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The Influence of The NHT Type Cooperative Learning Model Assisted by Problem Based LKPD on Critical Thinking and Collaboration Skills in Environmental Change

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Article Info	Abstract
	At SMA Negeri 1 Tengaran, students' critical thinking and collaboration skills in environmental change material are still low. This is reinforced by student learning results in environmental change material which show that only 40.62% of students meet the criteria for achieving learning objectives and the results of the collaboration skills questionnaire which show that 32.3% of students find it difficult to collaborate with friends. These results are motivated by the low level of student involvement in learning so that a student-centered learning model is needed, such as the NHT type learning model assisted by problem-based LKPD. This learning model can train critical thinking skills through learning activities that invite students to think in solving problems on the LKPD while also training students' collaboration skills through group collaboration. The aim of this research is to analyze the effect of implementing the NHT type learning model assisted by problem-based LKPD on students' critical thinking and collaboration skills in environmental change material. The research is Pre-Experimental research with one group pretest-posttest. The research sample consisted of classes X-1, X-4 and X-5 which were selected using purposive sampling techniques. Critical thinking skills data were analyzed using the paired sample T-test while collaboration skills data used the Wilcoxon test. The results of the Paired Sample T test show a significance value of 0.000 (<0.05), meaning that the use of the NHT model assisted by problem-based LKPD has an effect on students' critical thinking skills. Each aspect of critical thinking has an N-gain value > 0.3 with the highest N-Gain in the indicators of advanced clarification and strategies & tactics. For the collaboration variable, the results of the Wilcoxon test show an Asymp.Sig.(2-tailed) value of 0.000 (<0.05), meaning that the use of the NHT model assisted by problem-based LKPD has an effect on collaboration skills. Each aspect of collaboration has an N-gain value > 0.3 (medium category) with the highest N-Gain in the indicator of working in a group. Based on these results, it can be concluded that the application of the NHT model assisted by problem-based LKPD has an effect in improving students' critical thinking and collaboration skills at SMA Negeri 1 Tengaran in environmental change material. The results of this research can be used as an alternative learning model to improve students' critical thinking and collaboration skills.

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INTRODUCTION

In 21st century learning, students are required to have various skills to prepare for the future, such as critical thinking and collaboration skills. This is in line with the opinion of Daryanto & Karim (2017) that critical thinking skills, problem solving and collaboration are an important part of 21st century development. This research focuses on developing two 21st century skills, namely critical thinking and collaboration skills.

According to Hartini (2017), critical thinking skills are the ability to know problems in depth and the solutions to these problems so that critical thinking skills are important for every student to have as preparation for facing the future. Critical thinking skills were chosen because critical thinking skills are the parent of skills that are a priority in 21st century education (Halim, 2022). In this research, collaboration skills were chosen because of the importance of collaboration skills for students in building a culture of cooperation (teamwork) as a preparation for facing 21st century competition (Muiz *et al.*, 2016). Collaboration is a form of cooperative interaction between students in groups so that they can provide information through exchanging opinions and working together for the common good (Junita & Wardani, 2020).

In biology learning, one of the biological materials that requires critical thinking skills is environmental change material. According to Syahrul *et al.* (2021), environmental change material is material that is closely related to everyday life. In this material, students' critical thinking skills are needed in analyzing the factors that cause environmental damage, analyzing cases of environmental change and efforts to overcome existing environmental change problems.

Based on the results of interviews and observations at SMA Negeri 1 Tengaran, students' critical thinking skills in environmental change material are still in the low category. Student learning results in environmental change material show that only 40.62% of students can meet the minimum completeness. According to Miswari *et al.* (2020), students' low biology learning outcomes indicate that students' critical thinking skills are still low. The low level of critical thinking skills SMA Negeri 1 Tengaran is due to the fact that many students are still passive during the learning process. This is in line with the opinion of Shalihah (2019), that a lack of student involvement in the learning process can make it difficult for students to develop their critical thinking skills.

Students' collaboration skills at SMA Negeri 1 Tengaran are also still low, where based on observations there are several students who have difficulty collaborating with other friends when working on assignments in groups. This is reinforced by the results of the collaboration skills questionnaire before implementing the NHT model which showed that 32.3% of students found it difficult to collaborate with other friends. Students' low collaboration skills can be seen from when learning activities involve group discussions, students do not complete assignments but spend more time telling stories.

