The Effect of Reciprocal Teaching on Cognitive Learning Outcomes and Learning Interests of Learners on the Theme of Environmental Change and Preservation

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Article Info	Abstract
	The Covid 19 pandemic has reduced student learning outcomes. The decrease in learning outcomes is directly proportional to the decrease in learning interest. The reciprocal teaching model supports students to play an active role in learning with the teacher as a facilitator. The purpose of this study was to analyze the effect of the reciprocal teaching model on cognitive learning outcomes and students' interest in learning about environmental change and preservation at MAN 1 Semarang. This type of research is quasi-experimental with a non-equivalent control design. The sample in the study was determined by purposive sampling technique with X MIPA 3 as the experimental class and X MIPA 4 as the control class. Data on students' cognitive learning outcomes were measured using a test instrument and learning interest was measured using a questionnaire instrument. The results showed that there was a significant difference in the average cognitive learning outcomes in the experimental class compared to the control class with an average learning outcome of 83.89 > 73.47. The average increase in learning outcomes in the experimental class and control class is in the same category, namely moderate and significantly different with an N-Gain value of 0.46 > 0.33. The classical completeness of the experimental class was 91.67% and that of the control class was 61.11%. The experimental class gave a response that greatly increased interest in learning with an average percentage of 87.48% and the control class gave a response that did not increase interest in learning with an average percentage of 65.88%. The conclusion of this study is that the reciprocal teaching model has an effect on cognitive learning outcomes and students' interest in learning at MAN 1 Semarang.

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PRELIMINARY

Restricting meetings for learning activities in class is a challenge and produces problems (Yuangga & Sunarsi, 2020). The main problem that arises because of learning activities without face-to-face method/in the network (online) is the material does not convey optimally which causes a lack of achievement of student competence. The lack of achievement of student competence results in a decrease in learning ability which has an impact on learning-adjusted years. In line with the research of Afkar, Masood, & Yarrow (2020), which reported that Indonesia's status quo was at 7.83. Online learning for 4 months will reduce the status quo to 7.61. Online learning for 6 months will reduce the status quo to 7.5. Online learning for 8 months will reduce the status quo to 7.35. The cumulative nature of learning has implications in the form of a continued decline in learning ability even after schools have been opened (World Bank, 2020).

The decrease in learning outcomes is directly proportional to the decrease in students' learning interests. The results of research conducted by Rosalin (2020) from the Ministry of Women's Empowerment and Child Protection (PPPA) on students from 29 Provinces, obtained data that 58% of children had feelings of displeasure while undergoing the study at-home policy. As many as 38% of children think schools do not yet have a good program for implementing learning activities at home. The conventional learning model that is applied online is one of the factors in learning outcomes and students' interest in learning decreases (Rahayu, 2021).

The concept of meaningful learning directs students to constructivist learning (Mustafa & Setya, 2021). Students are allowed to link new information with previously owned concepts containing facts, concepts, and experiences into new concepts (Islami, 2021). Biology subject is one of the subjects for developing the ability to relate concepts supported by the government in the Center for Research and Development of the Ministry of National Education (Hidayati et al., 2014) . The ability to relate concepts to material change and environmental preservation needs to be developed. Basic Competency (Kemampuan Dasar/KD) 3.6 and 4.6 place minimal demands on students to be able to analyze (Kemendikbud, 2020). The ability to analyze is in the fourth hierarchy (C4) and is classified into abilities that require high-level thinking based on Bloom's Taxonomy (Krathwohl, 2022). Students are not only required to know and memorize, but students must master the ability to think at a higher level, namely by analyzing (Umar, 2020). Learning in schools must lead to activities that encourage students to achieve meaningfulness in the learning process (Rizkianto & Murwaningsih, 2018).

The concept of meaningful learning is formed in 21st-century learning. 21st-century learning is designed to overcome problems that exist in the world of education (Kemendukbud, 2021). 21st-century learning helps educators design repeat activity learning, and produce students that are ready to face the challenge of this era. There are four main principles in 21st-century learning, namely: 1) Instruction should be student-centered; 2) Education should be collaborative; 3) Learning should have context, and 4) Schools should be integrated with society. The reciprocal teaching learning model fulfils the four principles of 21st-century learning. The concept of student-centered learning is in accordance with the first principle. In discussion in groups, students can learn to take roles, adapt and respect the strengths and weaknesses of other students, thus fulfilling the second principle. The four stages of reciprocal teaching namely summarizing, questioning, predicting, and clarifying fulfill the third and fourth principles.

