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Analysis of High School Students' Critical Thinking Skills Profile According to Ennis Indicators

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ABSTRACT

Objective: This study aims to identify the profile of senior high school students' critical thinking skills in ecosystem material on several critical thinking indicators compiled by Ennis. **Method:** This research uses quantitative descriptive methods. The research used six essay questions prepared to analyze students' thinking skills based on several indicators compiled by Ennis. The population in this study were all high school students at one of the senior high schools in West Nusa Tenggara, with the sample being class X students with a total of 60 students. **Results:** Based on research findings, it is known that the skills of the students in the sample are divided into three categories, namely very low, low, and moderate. Half of the sample size is in the very low category. At the same time, the rest is divided into the low and moderate categories, where a small number of students belong to the moderate category. **Novelty:** The novelty of this research is to explore the level of students' critical thinking skills using indicators compiled by Ennis. These results will provide an overall understanding of students' critical thinking skills, which teachers can use as a basis for designing learning designs to train students' critical thinking skills to reach the high and very high categories.

INTRODUCTION

Improving education in the 21st era includes several essential skills and expertise that are essential for students. This includes the ability to think critically, lateral, and systematic thinking skills, mainly when applied in the context of problem-solving (Djufri et al., 2022). Critical thinking is very important for students in various aspects of life because it enables students to understand the world, become assertive, and gain self-confidence, ultimately preparing them to face future challenges in both the personal and professional realms (Alifteria et al., 2023). A similar sentiment is also conveyed by Kusumah (2019), who states that individuals who can think critically can recognize relevant information, so when facing problems in daily life, they can provide appropriate solutions. High school students are in their teens, and developing critical thinking in this phase helps them maximize their potential. These skills are essential for success in academic and social activities, enabling them to be adept at communicating, building foundational skills, and concluding well to face the challenges of the 21st century (Fauziah & Kuswanto, 2020).

Critical thinking involves logical reasoning and a systematic approach to comprehending the connections between ideas or facts. Ennis (2011) states that critical thinking involves a logical and thorough thinking process used to determine appropriate beliefs or actions (Arini & Rahayu, 2023). Ennis's framework encompasses five aspects and twelve indicators, guiding individuals from essential explanations to organizing strategies and tactics to enhance their critical thinking

Abilities. Ennis has prepared aspects and indicators that can be guidelines or references in curriculum planning. In other words, it can be used to create the conditions needed to develop critical thinking skills and as a reference when conducting research. Not only that, according to Ennis, thinking skills can be related to scientific information literacy, namely the ability to discuss the limitations and potential of scientific information based on a good understanding of the method and the basis for its description (Lombard et al., 2020).

Education is essential in forming a society that thinks critically, and teachers are a critical factor in this process. Teacher assessment plays a role in measuring students' critical thinking abilities (Nurlailah & Hamdu, 2021). Critical thinking skills are not widely known and developed by teachers in school learning (Amprasto et al., 2020). Critical thinking skills that have yet to be developed in learning can be seen in the results of the latest research (Nasution et al., 2023). It was known that the critical thinking skills of high school students are still at a basic level. Students' abilities are known through the results of assessments using essay questions. Putriningtyas et al. (2022) revealed that students need to be more trained in analyzing problems, making arguments, and deciding on a course of action, even though they have critical thinking skills. Another study by Wijayanti and Siswanto (2020) stated in their research that the achievement of every aspect that reflects students' critical thinking is in the low to medium range. This data underlines the importance of improving students' critical thinking skills. Educators consistently choose teaching methods that do not help improve critical thinking skills, thereby contributing to the need for more development of these skills among students (Khoirunnisa & Sabekti, 2020).

Many factors influence the low level of critical thinking skills in students. According to Ramdani et al. (2020), the learning implemented by teachers in the Central Lombok district still needs to facilitate training students to think critically. The method still involves lectures and discussions, so students tend to be passive. Fauziah and Kuswanto (2020) stated the same thing; in research that has been conducted, it is known that educators in the Sleman district must develop appropriate learning innovations. Recent research by Julianto et al. (2023) stated that learning activities are still monotonous, do not explore students' critical thinking skills, and lack activities that explore the surrounding environment.

