

The Effectiveness of the PjBL Model Assisted by Cloud on Students' Critical Thinking Skills and Environmental Concern Attitudes Regarding Environmental Pollution Topics

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ABSTRACT

The 21st century is recognized as the age of knowledge, marked by technological advancements, where students are expected to possess strong critical thinking skills. However, in the realm of science education, students' attitudes towards critical thinking remain relatively low. This is primarily due to the passive reception of information, with students merely memorizing it for examinations or tests. Thus, there is a pressing need for solutions to address these challenges. This research aims to determine the effectiveness of the Cloud-assisted PjBL model on students' critical thinking skills on the topic of Environmental Pollution. The method used was a quasi-experimental. The research instruments were a test for critical thinking skills, a questionnaire for environmental care attitudes, and for the Cloud-assisted PjBL learning response questionnaire. The outcomes indicated that the N-Gain data for the experimental class yielded a value of 0.75, indicating a high category, while the control class obtained a value of 0.49, indicating a medium category. The average result for environmental care attitudes among students in the experimental and control class is good. The conclusion in this research is that the Cloud-assisted PjBL model is effective on students' critical thinking skills and can improve students' environmental care attitudes.

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1. INTRODUCTION

Education is one of the endeavors aimed at cultivating national life and enhancing the quality of human resources, constituting a facet of national development. The goal of national education is to cultivate individuals capable of effective communication and collaboration with others, productive, able to evaluate themselves, have good time management, and are able to solve problems in accordance with the skill needs of the 21st century (Seftiani et al., 2021). The 21st century is known as the era of knowledge and the era of society 5.0 which is characterized by creative thinking and higher order thinking (Miterianifa et al., 2021). In the 21st century, all aspects of life are related to technology, technological development is progressing very rapidly and one of the aspects affected by technological development is the world of education, so education must certainly transform in the era of Society 5.0 (Mayarni & Yulianti, 2020).

The ability development that needs to be developed in facing the demands and challenges of the 21st century is the ability to think at a high level (High Order Thinking Skill/ HOTS). In the Merdeka Curriculum, there are two basic things that become the profile of students, namely the ability to reason critically and think creatively (Direktorat Jenderal Pendidikan Tinggi Kementerian Pendidikan dan Kebudayaan, 2020). Higher Order Thinking Skill is a high-level thinking skill that requires a person to think critically, creatively, and analytically about information and data in solving a problem (Hastuti & Fauzan, 2022). In this research, thinking skills are emphasized on critical thinking skills in science learning.

Science learning relies on the thinking process in training students to improve critical, logical, and systematic thinking skills in every problem solving through the stages of learning. But in fact, science learning as a shaper of students' critical thinking attitudes is still fairly low because students only receive information passively, and then remember it when heading for an exam or test.

Critical thinking skills are the ability of students to solve problems and make decisions appropriately. The category of critical thinking skills of Indonesian students is still relatively low. This is shown through the results of Indonesia's Programme for International Student Assessment (PISA) score in 2022 issued by the Organization for Economic Cooperation and Development (OECD) which shows a decrease in international learning outcomes, but Indonesia's ranking in PISA in 2022 rose 5-6 compared to the 2018 PISA results (Kemendikbudristek, 2023) with the results of the science category getting a score of 383. PISA is a type of question that has a standard for students' higher order thinking skills which is one of the sources of reference in assessing and measuring students' ability to do science analysis, reasoning, knowledge communication, and problem solving. (Girsang et al., 2022). The low achievement of Indonesian students can be caused because students are not accustomed to solving PISA questions that have Higher Order Thinking Skills (HOTS) categories (Destiani, Ismet, Wiyono & Murniati, 2017). According to Trends in International Mathematics and Science Study in 2015, Indonesia's scientific literacy is ranked 50th out of 53 countries (Badan Pusat Statistik Pendidikan, 2017). This shows that students' critical thinking abilities are still low due to the less than optimal approach or learning model used by the teacher (Pauzi, 2021). Responding to this requires learning that supports the improvement of students' critical thinking skills.

