Research Article

The influence of student teams achievement division and numbered heads together learning models on students' cognitive learning outcomes and critical thinking abilities

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ABSTRACT

A conceptual analysis of the established functions and goals of education found that the low quality of education in Indonesia is still motivated by low student interest and learning. This problem must be addressed immediately by using learning strategies that can facilitate the development of student's skills. Learning strategies using the STAD (Student Teams Achievement Division) and NHT (Numbered Heads Together) models are believed to be able to overcome this problem. The STAD and NHT models are cooperative learning models where both models condition students to study together in small groups and help each other. The type of research used is a quasi-experiment (Quasi experiment) which aims to determine the effect of the STAD and NHT learning models on cognitive learning outcomes and critical thinking abilities. Data were analyzed quantitatively using descriptive and inferential statistics in the form of ANCOVA analysis. The research results show that there is an influence of the STAD and NHT learning models in improving students' cognitive learning outcomes and critical thinking abilities.

Keywords: STAD, NHT, cognitive, critical thinking

INTRODUCTION

Education plays a very important role human life and in the development of a nation, both in developing and developed countries. The progress of a nation can be seen from the high and low quality of education of the nation itself. Efforts to increase student learning success can be made through efforts to improve the learning process. In improving this learning process, the role of educators is very important, therefore teachers as educators should be able

to find the right strategies to teach students through the learning process carried out, to achieve learning goals by the national education goals of the Unitary State of the Republic of Indonesia (Safitri et al., 2022).

National education in general aim to make the life of the nation intelligent by the National Education System Law No. 20 of 2003 Chapter II Article 3 that national education functions to develop abilities and shape the character and civilization of a dignified nation to make the life of the nation intelligent, aiming for its development. the potential of students to become human beings who believe and are devoted to God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens. The ultimate goal of education is the realization of a social order that is characterized by the existence of noble character in every individual, knowledgeable, capable, creative, independent, and a democratic and responsible citizen (Wartoyo, 2022).

Based on a conceptual analysis looking at the established educational functions and objectives, it was found that the low quality of education in Indonesia is still motivated by low student interest and learning. This problem must be addressed immediately by using learning strategies that can facilitate the development of students' skills (Faizah et al., 2022). The STAD and NHT learning strategies are believed to be able to overcome this problem. The STAD model is a cooperative learning method, where this model conditions students to study together in small groups who help each other. Meanwhile, the NHT Model is a cooperative learning model that allows students share ideas with each other and consider the most appropriate answers and encourages students to increase their cooperation (Nuraini, 2023; Putri, 2021).

It is hoped that STAD and NHT type cooperative learning can train students' cognitive thinking and critical thinking skills in solving problems together. Critical thinking is a thinking skill that involves cognitive processes and invites students to think reflectively about a problem. Critical thinking involves inductive thinking skills such as recognizing relationships, analyzing open-ended problems, determining cause and effect, making conclusions and taking into account relevant data. Meanwhile deductive thinking skills involve the ability to solve spatial problems, logical syllogisms and distinguish facts and opinions (Saputra, 2020).

STAD and NHT are learning models developed to involve more students in studying the material covered in a lesson and checking their understanding of the content of the lesson instead of asking questions to the whole class. STAD is defined as a model that is carried out in the form of small groups to help each other and NHT is interpreted in Indonesian as a structured numbered head technique, this makes it easier to divide tasks. With this technique, students learn to carry out personal responsibility in interconnectedness with their group colleagues. This technique can be used in all subjects and for all age levels of students (Wulandari, 2020).

Several previous studies regarding the application of the STAD and NHT learning models have also been carried out, such as research by Nirmala (2015) regarding a comparative study of the STAD and NHT learning models using modules on environmental change, waste and recycling materials for class X, even semester, SMA Negeri 1 Seram Bagin. West school year 2022/2023, Herlina's (2014) research on the comparison of STAD and NHT types of cooperative learning on biology learning outcomes, Auliya's (2016) research on the influence of NHT and STAD learning using audio-visual media on science learning outcomes for class VIII students at SMP Muhammadiyah 1 Surakarta 2015/2016 Academic Year, Marfani's (2017) research on the influence of the STAD type cooperative learning model in NHT integration on students' motivation and cognitive learning outcomes

The results of observations in class Therefore, an effective learning method is needed to improve student learning outcomes in this material and the STAD and NHT learning models are believed to be able to improve student learning outcomes and critical thinking.