Investigating school students' critical thinking skills is essential because research results can indicate how effective high school students are in applying their critical thinking skills to understand, evaluate, and apply concepts in material. The findings of this analysis should serve as a guide for educators in designing and improving teaching models, learning environments, and products that support efforts to develop students' critical thinking capacity (Chairatunnisa et al., 2023). According to Andayani (2020), access to communication and information has increased significantly. Developing students' critical thinking skills for academic achievement prepares them for influential leadership roles in an increasingly complex and sustainable society. Therefore, this research can be novel regarding the initial critical thinking skills of tenth-grade high school students, especially in ecosystem material. The indicators used in this research can be used as a reference for preparing learning plans that can train students' critical thinking skills.

RESEARCH METHOD

This research is pre-research by adopting a descriptive approach with significant quantitative elements. This research was conducted in September 2023. The sample in this research was 60 tenth-grade high school students at a senior high school in West Nusa Tenggara. The focus focuses on describing high school students' critical thinking abilities. In a descriptive approach, this research describes actual conditions without involving independent or manipulated variables, as this research has been carried out (Ayun et al., 2020; Khoirunnisa & Sabekti, 2020; Nurhayati et al., 2022). Previous research also used critical thinking indicators compiled by Ennis. In the research, only a few indicators were used adapted to the material characteristics provided. The data collected is based on students' critical thinking ability tests related to ecosystems. This descriptive research aims to present a more detailed picture of students' critical thinking abilities. The procedure of this research is explained in Figure 1.

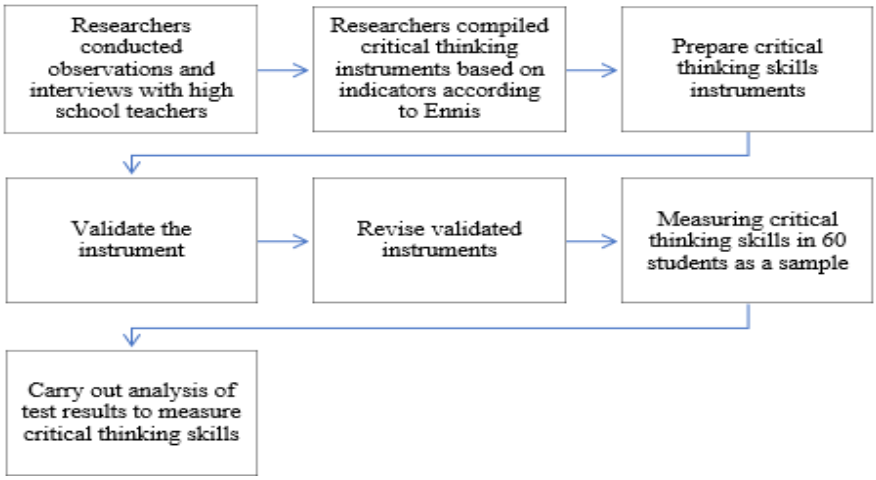

Figure 1. Research procedure.

This research was conducted in the 2023/2024 academic year. Figure 1 shows that before starting the research, observations, and interviews were carried out with teachers at the school. From the observations and interviews, it is clear that the questions created using the critical thinking indicators prepared by Ennis have never been given to students. Next, instruments were prepared based on modifying the indicators used in the research by Yusar and Kurniawati (2023), which were appropriate to the ecosystem material. The test questions that have been prepared are then validated by three validators. After revising the validation results, the questions were tested on 60 tenth-grade high school students as a sample. The test results were then analyzed to determine the critical thinking skills of class 10 students on ecosystem material.

