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THE INFLUENCE OF STAD TYPE COOPERATIVE LEARNING MODEL ON HEAT MATERIAL AND ITS TRANSFER ON CRITICAL THINKING ABILITY AND SCIENCE LEARNING OUTCOMES

Yulia Rahmawati [*1)], Sutarto [2)], Nur Ahmad [3)]
[1,2,3)] Science Education, Faculty of Teacher Training and Education, University of Jember
** Corresponding author*
e-mail: yuliarahmawati314@gmail.com [1)], sutarto.fkip@unej.ac.id [2)], masnurauai.fkip@unej.ac.id [3)]

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ABSTRACT

The development of education is marked by advances in science and technology which cause every individual to have the ability "The 4Cs". Low critical thinking caused who are passive and teachers who do not package learning in an interesting way resulting in learning heat material. So, it overcome through the selection of a learning model, namely the STAD. The researchers aimed to examine the significant effect of the STAD on critical thinking skills and learning outcomes. This quasi-experimental study used a non-equivalent control group design. The research location is at SMPN 10 Jember in semester of 2022/2023. The conclusions of the entire test are, (1) the STAD-type cooperative learning model on heat material and its locking have a significant effect on students thinking abilities, and (2) the STAD-type cooperative learning model on heat material and its locking have a significant effect on science learning outcomes for junior high school students.

Keywords : STAD; critical thinking skills; learning outcomes

INTRODUCTION

The development of education is marked by advances in science and technology, causing each individual to have competitive abilities in developing their potential through the elaboration of abilities needed in the 21st century. In building sustainable education, Indonesia must be supported by the creativity and innovation of human resources (Ahmad et al., 2022). The abilities that must be mastered by individuals in the 21st century, namely 1) the ability to think critically; 2) collaboration between individuals with each other; 3) communication skills; 4) creativity and innovation; 5) technology, information, and communication literacy (Redhana, 2019). If students face global competition, then students have skills as a communicator, creators, collaborators, and critical thinkers (Ritonga et al., 2021). The National Education Association refers to it as "The 4Cs", namely, critically, solve problems, collaborate, or communicate effectively (Erdoğan, 2019). Therefore, individuals must adapt to face global competition by mastering 21st-century skills.

One development of individual potential can be done in formal education, which refers to the curriculum. The curriculum transformation from KTSP to the 2013 curriculum is an example of adjusting to changing global demands and will continue to experience improvements towards the era of an independent curriculum. Formal education levels, from elementary to high school, are developed according to the potential needs of students (Bahri, 2017). According to UNESCO, Aseany (2021) states that the four pillars

of education are learning to know, learning to do, learning to live together, and learning to be. Based on the results of interviews with researchers and observations with science teachers at SMP Negeri 10 Jember that after the Covid-19 pandemic, students did not interact much with their friends in one class, students were also classified as passive because only a few students responded to questions from the teacher, and students were still centred on the teacher. So that the teacher still dominates the lecture method in a class. The teacher's domination in the learning process also influences student learning outcomes. According to Aisyah et al. (2017), the method used by the teacher influences learning outcomes because the learning atmosphere in the class builds students' interest and activeness in learning. Learning outcomes are a document that contains the value of a student's assessment due to a series of student learning processes that take place over a certain period (Gunawan et al., 2018). So, the teacher plays an important role in bringing the learning atmosphere of students into the learning process. Educators carry out learning activities to help students acquire knowledge, character formation, and attitudes. Middle school science learning is developed from a combined aspect of attitude, knowledge, application-oriented skills, reasoning ability, curiosity, concern for the environment, and responsible for actions (Mashinta et al., 2015).

The ability to think critically in science junior high school students in Indonesia is still relatively low. One of the factors for low education in Indonesia is the effect of low literacy on students and low critical thinking skills (Anggiasari et al., 2021). Students' low critical thinking ability is caused by many things, including inappropriate learning, namely the need for active student participation in the learning process, student preparation, feelings of pleasure in learning, environment, and experience in the learning process. Will be great potential to determine the degree of success in achieving goals (Anggraeni et al., 2020). Students' critical thinking skills are influenced by the number of students who are passive and dominantly listen to the teacher during learning and teachers who do not package learning in an interesting way resulting in monotonous learning (Pasaribu et al., 2020). Other research shows that teachers are one of the factors for students' low critical thinking because in carrying out assessments of critical thinking abilities by educators, they have not referred to indicators of critical thinking skills, so that measurements produce data that is not effective and efficient (Anggiasari et al., 2018). So, students' low critical thinking skills result from various factors that lead to less than optimal science learning. Critical thinking skills are described as one of the skills needed by individuals in the 21st century, especially students. According to Susanti et al. (2019), critical thinking skills can hone students to observe, analyze and evaluate information or opinions before accepting or rejecting the information received. Facione (2015) describes six critical thinking skills indicators: interpretation, analysis, evaluation, inference, explanation, and self-regulation. In line with research conducted by Rahayu et al. (2013), the STAD model increases the indicators of critical thinking skills, namely interpretation, analysis, explanation, and inference. The four indicators have a high category in the class

because learning is carried out in group work practicums and giving quizzes so that students' minds will be actively involved.