METHODS

Research design

This type of research is quasi-experimental research. Quasi-experimental research was conducted to determine the application of the STAD and NHT learning models to students' cognitive learning outcomes and critical thinking abilities. The research design used is (Non Equivalent Group Design) which procedurally follows the pattern as shown in Table 1.

Table 1. Research design

X1	Y1	Z1
X2	Y1	Z1
X3	Y1	Z1

Note:
X1　: Class group taught using the STAD learning model
X2　: Class groups taught using the NHT learning model
X3　: Combined class group (STAD-NHT)
Y1　: Pre-test
Z2　: Post-test

Sample of research

The populations and sample in this study were all class X MIA affair SMA Negeri 1 Seram Bagian Barat as many as 3 classes (MIA-1, MIA-2, MIA-3) with a total of 99 students.

Instruments and procedures

The instrument developed in this research went through the following stages (1) Preparation of learning tools including syllabus, learning implementation plan (RPP), student worksheets (LKPD) and teaching materials, (2) Development of instruments in the form of essay test questions and scoring sheets to measure cognitive learning outcomes, as well as questionnaires to measure students' critical thinking abilities.

The techniques used by researchers in this research are as follows: (1) primary data in the form of written tests which are used to obtain primary data about students' cognitive learning outcomes (pre-test and post-test), observation is used by researchers to directly observe the state of activities learning, questionnaires used to determine students' critical thinking abilities, and documentation to obtain notes or archives related to research. (2) Secondary data obtained from various literature studies related to the problems in this research such as data from literature studies, both data from government and private agencies, as well as journals that support research

Data analysis

The data from this research is in the form of student learning outcomes and critical thinking skills which were analyzed quantitatively using descriptive and inferential statistics. Descriptive statistics are used to describe students' learning outcomes and critical thinking abilities in cumulative intervals and frequencies. Meanwhile, inferential statistics uses Ancova analysis which is used to analyze the effect of implementing the NHT and STAD learning models on students' learning outcomes and critical thinking abilities.

RESULTS AND DISCUSSION

Student pre-test achievement and post-test

The pre-test results students' initial abilities before following the learning process and the final test results show students' abilities after following the learning process by applying the STAD and NHT learning models. Based on research data, students' initial and final test scores described in Table 2.

Table 2. Qualification of student achievement scores in the preliminary and final tests

Interval	Class	Frequency	Presentation	Qualification
		Student pre-test results		
> 70	X MIA-1	9	28.12 %	Complete
< 70		23	71.87 %	Fail
> 70	X MIA-2	8	25 %	Complete
< 70		24	75 %	Fail
> 70	X MIA-3	4	12.5 %	Complete
< 70		28	87.5 %	Fail
		Student post-test results		
> 70	X MIA-1	31	96.87 %	Complete
< 70		1	3.12 %	Fail
> 70	X MIA-2	30	93.75 %	Complete
< 70		2	6.25%	Fail
> 70	X MIA-3	32	100%	Complete
< 70		0	0%	Fail

Based on Table 2, it can be seen that the average student when taking the initial test had a score with the qualification of failing to master the learning indicators to be studied, while the average student after taking the final test was in the complete category.

Table 3. Normality and homogeneity test results of cognitive values and critical thinking ability

		Normaity test								
		X MIA-1			X MIA-2			X MIA-3		
Variable	Results	Shapiro values	Sig	Description	Shapiro values	Sig.	Description	Shapiro values	Sig.	Description
Cognitive	Pretest	.941	.081	Normal	.946	.099	Normal	.950	.160	Normal
	Posttest	.947	.117	Normal	.943	.084	Normal	.968	.463	Normal
Critical thinking	Pre test	.936	.059	Normal	.943	.081	Normal	.959	.278	Normal
	Posttest	.953	.091	Normal	.942	.079	Normal	.977	.717	Normal

Homogeneity test			
Variable	Levene values	Sig.	Ket
Cognitive	2.110	.127	Homogeneous
Critical thinking	.343	.711	Homogeneous

The results of normality and homogeneity testing for cognitive learning and critical thinking show that the significant value of each variable tested is smaller than significant > α= 0.05. This means that the variable data comes from a homogeneous and normally distributed population

Student cognitive learning outcomes
The results of ANCOVA calculations on students' cognitive learning outcomes are shown in Table 2 below.