Learning activity in the 21st century is packaged in curriculum 13. Successful curriculum 13, will produce students that master the 4C skills, i.e. creativity and innovation skill, critical thinking and problem-solving, communication, and collaboration. These four stages of reciprocal teaching will produce students with the 4C skills. This is corroborated by the results of Hairus' research (2016) stating that reciprocal teaching can increase student creativity. Umam (2018), Misbachul et.al (2017) state that reciprocal teaching can improve critical thinking. Anis & Indah (2020) state that reciprocal teaching can improve communication skills. Collaborative skills can be seen in group discussions that are carried out when learning the reciprocal teaching model and increasing student activity. This is corroborated by the

results of Bimo's research (2020) stating that reciprocal teaching can increase student activity.

The reciprocal teaching model requires students to be active in acquiring knowledge on the basis of constructivism and some process skills in learning. The aim of the reciprocal teaching model is to understand how children think, communicate and discuss. The advantages of the reciprocal teaching model are training students' ability to learn independently, practicing determining important things from learning, and honing students' abilities in solving problems (Hayati, 2012). Through the application of the reciprocal teaching model, students are expected to be able to learn effectively and meaningfully by constructing their own understanding so that their cognitive learning outcomes and learning interest can increase.

RESEARCH METHODS

This research was conducted at MAN 1 Semarang from January 10 to February 11, 2022. This type of research is quantitative, with a quasi-experimental design and nonequivalent control design models. Sampling was done by purposive sampling technique. The samples used in this study were class X MIPA 3 as the experimental class and X MIPA 4 as the control class. The treatment in the two classes was distinguished, the experimental class used the reciprocal teaching learning model, while the control class used teacher-centered learning. Data on cognitive learning outcomes were obtained using a test instrument while learning interest data used a questionnaire instrument. The sheet consists of 20 multiple-choice items which have been tested for validity and reliability. The effect of applying the model was analyzed by independent sample t-test to find out the difference in the average learning outcomes of the experimental and control classes, the N-gain test to determine the increase in cognitive learning outcomes in the experimental and control classes, to compare classical completeness in the experimental and control classes. The interest sheet consists of 20 statements which are guided by four indicators according to Slameto (2015) which include feelings of pleasure, interest, attention, and involvement. Data on student interest in learning were analyzed and categorized as increasing student interest in learning if it reached 70%.

RESULTS AND DISCUSSION

The results of the study were used to determine the effect of reciprocal teaching on cognitive learning outcomes and students' learning interest measured based on predetermined indicators, namely: 1) percentage mark completeness classic reach 80% of total participant educate that get $\geq$ 70. The minimum value adapts with KKM at MAN 1 Semarang and 2) Interests study said to increase if achieve at least 70% yield calculation percentage response of the students.

Learning Outcomes and Student Learning Interests

Data on student learning outcomes in the experimental class and control class in the form of pretest-posttest scores were analyzed using the normality test and homogeneity test as prerequisite tests presented in Table 1

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Table 1. Normality and homogeneity test results for pretest-posttest experimental and control classes

Data	Class	*Sig.* Normality	*Sig.* homogeneity
Pretest results	Experiment	0.200	0.162
	Control	0.045	0.089
Posttest results	Experiment	0.019	0.179
	Control	0.033	0.065

Based on Table 1, it is known that all learning outcomes data in the experimental class (implementation of reciprocal teaching) and control (teacher-centered learning model) are normally distributed and homogeneous. So, it can be decided that the statistical test used to find out the difference in the mean is the parametric test.

Based on the analysis results the learning outcomes of students obtained average pretest and post-test scores as presented in Table 2.

