-test results. The value data obtained from the pre-test and post-test can be analyzed using the gain score, which can be calculated using the following formula:

$$< g > = \frac{(\,(S_f) - (S_i)\,)}{100 - (S_i)}$$

[17]

Description: <g> = gain score, (s_f) = post-test, (s_i) = value pre-test

Following <g> calculation results to determine the students' metacognitive skills between the pre-test and post-test obtained can be converted to the gain score in Table 4.

Table 4. Gain Score

Value	Criteria
$g \geq 0{,}7$	High
$0{,}3 \leq g < 0{,}7$	Medium
$g < 0{,}3$	Low

[17]

Students' Metacognitive skills can be trained through the NHT type cooperative learning model if the score gains score is $0,3 \leq g < 0,7$with medium relevant activity criteria.

A metacognitive inventory sheet for students is made through Google Form, which contains multiple choices related to the impact or response of students after receiving the process of implementing the NHT-type cooperative learning model on the reaction rate material. It is said that the metacognitive inventory was successful in both good and very good categories if the percentage value was in the results ≥ 61.

RESULTS AND DISCUSSION

Implementation of the NHT Type Cooperative Learning Model

Observations on implementing the NHT-type cooperative learning model were carried out by three observers from one chemistry teacher from the Senior High School of 19 Surabaya and two students from the State University of Surabaya. The purpose of analyzing the implementation of this learning model is to synchronize per-phase syntax between implementation in the learning process and lesson plans and to know the teacher's skills when conditioning the class. So, this can guide finding out whether the syntax is done. Learning using the NHT type cooperative model was conducted in two meetings with a 6-phase syntax.

Phase 1 is a preliminary activity to clarify goals and motivations for students by providing a picture phenomenon so that students can write down learning objectives. This phase was carried out in two meetings, with each value obtained, 100%; 100%, categorized as very good.

Phase 2 is a prefix for core activities to present information on material to students. This phase is given with the aim that students can make notes about the concept of material conveyed by the teacher so that it spurs students to ask questions out of curiosity. This phase was conducted in two meetings with each value obtained, namely 91,6%; 100%, which is categorized as very good.

Phase 3 is the core activity for organizing students into learning teams. Team division is done by giving numbers to students as a prefix for the NHT type of cooperative learning model [18]. Then the students are grouped according to the number to be combined into Whatsapp according to the number obtained. This phase was carried out in two meetings, with each value obtained, namely 100%; 91,6%, categorized as very good.

Phase 4 is a core activity to help students work in teams and learn. This phase is a continuation of the stages of the NHT cooperative learning model in the form of planning skills. In this phase, students can identify to obtain important information and monitoring skills, namely consulting references by collecting data through discussion so that important notes are formed through the distribution of worksheets by the teacher. This phase was carried out in two meetings, with each value obtained, 83,3%; 91,6%, which is categorized as very good.

Phase 5 is a core activity to evaluate student activities. This phase was conducted in two meetings with each value obtained, namely 91,6%; 91,6%, so it is categorized as very good. In activities carried out in this phase, students and their groups make statements on the conclusions. The conclusion is then communicated in front of the class so that other groups with the same number can consider it.

Phase 6 is the final activity to reward students and their groups. This phase was carried out in two meetings, with each value obtained, namely 100%; 100%, categorized as very good. In evaluating skills, students personally complete evaluation tests to reflect the learning that has been passed. Then this stage is also the moment when the award is given to the group with the highest evaluation score.

That way, the percentage of implementation of the NHT type cooperative learning model for two meetings is 94.4% and 95.8%, which are categorized as very good. So that with an increase in the percentage result, the NHT type cooperative learning model can train students' metacognitive skills in the reaction rate material.

Student Activities

Observations of student activities were carried out by three observers from one Chemistry teacher at Senior High School of 19 Surabaya and two students from the State University of Surabaya. The purpose of the analysis of student activity is to obtain information about the activities of students in their dominant group, which are observed every 3 minutes in one hour where each observer follows 2-3 groups.

Table 5. Percentage of Student Activities

Meeting	Average	Activities
Meeting 1	95.97%	4.03%
Meeting 2	97.20%	2.8%

In student activities, there is different learning for two meetings. Students will learn about reaction rate factors, concentration, and surface area at the first meeting, while at the second meeting, students will learn about reaction rate factors, temperature, and catalysts. Basically, in student activities, their metacognitive skills are still applied.

Activities Planning skills include student activities to determine learning objectives by observing phenomena related to the reaction rate factor as a provision for strategies to identify other

information. Activities monitoring skills include completing tasks given through worksheets, such as observing reaction rate practicum videos to determine problems, hypotheses, and variables. In this stage, students wrote down tools and materials used in practicum, wrote down procedures performed, made tables to write down the practicum results, and analyzed by graphing. Activities Evaluating skills include self-reflection from students by making conclusions on the material studied and giving rewards to the group with the highest score. Thus, the results of irrelevant student activities were lower than the results of relevant student activities, namely 95.97% and 97.20%, respectively.