One learning model that can be used to improve students' critical thinking and collaboration skills is the Numbered Head Together (NHT) cooperative learning model (Masullah & Jailani, 2023). The NHT learning model can train critical thinking skills through learning activities that invite students to actively think in discussions, collect information, analyze and discover the concepts being studied. The Numbered Heads Together (NHT) learning model is a cooperative learning model that emphasizes group cooperation and discussion. According to Yasa *et al.* (2020), through group discussion activities in the NHT type learning model, students can train cooperation and a sense of responsibility. The application of group discussions is able to make students work together and respect each other's opinions in completing the teacher's assignments so that students' collaboration skills are honed.

In learning activities, the use of appropriate media and teaching materials is needed to improve students' critical thinking and collaboration skills. According to Elfina & Sylvia (2020), the use of learning media such as LKPD as a variation in learning can improve critical thinking skills. LKPD is a learning media that contains activities and problems that must be answered by students when carrying out real activities with the objects and problems being studied (Arsana & Sujan, 2021). According to research by Agmita *et al.* (2021) and Yunipiyanto *et al.* (2020), the use of problem-based LKPD can improve students' critical thinking and collaboration skills. The use of problem-based LKPD can develop critical thinking

skills through activities that contain issues or problems in everyday life, thus encouraging students to discover a concept (Pahrudin & Pratiwi, 2019). LKPD as a learning medium that is done in groups can be used to train students' collaboration skills. Based on the background that has been described, research was conducted on "The Influence t of the NHT Type Cooperative Learning Model Assisted by Problem-Based LKPD on Critical Thinking and Collaboration Skills in Environmental Change Material".

RESEARCH METHOD

This research is a quantitative research with a pre-experimental design. The type of design used is one group pretest-posttest. This research only consisted of an experimental class to be given treatment on the application of the NHT type Cooperative Learning model assisted by problem-based LKPD without a control class. The research was carried out at SMA Negeri 1 Tengaran in the even semester of 2022/2023. The sampling technique for this research uses a purposive sampling technique, with considerations or suggestions from the biology teacher concerned. The sample used consisted of 3 classes, namely classes X-1, X-4 and X-5.

The independent variable in this research is the NHT type Cooperative Learning model assisted by problem-based LKPD while the dependent variable is critical thinking and collaboration skills. There are three stages in conducting research, namely pretest, treatment, and posttest. The pretest was carried out before treatment to determine the initial level of critical thinking and collaboration skills of the students. The second stage, providing treatment in the form of implementing the NHT type Cooperative Learning model assisted by problem-based LKPD. The final stage is the posttest, this stage is carried out to determine students' critical thinking and collaboration skills after implementing the NHT type Cooperative Learning model assisted by problem-based LKPD.

The syntax of the NHT type Cooperative Learning model that is applied consists of four phases, namely: 1) Numbering Phase, 2) Question Asking Phase, 3) Heads Together Phase, and 4) Answering Phase.). The material used in the experimental class is environmental change material. To measure students' critical thinking skills, they use a test instrument in the form of 20 multiple choice questions. The test instrument used refers to indicators of critical thinking skills according to Ennis (1985), namely: 1) Elementary clarification, 2) Basic support, 3) Inference, 4) Advanced clarification, 5) Strategies and tactics. Before being used for research, the multiple choice question test instrument was tested for validity and reliability using the IBM SPSS Statistics 26 application. The results of the analysis showed that the 20 multiple choice questions were valid with a reliability of 0.891 which was included in the very high reliability category.

Students' collaboration skills are measured using self-assessment and peer assessment questionnaire instruments adapted to 5 indicators of collaboration skills, namely: (1) Individual personal accountability and responsibility, (2) Face-to-face interaction, (3) Positive interdependence (4) Communication skills and 5) Skills for working in groups (Meilinawati, 2018).

The critical thinking skills data analysis technique uses the Ngain test and parametric statistical techniques, namely the Paired Sample T test with the help of the SPSS application. The Paired Sample T test was carried out because the critical thinking skills data was normally distributed. The N-gain test and Paired Sample T test were carried out to determine whether or not there was an effect of using the NHT type Cooperative Learning model assisted by problem-based LKPD on critical thinking skills. In collaboration skills, data analysis techniques use the Ngain test and non-parametric statistical techniques, namely the Wilcoxon test with the help of the SPSS application. The Wilcoxon test was chosen because collaboration skills have data that is not normally distributed. The N-gain test and Wilcoxon test were carried out to determine whether or not the use of the NHT type Cooperative Learning model assisted by problem-based LKPD had an influence on collaboration skills.