Table 2. Average pretest and posttest scores for the experimental and control classes

Data	Class	N	Average
Pretest results	Experiment	36	68.19
	Control	36	62.92
Posttest results	Experiment	36	83.89
	Control	36	73.47

Based on the results of the analysis of the independent sample t-test, it is known that the pretest results of students do not show a significant average difference where t_{count} (1.334) < t_{table} (1.994) and the significance value (2-tailed) is more than 0.05 (0.187 > 0.05). That is, the initial abilities of the experimental and control classes were almost the same. This is in accordance with Duda's statement (2010), which explains that equivalence in different groups is very necessary because the different results between groups indicate that the results are obtained from a treatment. After being given treatment, it was found that there was a significant difference in average learning outcomes between the experimental and control classes with t_{count} (3.362) > t_{table} (1.994) and a significance value (2-tailed) less than 0.05 (0.001 < 0.05) so that it can be interpreted that there is a significant difference in the average posttest results between the experimental and control classes. One of the external factors that influence student learning outcomes is the learning process in class (Udil, 2021).

The application of the reciprocal teaching model was carried out in the experimental class and the teacher-centered learning model was carried out in the control class, resulting in an increase in cognitive learning outcomes and interest in learning in the experimental class. The application of the reciprocal teaching model for syntax learning refers to Palincsar and Ann Brown namely summarizing, questioning, predicting, and clarifying. Students are divided into small groups for group discussions, each student in the group has their own role so that each student has the opportunity to try to communicate. The four syntaxes form a learning cycle that is interconnected with one another. Activities in each syntax provide information and experiences that make it easier for students to understand the concepts that have been obtained so that meaningfulness occurs in learning. In the process, the teacher still has a role in providing direction and guidance to students who learn actively in accordance with the learning objectives so that students' cognitive learning outcomes can increase.

Based on the results of the N-gain test analysis, it is known that the results of the interpretation of the class average cognitive learning outcomes show an increase in the cognitive learning outcomes of the experimental class higher than the control as presented in Table 3.

Table 3 Results of the Average N-gain Analysis of Experimental and Control Classes.

Data		Means	Maximum (%)	Minimum (%)
N-gain	Experiment Class	0.46	100.00	-33,33
	Control Class	0.33	100.00	-12.5

Based on Table 3 according to Meltzer in Dewi (2017), it shows the interpretation of increasing the analytical abilities of the two classes in the same category, namely moderate. Even though it is in the same

category, the increase in the experimental class is higher than the control class as evidenced by the results of a significant difference in the average N-gain with t_{count} (2.114) > t_{table} (1.994) and a significance value (2-tailed) less than 0.05 (0.038 < 0.05).

Table 4 Mastery of Classical Learning

Data		N	complete	Percentage
Pretest results	Experiment	36	14	38.89%
	Control	36	11	30.56%
Posttest results	Experiment	36	33	91.67%
	Control	36	22	61.11%

The superiority of the experimental class compared to the control class is reinforced by the results of the classical adequacy test analysis. The learning completeness of students is adjusted to the Minimum Completeness Criteria (KKM) in MAN 1 Semarang, namely 70. A class is said to have completed learning if the class contains ≥ 80% of students who have completed and achieved the specified KKM (Nurfaidah et al., 2013). Based on the results of the classical analysis, it is known that the percentage of completeness in the classical study of the experimental class was 91.67%, which was declared classically completed, while the control class was 61.11%, which was declared not classically completed. Learning completeness in learning indicates students have mastered basic competencies (Sudaryono, 2021). The percentage obtained by the experimental class using the reciprocal teaching model is proven to increase cognitive learning outcomes in order to achieve the specified KKM.

The learning interest of the students of MAN 1 Semarang in the experimental class using the reciprocal teaching model showed an increase in learning interest and the control class using the teacher-centered learning model showed no increase in learning interest. It can be seen from the results of the questionnaire in Table 5. In line with the research of Shefa & Mas'udhatul (2021) which reports that the reciprocal teaching model can increase students' interest in learning.