The material in science subjects is very broad, one of which is the material of heat and its transfer. Heat material and its transfer are considered difficult by students. According to Sumarli et al. (2022), the material of heat and its transfer is classified as difficult because students are required to master the material by not only memorizing and being able to do the questions. According to Rosyadi et al. (2017), there are often misconceptions about the material of heat and its transfer because students have not got the full concept by constructing their knowledge, both in terms of the environment, experiences, challenges, and the material being studied. Therefore, difficulties in studying heat and transfer material can be solved by selecting an effective and student-oriented learning model to gain direct experience. The selection of learning models is one of the urgent for implementing learning. An effective learning model to apply is an active, creative, and innovative learning model that can make learning more meaningful (Rahayu et al., 2019). Based on the problems above, one of the effective learning models for improving critical thinking skills and learning outcomes is the STAD model. This model is a simple learning model that fosters collaborative skills, creativity, and critical thinking (Johariah, 2017).

The STAD model is one of the cooperative learning development models by Robert Slavin at Johns Hopkins University, USA. The STAD model is simple enough to apply to various areas of school subjects and is used effectively to improve student learning outcomes (Fahruddin, 2022). According to Slavin (2005) that the STAD model has five important components, including 1) class presentation; 2) teamwork, 3) giving quizzes; 4) individual progress score, and 5) team recognition.

The above description is supported by the results of research that has been conducted (Rahayu et al., 2013). The implementation of the STAD model can train the critical thinking skills of class VIII A students of SMP Negeri 2 Sugio on photosynthesis material, which is shown in the percentage of high critical thinking skills of 54 .16% (high), 29.16% (medium), and 16.7% (low), and learning outcomes have a percentage of 83.3% better. In addition, research by Anggraeni et al. (2020) concluded that the critical thinking skills of high school students could be improved through the application of a project-based STAD approach which led to an increase in student's GPA for critical thinking skills in each cycle and the existence of group learning resulted in students not only communicating with teachers but also with classmates who others to exchange ideas to solve a problem. The results of this study can be concluded that using the STAD model affects students' critical thinking skills in science material. The aims of the study were (1) to test the significant effect of the STAD-type cooperative learning model on junior high school students' critical thinking skills and (2) to test the significant effect of the STAD-type cooperative learning model on junior high school student science learning outcomes.

METHODS

Quasi-experimental research and non-equivalent control group design research with two classes as the experimental class (VII G) which is given treatment, and the control or comparison class is not given treatment (VII F). The research location is at SMP Negeri 10 Jember and is in the odd semester of the 2022/2023 academic year. The operational definitions of the variables in the study are explained as follows: 1) The independent variable, namely operationally, the STAD type cooperative learning model, is interpreted as an independent variable, where the learning model is useful in influencing the interaction process in students because they are allowed to think, complete quizzes, and interactively develop discussion skills. In groups, and able to communicate; 2) The dependent variable is (a) operationally, students' critical thinking skills are explained as the average pretest and posttest answer scores of control and experimental classes on description questions by paying attention to indicators of critical thinking skills, and (b) operationally, the results Student learning is defined as the average pretest and posttest results of the control class and experiments on multiple choice questions to assess student learning outcomes in the knowledge and skill domains by giving non-tests in the form of project assignments to make simple stoves according to basic competencies 4.4.

The data analysis technique is a way to find out the results of data acquisition collected for research conclusions. Research data processing uses SPSS 25 software to test research data. Critical thinking skills and student learning outcomes using data analysis techniques are as follows.

1) Critical Thinking Ability Data Analysis

Students' critical thinking ability is measured by the percentage of critical thinking ability from the formula:

$$\text{Percentage score} = \frac{\text{gain score}}{\text{maximum score}} \times 100\%$$

According to Puspitasari and Saputri (2021), the percentage category of students' critical thinking skills, which is the guideline for this research, is presented in Table 2.

