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Preliminary Study on Critical Thinking Skills of Learners in South Sumatra Related to Climate Change (Global Warming)

Dwi Purnomo Aji[1], Hamdi Akhsan[2], Leni Marlina[3]

[1 2 3]Master of Physics Education Study Program, Sriwijaya University, Bukit lama, Palembang City, South Sumatra, Indonesia

Abstract

In the 21st century, critical thinking skills play an important role in facing the challenges of globalization in the world of education; in Indonesia, students' critical thinking skills are still in the low category. Therefore, it is necessary to conduct an initial study to find out an overview of students' essential level of thinking skills. The subjects in this study involved 192 students of class X phase E independent curriculum who were available and willing to be studied, divided into five schools in South Sumatra. Critical thinking skills data uses Ennis indicators packaged as a questionnaire. The data collected were analyzed using descriptive qualitative methods per indicator and the overall average of the indicators. The results of this study show that only one of the five indicators of students' thinking skills shows a high category. For the average critical thinking skills in each school, namely for the first school, the average percentage is 85.30% with a high category; in the second school, the average percentage is 47.38% with a medium category; in the third school, the average percentage is 37.78% with a medium category, the fourth school, the average percentage is 36.66% with a medium category and the fifth school, the average percentage is 29.44% with a low category. Following up on the findings in this study, the critical thinking skills of grade X high school students in South Sumatra on global warming material must be improved. Some solutions to improve students' critical thinking skills are using learning models, learning methods, teaching materials, LKPD, and appropriate technology in the learning process.

Keywords: Critical Thinking Skills, Global Warming, Augmented Reality

1. Introduction

In the 21st century, Education for Sustainable Development (ESD) plays a vital role in facing the challenges of globalization in education (Fekih Zguir, Dubis and Koç, 2021). The integration of ESD in education in Indonesia is reflected in revitalizing the curriculum into an Independent Curriculum. The independent curriculum gives students the freedom to explore their skills and interests, so that teachers are more flexible to be creative in teaching as much as possible, and know more about the interests, talents, needs and skills of students (Nursalam, Sulaeman and Latuapo, 2023). Higher-order thinking skills are needed in the implications of an independent curriculum in the 21st century (Akhsan et al., 2020). In Indonesia, higher-order thinking skills are still a problem that must be resolved (Akhsan et al., 2020). One of the higher order thinking skills is critical thinking, which are still very low (Chairatunnisa,

Marlina and Wiyono, 2023).

Several factors, namely cause the low critical thinking skills of students: The first factor is the monotonous role of the teacher in the learning process, the teacher plays a vital role in the process of developing students' critical thinking skills (Fikriyatii, Agustini and Sutoyo, 2022). The use of a suitable learning model will affect the level of thinking skills of students. Problem-based learning model (Putri et al., 2023), video-assisted problem-based learning (PBL) learning model (Astra, Khoirulloh and Rahayu, 2024), and STEM-PjBL learning model (Kurniahtunnisa et al., 2023) are adequate to improve students' critical thinking skills.

The second factor is teaching materials; teaching materials that only utilize printed books makes students feel bored. To overcome this problem, teachers can use electronic teaching materials like digital handouts (Akhsan et al., 2021) STEM-based digital handouts as teaching materials (Murniati, Fathurrohman and Letari, 2022). The use of Google site-based E-modules (Susanti et al., 2023), scientific Critical Thinking (SCT) based E-modules (Mahdian, Ariyanti and Bakti, 2024), ethnophysics E-modules (Lestari and Apsari, 2022) and E-modules integrated with STEM (Adhelacahya, Sukarmin and Sarwanto, 2023) are effective as teaching materials that can improve students' skills.

The third factor is the test instrument. In evaluating learning carried out by teachers, it is found that the instruments used have not been able to measure students' skills and have not been by the indicators of making test instrument questions. Therefore, it is necessary to develop manual and computer-based instruments (Murniati et al., 2023). To measure students' critical thinking skills, the CTDBT instrument can be used (Syahfitri and Firman, 2022). Indicators that can be used to measure the level of critical thinking skills of students are using Ennis indicators. According to (Ennis, 1993), critical thinking indicators are divided into five categories: providing simple explanations, building basic skills, summarizing, providing more explanations, and formulating strategies and tactics.

