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Profile of Critical Thinking Skills of Class VIII Students at SMPN Bulukumba in Learning Science Material on the Human Respiratory System

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ABSTRACT
This study aims to assess and improve students' critical thinking skills in science education, specifically focusing on the human respiratory system. The research was conducted with grade VIII students at SMPN 31 Bulukumba, using a set of 10 multiple-choice questions developed based on the critical thinking skill indicators outlined by Facione (2020), including interpretation, analysis, evaluation, inference, and explanation. The results show that students' critical thinking skills were generally in the moderate category, with the highest scores in the evaluation indicator and the lowest scores in the interpretation and inference indicators. The study suggests that the use of Problem-Based Learning (PBL), supported by video-based learning, inquiry-based methods, and tools like Canva, can significantly enhance students' critical thinking abilities. Additionally, the integration of visual aids such as 3D animations can help students better understand complex concepts. The study emphasizes the importance of selecting effective teaching strategies that foster higher-order thinking skills and improve students' performance in interpreting, analyzing, and explaining scientific concepts. These strategies can enhance students' critical thinking skills, equipping them for the challenges of the 21st century.

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1. INTRODUCTION

The Partnership for 21st Century Skills outlines the essential skills that every individual must possess in the 21st century, including critical thinking skills (Agustine et al., 2020). Critical thinking skills train individuals to think logically and rationally about phenomena they wish to understand (Purba, 2022). This forms an important foundation for developing a critical mindset that is not only logical and rational but also ethical and inclusive. Critical thinking is crucial in the field of education (Tuxtayevich et al., 2024). This is in alignment with the Minister of Education Regulation Number 13 of 2025, which underscores the necessity of an education system that is more adaptive to contemporary advancements and societal demands through curriculum flexibility, while simultaneously enhancing the quality of learning through approaches that are meaningful, engaging, and learner-centered. This principle is further reinforced in Article 17 of the Decree of the Head of BSKAP Number 046/H/KR/2025, which stipulates that student competencies are formulated to strengthen faith and devotion to God Almighty, civic disposition, critical reasoning, creativity, collaborative ability, independence, health, and communication skills (Permendiknasmen, 2025).

Ennis (2011), there are six main indicators that reflect an individual's critical thinking skills: (1) basic clarification, (2) bases for a decision, (3) inference, (4) advanced clarification, (5) supposition and integration, and (6) auxiliary abilities. According to Facione (2020), the fundamental indicators of critical thinking include: (1) Interpretation, which is the ability to understand and express the meaning or significance of various experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures, or criteria; (2) Analysis, which involves identifying inferential relationships between statements, questions, concepts, descriptions, or others; (3) Evaluation, which refers to assessing the credibility of statements or representations of descriptions, perceptions, experiences, situations, judgments, beliefs, or opinions in order to judge them logically; (4)

Inference, which means identifying the necessary elements to draw reasonable conclusions, formulating guesses and hypotheses; and (5) Explanation, which is the ability to provide convincing and rational reasoning for one's conclusions. This suggests that efforts to develop students' critical thinking skills must include confidence in their own abilities as well as self-assurance in facing various thinking challenges (Prajono et al., 2022).

Critical thinking skills in learning, especially in science education, play a crucial role (Fitriyati et al., 2017). Science is a process that generates knowledge based on a series of scientific activities conducted systematically. The purpose of science education is to provide individuals with skills, abilities, scientific attitudes, understanding, habits, and appreciation to explore the phenomena happening in their surroundings. Therefore, science education must be implemented optimally and enjoyably (Sa'adah & Pertiwi, 2022). This allows students to actively participate in the learning process and become resilient and competent individuals capable of facing the challenges of the 21st century. Factors that can influence students' critical thinking skills include physical condition, motivation, emotional condition, intellectual development, and a conducive learning environment or atmosphere (Amalia et al., 2021).

In fact, students' critical thinking skills in Indonesia are still relatively low (Rosliani & Munandar, 2022). Critical thinking skills are also not widely recognized or developed by teachers in the learning process (Sae & Radia, 2023). The lack of training in critical thinking skills in education is evident from research conducted by Sartika (2021), which shows that students' critical thinking skills in Bulukumba are still at a basic level, as many students struggle with questions that require formulation or deep understanding. Another factor, according to Bahtiar et al (2022) is that the low critical thinking test scores of students are influenced by the curriculum, learning environment, and teaching practices. However, critical thinking skills cannot improve on their own; they need to be trained (Kristanto & Susilo, 2021).