In the world of education, technological advances are utilized by teaching staff in supporting the learning process such as exploring scientific information to facilitate achieving a learning goal. The use of the Cloud platform can be an effort by educators to provide digital technology innovations to students so that they can keep up with technological developments and be sensitive to current problems. Cloud is a digital platform that tends to be more familiar among young people or students, in this digital era prohibiting the use of digital media is no longer the right choice (Sahidillah & Miftahurrisqi, 2019). One of the efforts to avoid the negative impact of digital media is to raise student awareness through critical thinking and educate students in using digital media wisely.

Critical thinking skills are a person's ability to analyze problems, solve problems at hand, evaluate arguments that require discipline and deep logical thinking, and make the right decisions (Harjono, 2019). Partnership for 21st Century Skills (2015) suggests that critical thinking skills consist of 3 indicators, namely reasoning effectively, using thinking systems, and making judgments and decisions. Critical thinking skills are one of the abilities needed to face challenges in the 21st century globalization era.

The problem that has recently become the main topic in the mass media into a global issue is environmental problems. The number of environmental problems today requires us to think critically about overcoming them, so it is hoped that educational actors can help implement their knowledge to preserve the environment. Science subject is one of the sciences that studies related to the environment that involves skills and reasoning.

Based on observations and interviews with teachers and students conducted at SMPN 15 Sukabumi City, it was found that critical thinking skills and environmental awareness of seventh grade students still need to be improved. This result is based on the fact that the achievement of critical thinking indicators in students with most student scores that have not reached the Learning Objective Achievement Criteria with an average of 50.5, this is because students do not dare to express opinions in answering a problem and making a decision. Students' critical thinking skills should be optimized by integrating students' environmental care attitudes related to the ability to solve problems that occur in the surrounding environment. Supported by the Adiwiyata program which has been launched at SMPN 15 Sukabumi City so that students already have environmental knowledge, however students' environmental care attitudes are still in the low category, judging from the results of observation that students do not participate enough in solving environmental problems such as still throwing rubbish carelessly, so Efforts are needed to improve students' environmental care attitudes. The topic of environmental pollution teaches students to recognize the surrounding environment, analyze the factors that cause a decrease in environmental quality, and direct students in solving environmental problems and utilizing technology cloud in outcome sources of information from problems and solving these problems through projects. So teachers need to find alternative learning models in teaching.

PjBL is an effective learning model for increasing student knowledge by reflecting on a project (Arlinda et al., 2022). PjBL is a model that provides ample space for students to make decisions in solving a problem with a project (Aulia et al., 2023). PjBL has advantages including, 1) facilitating students to collaborate in solving a problem; 2) improving students' critical thinking skills; 3) challenging students to solve a problem well; 4) motivating students; 5) increasing content knowledge and fulfilling various student skills and learning styles (Ummah et al., 2019).

Aulia et al.'s research (2022) states that the Project Based Learning learning process can increase creativity, and student motivation in learning outcomes, improve students' ability to manage various information, and can train students in creating a project. Project learning is considered one of the approaches to creating a learning environment that can support students in building knowledge, attitudes, and skills (Astuti, 2018). The results of Issa & Khataibeh's research, (2021) state that the application of the PjBL model affects students' critical thinking skills in science with the highest average value compared to students who use conventional methods.

PjBL has a significant effect on students' cognitive learning outcomes and environmental care attitudes with a higher N-Gain value than classes that use the discussion method (Rafsanjani et al., 2020). Likewise, the results of research by Arlinda et al., (2022) stated that the application of PjBL with Instagram as a medium can improve students' critical thinking skills compared to only applying the PjBL model.