The fourth factor is the utilization of technology; in the learning process, teachers often need to utilize technology and still do conventional learning. Several technologies can be used to improve students' thinking skills, such as augmented reality technology which brings great benefits in the field of education (López-Belmonte et al., 2023). Augmented reality (AR) technology enables interactive experiences with the natural world where real-world objects are enhanced with computer-generated perceptual information (Garzón, 2021). the novelty of augmented reality technology is a unique attraction for stakeholders to improve the quality of education (Muslim et al., 2021). In addition, artificial intelligence technology is a critical educational technology and digital learning tool in the 21st century (Taşçi & Durmuşçelebi, 2020). Artificial intelligence technology is effective in education today or in the future (Tartuk, 2023). Artificial intelligence can be utilized in educational activities (Kaban, 2023). In another study artificial intelligence was able to visualize the concept of images, it was concluded that the potential use of images generated by artificial intelligence for educational purposes was high (Aktay, 2022). In this case, conceptual perception in the learning process will be meaningful (Aydin et al., 2022).

Many factors influence students' critical thinking skills. Therefore, it is necessary to conduct an initial study to analyze students' students' level of thinking skills. The initial research will be carried out on global warming material, where global warming material is class X phase E independent curriculum material. Through observations and interviews with high school physics teachers in South Sumatra, it was found that global warming material is challenging to explain, so students need help defining concepts, solving problems, analyzing, and focusing on solving questions on global warming material.

Therefore, a questionnaire instrument was distributed to examine the level of students' critical thinking skills in five South Sumatra schools on global warming material and to find out what factors caused the low or high level of critical thinking skills of students on global warming material for students in South Sumatra.

2. Methods

This study uses a qualitative descriptive method that aims to describe or provide an initial description of the level of critical thinking skills of high school students on global warming material in South Sumatra. In this study, no treatment was given to the research subjects, but by providing instruments to students by the actual situation to see an overview of the level of thinking skills of high school students on global warming material in South Sumatra.

To obtain an initial picture of students' level of thinking skills is done by giving an instrument in the form of a questionnaire that represents 5 indicators of critical thinking skills (Ennis, 1993). The instrument used was 10 questions with the research subjects, namely 5 schools with 192 students who were available and willing to be analyzed and had implemented an independent curriculum in South Sumatra.

The data analysis calculated the percentage of students' skill level at the high school level in South Sumatra on global warming material. The results of the students' answer scores are differentiated on each indicator and each school to be analyzed and compared. If written mathematically, it is as follows:

$$NP = \frac{R}{SM} x100\%$$

Description:

NP = Percentage value sought or expected
R = Total score of critical thinking skills indicators
SR = Maximum score of essential skills of thinking indicators

The level of critical thinking skills is divided into three categories: low, medium, and high.

Table 1: Levels of Critical Thinking Skills

No.	Category	Percentage score %
1.	Low	33% <
3.	Medium	33% - 67%
3.	High	67% >

3. Results and Discussion

The description of the calculation results is based on the calculation of the score obtained from each student's answer. An overview of the measurement of the level of critical thinking skills in the form of a questionnaire consisting of 10 questions representing each of the 5 indicators of critical thinking skills (Ennis, 1993).

Table 2: Indicators and Sub-Indicators of Critical Thinking Skills (Ennis, 1993)

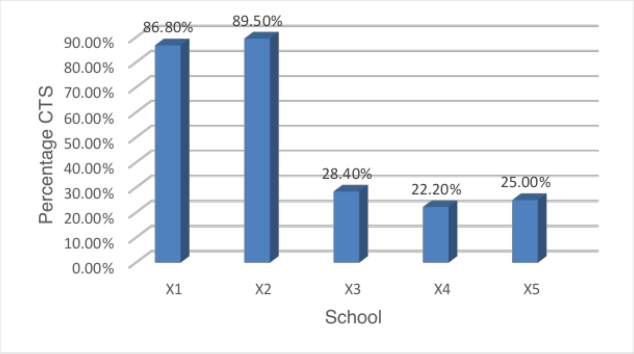
No.	Indicator	Sub Indicator
1.	Providing simple explanations	a. Focusing questions and Analyzing questions b. Asking and answering questions