Table 4. ANCOVA of cognitive learning results

Source	Type III sum of squares	df	Mean square	F	Sig.
Corrected Model	5269.102[a]	3	1756.367	32.484	.000
Intercept	18048.924	1	18048.924	333.810	.000
Pre_Test	276.832	1	276.832	5.120	.026
Model_Pembelajaran	2240.536	2	1120.268	20.719	.000
Error	4974.387	92	54.069		
Total	542025.000	96			
Corrected Total	10243.490	95			

Table 4 shows that the significant independent variable of the learning model is 0.000 < α = 0.05. Based on these results, H0 is rejected and H1 is accepted, meaning that there is an influence of the learning model on students' cognitive learning outcomes. The next stage is to carry out further tests to find out the differences in the learning models used. The LSD test is shown in Table 3 below.

Table 5. LSD advanced test results of cognitive learning results

Learning model	Average	Notation
STAD	69.25	a
NHT	69.41	b
STAD+NHT	84.63	c

The difference in notation shows that there are different stages of different learning models between STAD, NHT and a combination of STAD combined with NHT in improving students' cognitive learning outcomes. Classes taught using the combined learning model have a higher average value compared to the average value of the STAD (X MIA-1) and NHT (X MIA-2) classes. This proves that students taught using the combined STAD and NHT learning model

have better cognitive learning outcomes than students taught using the STAD (X MIA-1) and NHT (X MIA-2) learning models.

Learning outcomes are the final results of implementing learning activities at school. Improving learning outcomes can be done through systematic conscious efforts and lead to positive changes. Several factors influence learning outcomes other than the application of the model, namely internal factors and external factors (Aryani & Kristin, 2021). Cognitive learning outcomes are assessments carried out on students' initial and final tests in learning. Inferential analysis using the ANCOVA test shows that there are differences in learning models on cognitive learning outcomes (Table 2 and Table 3) and the further description of the ANCOVA test, namely the LSD test, shows that the combined learning model between STAD and NHT that is applied is applied can improve students' cognitive learning outcomes. compared with using the STAD and NHT learning models.

The differences in students' cognitive learning outcomes were influenced by the treatment given to three classes, namely classes X MIA-1, X MIA-2 and X MIA-3. The experimental class that was given treatment in the form of the STAD learning model combined with NHT obtained a higher average score than the class that was only given STAD and NHT learning. This is because in the syntax of the STAD learning model combined with NHT, the group work stage is combined with the thinking together stage (Heads Together) because both have the same function, namely working together in heterogeneous groups to solve problems or questions from the teacher (Nawangsasi, 2013). Astrawan (2013) stated that STAD provides direct experience to students and with this experience students' understanding will be stronger and deeper towards the material being studied. With this direct learning experience, students can built their own knowledge (constructivist) and the knowledge that is built by themselves will stick for a long time in the student's memory or mind. Apart from providing direct experience, the STAD type cooperative learning model is also student-centered learning model.

Increasing students' cognitive learning outcomes is by giving quizzes. Quizzes on STAD syntax in NHT combined with answering. Rahmayani and Subekti (2022) state that some things that are fun and interesting for children are challenges (in the form of individual quizzes). The quizzes that students experience in learning function as a review to strengthen students' understanding of the learning material they have studied before students take part in the evaluation. In NHT learning, there is a number calling stage at the answering stage which is carried out randomly so that each group member is always ready to understand and is totally involved in the learning. By combining the quiz stage and answering (answering) it will be possible to improve students' cognitive learning outcomes in studying biology (Putri et al., 2017).