Based on previous research in improving students' critical thinking skills, innovation is needed in the learning process. As well as utilizing digital media with the Cloud platform and providing examples of real problems in the daily environment including global issues that are currently being discussed. So one of the efforts in dealing with the problem is that research is needed to determine the effectiveness of digital-assisted learning models using the Cloud in improving students' critical thinking skills and environmental care attitudes. One of the advantages of using the cloud is that learning can be done anytime and anywhere, the cloud has unlimited storage, backup, and security (Srikan et al., 2021). Based on this background, this research aims to analyze the effectiveness of the Cloud-assisted PjBL model on students' critical thinking skills and environmental care attitudes on the topic of environmental pollution.

2. RESEARCH METHOD

This research uses a quantitative approach, a type of quasi experimental design with a Non-equivalent Control Group Design pattern, which is a research design where the experimental group or control group is not randomly selected (Sugiyono, 2018).

Table 1. Non-equivalent Control Group Design

Class	Pretest	Treatment	Posttest
Experiment	O ₁	X	O ₂
Control	O ₃		O ₄

(Sugiyono, 2018)

Description:

- O₁ : Experimental class before being given treatment (pretest)
- O₂ : Experimental class after being given treatment (posttest)
- O₃ : Control class before being given treatment (pretest)
- O₄ : Control class after being given treatment (posttest)
- X : Deployment of the Cloud-assisted PjBL model

This research used two classes, namely experimental and control classes in class VII (Seven) Junior High School in Sukabumi City even semester of the 2023/2024 academic year with different learning activities, namely the experimental class using the PjBL model assisted by Cloud, while the control class used the discovery learning model. The research subjects amounted to 32 students for each experimental class and control class with research instruments as many as 6 questions for critical thinking skills, 16 questionnaire items for environmental care attitudes, and 16 questions for the Cloud-assisted PjBL learning response questionnaire. Analysis of critical thinking skills tests using the N-Gain calculation. N-Gain is the difference between pretest and posttest scores to determine the value criteria or show an increase in student ability.

$$N - \text{Gain} = \frac{\text{Score posttest} - \text{score pretest}}{\text{Score ideal} - \text{score pretest}}$$

Table 2. Critical Thinking Skills N-Gain Criteria

Normalized N-Gain Range	Criteria
$(\langle g \rangle) > 7$	High
$0.3 \leq g \leq 0.7$	Medium
$g < 0.3$	Low

(Sugiyono, 2018)

The results of the measurement of students' Critical Thinking Skills are not only seen based on the N-Gain value but also through the category of Critical Thinking Skills indicator percentage which consists of 3 critical thinking indicators according to P21. The results of the percentage data are assessed by the following data analysis techniques.

$$\text{Value} = \frac{\text{Score acquisition}}{\text{Score maximum}} \times 100\%$$

The two classes after obtaining the results of the N-Gain value then carried out a normality test, if the data is normal, it can be continued to carry out a homogeneity test, if the data is homogeneously distributed, then a hypothesis test is carried out. The tests on the normality test, homogeneity test, and hypothesis test use the SPSS 22 application tool. Data analysis of the results of the environmental care attitude scale questionnaire and student response questionnaire using the Likert scale with the following calculations.

$$\text{Percen} = \frac{\text{Total student score}}{\text{Score maximum}} \times 100\%$$

Table 3. Likert Scale Criteria

Percentage	Category
81% – 100%	Very good
61% – 80%	Good
41% – 60%	Good enough
21% – 40%	Not so good
0% – 20%	Not very good

(Sugiyono, 2018)

3. RESULT AND DISCUSSION

The results of the data in this study were obtained from pretests and posttests given in the experimental class and control class, a questionnaire on environmental care attitudes in the experimental class and the control class, and a questionnaire on student responses to the Cloud-assisted PjBL model in the experimental class. The pretest is given before the start of the learning process, and then after the completion of the learning process with the aim of seeing the difference in students' Critical Thinking Skills scores. Based on the data that has been collected, an overview of the data obtained will be explained.