Metacognitive Skills

Metacognitive skills are a person's ability to independently control and understand the learning process to achieve the desired achievement [19]. This metacognitive skill test aims to obtain information about students' understanding of the concept of reaction rate material.

Metacognitive skills can be obtained from the pre-test and post-test with 16 essay questions and four factors affecting the reaction rate in every four questions. The question contains metacognitive components, including planning, monitoring, and evaluating skills. Metacognitive skills are obtained from the metacognitive inventory as data support with 20 questionnaire questions. Skill results for two meetings are presented in Tables 6 and 7.

With metacognitive skills, students can process their way of thinking to complete the task. At each meeting, students' metacognitive skills are trained by doing worksheets based on metacognitive skills. Then through pre-test and post-test, students' metacognitive skills can be monitored to determine which learning strategies are used to complete the task to match the metacognitive stages.

Students' planning skills can be seen in Table 6 and Table 7. The average result of post-test metacognitive skills for two meetings is 72.28 in the good category. The supporting data for metacognitive inventory are 80 in the good category. The obtained value was obtained by testing the data with normality and a T-test. The normality test obtained a significance value of 0.060 > 0.05 so that the data were normally distributed. Value is then used as a provision to test the data with the T-test, which obtained a significance value of 0.000 < 0.05. The data shows differences in the pre-test and post-test results on metacognitive skills in the planning skills of students. The difference in the pre-test and post-test results caused an increase in N-gain of 0.6, which was categorized as medium. In planning, students will ask themselves to determine learning objectives to identify the information to be studied. Constructivist principles make students aware of their responsibilities through learning [11]. So, it can be concluded that the planning skills of students can be adequately trained.

Table 6. Results of the Mean Value of Metacognitive Skills for Each Indicator

Metacognitive Skills Indicator	Pre-test	Post-test	N-gain
Planning skills	34.31	72.28	0.6
Monitoring skills	24.94	71.62	0.5
Evaluating skills	27.11	71.88	0.5

Table 7. Metacognitive Inventory Results

Planning	Skills	Monitoring Skills	Evaluating Skills	Mean
Pre-test	65.7	68.6	62.9	65.7
Post-test	80	71.4	74.2	75.2

Student monitoring skills can be seen in Table 6 and Table 7. The average post-test of metacognitive skills during the two meetings was 71.62 in the good category. The results of supporting data for metacognitive inventory are 71.4 in the good category. The value obtained was obtained by testing the data with the normality and T-tests. The normality test obtained a significance value of 0.200 > 0.05 so that the data were normally distributed. Value is then used as a provision to test the data with the T-test, which obtained a significance value of 0.000 < 0.05. The data shows differences in the pre-test and post-test results on metacognitive skills in the monitoring skills of students. The difference in the pre-test and post-test results caused an increase in N-gain of 0.5, which was categorized as medium. In monitoring student activity, the teacher divides students into small groups to discuss and work together to complete assignments. Completing these tasks allows students to monitor themselves by consulting the initial information, which is then processed into important tables and notes. That aligns with metacognitive knowledge, namely general cognitive knowledge and awareness of one's understanding. The learning characteristics emphasize methods to make students more aware and responsible for their knowledge and thoughts [20]. So, it can be concluded that student monitoring skills can be appropriately trained.

Evaluation of student skills can be seen in Table 6 and Table 7. The average post-test result of metacognitive skills during the two meetings was 71.88 in the good category. The effect of supporting data for the metacognitive inventory

was 74.2 in the good category. The obtained value was obtained by testing the data with normality and a T-test. The normality test obtained a significance value of 0.063 > 0.05 so that the data were normally distributed. Value was then used as a provision to test the data with the T-test, which obtained a significance value of 0.000 < 0.05. The data shows differences in the pre-test and post-test results on metacognitive skills in the evaluating skills of students. The difference in the pre-test and post-test results caused an increase in N-gain of 0.5, which was categorized as medium. At this stage, students will self-reflect by writing conclusions that answer what has been obtained during learning. So, it can be concluded that students' evaluation skills can be appropriately trained.

CONCLUSION

Based on the results and discussion, it can be concluded that the NHT type cooperative learning model, which is trained students to train students metacognitive skills with the reaction rate material, is said to be successful. That is evidenced by implementing the NHT type cooperative learning model, which has very good criteria. Student activities are categorized as good because relevant activities are higher than irrelevant activities, and metacognitive skills are classified as good because there is an increase in N-gain on the post-test.

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