2.	Building basic skills	a. Considering whether the source is trustworthy b. Observing, considering observation reports
3.	Summarizing	a. Doing and considering b. Make and determine
4.	Provide further explanation	a. Define, consider a definition b. Identifying assumptions
5.	Organizing strategies and tactics	a. Determining an action b. Interacting with others

After researching class X students in 5 public high schools in South Sumatra. So, the average critical thinking skills of students are divided into five indicators according to Ennis, 1993 which are contained in the form of bar charts, namely:

First Indicator (Providing Simple Explanations)

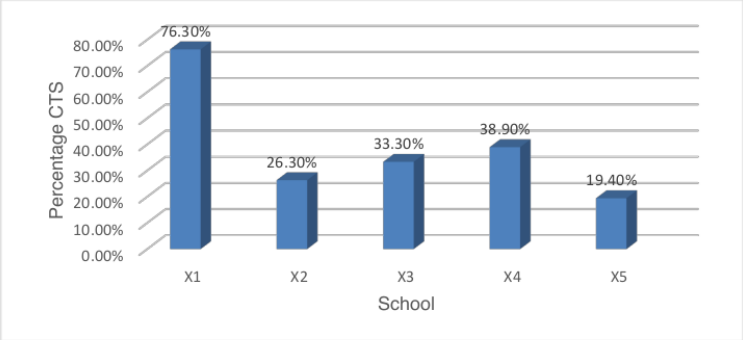
Figure 1: Providing Simple Explanations



In Figure 1 the critical thinking skills indicator (Ennis, 1993) in 5 schools in South Sumatra shows the results, namely: the first school shows an average percentage score of 86.80% with a high critical thinking skills level category, the second school shows an average percentage score of 86.80% with a high critical thinking skills level category, the third school shows an average percentage score of 28.40% with a low critical thinking skills level category, the fourth school shows an average percentage score of 22.20% with a low critical thinking skills level category and the fifth school shows an average percentage score of 25% with a low critical thinking skills level category. This indicates that of the 5 schools studied, 2 schools have a high average percentage of essential skills of thinking scores. At the same time, the other 3 schools have an average percentage score of low critical thinking skills. The difference in the level of critical thinking skills of students in South Sumatra high schools is a common thing that happens. This is caused by several factors, namely differences in accreditation for each school, the learning model used, the teaching materials used, and the utilization of technology (facilities and infrastructure) in different learning processes.

Second Indicator (Building Basic Skills)

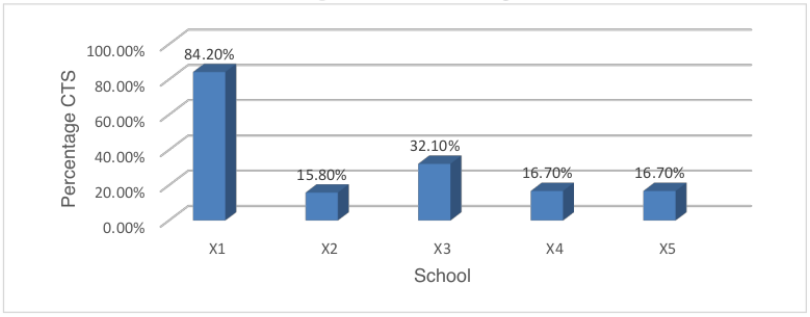
Figure 2: Building Basic Skills



In Fig.2 indicators of critical thinking skills (Ennis, 1993) 5 schools in South Sumatra showed the results, namely: the first school showed an average percentage score of 76.30% with a high critical thinking skills level category, the second school showed an average percentage score of 26.30% with a low critical thinking skills level category, the third school showed an average percentage score of 33.30% with a medium critical thinking skills level category, the fourth school showed an average percentage score of 38.90% with a medium critical thinking skills level category and the fifth school showed an average percentage score of 19.40% with a low critical thinking skills level category. This indicates that of the 5 schools studied, 1 school has an average percentage score of high critical thinking skills, 2 schools have an average percentage score of medium critical thinking skills, and 2 schools have an average percentage score of low critical thinking skills. The difference in the level of critical thinking skills of students in South Sumatra high schools is several factors cause a common thing that happens this, namely: differences in accreditation for each school, the learning model used, the teaching materials used and the utilization of technology (facilities and infrastructure) in different learning processes.