METHODS

This study employs an evaluative tool to assess critical thinking abilities, utilizing essay-based questions as the instrument. The questions consist of 6 essay questions related to ecosystem material. The essay test is an assessment tool comprising open-ended questions, prompting students to furnish responses in detailed descriptions instead of merely selecting predetermined answers (Yusar & Kurniawati, 2023). Harahap et al. (2020) said that tests in the form of essays hone students' critical thinking skills better than questions in the form of multiple choices. Each question will receive a

score of 0-4 according to the criteria for each indicator. The percentage of students' answers will be calculated. Subsequently, individuals will be classified according to their proficiency in critical thinking and by the critical thinking skill indicators employed in this study. The scores for each student will be analyzed using the formula :

$$Score = \frac{Total\ score\ obtained}{Maximum\ Score} 100\%$$

Information :

a. The assessed value of the sample is determined by the total score obtained.
b. The designated maximum score is 24. The calculation of the maximum score is derived from the highest score possible for each question, which is 4, multiplied by the number of the questions, totaling 24 (Modification of Arini & Rahayu, 2023).

Using the abovementioned formula, we can identify critical thinking level categories listed in Table 1.

Table 1. Category critical thinking skills.

Score acquisition scale	Criteria
81.25 < score ≤ 100.00	Very High
71.50 < score ≤ 81.25	High
62.50 < score ≤ 71.50	Moderate
43.75 < score ≤ 62.50	Low
0.00 < score ≤ 43.75	Very Low

(Ramdani, et al., 2020).

To calculate the value of critical thinking skills for each indicator used, we can use the same formula to calculate critical thinking skills for each student. The only difference is the number of divisors used, namely the maximum number that can be obtained from the entire sample.

RESULT AND DISCUSSION

Result

In this research's overview of critical thinking skills concerning ecosystem material for high school students, tools assessing critical thinking skills were employed and compiled based on indicators, according to Ennis (2011). The indicators used in the instrument include (1) focusing questions, (2) analyzing arguments, (3) considering the credibility of the source, (4) compiling and considering induction, (5) identifying terms and considering definitions, and (6) determining an action. After validation, it was stated that this research was valid and reliable. Table 2 displays the outcomes of validating the instrument for assessing critical thinking skills.

Table 2. Validity and reliability results of critical thinking skills instruments.

Question Number	Validity		Reliability	
	Score	Information	Score	Information
1	97.00%	Very Valid	98.00%	Reliable
2	98.00%	Very Valid	95.00%	Reliable
3	98.00%	Very Valid	98.00%	Reliable
4	97.00%	Very Valid	99.00%	Reliable
5	97.00%	Very Valid	99.00%	Reliable
6	97.00%	Very Valid	98.00%	Reliable

Three validators carried out the validation, and the validation value given was in the score range of 1-4. The ultimate validation value is established by considering the mode value among the assessments of the three validators (Bungin, 2009). The mode for each aspect is calculated as a percentage and then interpreted for its level of validity. Meanwhile, the reliability is calculated based on the agreement percentage formula. If the value is ≥ 75.00%, the critical thinking skills instruments are considered reliable (Sutoyo et al., 2023).

The evaluation of students' critical thinking skills was conducted using a test comprising descriptive questions. The analysis was conducted individually, considering overall scores, each critical thinking category, and the percentage for each critical thinking indicator. This approach aimed to evaluate the extent of student's critical thinking skills. They analyzed data to ascertain each indicator's critical thinking skills category, as illustrated in Table 3.

Table 3. Student's critical thinking skills per indicator.

Indicator	Result Per Indicator	Category
Focusing questions	51.67%	Low
Analyzing arguments	42.50%	Very Low
Considering the credibility of the source	45.83%	Very Low
Compiling and considering induction	37.92%	Very Low
Identifying terms and considering definitions	43.75%	Very Low
Determining an action	36.25%	Very Low

Another result from the research pertains to the scores reflecting students' critical thinking skills, which are subsequently interpreted according to the criteria outlined in the CTS table. Figure 2 visually represents the outcomes of the test assessing students' critical thinking skills.