The role of teachers is crucial in the development of students' critical thinking skills, as it requires significant effort and time to design appropriate methods or approaches for the learning process (Sugiharti & Gayatri, 2021). To achieve this, several solutions have been proposed to enhance students' critical thinking skills, such as the implementation of the Problem-Based Learning (PBL) model, which strengthens students' critical thinking by engaging them in real-world problem-solving, encouraging them to connect various pieces of information within real-world contexts (Wulandari et al., 2020). Furthermore, Inquiry-Based Learning involves students actively in the learning process by encouraging them to ask questions, conduct experiments, and explore information more deeply (Afifah & Astriani, 2025). Additionally, it is important to use media that supports the teaching model to be more effective in enhancing critical thinking skills, such as video-based learning (Fiirdaus et al., 2021). Therefore, it is necessary to identify the level of students' critical thinking skills and determine which indicators need improvement (Intensitas et al., 2023). The use of Canva media in project-based learning encourages students to more easily identify, analyze, and evaluate information by creating visual presentations, infographics, or posters (Satria et al., 2021). The aim of this study is to determine the level of students' critical thinking skills in science education, specifically in the topic of the respiratory system, to serve as a basis or input for teachers in designing the right learning process that can improve the indicators of critical thinking skills that are currently low.

2. RESEARCH METHOD

This study is a type of quantitative research with a descriptive approach. The descriptive quantitative research method aims to systematically, factually, and accurately describe the characteristics of a sample (Sugiyono, 2011). The subjects of this study were 50 grade VIII students from SMPN Bulukumba who had studied the material on the human respiratory system. Of this number, 31 students were female and 19 students were male. Additionally, the students' ages ranged from 13 to 14 years, with an average age of 13.5 years. The students involved in this study were from two classes, namely Class VIII A and Class VIII B, with a homogeneous educational background. Most of the students came from families with diverse parental education levels, though the majority had parents with at least a junior high school education or higher. The sampling technique used was a conducive sampling technique, namely determining the sample based on the availability of participants. The instrument used in this study consists of 10 multiple-choice questions on the topic of the respiratory system. The questions were developed based on the critical thinking skill indicators according to Facione (2020), which consist of 5 indicators: interpretation, analysis, evaluation, inference, and explanation. The validity of the items used in this study was assessed using Aiken's V formula (Aiken, 1985), which measures the agreement between raters. This formula calculates content validity by comparing the scores on the items and determining their level of agreement. The validity index (V) ranges from 0 to 1, where values closer to 1 indicate high validity. In this study, the validity index for all items was found to be 1.00, indicating that the items are highly valid and appropriate for assessing students' critical thinking skills. Additionally, the validity index was calculated based on the ratings provided by two subject matter experts. The results of the analysis were categorized as follows: items with a validity index of 0.8 or higher were classified as "Very Valid," items with a range between 0.4 and 0.8 as "Valid," and items with a value lower than 0.4 were categorized as "Not

Valid" (Aiken, 1985). Based on this criterion, all 10 items in the test were found to be very valid, with an index of 1.00, confirming that the test items are suitable for measuring critical thinking skills.

This research design uses a post-test-only design, which involves measuring critical thinking skills by giving multiple-choice questions to classes VIII A and VIII B that have studied the human respiratory system, without conducting a pre-test before the learning process. Data collection in this study involves students answering the questions through Google Forms, which are then inputted into Microsoft Excel for analysis. The research procedure consists of three stages: First, creating 10 multiple-choice questions on the topic of the respiratory system that are aligned with the critical thinking skill indicators according to Facione (2020). Second, testing the questions with class VIII students through Google Forms. Third, the students' answers were analyzed using Microsoft Excel and categorized based on the obtained scores. The categorization of the students' response scores was carried out according to the predetermined assessment rubric. The formula to measure the percentage of students' critical thinking skills is as follows (Meryastiti et al., 2022).

$$Persentase = \frac{Jumlah\ Skor}{Jumlah\ Skor\ Maksimal} \times 100\%$$

After obtaining the percentage of students' critical thinking skills, the next step is to categorize the assessment for each critical thinking skill indicator based on Facione's framework. The categorization of these indicators was then determined with reference to the score classification table formulated by Riduwan (2013).