The syntax of the STAD learning model in NHT padu that can help improve student learning outcomes is by giving group awards. The awards given make students feel happy about learning because students will receive recognition for the learning outcomes they achieve. To get awards, students must really learn in their groups, discussing group problems given or answering questions from the teacher (Uno, 2023).

The increase in learning outcomes in classes taught using the STAD model in combination with NHT is also triggered by the advantages of the model used by the teacher so that it can influence learning outcomes and good learning results can be obtained. The advantages of the STAD learning model include (1) students working together. in achieving goals by highly supporting group norms, (2) able to motivate students to develop individual potential, especially creativity and responsibility for collective success, (3) training students to work together and help each other in groups, (4) students able to convince themselves and others that the goals they want to achieve depend on how they work, not because of luck, (5) students can communicate verbally and non-verbally in working together (Wulandari, 2022). The advantages of the NHT model include (1) Every student is ready, (2) they can have serious discussions, (3) smart students can teach students who are less smart (Nandhita et al., 2023).

Based on the discussion above, it can be concluded that there is an influence of the STAD type cooperative learning model in combination with NHT on students' cognitive learning outcomes. The results of this research are in line with research conducted by Gustaviana (2013) which states that there is a significant difference between the learning outcomes of students who use type and students who use conventional methods. Apart from that, this research is also strengthened by previous research, namely research conducted by Rizki (2013) which states that the application of NHT cooperative learning combined with STAD can increase student motivation and learning outcomes.

Thus, it can be proven that the application of the STAD learning model combined with the NHT that has been implemented can influence learning outcomes, especially the cognitive learning outcomes of students, compared to just the application of the STAD learning model or the application of the NHT learning model. Data from all sources in this research confirms that interactions have occurred between students and students, students and educators, as well as students during the learning process in the classroom, so this allows students to play an active role in the process. teaching and learning activities that will influence students' cognitive learning outcomes (Puspitasari, 2022).

Students' critical thinking

The results of of critical thinking ability analysis are shown in Table below.

Table 6. Critical thinking ability analysis

No	Indicator	Class	Percentage	Category
1	Classifying	X MIA-1	78.4	Critical
		X MIA-2	79.2	Critical
		X MIA-3	98.0	Very Critical
2	Hypothesize	X MIA-1	86.4	Very Critical
		X MIA-2	73.2	Critical
		X MIA-3	89.4	Very Critical
3	Conclude	X MIA-1	76.4	Critical
		X MIA-2	78.6	Critical
		X MIA-3	89.4	Very Critical
4	Interpreting data	X MIA-1	78.4	Critical
		X MIA-2	72.6	Critical
		X MIA-3	94.0	Very Critical
5	Analyze	X MIA-1	73.4	Very Critical
		X MIA-2	71.2	Critical
		X MIA-3	95.4	Very Critical
6	Evaluate	X MIA-1	76.4	Critical
		X MIA-2	72.4	Very Critical
		X MIA-3	84.6	Very Critical

The results of ANCOVA calculations on students' critical thinking results are shown in the table below:

Table 7. ANCOVA results of class students' critical thinking

Source	Type III sum of squares	df	Mean square	F	Sig.
Corrected model	7123.609[a]	3	2374.536	62.164	.000
Intercept	21396.955	1	21396.955	560.158	.000
Critical_pre	672.026	1	672.026	17.593	.000
Model_learning	6921.298	2	3460.649	90.597	.000
Error	3514.224	92	38.198		
Total	494006.000	96			
Corrected total	10637.833	95			

Table 7 shows that the significant independent variable learning model is 0.00 <α = 0.05. Based on these results, H0 is rejected and H1 is accepted, meaning that there is an influence of the learning model on students' critical thinking results. The next stage is to carry out further tests to find out the differences in the learning models used. The LSD test is shown in the table below

Table 8. LSD advanced test results of critical thinking

Learning model	Average	Notation
STAD	63.81	a
NHT	66.63	b
STAD+NHT	82.44	c

The difference in notation shows that there are different stages of different learning models between STAD, NHT and a combination of STAD combined with NHT in improving students' critical thinking. The class taught using the combined STAD and NHT learning model has a higher average score compared to the average score of classes X

MIA-1 and X-MIA 2. This proves that students taught using the combined STAD and NHT learning model have better critical thinking results than students taught using the STAD (X MIA-1) and NHT (X MIA-2) learning models.