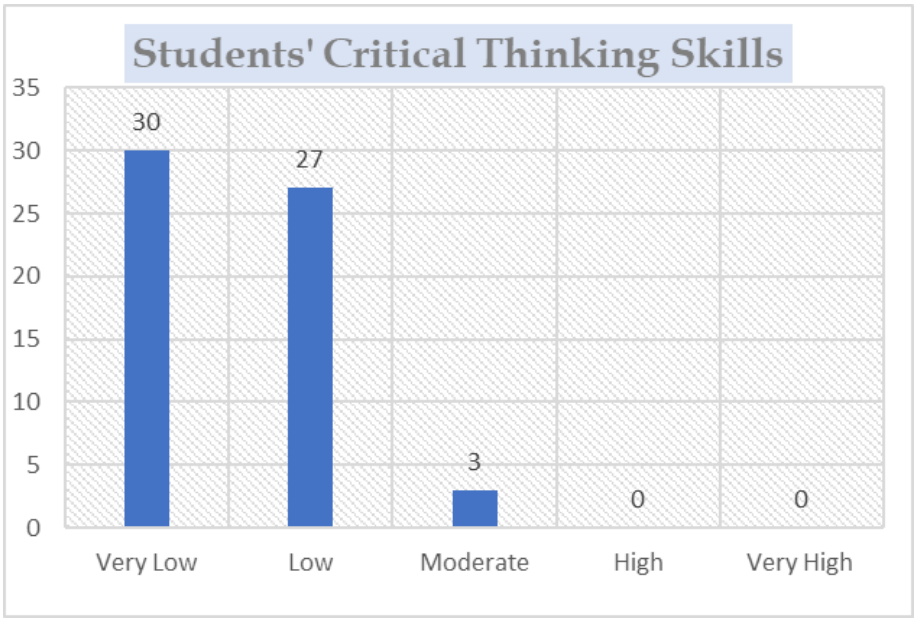

Figure 2. Students' critical thinking skills result.

Discussion

In this study, essay tests are utilized as measurement instruments. Ennis (2011) stated that the test format should preferably be open-ended in measuring students' critical thinking skills, given its broader scope compared to multiple-choice queries. The data obtained indicates that, across the six indicators used, the overall category of students' critical thinking levels falls below the moderate category.

The indicator of focusing on the question received the highest result compared to other indicators. However, the achievement outcome category still needs to be higher. Questions based on this indicator ask students to prepare two appropriate questions, according to articles about rice field ecosystems and their problems. Each answer will be given the highest score of 4 and the lowest score of 0. The percentage of this indicator is higher than other indicators because the articles that appear are related to students' daily lives and can be observed. Ayun et al. (2020) stated in their research that familiar and contextual problems could help students analyze questions.

The results obtained for considering source credibility fall into the very low category. Questions on this indicator ask students to provide reasons for statements regarding the disruption of the food chain if one of the components of the food chain becomes extinct or disappears. Based on the answers given, the results obtained were that no one got a score of 4 on this question. These results indicate that students need direction to provide appropriate reasons based on the problems in the questions. Learners do not employ analysis, evaluation, and review techniques rooted in their understanding to uncover viable solutions (Umami & Indana, 2023). Another finding by Khumairo et al. (2021) states that students possessing advanced critical thinking abilities can utilize reasoning and analytical power to assess, evaluate, and scrutinize opinions informed by their knowledge, leading to the identification of the most effective solutions for problem-solving.

Furthermore, the indicator for preparing and considering student induction still needs to be higher. The questions on this indicator are in the form of conclusions by students based on the ecological pyramid provided. From the results obtained, most students' answers still need to be more accurate and unable to conclude. The analysis of students' responses to the critical thinking test on the indicator of identifying terms and considering definitions reveals that the obtained results fall into the very low category. The questions on this indicator are in the form of pictures, and students describe the interaction between living things and the role of each component in this interaction. This low result can be caused by students needing to be more interested in finding further information regarding interactions between living things in the questions. Anisa et al. (2021) stated that there is a connection between Indonesian reading culture and critical thinking skills. By getting into the habit of reading, students will find it easier to find and filter information.

The final indicator in this research is determining an action. The questions given ask students to provide the right solution to a condition that causes an imbalance in the ecosystem. The results of the students' answers illustrate that this is a deficient category. Skills that correspond to this indicator need to be trained in learning activities. According to Agnafia (2019), it is necessary to have student worksheets that practice skills to determine appropriate actions as solutions to existing problems.

Figure 2 illustrates the scores resulting from students' critical thinking skills, which have been categorized based on predetermined criteria. The picture explains that no students could achieve that score in the very high category. Pre-research conducted by

(Ramadhanti and Agustini, 2021) at SHS in East Java province revealed that students' critical thinking skills needed to improve. The data indicates a modest percentage for various critical thinking indicators, ranging from 37.50% to 45.00%. These findings suggest that students have yet to master critical thinking skills.