Effectiveness of Cloud-Assisted PjBL Model on Students' Critical Thinking Skills on The Topic of Environmental Pollution

Students' Critical Thinking Skills were measured using instrument tests in the form of pretest and posttest with a total of 6 description questions given to students in the experimental and control classes which contained 3 indicators of Critical Thinking Skills according to P21, namely: a) Reasoning effectively, b) Using a thinking system, c) Making assessments and decisions. Learning activities in the experimental classroom use the Cloud-assisted PjBL model and in the control, class use the Discovery learning model. The first stage of the analysis test is the N-Gain test of pretest and posttest data. The results of the calculation can be seen in table 3 below.

Table 4. Recapitulation of N-Gain of Pretest and Posttest Results

Class	Grade point average			Category N-Gain
	Pretest	Posttest	N-Gain	
Experiment	41.02 ±0.15	85.42 ±0.09	0.75 ±0.15	High
Control	32.16 ±0.16	65.76 ±0.12	0.49 ±0.16	Medium

Table 3, shows that the scores in the experimental and control classes have increased, but the average pretest score of the experimental class is 41.02 higher compared to the control class pretest average value of 32.16. After the pretest was carried out, the posttest data was obtained which showed that the experimental class got an average value of 85.42 which was superior to the average value of the control class of 65.76. Based on the data from the pretest-posttest scores, it can be stated that the learning model has a role in improving students' critical thinking skills. The increase in students' critical thinking skills in the experimental class was due to the application of the Cloud-assisted PjBL learning model applied by the teacher in the experimental class. This is in line with research conducted by Issa & Khataibeh, (2021) that the application of the PjBL model affects students' critical thinking skills in science with the highest average value compared to students who use conventional methods.

The measurement of data on Critical Thinking Skills, in addition to being seen based on the N-Gain value, also uses the percentage category of the Critical Thinking Skills indicator (Figure 1).

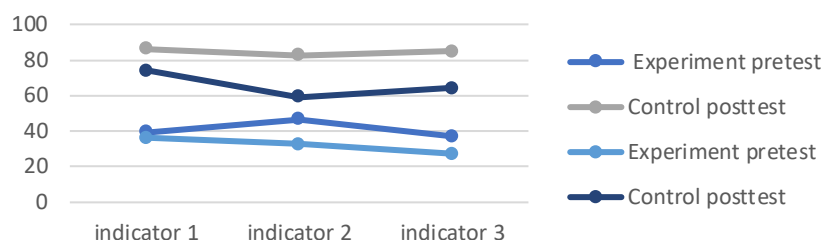


Figure 1. Percentage of Initial Critical Thinking Skills Indicators

Based on the bar chart (Figure 1), illustrates that the pretest results of the experimental class and the control, after the learning treatment in both classes was carried out, a posttest was carried out with results showing that the average score of the final test results (posttest) in the experimental class and the control class increased compared to the pretest score with the results of the average indicator score in the experimental class of 85.42 persen in the very good category, while the control class was 65.76 persen in the good category. The increase in N-gain in the experimental and control classes is due to the use of a learning model that is able to support improving students' critical thinking skills, which consists of teaching modules and LKPD that present real phenomena or problems in the student environment. Based on the results obtained, the increase in the experimental class was higher than that of the control class, this happened because the experimental class used the cloud-assisted PjBL model, so in learning students were involved in problem-solving in the form of projects that required students to apply knowledge and search for various sources of information, be involved in problem-solving, planning, make decisions, and they interacted and discussed with teachers and colleagues anywhere and anytime in project completion. In contrast to the control class, during the learning process, the teacher explains the entire material to be discussed, and then students are asked to discuss with the group to do the LKPD. The process of implementing learning in the control class is quite enthusiastic in listening to and listening to the teacher's explanation, but students tend to be passive when the teacher invites them to ask questions and during group percentages. This is relevant to the results of the observation of the implementation of the learning model during student learning activities with the cloud-assisted PjBL model, students are more active in question and answer sessions and discussions and students are enthusiastic about working on the project, so the learning process is more student-centered while the teacher is the facilitator.