Table 1. Categories of Critical Thinking Skills

Index (%)	Categories
81-100	Very High
61-80	High
41-60	Enough
21-40	Low
0-20	Very Low

3. RESULT AND DISCUSSION

The research data was obtained from multiple-choice questions on science learning about the human respiratory system that students had previously studied. The questions were given to assess the level of students' critical thinking skills. There were 10 questions given with a score of 10 and each question had four answer choices. After the test results were obtained, the data were then analyzed and categorized based on the level of critical thinking skills. The results of students' critical thinking skills can be seen in Figure 1.

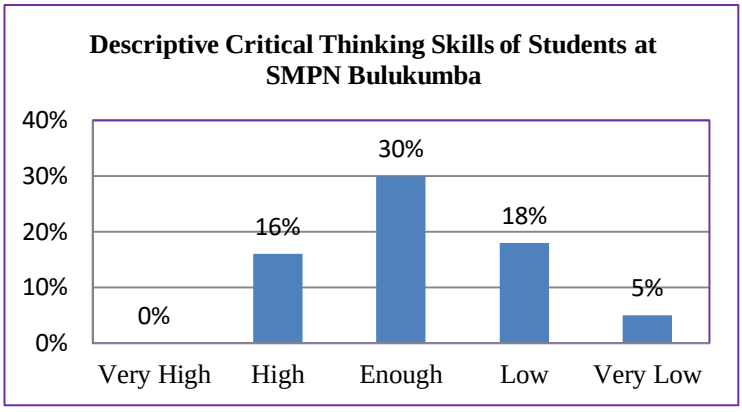

Figure 1. Description of Students' Critical Thinking Skills

The research findings indicate that 16% of students possess high critical thinking skills, while 5% exhibit very low critical thinking skills. However, the largest group of students falls into the moderate category, comprising 30%. The very high category, however, has a percentage of 0%, which may be attributed to the predominant use of direct instruction or lecture-based teaching methods. As found by Simatupang et al (2023) in their study, the use of the flipped classroom teaching method has been proven effective in enhancing students' critical thinking skills, particularly in the topic of the human respiratory system. The flipped classroom model allows students to study the material independently outside of class hours and allocate class time for more interactive discussions and problem-solving. This approach provides students with more opportunities to practice critical thinking skills in a more applied context, which, in turn, can help them achieve better

improvements in their critical thinking abilities. Furthermore, in the learning process, where practice or the use of formulas is required, there is still a lack of sufficient training Suriati et al (2021). Therefore, it is essential to consider the implementation of this teaching model at SMPN Bulukumba as a step toward improving students' critical thinking skills in the study of the respiratory system. Based on this, to improve students' critical thinking skills to a higher level, it is necessary to gather data to identify which critical thinking skill indicators need to be focused on during the learning process. Below is the data analysis based on each critical thinking skill indicator according to (Facione, 2020).

Table 2. Description of Critical Thinking Skills of Class A and Class B Students for Each Indicator

Indicator of Critical Thinking Skills	Persentase		Category
	Class A	Class B	
Interpretation	46%	48%	Enough
Analysis	56%	50%	Enough
Evaluation	62%	62%	High
Inference	52%	50%	Enough
Explanation	50%	54%	Enough

Based on Table 2, the results of the critical thinking skills test show that the interpretation indicator has the lowest scores, with Class A scoring 46% and Class B scoring 48%, both falling into the "Adequate" category. The low interpretation skills may be caused by several factors, one of which is the teaching method used by the teacher in delivering the material. If the material on the human respiratory system is presented in a lecture-style manner without providing students with opportunities to delve deeper and interpret the information, students are likely to rely on memorization rather than understanding and connecting the concepts.

Critical thinking skills are essential abilities that students must possess in order to understand, analyze, and evaluate information deeply, as well as make sound decisions. Based on the research conducted at SMPN Bulukumba using a descriptive quantitative method for data collection, 10 multiple-choice questions on the respiratory system were distributed to class VIII students. After data collection and analysis, it was found that the majority of students fell into the moderate category (30%), with 0% in the very high category. This indicates that most students have fairly good critical thinking skills, but still need further practice in certain learning processes that align with their needs. This finding is in line with the opinion of Muhtarom et al (2024) who suggest that improving students' critical thinking skills requires the teacher's role in selecting appropriate teaching methods. Teachers are responsible for developing students' potential by building skills, knowledge, and providing broad insights, while also considering students' goals and targets (Ramadhan, 2024).