Table 5. Interest in Learning Questionnaire Results

Class \ Indicator	Experiment		Control	
	Percentage (%)	Category	Percentage (%)	Category
Feeling happy	90.28	Greatly improve	60.53	No upgrade
Involvement	87.36	Greatly improve	64.72	No upgrade
Interest	85.28	Greatly improve	69.17	No upgrade
Attention	86.98	Greatly improve	69.91	No upgrade
Average	87.48	Greatly improve	65.88	No upgrade

Based on Table 5, the experimental class using the reciprocal teaching learning method is in the category of greatly increasing students' learning interest. The control class using the teacher-centered learning method is in the category of less improving students. The recapitulation of the results of the analysis of student responses per statement is presented in Figure 1.
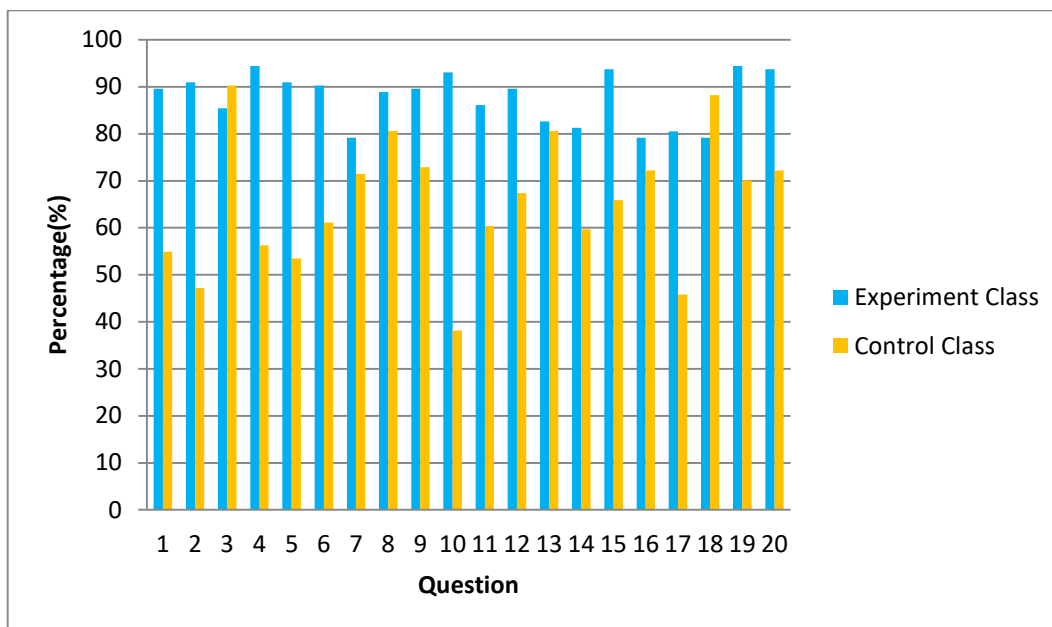
Figure 1. Recapitulation of Student Learning Interest Response Analysis Results

The results of the experimental class' interest in learning questionnaire obtained an average of 87.48% in the category of greatly increased interest in learning. The control class obtained an average of 65.88% in the category of not increasing interest in learning. This advantage is because the experimental class applies the reciprocal teaching model which has four syntaxes, namely summarizing, questioning, predicting, and clarifying.

At the summarizing stage, it can be interpreted as decomposing an article or discussion into a shorter description with a proportional comparison between the parts summarized and the summary (Djuharni, 2001). Students are asked to summarize material for environmental change and preservation according to the material sub-themes that had been given to each group. References in sum marizing are obtained from the results of exploration, the internet, and other literacy. This stage can train students' inference abilities, namely the ability to identify and obtain the elements needed so as to improve students' cognitive learning outcomes. The involvement of students at the summarizing stage can increase learning interest. This was supported by 88.89% of students responding to students' learning interest increasing after the summarizing stage was carried out.

The questioning stage is a way to convey or present lesson material in the form of statements from the teacher to students or vice versa. Students are asked to make questions related to material change and environmental preservation then other students are asked to answer the questions that have been made. The questioning strategy is used to monitor and evaluate the extent to which students understand. When there are students who ask questions to the teacher and other students explain to students who ask, this shows that the teacher is doing his job for scaffolding. Through scaffolding, it is hoped that the actual abilities of students, namely abilities that can be achieved by students by learning on their own can develop higher and better so that their potential capabilities are achieved (Efendi, 2013). The involvement of students at the questioning stage can increase interest in learning. This was supported by 82.64% of students responding to students' learning interest increasing after the question and answer stage was carried out. In line with the results of Halim's research (2013), question and answer can increase students' learning interest.