The first indicator is that students are able to reason effectively with a result of 89.06 persen in the experimental class with a very high category, while the control class obtained a result of 74.22 persen with a high category. Wahyuni, et al., (2019) in their research showed that Critical Thinking Skills can be improved for junior high school students using alternatives that are in accordance with the level of characteristics possessed by the student. During the learning activities, students were enthusiastic about the process of collecting information through the cloud platform after being given the opportunity to find information related to environmental problems, so this indicator obtained the highest percentage of the other two indicators. PjBL provides tasks that are sourced from problems so that students are required to solve problems independently which allows the development of students' skills and knowledge through the help of technology as a source of information and learning that can encourage effective and meaningful learning experiences and as a catalyst to help improve student interaction with information (Al-Taai, 2022). This was strengthened by the results of student responses that showed that students were interested in learning the cloud-assisted PjBL model for students' critical thinking skills with a percentage of 72.77 persen or a good category. Relevant to the results of observations of the implementation of the cloud-assisted PjBL model at the stage of searching for information, it can give students the opportunity to think effectively, think logically in reasoning, thus enabling students to think critically in choosing the correct information according to trusted learning sources.

The second indicator, students were able to use the thinking system was included in the very high category in the experimental class with a result of 82.42 persen, while the control class of 58.98 persen was in the medium category. In the learning process, students collect information from various sources and then analyze it according to data, and facts that are relevant to factual problems in daily life. Surya in Astari (2020) said that one of the characteristics of a person who has Critical Thinking Skills is being able to utilize information in formulating problem solutions or making decisions, and if necessary, looking for additional relevant information. This is supported by the results of observation of the implementation of cloud-based PjBL learning where students in the experimental class are active in looking for relevant literacy sources.

The third indicator is that students are able to make assessments and decisions with a result of 84.77 persen in the experimental class belonging to the very high category, while the control class of 64.06 persen is included in the high category. In line with the research of Nugraha et al., (2019) one of the efforts to teach students to think critically is that with the skill of summarizing, students are required to be able to elaborate and

understand various indicators gradually until the conclusion. In this study, students must be able to explain the problems that occur and the results of problem analysis. Also supported by the research of Jaya et al., (2020) students who are able to draw conclusions means that students are also able to understand the process of the problem itself in accordance with the factual problem. Relevant to the results of the students' responses that they are happy to learn with the cloud-assisted PjBL model because, in addition to being able to understand the material being taught, students can also communicate and cooperate with the group in solving the given problems with a percentage of 82.68 percent or the very good category.

The data of the N-Gain results of the students were obtained, then carried out the first stage of analysis prerequisite test, namely the data normality test using Shapiro Wilk because the number of samples in this study used a small number of samples (<100). The calculation results show that the data of the experimental class is 0.312 and the value of the control class is 0.098. This shows that the N-Gain value in the experimental class and the control class is normally distributed because it has a significance greater than 0.05. The second stage prerequisite test is the data homogeneity test which shows that the significance value Based on Mean is $0.944 > 0.05$, so that the data results are homogeneous because the significance value is greater than 0.05. In the next stage, the data will be analyzed by hypothesis testing independent sample test which aims to determine the effectiveness of the Cloud-assisted PjBL model on students' Critical Thinking Skills on the topic of environmental pollution. The t-independent test on the N-Gain data obtained a sig (2-tailed) result of 0.000 which showed that the data was of different significance, so H_0 was not accepted, while in H_1 it was accepted, which showed that the Cloud-assisted PjBL model was effective on students' Critical Thinking Skills on the topic of Environmental Pollution.