RESULTS AND DISCUSSION

1. **The Influence of the NHT Learning Model Assisted by Problem-Based LKPD on Students' Critical Thinking Skills**

The results of the average pretest and posttest scores for students' critical thinking skills are presented in Table 1.

Table 1. Critical Thinking Pretest and Posttest Results Scores

	Class	Highest Score	Lowest Score	Average	Average of all classes
Pretest	X-1	75	25	53,13	
	X-4	80	15	44,83	50,25
	X-5	75	30	52,81	(Passably)
Posttest	X-1	90	55	76,88	
	X-4	90	45	74,31	77,48
	X-5	100	70	81,25	(Good)

Based on the results of the average pretest and posttest critical thinking skills scores in Table 1, it shows that there was an increase in the category of students' critical thinking skills before being given treatment. This can be seen from the average value of students' initial critical thinking skills, which was initially 50.25, which increased to 77.48 after the implementation of the NHT model assisted by problem-based LKPD.

Table 2. Paired Sample T Test Results for Critical Thinking Skills

	Data	N	Sig. (2-tailed)	Acceptance H_{01} ($\alpha = 0,05$)	Conclusion
Class X-1	Posttest_X1 - Pretest_X1	32	0,000	Reject H_{01}	Significant influence
Class X-4	Posttest_X4 - Pretest_X4	29	0,000	Reject H_{01}	Significant influence
Class X-5	Postes_X5 - Pretest_X5	32	0,000	Reject $H_{0}1$	Significant influence

The results of the Paired Sample T test for the three experimental classes showed a significance value of 0.000 (<0.05) so that H_01 was rejected, meaning there was an average difference between the pretest and posttest results of students' critical thinking skills. These results show that the application of the NHT learning model has an impact in the form of increasing students' critical thinking skills. This is in line with Wahyuni's (2018) opinion, that the NHT learning model can be used to improve students' critical thinking skills in understanding learning material. This increase in students' critical thinking skills is due to the stimulus given to students through the NHT learning model using the discussion method on problem-based LKPD. Student-centered and problem-solving-oriented learning can help students improve their critical thinking skills. This is in accordance with Wayudi *et al* (2020) that learning processes that involve students such as discussion activities can improve students' critical thinking skills.

Table 3. N-Gain Test Results for each Aspect of Critical Thinking Indicators

Class	N-Gain				
	Elementary clarification	*Basic support*	*Inference*	*Advanced clarification*	*Strategies and tactics*
X-1	0,44	0,56	0,38	0,53	0,6
X-4	0,44	0,5	0,53	0,55	0,48
X-5	0,64	0,59	0,45	0,64	0,63
Average	0,51	0,55	0,45	0,57	0,57

Based on Table 3, every aspect of critical thinking in the experimental class has an N-gain value > 0.3, which means that every aspect of critical thinking has increased in the medium category. The highest N-Gain value for the indicator for advanced clarification and strategies & tactics is 0.57 and the lowest N-Gain for the indicator Inference is 0.45.

The inference indicator has the lowest N-Gain value compared to other critical thinking indicators. This is because there are still students who have not been able to carry out proper analysis and assessment in formulating decisions regarding the causes and solutions to reduce global warming by providing the right reasons. These results are in line with the research results of Supriyati *et al.* (2018) that the inference indicator has a lower value than other indicators of critical thinking skills because in the analysis of the inference indicator students have not been able to provide an accurate assessment. Low indicators of inference can also be caused by students who still have low abilities so that they have difficulty connecting the information they have obtained to make conclusions because they still lack understanding of the material. This is in accordance with the opinion of Hayudiyani *et al.* (2017), that students with high abilities can make conclusions from the relationship between question information well.

The N-Gain results in advanced clarification and strategies and tactics have a higher N-Gain value than the other indicators, namely 0.57 which is included in the medium category. Students are able to achieve the highest N-Gain score in Advanced Clarification because students already understand important terms such as global warming, greenhouse effect, greenhouse emissions, domestic waste in environmental change material through the application of the NHT model assisted by problem-based LKPD and teaching materials that has been given. Students are also able to achieve the highest N-Gain on the highest Strategies and Tactics indicators because in implementing the NHT learning model assisted by problem-based LKPD, students are trained to find solutions to environmental change problems that exist in the LKPD. This is in line with the opinion of Amalia & Sulastry (2018), that the increase in indicators for managing strategies and tactics is because most students are able to solve problems and determine appropriate actions in analyzing and identifying problems, which greatly influences students' critical thinking skills.