Table 2. Percentage Category of Critical Thinking Ability

Interpretation	Category
$81.25 < X \leq 100$	Very high
$71.50 < X \leq 81.25$	Tall
$62.50 < X \leq 71.50$	Currently
$43.75 < X \leq 62.50$	Low
$0 < X \leq 43.75$	Very low

2) Analysis of Learning Outcome Data

According to Fauziah (2021), the acquisition of student learning outcomes scores can be calculated using the following formula.

$$\text{Score} = \frac{\text{gain score}}{\text{maximum score}} \times 100$$

The criteria for evaluating learning outcomes can be described in Table 3 as follows.

Table 3. Criteria for Assessment of Learning Outcomes

Mark	Category
80 – 100	Very good
66–79	Good
60 – 65	Enough
6 - 59	Not enough
≤ 45	Very less

Furthermore, statistical tests were carried out using the Shapiro-Wilk normality test, the Independent Sample T-test, and the one-tailed test. If there are data that are not normally distributed, then proceed with the Mann-Whitney U-test.

RESULTS AND DISCUSSION

Data acquisition for the experimental and control classes was made by pretest and posttest on the variables of critical thinking skills and learning outcomes in the knowledge domain. In contrast, the learning outcomes in the skills domain were obtained from making a simple solar stove. Following is a recapitulation of data analysis on the Shapiro-Wilk normality test.

Table 4. Recapitulation of Statistical Test Data Analysis

Statistic test	Data		Significance Value
Normality test	Critical thinking ability	Experiment class pretest	0.058
		Experiment class posttest	0.353
		Control class pretest	0.155
		Control class posttest	0.101
	Knowledge domain learning outcomes	Experiment class pretest	0.169
		Experiment class posttest	0.278
		Control class pretest	0.277
		Control class posttest	0.066
	Skills domain learning outcomes	Experiment class	0.000
		Control class	0.000

The results of data analysis are processed in the next stage, namely the Independent Sample T-test and the one-tailed test if the data is normally distributed, and the Mann-Whitney U-test if the data is not normally distributed.

Table 5. Summary of Independent Sample T-test Results

Statistic test	Data		Significance Value
Independent Sample T-test	Critical thinking skills	Experiment class pretest Control class pretest	0.185
		Experiment class posttest Control class posttest	0.011
	Learning outcomes in the realm of knowledge	Experiment class pretest Control class posttest	0.780
		Experiment class pretest Control class posttest	0.032

Based on the statistical hypothesis, if it shows a significance value (2-tailed) <0.05, then H_0 is rejected, and Ha is accepted, so it can be said that there is a difference in the average value between the experimental class and the control class. Next, the one-tailed test to find out which level of average learning outcomes in the knowledge domain is better in the experimental class and the control class in Table 6.

Table 6. Recapitulation of the results of the one-tailed test

Statistic test	Data	T_{count}	T_{table}
One-tailed	Critical thinking skills	2,610	1,998

test	Learning outcomes in the realm of knowledge	2,042	1,669

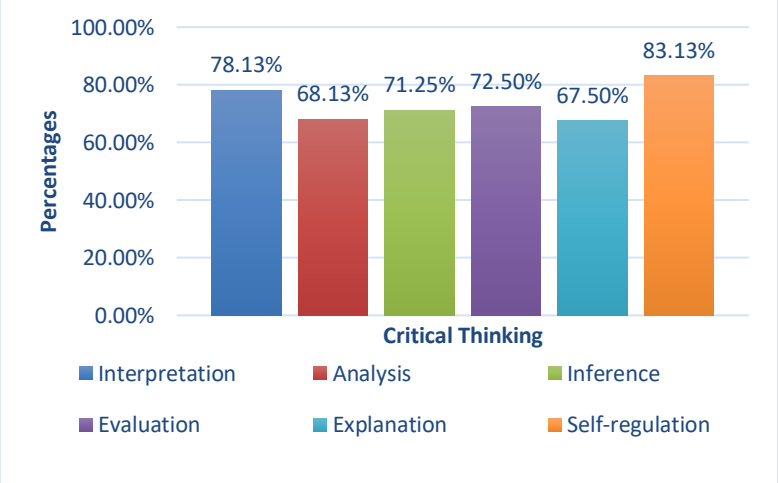
Referring to the statistical hypothesis and the basis for decision making, if the value of $t_{count} > t_{table}$, then H_0 is rejected, and Ha is accepted, which means that the average value of the experimental class is better than the control class. In addition, the acquisition of the results of the Shapiro-Wilk normality test on the learning outcomes in the skills domain is not normally distributed, so it is continued using the Mann-Whitney U-test in Table 7.