Novitasari and Puspitawati (2022) convey a comparable view, noting that the educational approach remains traditional, leading students to passively receive information from teachers without involving them in activities that promote the development of critical thinking skills. Students exhibiting deficient critical thinking skills require ongoing training to enhance their proficiency in critical thinking (Anggraeni et al., 2021). Developing students' critical thinking skills is possible when teachers intermittently showcase them throughout learning activities, ultimately preparing them for real-life situations (Saphira & Prahani, 2022). According to Rahmawati et al. (2023), training and development of critical thinking skills are needed from an early age. This training can be carried out through various learning strategies or approaches, models, and methods that create a learning environment that supports collaboration, idea activity, daring to voice opinions, and being open to various ideas (Saphira et al., 2022).

Critical thinking skills are an essential aspect that students should have, especially in learning that requires understanding concepts, especially abstract concepts, at a high level. Biology lessons are often considered challenging due to their complex nature. Therefore, learning aims to build students' critical thinking skills, which aim to overcome various problems that arise in everyday life (Wulandari et al., 2023). Many studies have been conducted to find alternative solutions to students' low critical thinking skills. One way is through the application of various learning designs that are focused on improving critical thinking skills. This is done by modifying learning models that are considered adequate in training students' critical thinking skills, as Nufus and Kusaeri (2020) stated. Hwang et al. (2023) stated that assessments of students' critical thinking abilities can reveal various levels and forms, or both, directly related to the school's goal of developing strong reasoning and thinking abilities.

Several studies have been conducted to determine the success of implementing specific learning on students' critical thinking abilities. In their research results, Dewi et al. (2023) stated that the STEM-based Project Based Learning (PjBL) model was able to form students' critical thinking skills and academic values with an average score of 80.24. Research conducted by Istiqomah et al. (2022) discusses implementing the PjBL learning model, which is integrated with study practicum to improve students' critical thinking skills. According to the results of this research, the application of the PjBL model integrated with practicum improved critical thinking skills in the high-level class group in the experimental class. This is proven through paired sample tests, average mean, n-gain, and independent sample tests. The PjBL model integrated with practicum is an effective method for improving critical thinking skills. Afifah et al.'s (2020) research regarding the influence of the PjBL model using a STEM approach in improving the critical thinking skills of Madrasah Aliyah students. The hypothesis test results show that the hypothesis is accepted, indicating an influence of the PjBL model with the STEM approach on critical thinking skills. PjBL is a learning model aimed at enriching students' critical thinking skills through implementing project activities as the primary method (Rineksiane, 2022). Thinking critically is an essential skill for students, especially considering the demands of the 21st century and the global changes occurring (Indahwati et al., 2023). Critical thinking skills become necessary, guiding

students to focus on existing problems. In fact, by mastering critical thinking skills, students can overcome and find solutions to their various challenges. This ability can be improved by designing learning to train and develop critical thinking skills (Sutoyo et al., 2023).

CONCLUSION

Fundamental Finding: Critical thinking skills in the tenth-grade students at a West Nusa Tenggara high school still need improvement. Based on the research results, it is known that of 60 samples given the critical thinking skills test, 30 students were in the very low category. Twenty-seven students achieved the low category, and only three reached the moderate category. None students can reach the high and very high categories. **Implication:** Several factors cause students' critical thinking skills to remain in the low categories, so they must be improved further. The learning carried out needs to train students' critical thinking skills. Students must also become more accustomed to answering questions with critical thinking indicators. Critical thinking skills can be enhanced by utilizing suitable learning models, interactive media, and practice questions that prompt students to engage in critical thinking. **Limitation:** This research only provides information on students' critical thinking skills in one school in the tenth-grade. Data on critical thinking skills was obtained from the results of instruments in the form of essay questions whose references used several critical thinking indicators compiled by Ennis. **Future Research:** This can be useful for other researchers and can be used as a reference in carrying out appropriate learning interventions and can train students' critical thinking skills, including the Project Based Learning model.

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