In this research, the core learning activity uses the NHT model syntax which consists of four phases, namely the numbering, questioning, heads together and answering phases. In the numbering syntax, students are in heterogeneous groups consisting of 4-6 people with each group member given a number to wear on the student's shirt pocket. The formation of heterogeneous groups by randomization aims to encourage student involvement in learning so as to improve students' critical thinking skills. This is in line with Febrianti (2020), that working together in heterogeneous groups makes students think more critically because students are exposed to diverse thoughts. In the questioining phase, students are given questions in the form of problem-based Student Worksheets (LKPD) which contain articles about environmental problems such as greenhouse gas emissions, ocean warming and Rawa Pening eutrophication which are equipped with questions that must be solved by students through group discussions. Students who actively carry out discussions to solve cases of environmental problems on LKPD facilitate students and get used to practicing their critical thinking skills.

In the heads together phase, students are directed to conduct group discussions to answer questions on the LKPD. The use of problem-based LKPD using the group discussion method requires students to be able to analyze the causes and impacts of environmental problems presented on the LKPD together and encourage students to find solutions to these environmental problems. Having problem solving activities through discussion in the NHT phase will improve students' critical thinking skills. This is in accordance with the opinion of Susana & Suyato (2017), that group learning with discussion can improve critical thinking skills.

2. The influence of the NHT learning model assisted by problem-based LKPD on students' collaboration skills

The influence of the NHT model assisted by problem-based LKPD on students' collaboration skills in this study was demonstrated through hypothesis testing and the N-Gain Test. Hypothesis testing on collaboration skills data uses non-parametric analysis, namely the Wilcoxon test (Table 4.9). The Wilcoxon test results obtained Asymp.Sig.(2-tailed) values of 0.000 in all three classes. This means that there is a significant influence of using the NHT model assisted by LKPD on students' collaboration skills in classes X-1, X-4, and X-5.

Table 4. Wilcoxon Test Results for Collaboration Skills

Class	Ranks				Asymp. Sig. (2-tailed)	Acceptance H_{02} ($\alpha = 0,05$)	Conclusion
	Negative	Positive	Ties	$\overline{x}$			
Kelas X-1	0	32	0	16,50	0,000	Reject H_{02}	Significant influence
Kelas X-4	0	29	0	15,00	0,000	Reject H_{02}	Significant influence
Kelas X-5	0	32	0	16,50	0,000	Reject H_{02}	Significant influence

In hypothesis testing using the Wilcoxon test, the Asymp.Sig.(2-tailed) value was 0.000 in all three classes. A value of $0.000 \leq 0.05$ means that there is an average difference between the pretest and posttest results of students' collaboration skills in classes X-1, X-4, and X-5. The results of the hypothesis test show that the application of the NHT learning model can have an impact in the form of increasing students' collaboration skills. This is in accordance with the research results of Karmila & Mawardi (2020) that the use of the NHT learning model makes a significant difference in improving students' collaboration skills. The research results of Prayekti *et al*. (2019) also showed the same results that the use of NHT type cooperative learning can improve collaboration abilities.

In this research, students' collaboration skills were honed from the start of implementing the NHT model. In the initial syntax of NHT, namely Numbering, the formation of heterogeneous groups encourages students to develop their collaboration skills through interaction during discussion activities without distinguishing between friends. When using the heads together syntax, students are directed to conduct discussions in groups to jointly solve environmental problems on the LKPD. This group discussion process will help students to develop collaboration skills by actively interacting with their friends to solve problems. This is in line with the opinion of Hendriana *et al*. (2018) and Palennari *et al*. (2021) that the use of problem-based learning and learning carried out in groups can improve collaboration skills by involving students to be active in learning activities and solving problems together.

During the answering phase, students are also trained to be able to collaborate on answers from each group through question and answer activities during presentations to determine effective solutions to the problems presented on the LKPD by considering the strengths and weaknesses of each solution offered. According to Yunus (2023), implementing the heads together and answering syntax in the NHT model can train students' cooperation skills, mutual respect and responsibility. The magnitude of the influence of using the NHT model assisted by LKPD on collaboration skills can be determined through N-Gain analysis on each collaboration skills indicator (Table 5).