Understanding students' needs in critical thinking skills requires a detailed analysis of each indicator. The indicators that were analyzed include interpretation, analysis, evaluation, inference, and explanation. By analyzing each indicator, teachers can gain a more detailed understanding of students' weaknesses in critical thinking that need improvement. This aligns with Amarila (2021), opinion that achieving the goals of science learning will be easier if identification is done first. The analysis is carried out by differentiating the data between class A and class B to better understand the students' needs.

The interpretation indicator questions ask about the phases of human respiration based on the position of the diaphragm muscles and ribs. The results obtained from Class A (46%) and Class B (48%) indicate that the majority of students struggle to understand and interpret the information presented. This difficulty is attributed to a lack of deep understanding of the material, with many students more accustomed to memorizing information rather than truly comprehending the meaning or context behind it. These results align with the findings of Sugiharti & Gayatri (2021), which indicated that students were unable to fully meet the interpretation indicator due to difficulties in understanding the material, often providing only simplistic explanations when asked interpretation questions. Based on these findings, several teaching strategies can be implemented. As a solution, Fiirdaus et al (2021) suggest the use of contextual video-based learning to improve students' understanding and critical thinking skills. Video-based learning, which connects theoretical content to real-world contexts, can assist students in grasping abstract concepts, such as the phases of human respiration. By visualizing the positions of the diaphragm muscles and ribs during respiration, students can gain a deeper understanding of the material, moving beyond rote memorization. This approach, integrating video learning into instruction, is expected to provide students with more interactive and practical opportunities to understand and interpret the material effectively.

The results obtained from the analysis indicator show that although Class A (56%) performed slightly better than Class B (50%), both classes are still in the "Adequate" category. The questions presented in this indicator ask students to analyze factors affecting respiratory frequency by providing case data related to variations in human breathing rates. Based on the data, Class A had a higher number of students correctly answering the questions compared to Class B, which had an equal number of students answering correctly. The

relatively low results are also due to the lack of practice in connecting various pieces of information to form a deeper understanding. These findings align with the results from Umar & Yakub (2025), which shows that although students experienced some improvement, most remained in the "Adequate" category. This is due to a lack of students' skills in linking different pieces of information to form a deeper understanding. The main cause of this issue is the insufficient practice in analyzing and critically integrating data. Many students are more focused on memorization than on the process of deeper analytical thinking. To address this issue, the PBL model allows students to engage in solving real-world problems, which forces them to analyze information in depth and link it to broader concepts. PBL encourages students to think critically, investigate, and solve problems in a more practical way, which can strengthen their analytical skills. By providing real-life cases and relevant contexts, students are more motivated to explore information and develop a deeper understanding Wulandari et al (2020).

The evaluation indicator in both Class A and Class B falls within the "high" category, with a percentage of 62%. Evaluation involves assessing the relationship between information or concepts related to a problem based on statements or opinions. The questions presented focus on disorders in the human respiratory system. Students are guided to choose the correct answer to prevent and diagnose diseases based on the described symptoms. In this indicator, most students were able to answer correctly, possibly because the teacher had previously guided them to create a poster about respiratory disorders using Canva. Research conducted by Satria et al (2021) shows that the use of Canva media in project-based learning successfully enhanced students' critical thinking skills, especially in the evaluation indicator. In this study, students were involved in activities that encouraged them to evaluate various ideas and concepts presented in the lesson material. Canva was used to assist students in creating visual presentations, infographics, and posters, allowing them to identify, analyze, and evaluate information more deeply. This aligns with the research conducted by Erlita & Hakim (2022),which found that students in the high category were able to identify key elements in the questions when trained in evaluation, using the appropriate strategies to solve the presented problems.