Third Indicator (Summarizing)

Figure 3: Summarizing

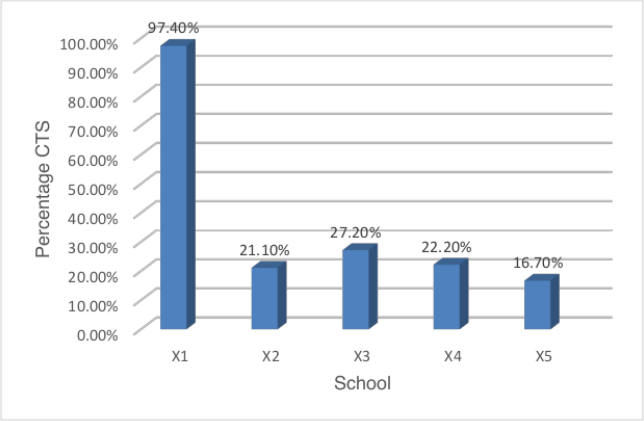


In Fig.3 critical thinking skills indicators (Ennis, 1993) 5 schools in South Sumatra showed the results, namely: the first school showed an average percentage score of 84.20% with a high critical thinking skills level category, the second school showed an average percentage score of 15.80% with a low criti-

cal thinking skills level category, the third school showed an average percentage score of 32.10% with a low critical thinking skills level category, the fourth school showed an average percentage score of 16.70% with a low critical thinking skills level category and the fifth school showed an average percentage score of 16.70% with a low critical thinking skills level category. This indicates that of the 5 schools studied, there is 1 school that has a high average percentage score of critical thinking skills, while the other 4 schools have a low average percentage score of critical thinking skills. The difference in the level of critical thinking skills of students in South Sumatra high schools is several factors cause a common thing that happens this, namely: differences in accreditation for each school, the learning model used, the teaching materials used and the utilization of technology (facilities and infrastructure) in different learning processes.

Fourth Indicator (Providing Further Explanation)

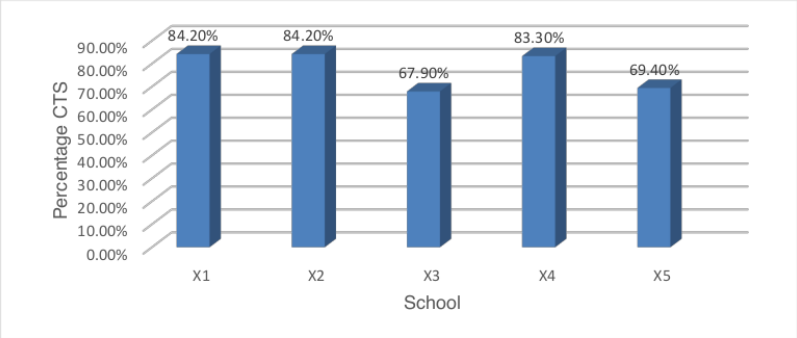
Figure 4: Giving Further Explanation



In Fig.4 indicators of critical thinking skills (Ennis, 1993) 5 schools in South Sumatra showed the results, namely: the first school showed an average percentage score of 97.40% with a high critical thinking skills level category, the second school showed an average percentage score of 21.10% with a low critical thinking skills level category, the third school showed an average percentage score of 27.20% with a low critical thinking skills level category, the fourth school showed an average percentage score of 22.20% with a low critical thinking skills level category and the fifth school showed an average percentage score of 16.70% with a low critical thinking skills level category. This indicates that of the 5 schools studied, there is 1 school that has a high average percentage score of critical thinking skills, while the other 4 schools have a low average percentage score of critical thinking skills. The difference in the level of critical thinking skills of students in South Sumatra high schools is several factors cause a common thing that happens this, namely: differences in accreditation for each school, the learning model used, the teaching materials used and the utilization of technology (facilities and infrastructure) in different learning processes.