The predicting stage reveals future results or events based on patterns of clues or evidence (Susilawati, 2014). Students are asked to predict the relationship between one material concept and

another, such as linking global warming to the increase in the earth's temperature. This stage teaches students to identify the relationship of information used to express thoughts and opinions. Padilla (2015) revealed that making predictions can activate students' thinking and help students make connections between new information and what is already known. Students use known phenomena and those that are considered likely to occur to make connections in solving problems. Student involvement at the predicting stage can increase learning interest. This was supported by 81.25% of students responding to the increase in student learning interest after the predicting stage was carried out. In line with the results of Ramadani's research (2021) predicting can increase students' interest in learning. The predicting stage is the most important stage of the reciprocal teaching model because students are trained to analyze and develop concepts through group discussions.

In the clarifying stage, students explain terms and sentences that they do not understand, such as defining global warming, pollution, the environment, and so on. This stage makes students understand, explain, and draw conclusions. The clarification process during learning helps students understand to be better. The involvement of students at the clarifying stage can increase interest in learning. This was supported by 93.75% of students responding to the increase in students' learning interest after the clarifying stage was carried out. In line with the results of Sujana's research (2018), clarification can increase students' learning interest. Every syntax contained in the reciprocal teaching model makes learning more meaningful (Westwood, 2008). Meaningful learning means learning that demands solving problems that exist in everyday life by associating the concepts being studied (Tantu, 2018).

The control class uses the teacher-centered learning method with stages, namely: listening to teacher's explanation, students are asked to listen to the teacher's explanation and summarize the results of the explanation. The stage of listening to explanations does not increase students' learning interest. This was supported by 67.36% of students responding to listening to the teacher's explanation which did not increase interest in learning. The involvement of students at the summarizing stage can increase learning interest. This is supported by 80.56% of students giving responses that summarize can increase interest in learning.

The question and answer stage is a way of presenting lessons in the form of questions raised by students. Students are asked to ask questions which are then answered by the teacher as a source of knowledge. Questions and answers familiarize students to express what comes to mind. So that it can arouse students' interest in learning (Syahraini, 2014). The involvement of students in the question and answer stage can increase interest in learning. This was supported by 80.56% of students giving question-and-answer responses to increase interest in learning. In line with the results of Halim's research (2013), question and answer can increase students' learning interest.

Cognitive learning outcomes of students are measured through test techniques using instruments in the form of multiple-choice question sheets. The questions refer to KD 3.6 with a minimum category at C4 cognitive level (analyzing). This refers to the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 103 of 2014, in paragraph (4) letter b, namely abilities that can be measured and/or observed to be concluded as a fulfillment of Basic Competences in Core Competency 3 and Core Competency 4. Students are asked to be able to analyze environmental change data, analyze environmental causes, analyze impacts on life, and formulate ideas for solving problems of environmental changes that occur in the surrounding environment. The experimental class learning process was assisted by LKPD which integrated the reciprocal teaching model.

In the learning process that is carried out online, the experimental class applies an integrated LKPD reciprocal teaching model. Students can integrate material with KD and reciprocal teaching models, such as KD 3.6, namely analyzing data on environmental change, its causes and its impacts on life. This activity was carried out by students in activity LKPD 1.1. Students make observations in the home environment regarding environmental changes, causes, and impacts on life according to the sub-chapters of the material provided, followed by summarizing, for example, soil pollution material. Students summarize

important matters such as the definition of soil pollution, examples of soil pollution, causes and effects of soil pollution and so on. The summary is taken from observations and literacy sources such as LKPD, books, the internet and so on. Syntax summarizing has contributed to analyzing the initial stages of a problem that arises from the problem of soil pollution, namely by knowing the meaning of the terms in soil pollution.

The summary is used for the next syntax, namely questions (questioning) students make questions about things they don't understand from their colleagues. The questioning stage contributes to analyzing problems caused by soil pollution, such as: what causes soil pollution has not been handled yet and why waste can have a serious impact on life.