Table 7. Results of the Mann-Whitney U-test of Learning Outcomes in the Skills Domain

Test Statistics [a]	
	Learning outcomes
Mann-Whitney U	198,000
Wilcoxon W	726,000
Z	-4,496
Symp. Sig. (2-tailed)	.000

Critical thinking skills data was obtained through pretest and posttest scores between the experimental and control classes. Critical thinking questions are based on the indicators of Facione (2015). Several indicators are made in six description questions, and data analysis is carried out in the percentage of each indicator as follows.

Figure 1. Percentage of Critical Thinking Ability for Each Indicator



Data on the ability to think critically in the experimental class was better than in the control class. Based on the recapitulation of the value of critical thinking skills, the indicators of critical thinking ability are in the very high category, namely self-regulation. The high category, namely interpretation, and the moderate category, respectively, namely evaluation, inference, analysis, and explanation. The indicator of critical thinking ability is very high, namely self-regulation, where students can consciously monitor and correct themselves in writing answers. Because students already understand the material being studied supported by more contextual worksheets. According to Rizky et al. (2019), self-regulation explains students' ability to self-correct and monitor activities in the cognitive domain. Then, the interpretation in the high category can increase when students are asked questions by the teacher that are constructive and relevant to the topic of heat and its transfer. According to Rizky et al. (2019), interpretation is a relatively easy

student skill because students can express and understand the meaning of the information received. Interpretation indicators for students are characterized by students being able to clarify the meaning of the description questions by the theory.

The next medium category indicators are evaluation, inference, analysis, and explanation. The evaluation indicator is in the medium category, where students working on description questions can still not consider and judge a statement's credibility. Suriati et al. (2022) state that the evaluation indicator is caused when students encounter problem-solving obstacles. Students do not answer completely and do not even complete them. Furthermore, the inference indicator is classified as moderate because some students have difficulty drawing the right conclusions from a statement or material information. This statement is supported by Yustika and Yarman (2019), that students complete the questions correctly, but only 59% can draw conclusions perfectly. An analysis indicator is the student's ability to identify correlations between concepts and statements or reasons from an information material on heat and its transfer, and explanation is the student's ability to provide further explanation of an argument in terms of evidence to state the truth. Difficulties in analysis and explanation are caused because students are still unable to focus on what is asked in the problem and are not used to analyzing problems coherently (Wayudi et al., 2020). This statement is also supported by Suriati et al. (2021), that analysis and explanation are continuous. If students work on questions and understand concepts well, this ability can also increase with student knowledge.

The STAD model on heat and its transfer is explained in six learning phases. The first phase is conveying the learning objectives and student motivation, in which the teacher conveys the learning objectives on heat and displacement material and motivates students by showing PPT material and providing questions that construct students' thoughts so that they can train student interpretation. The second phase is the delivery of information by the teacher by providing LKPD material on heat and its displacement. In addition, at the first meeting, students were given a project assignment to make a simple solar stove as a product (C6) and brought it to the third meeting. Furthermore, in the third phase, the teacher coordinates students into study groups with efficient transitions and agrees on provisions, namely consisting of 4-5 heterogeneous students. Ermayanti and Sulisworo (2016) believe that motivation can improve interpretation in the delivery phase of learning objectives and student learning objectives because students can answer simple questions from the teacher regarding the material to be studied.

The fourth phase is that the teacher guides the study group by instructing them to work on the LKPD cooperatively between members. Groups of students working on it work together to find answers and solve problems. Groups of students in this work step are guided by study groups so that they can practice their ability to analyze and draw conclusions. According to Ermayanti and Sulisworo (2016), the stages of tutoring study groups can improve indicators of building basic skills and concluding. Therefore, the teacher's role is crucial in building and assisting students in implementing the STAD model.