Fifth Indicator (Organizing Strategies and Tactics)

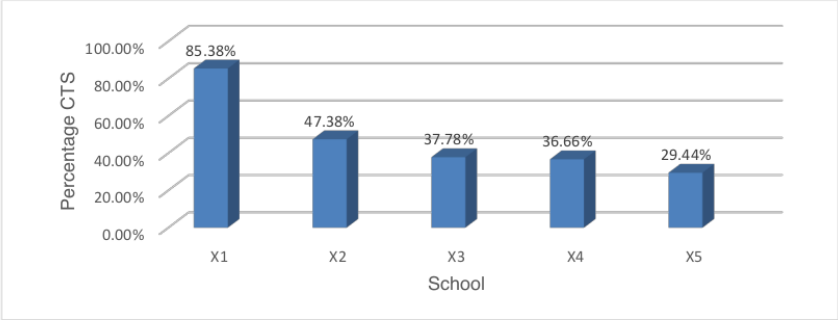
Figure 5: Organizing Strategies and Tactics



In Fig.5 indicators of critical thinking skills (Ennis, 1993) 5 schools in South Sumatra showed the results, namely: the first school showed an average percentage score of 84.20% with a high critical thinking skills level category, the second school showed an average percentage score of 84.20% with a high critical thinking skills level category, the third school showed an average percentage score of 67.90% with a high critical thinking skills level category, the fourth school showed an average percentage score of 83.30% with a high critical thinking skills level category and the fifth school showed an average percentage score of 69.40% with a high critical thinking skills level category. This indicates that of the 5 schools studied, all of them show a high average percentage score category of critical thinking skills. After analyzing each school and each critical thinking skills indicator, look at the overall average of each critical thinking skill indicator in each school.

Average of All Indicators (Ennis, 1993) for Five Schools in South Sumatra

Figure 6: Average of All Indicators (Ennis, 1993)



In figure.6 is the overall average result of 5 indicators of critical thinking skills (Ennis, 1993) for 5 schools in South Sumatra can be seen in table.3

Table 3: **Level of Critical Thinking Skills of High School Students in South Sumatra**

No.	School	Average	Category
1.	First school (X1)	85,30%	High
2.	Second school (X2)	47,38%	Medium
3.	Third school (X3)	37,78%	Medium
4.	Fourth school (X4)	36,66%	Medium
5.	Fifth school (X5)	29,44%	Low

The level of critical thinking skills of high school students in class X phase E on global warming material in South Sumatra has, namely: the first school has an average percentage of 85.30% with a high category, the second school has an average percentage of 47.38% with a medium category, the third school has an average percentage of 37.78% with a medium category, the fourth school has an average percentage of 36.66% with a medium category and the fifth school has an average percentage of 29.44% with a low category. Differences in critical thinking skills of high school students in South Sumatra are common, because several factors influence it such as differences in school accreditation, learning models used by teachers in the learning process, teaching materials used and the utilization of technology. This is what causes differences in the skills of students in each school.

4. Conclusion

In this study, researchers wanted to know the initial study description of the level of critical thinking skills of high school students in South Sumatra on global warming material. The implication of global warming material is in high school class X, phase E of the independent curriculum, using descriptive qualitative research methods and questionnaires.

Based on the findings and analysis of the level of critical thinking skills (Ennis, 1993) on global warming material in South Sumatra, there are different results for each indicator and school. Learners have different abilities in each indicator, such as in the fifth indicator of organizing strategies and tactics; students have high critical thinking skills. In other indicators, almost all students have low critical thinking skills. The difference in the level of critical thinking skills of students in each school is also different, as indicated by the average percentage for the first school of 85.30% with a high category, the average rate for the second school of 47.38% with a medium category, the average percentage for the third school of 37.78% with a medium category, the average percentage for the fourth school of 36.66% with a medium category and the average percentage for the fifth school of 29.44% with a low category. In this finding, only one out of five schools has a high level of critical thinking skills in South Sumatra. More is needed to face the challenges of globalization in education in the 21st century. Students' critical thinking skills must be in the high category. Therefore, it is necessary to improve the thinking skills of high school students in South Sumatra on global warming material.

Critical thinking skills are needed for students (Alharbi, 2022), solutions that can be done to improve critical thinking skills such as the use of appropriate learning models (Yaki, 2022), appropriate learning methods (Xhomara, 2022), the use of teaching materials (Oikonomidis and Sofianopoulou, 2023), the use of LKPD (Net *et al*., 2023) and the use of technology in the form of interactive media (Alqahtani and Alsalem, 2023). Renewable technologies such as augmented reality are the use of new technology, especially in global warming material that can provide an accurate picture to create interactive learning (Hazaymeh and Alomery, 2022).

5. Acknowledgement

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