The questions above are linked in order to get a complete analysis of a soil pollution problem. This linking process is named prediction. Students look for the red thread from a problem like pollution land not visit handled because every man produces trash. Trash that is produced sometimes were not thrown away accordingly, for example throwing trash into a river result in a flood, a dirty environment can bring many diseases, and rubbish not only cause land pollution but also cause air pollution because of the rotting smell.

The common thread obtained at the prediction stage is then concluded in the syntax clarification. Students conclude from the analysis they have done from the stages of summarizing, asking, and predicting. Clarifications were made, such as Observations showing that there was soil contamination. Causes of soil pollution such as waste that is not managed properly, organic and inorganic waste mixed in one landfill, and littering. The impacts faced by the community due to soil pollution are that the environment becomes smelly, the soil becomes infertile because a lot of waste that is difficult to recycle gets buried in the ground, floods, and becomes a source of disease for the community such as drums filled with rainwater that become mosquito nests.

KD 4.6, namely formulating ideas for solving problems of environmental changes that occur in the surrounding environment. This activity was carried out by students in activity LKPD 1.2. The process of formulating ideas for solving environmental change problems uses four reciprocal teaching syntaxes, namely the summarizing stage, students summarize important things in finding environmental solution ideas, such as: re-reading the results of the analysis on LKPD 1.1 to record the things needed to find the idea of soil pollution found in the environment, it was found that one of the important things was that waste had not been separated according to its type.

In the asking stage, students conduct a question and answer session to get ideas for solving pollution, such as: are there already trash bins in the surrounding environment that are differentiated according to type; can we use waste to become a trash can, what are the benefits of differentiating organic and inorganic waste for the environment.

In the prediction stage, students make threads from questions that have arisen from the previous stage, namely: making trash cans that are differentiated according to type, namely inorganic and organic, using used drums lying in the trash. The use of used drums will make something that was not functioning at first have a better function. Waste that has been separated, namely organic and inorganic, will then be processed according to needs.

In the clarification stage, students draw conclusions from the results of group discussions, such as Empty drums left by the community and filled with rainwater becoming mosquito nests which can endanger the community because they can have an impact on the spread of disease. The drum is converted to function as a trash can according to the type, namely organic and inorganic so that the waste that has been divided can be reused. Organic waste will be used in the manufacture of mol (mikroorganisme lokal/local microorganism) and compost, while inorganic waste will be made into crafts that have selling value. The grouping of waste will have a good impact on the community, namely a cleaner environment, avoiding disease, and opening up new job opportunity for waste craftsmen.

LKPD is able to provide a better understanding. This is due to the influence of the use of LKPD as a learning companion media. LKPD can control students individually in finding information and building

the concept of knowledge. Students are given the responsibility to solve the problems contained in the LKPD. LKPD answers are presented in front of the class so that it can be ascertained that all students have completed the problems in LKPD and are involved in the learning process.

The control class uses teacher-centered learning without LKPD, in the learning process it is difficult to control because it is possible that not all students focus on the learning process. This is also in line with the research of Marianti, et al. (2021) which states that LKPD media can improve student learning outcomes when learning from home (BDR) because teachers can develop subject matter that is difficult to convey orally. In addition, LKPD can also minimize the teacher's role and train students' independent learning so that it is suitable for use in online learning.

The use of LKPD can maximize the understanding of basic skills (KD) achieved. LKPD is able to facilitate students to achieve KD material for environmental change and preservation, namely KD 3.6 analyzing data on environmental change, its causes and impacts on life; KD 4.6 formulates the idea of solving the problem of environmental change that occurs in the surrounding environment. Concept development through activity tables makes students' conceptual understanding more structured. Learning media has an important role in supporting the quality of the teaching and learning process (Purwono, 2014).

Collaboration between the reciprocal teaching model and LKPD can improve cognitive learning outcomes and students' learning interests. LKPD can make it easier for individual students to find information and construct their knowledge concepts systematically. In line with the research of Wulandari & Jeni (2021) stating that LKPD can improve cognitive learning outcomes and students' interest in learning.

CONCLUSION

Based on the results of the analysis and discussion, it can be concluded that the application of the reciprocal teaching model to material change and environmental preservation has an effect on increasing cognitive learning outcomes and students' interest in learning at MAN 1 Semarang.

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