Student critical thinking data was obtained from the results of the critical thinking ability rubric assessment given to each student in class X MIA-1, STAD and NHT learning. Based on the results of data analysis carried out using the ANCOVA test to see differences in critical thinking in the three classes, it was found that students' critical thinking was high in the classes taught with the STAD learning model combined with NHT.

The STAD type cooperative learning model is cooperative learning which is not only superior in helping students understand difficult concepts but is also very useful in generating activity and interaction between students and teachers and between students and students, as well as being able to improve other learning achievements such as: increasing cooperation, creativity , think critically and encourage students' willingness to help friends (Suparsawan, 2020). Critical thinking is a vital topic in modern education. The specific aim of learning critical thinking in teaching science or in other fields of study is to improve students' thinking skills and at the same time prepare students for everyday life (Putri, 2023).

The increase in students' critical thinking skills occurred because the learning process by applying the STAD learning model in NHT combined with material on environmental change, waste and recycling was carried out through students' work sheet (LKPD) activities and discussion of presentations of LKPD work results in the classroom. Through LKPD work activities and presentation of LKPD results, students can improve their abilities in organizing, communicating and interpreting students' work results. Active participation of students in LKPD work on the material provided influences the formation of students' social behavior (Hidayati, 2021).

The critical thinking integration process is carried out by the teacher in the core activities when students observe and the teacher and students discuss questions on the LKPD that students have worked on in groups. Aeni (2022) said that core activities are the most important and main activities in the learning process because the learning material will be delivered to students. The process of integrating critical thinking is also demonstrated by the teacher in the closing activity of the lesson when reflecting on activities with students. Assidiqi (2023) said that the closing activity is aimed at validating the concepts or principles that have been constructed by students.

The critical thinking that is developed is formulating problems, providing arguments, making inductions, deducing, evaluating, deciding and implementing. It is hoped that students will develop critical thinking skills. Based on the scores achieved from each critical thinking indicator, it can be seen that the percentage of scores in the STAD class in NHT combined is compared to other classes, this is because this learning model is related to critical thinking (Hamia et al., 2023).

Significant results result when the learning process takes place, students play an active role in learning activities. In STAD type cooperative learning, students are directly involved in learning, starting from students understanding the problem, until students discover the concepts contained in the problem. This involvement does not only extend to finding concepts but also continues in class discussion activities, both discussions about concept discovery, as well as discussions about the results of working on examples and practicing questions in front of the class. Students in discussion activities may provide responses, questions, and even answers regarding the front of the class. This then makes students not only skilled in answering questions but also skilled in giving reasons related to the answers they have (Yusup, 2021).

Followed by the application of the NHT model which is divided into 5 stages, namely: preparation, group formation and numbering, discussion of problems, calling numbers or giving answers, and providing conclusions. The teacher makes preparations (prepares the learning media, the teacher delivers the initial material), then forms groups (each group has its own task and each group is given a number), each group holds a discussion according to the task given, then the teacher calls the students according to the number given. drawn, the student whose number is called must explain the assignment given by the teacher, here students use communication skills to convey the assignment and students must be able to solve problems from each assignment and question given. So the NHT method is also said to be effective in improving students' critical thinking skills (Yusup, 2021).

The learning process using a combination of these two learning models requires students to be able to apply new ideas, provide lots of suggestions for doing various things, present a concept from a different point of view, solve problems in detail, be able to put forward various solutions or approaches to the problem. problems, and places more emphasis on group cooperation (Lutfiyyah, 2021). The material provided also provides contextual examples so that it can encourage students' curiosity and critical thinking towards the material on the LKPD provided to a higher level. This curious attitude, it causes a conflict in the students so that a problem arises which is manifested in the form of questions. Students are more careful and critical in understanding concepts actively to satisfy their curiosity (Waris, 2019).

CONCLUSION

Based on the discussion of the research results, it can be concluded that there is an influence of the Student Teams Achievement Division (STAD) and Numbered Heads Together (NHT) learning models on improving students' cognitive and critical thinking learning outcomes.

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