The inference indicator refers to the skill of drawing conclusions by considering the results and evaluating the decision values. The question in this indicator involves an experiment to measure respiratory volume, and students are asked to select the correct conclusion based on the results obtained. The inference indicator for both classes falls into the "sufficient" category, with Class A having a percentage of 52% and Class B 50%. This aligns with the research conducted by Ardiyanti & Nuroso (2021), which showed that some students were able to draw conclusions at a sufficient level if they had been trained in problem deduction. Students with lower scores struggled due to a lack of understanding related to the experiment in identifying types of human respiratory volumes, which led to errors in their responses (Parameswari & Kurniyati, 2020). To address this issue, the inquiry-based learning method can be an effective solution to improve students' critical thinking skills, especially in the inference indicator. This approach allows students to actively engage in the learning process by asking questions, conducting experiments, and exploring information in more depth. Thus, students are not just passively receiving information, but are also trained to draw conclusions based on existing evidence, which will develop their inferential skills. Additionally, 3D animations play an important role in helping students visualize the body organs and processes occurring within them. These animations provide a clearer and more detailed view of processes that are difficult to understand through text or static images alone, such as respiration and the interaction between body organs. The use of animation allows students to see the processes concretely, which facilitates understanding more complex concepts. When inquiry-based learning is combined with 3D animations, students are not only able to analyze experimental data better but also draw more accurate conclusions. Both methods help students connect the concepts they have learned in a more visual and applicable way, improving their inferential abilities. This approach enriches students' learning experiences and overall enhances their critical thinking skills (Afifah & Astriani, 2025).

The explanation indicator refers to the skill of explaining the reasoning behind conclusions drawn or presenting results (Facione, 2020). The questions presented in this indicator consist of a series of multiple-choice questions about the sequence of air entering the respiratory system and the correct role of the bronchioles in the answer choices. The data obtained after students answered the questions show that Class A has a percentage of 50% and Class B 54%, both falling into the adequate category. This aligns with the research conducted by Suriati et al (2021), which found that the explanation indicator was in the moderate category because students were able to explain their answers in a structured manner. The lower scores on this indicator for some students were caused by difficulties in identifying and defining the problems (Najaah, 2021). To improve explanation skills, Problem-Based Learning (PBL) proposed by Aggraini et al (2024) is an effective solution. PBL engages students with real-world problems, encouraging them to explain their reasoning and communicate their analysis more deeply. By connecting learned information to practical cases, PBL enhances students' ability to provide clear, logical, and evidence-based explanations, thereby improving their performance in the explanation indicator.

The low performance on certain critical thinking skill indicators among some students can have a negative impact on education, particularly on the mastery of these skills in the 21st century. Therefore, based on

the analysis of the indicators conducted, this can serve as a guide for science teachers, especially at SMPN 31 Bulukumba, in selecting teaching models or media that support the improvement of each critical thinking skill indicator. However, the development of critical thinking skills should not rely solely on the learning process but must also be supported by instruments or critical thinking questions (Susilawati et al., 2020).

4. CONCLUSION

The research conducted at SMPN 31 Bulukumba reveals that students' critical thinking skills, as assessed through a series of multiple-choice questions on the human respiratory system, were generally categorized as moderate. The analysis of critical thinking skill indicators showed that while a small percentage of students scored in the high category, the majority were in the moderate category, with the lowest scores observed in the interpretation and inference indicators. Specifically, for the interpretation indicator, Class A scored 46% and Class B scored 48%, both in the adequate category, while for the analysis indicator, Class A scored 56% and Class B scored 50%, also in the adequate category. The highest scores were found in the evaluation indicator, with both classes scoring 62%, placing them in the high category. The inference and explanation indicators were also in the adequate category, with Class A scoring 52% and Class B scoring 50% for inference, and Class A scoring 50% and Class B scoring 54% for explanation. These results highlight the need for further practice and the implementation of more effective teaching methods to enhance critical thinking skills. The findings suggest that students' abilities to explain, analyze, and interpret information require improvement. Teaching models such as Problem-Based Learning (PBL), complemented by tools like video-based learning and inquiry-based methods, can significantly enhance students' critical thinking abilities. Additionally, the use of visual aids such as 3D animations and the incorporation of project-based learning tools like Canva can help students better understand complex concepts, particularly in the evaluation and inference indicators. Overall, this study emphasizes the importance of selecting appropriate teaching strategies to address students' weaknesses in critical thinking. By applying more interactive and problem-solving-based approaches, teachers can improve students' abilities to interpret, analyze, and explain scientific concepts, thereby fostering higher-order thinking and ultimately improving academic performance.

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