These results are in accordance with research conducted by Pratiwi (2020) that there is a significant influence in the application of the PjBL model that is able to show students' Critical Thinking Skills, judging from the sig-2 (tailed) value of $0.000 < 0.05$. Sharma (2017) states that the use of cloud platforms in the world of education provides independent learning. In independent learning, each student can develop strategies for obtaining information and solving a problem and teachers can evaluate their activities anywhere and anytime. Research (Khofiyah et al., 2019) explains that Critical Thinking Skills can be developed by practicing continuously with the help of teachers as facilitators to think independently, so that they are confident in expressing ideas, and can accept differences of opinion so that they can collaborate to find solutions. The method used is through seeking information from various experiences, communication, and observation so that the intellectual process becomes active.

Students Environmental Care Attitude in Experimental and Control Classes

The environment is one of the natural elements that should be preserved and cleaned, but in fact today many humans exploit natural resources and the environment without caring about what will arise, so it is necessary to instill an attitude of concern for the environment (Tiani, 2019). The topic of Environmental Pollution has the potential to develop an attitude of caring for the environment because this topic is close to real problems that exist in students' daily lives, such as air pollution, floods, and indiscriminate garbage disposal caused by a lack of human awareness.

The assessment of students' environmental care attitudes was carried out using an environmental care attitude questionnaire using a Likert scale, consisting of 20 statements containing indicators of environmental care attitudes. This scale is in the form of statements that have the choice of answers strongly agree (SS), agree (S), disagree (TS), or strongly disagree (STS). For positive statements, the score of the answer choice is SS = 4, S = 3, TS = 2, STS = 1. Meanwhile, in negative statements, the score of answer choice is SS = 1, S = 2, TS = 3, STS = 4.

Based on the data obtained, shows the results of questionnaire data on students' environmental care attitudes in experimental and control classes consisting of each indicator of environmental care attitudes. In the indicator of having awareness and gratitude for having awareness and gratitude for the existence of a beautiful environment, 82.97 percent was obtained in the experimental class and 83.43 percent in the control class with a difference of 0.46 percent. Assessment on the indicator of having awareness related to solving problems of environmental change obtained an assessment of 83.33 percent in the experimental class and 74.21 percent in the control class with a difference of 9.12 percent. Assessment of indicators Having curiosity, critical and caring about environmental pollution and the causes of various impacts of environmental pollution obtained an assessment of 83, 59 percent in the experimental class and 77.97 percent in the control class with a difference of 5.62 percent. Assessment of indicators controlling the handling of various types of waste and recycling waste that can be beneficial to life obtained a value of 83.33 percent in the experimental class and 80.47 percent in the control class with a difference of 2.86 percent. The average value of environmental care attitudes of experimental class students was 83.31 percent with a very good category and the control class was 79.02 percent with a good category. The two average results of the assessment aspects have a difference of 4.29 percent.

When viewed from this value, the group of students who applied the PjBL model in the learning process had a very good environmental care attitude compared to students who learned using the Discovery Learning

model. This is in line with the research of Rafsanjani (2020) that the PjBL model is proven to improve students' environmental care attitudes on the topic of Environmental Pollution.

There are results with a very good category in the experimental class and a good category in the control class on students' environmental care attitudes because students are happy to protect the environment and there is a school *adhiwiyata* program, but the improvement in the experimental class compared to the control class occurs because in the experiment class, there is a stage, namely the implementation of PjBL learning which can foster self-awareness to care for the environment through projects. This is relevant to the response of students who stated that students are happy in solving environmental problems in their daily lives. Apart from that, the use of cloud technology makes it easier for students to access sources of information related to environmental issues and how to deal with them, so that students can sort out the right information in solving environmental problems which can help improve students' environmentally caring attitudes.

The results of interviews with students in the experimental class showed that there was a more environmentally conscious attitude in the learning process at the project creation stage. Students said that making project results in the form of video invitations to prevent and counteract environmental pollution can make students individuals who care about the environment. The work that has been made in the form of a video can be used to appeal to students and other communities to protect the environment. This cloud-assisted PjBL model can foster students' environmental care, but there is a weakness in the application of this model, which requires a lot of time during the learning process.