Table 5. N-Gain Test Results for each Collaboration Indicator

Class	N-Gain				
	Accountability	Positive interdependence	Face to Face Interaction	Communication Skills	Work in groups
X-1	0,27	0,37	0,33	0,32	0,35
X-4	0,31	0,31	0,23	0,29	0,33
X-5	0,37	0,36	0,34	0,37	0,4
Average	0,32	0,35	0,3	0,33	0,36

Based on Table 5, face-to-face interaction indicators have the lowest average N-Gain compared to others because there are still some students who are just silent and less active in providing opinions and ideas during discussion activities. Students who are less active during discussions cause face-to-face interactions to not run optimally. In line with the opinion of Sari *et al*. (2018) which states that students' collaboration skills for several indicators have increased, but active contribution is more difficult to improve.

The indicator of working in groups has the highest average N-Gain compared to other indicators because the NHT learning model assisted by problem-based LKPD is able to facilitate students to develop collaborative skills through group discussion activities. This is in line with Palennari *et al*. (2021), that the application of the NHT model is able to provide opportunities for students to work together in groups to solve problems together. According to the research results of Masullah & Jailani (2023), the application of NHT learning can improve students' collaboration skills.

3. Student Responses to the Learning Model and Implementation of the NHT Learning Model Assisted by Problem Based LKPD

Data collection on student responses to the learning model was carried out using a questionnaire instrument. The student response data was then analyzed descriptively quantitatively by looking for the percentage of student agreement for the use of the NHT model assisted by problem-based LKPD in environmental change material.

Table 5. Student Responses to the Learning Model

No	Statement	Strongly Agree & Agree		Disagree & Strongly Disagree	
		Number of respondents	Results (%)	Number of respondents	Results (%)
1	Students feel happier if biology learning is carried out using the Numbered Head Together (NHT) learning model	80	86,02	13	13,98
2	Students feel happy when biology learning is carried out by discussing in groups	77	82,80	16	17,20
3	The Numbered Head Together learning model used makes students enthusiastic about participating in learning rather than using lectures	70	75.27	23	24.73
4	Students feel bored and stressed during learning	14	15,05	79	84,95
5	Students feel that learning with the Numbered Head Together type learning model can make it easier for students to understand environmental change material	75	80,65	18	19,35
6	Students feel that the problem-based LKPD and teaching materials are very helpful in understanding the material	79	84,95	14	15,05
7	The language used in the LKPD and teaching materials is easy to understand so that students can understand the material well.	84	90,32	9	9,68
8	The learning model applied encourages students to be able to think critically in solving problems	90	96,77	3	3,23
9	Students have difficulty connecting learning material with things that happen in everyday life, especially related to environmental change issues	10	10,75	83	89,25
10	Students like to do assignments in groups compared to doing it alone	78	83,87	15	16,13
11	Group activities can make students more active in learning in the classroom	81	87,10	12	12,90
12	Students feel that learning using the NHT type learning model can improve critical thinking and collaboration skills	80	86,02	13	13,98
13	Students prefer the NHT type learning model because they can work on assignments in groups so they can practice cooperation	77	82,80	16	17,20
14	Students are more able to respect each other	81	87,10	12	12,90

Based on the detailed analysis of student responses in Table 5, it shows that almost all students in the experimental class agree with biology learning using the NHT learning model assisted by problem-based LKPD. The average percentage of students who gave positive responses regarding the use of the NHT model assisted by LKPD reached >75%. Students gave the highest positive response to statement number 8 that the learning model implemented encouraged students to be able to think critically in solving problems with a percentage of 96.77%. The application of the NHT model assisted by problem-based LKPD is able to facilitate the development of critical thinking skills through learning activities that focus on students in solving environmental change problems presented in LKPD. This is in line with the opinion of Febyani & Setiawan (2022) who state that the syntax in the NHT model gives students the

opportunity to solve problems and improve their thinking abilities.

Data on the implementation of the learning model were analyzed by looking for the average percentage of implementation of the NHT learning model assisted by problem-based LKPD in each class. The results of learning implementation can be seen in Table 6.

Table 6. Results of Learning Implementation Analysis

Class	Percentage (%)
X-1	98,33
X-4	95,17
X-5	98.75
Average	97.42

The application of the NHT learning model assisted by problem-based LKPD in the experimental class can be carried out well, this is shown by the average percentage of implementation reaching 97.42% which is included in the very good criteria (Table 6). Through the application of the NHT model assisted by problem-based LKPD, students are able to be actively involved in the learning process so that students can experience changes in knowledge, understanding, attitudes and skills. In line with the opinion of Anggraini *et al*. (2018) that the NHT type cooperative model is designed to increase interaction between students and aims to increase mastery of concepts in learning.

CONCLUSION

The use of the NHT learning model assisted by problem-based LKPD in environmental change material had an effect in improving the critical thinking and collaboration skills of class

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