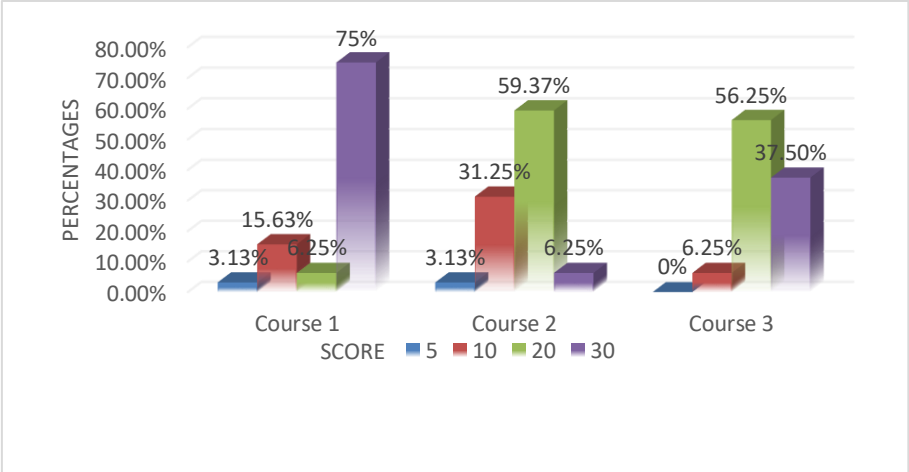
The fifth phase, evaluation, is when the teacher asks student team representatives to present the LKPD they have worked on and invites other teams to respond. This step can allow students to provide simple explanations (interpretation) and further (explanations). Following Kurniadi's research (2017) that presentations can train simple and further explanations so that students can focus more on answering questions from problems.

Interpretation and explanation indicators relate to students' habituation in correctly communicating and answering description questions. Furthermore, quizzes are carried out by students so that they train students to evaluate the truth, and students want to review the worksheets. According to Rahayu et al. (2013), giving quizzes is intended to develop students' understanding of difficult concepts and increase students' critical thinking. According to Perdani et al. (2019) that self-regulation in students also increases when students check the answer sheets again. Therefore, giving quizzes can train students on evaluation indicators and self-regulation.

The sixth step is calculating individual and team scores based on STAD scoring. Students are given an initial score (pretest) and then, after working on the quiz, will receive an individual score which is accumulated with progress points for each meeting. These individual scores are recapitulated in teams. The team that complies with the scoring provisions will be awarded at the last stage, the lesson's closing. This award is given in the form of verbal and material appreciation, such as giving snacks. This statement is supported by Listiyadi (2014) that the award given to the best team motivates students in groups to be more active in learning. The positive impact of this motivation makes learning students more active in class. The positive impact of this motivation makes learning students more active in class. In line with the research by Takko et al. (2020), they stated that there was a significant difference in the application of the IPA module with the STAD model in the matter of the digestive system and food absorption on the average HOTS score, where students were able to work on questions with short essays and had an impact on student achievement. The same thing was proven by Sholikhah et al. (2020) that there is a significant increase in the use of the STAD-assisted cooperative learning model with the help of LKPD, which can improve critical thinking skills as evidenced by the fact that students can answer description questions with correct answers seen in the pretest and posttest.

The STAD-type cooperative learning model in class is carried out with a series of learning phases with the privilege of giving quizzes based on STAD scoring. In line with Suyono's research (2016), when giving quizzes at each meeting, the STAD-type cooperative learning model shows a better development of individual values than the previous meeting. This score can show students' enthusiasm to learn better from each meeting to foster a desire to learn the material better too. The development of individual scores at each meeting increased and decreased because there was a level of difficulty with the material. Still, there was also an increase in quiz scores at each meeting. The percentage graph of the development of the following individual scores.

Figure 2. Percentage of Individual Score Development



The cooperative learning model can improve learning outcomes in knowledge and skills. The two classes were given project assignments in making simple solar-based stoves, according to KD 4.4. Giving non-test assignments affects learning outcomes in the realm of skills. In line with the research of Lantajo et al. (2018), the STAD-type cooperative learning model affected cognitive improvement in the experimental class and recorded more skill development during the treatment of physics material by encouraging groups of students to be actively involved in learning. Overall, the research was carried out according to the syntax of the learning model and the STAD type of cooperative learning model in terms of heat and its transfer, which significantly affected critical thinking skills and science learning outcomes for junior high school students.

CONCLUSION

Based on the results of the research that has been done, it can be concluded that the STAD cooperative learning model can be carried out in class VII SMP on natural sciences, where students show a significant increase in the implementation of pretest and posttest critical thinking skills and learning outcomes. As a whole, it can be concluded that (a) the STAD-type cooperative learning model on heat and displacement material has a significant effect on the critical thinking skills of junior high school students, and (b) the STAD-type cooperative learning model on heat and displacement material has a significant effect on learning outcomes IPA junior high school students.

As for the suggestions given by researchers, research focused on two variables: critical thinking skills and learning outcomes. Critical thinking skills use six indicators, and learning outcomes focus on knowledge and skills. Henceforth, research is expected to be developed in affective learning outcomes or other variables.

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