Student Response to Cloud-assisted PjBL Model on Critical Thinking Ability and Environmental Care Attitude on the Topic of Environmental Pollution

This research is also supported by a student response questionnaire to the Cloud-assisted PjBL model. Student responses to the Cloud-assisted PjBL model were given to the experimental class after completing the learning. Based on Table 4.8, the results of student responses to the Cloud-assisted Project Based Learning model with an average percentage of 78.56 percent or included in the good category.

The highest percentage of questionnaire indicators is in indicator 1 regarding interest in learning the PjBL model assisted by the Cloud platform in the learning process. In indicator 1, 6 statements were presented, namely "The project-based learning process is interesting and not boring", "I tend not to be able to communicate and work together in groups", "I prefer to learn environmental pollution materials with discussion methods", "Cloud-assisted PjBL models tend to make learning difficult", "Cloud-assisted group projects that can be done well", and "Project-based learning makes me know my learning style better". Based on the results of the response of indicator 1, a percentage of 82.68 percent was obtained which was included in the very good category. This means that using the Cloud-assisted PjBL model can increase students' motivation to learn. This is relevant to the improvement in indicator 1 critical thinking skills which is also the indicator with the highest percentage, namely reasoning effectively, in learning activities students are enthusiastic about the process of collecting information through the cloud platform after being given the opportunity to find information related to environmental problems.

The second indicator is related to the relationship of the Cloud-assisted PjBL model to students' Critical Thinking Skills. The number of statements presented was 7 statements, namely "I am not able to distinguish between scientific facts and personal opinions", "I am able to determine the purpose of the information provided", "I can draw conclusions from the assumed facts", "I tend not to be active in giving arguments by discussing during project activities", "I am not able to access new information from previous information properly", "I can understand the right or wrong of an argument based on the facts given", and "I tend to be hesitant in making decisions". Based on the results of the response to indicator 2, a percentage of 72.77 percent was obtained which was included in the good category. So it can be interpreted that the Cloud-assisted PjBL model can help students draw conclusions and make decisions in a problem through the information obtained. This is relevant to the third indicator of critical thinking where students must be able to explain the problems that occur and the results of problem analysis, in accordance with the results of the observation sheet in the learning process of the active experimental class in discussion and question and answer sessions that show students are able to argue and provide information on a problem.

The third indicator is the benefits of the Cloud-assisted PjBL model on the topic of environmental pollution. It consists of 3 statements, namely "Learning is fun because it can be closer to nature", "Materials about environmental pollution cannot spark Critical Thinking Skills and problem solving", and "I am happy with the environmental pollution material because it is suitable for real life". Based on the results of the response of indicator 3, a percentage of 80.21 percent was obtained which is included in the very good category, meaning that the PjBL mode with Cloud support has an influence on students' concern for the environment. The results are related to the results of the questionnaire on students' environmental care attitudes in the experimental class which showed a very good category.

Based on the results obtained overall, student responses regarding the Cloud-assisted PjBL model fall into the good category. This supports the data obtained, namely that there is an effectiveness of the Cloud-assisted

PjBL model on critical thinking skills and students' environmental care attitudes on the topic of Environmental Pollution.

4. CONCLUSION

The Cloud-assisted PjBL model is effective on students' critical thinking skills with experimental class scores higher than the control class scores treated using the discovery learning model, these values can be seen from the N-Gain data for the experimental class yielded a value of 0.75, indicating a high category, while the control class obtained a value of 0.49, indicating a medium category and the achievement of critical thinking skills indicators. In addition, the Cloud-assisted PjBL model provides an increase in students' environmental care attitudes which can be seen from the environmental care attitude questionnaire scale in the very good category, and student responses to the application of the Cloud-assisted PjBL model which are in the good category.

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