An Analysis of Critical Thinking Skills and Communication in Science Education : A Study of Grade VIII Students

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Abstract: This study aims to analyze the level of students' critical thinking and communication skills in science learning, identifying areas of strength and weakness. A descriptive quantitative method was employed, with tests and questionnaires as instruments. This research involved 73 students from the eighth grade of a junior high school as respondents. The data analysis technique used in this research is quantitative descriptive analysis. The results of this study indicate that the level of critical thinking and communication skills of junior high school students has a significant gap in science learning. In this study for critical thinking skills, each indicator is providing simple explanations (65%) in the medium category, building basic skills (51%) in the low category, concluding (45%) in the low category, providing advanced explanations (41%) in the low category, and organizing strategies and tactics (28%) in the very low category. And for communication skills, each indicator is Expressing 45% (low), Evaluating 42% (low), Responding 59% (medium), Negotiating 49% (low). Students' critical thinking and communication skills are in the low category, this indicates the need to improve learning strategies that encourage active involvement and reflective thinking of students.

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Introduction

The development of education in the 21st century has experienced rapid changes along with the development of science, technology and globalization. Education in the 21st century demands significant transformation in preparing students to face complex and ongoing global challenges (Mardhiyah et al., 2021). The challenges of the modern world require students to not only control knowledge academic, but also have 21st century skills that include critical thinking skills, communication, collaboration, and creativity (Suryani et al., 2025). There needs to be student readiness in facing global competition.

Facing increasingly tight global competition, the government has prepared an independent curriculum by improving 21st century skills. Critical thinking skills are one of the important skills that students need to have to problem solving and make decisions in the real world (Ariadila et al., 2023). Critical thinking skills are not just rote learning, but require skills to question assumptions, assess evidence, and formulate reasoned conclusions (Sari, 2023). For students, developing critical thinking skills is not only an academic need but also a life skill that fosters independence and adaptability.

Students' preparation for their future is not only having critical thinking skills but also other skills, one of which is communication skills to complement it. Communication skills play a role in establishing effective relationships in everyday life (Suleman, 2024). Communication skills are aimed at conveying ideas clearly, listening actively, and

understanding other people's perspectives can improve understanding of scientific knowledge (Wardhani et al., 2024). Therefore, developing communication skills is a crucial step to support student success in learning at school.

The development of communication skills in schools is very important because it is the basis for students to interact effectively in various situations. Through natural science learning that encourages discussion, presentation, and group work, students can learn to convey ideas clearly, listen well, and respect the opinions of others (Wakhudin et al., 2024). Communication skills are not only useful in the school environment, but also become valuable provisions in social life and the world of work in the future (Stellarosa & Ikhsano, 2021). In addition, good communication skills can increase students' self-confidence and critical thinking skills (Septia et al., 2021). Therefore, schools need to actively create a learning environment that supports the development of communication skills from an early age.

The development of critical thinking skill and communication during Junior High School (SMP) is very important. At this stage, students are transitioning from concrete operational thinking typical of younger children, to more abstract formal operational thinking (N. D. Anggraeni et al., 2024). This cognitive change allows them to handle more complex tasks that involve reasoning, reflection, and applying learned knowledge to new situations (Maulana, 2024). Therefore, the junior high school period is an important window for cultivating critical thinking and communication skills that will prepare students for the demands of higher education and their future professional lives.

However, although the importance of critical thinking skill and communication in education has been recognized, there is still a significant gap in understanding how well junior high school students develop these two skills, especially in the context of natural science subjects. Existing research often focuses on higher education or specific disciplines such as research conducted by Hasanah et al., the study was on improving critical thinking and communication skills of students at universities with a field of entrepreneurship, in addition to other research conducted by Louto et al. on improving critical thinking and communication skills in high school students (Hasanah & Malik, 2020; Louto et al., 2025). However, there is little empirical data on students' critical thinking and communication skills at the junior high school level. In addition, there is a lack of studies that measure these skills to assess the extent to which students' critical thinking and communication skills are aligned with educational benchmarks.

This study aims to analyze the level of critical thinking skill and communication in junior high school students when they are involved in natural science learning. Thus, this study will explain how well students are able to apply critical thinking and communication skills to solve scientific problems, whether they are performing basic tasks such as providing simple explanations or engaging in more complex activities such as determining strategies and tactics for experiments.

Research Method

This study employed a descriptive method with a quantitative approach. Descriptive research is a research method that attempts to describe the object or subject being studied according to what it is (Syahrizal & Jailani, 2023). This study was conducted in three junior high schools in Tuban Regency, East Java, and involved 73 eighth-grade students who completed critical thinking skills tests and communication questionnaires.

The main data collection instruments for this study include the Critical Thinking Skills Test and Questionnaire. These tools were chosen to comprehensively assess students' critical thinking and communication skills, using both quantitative and qualitative methods. Critical Thinking Skills Test: A standardized test specifically designed to measure critical thinking skills in the context of science learning on the circulatory system will be given to all participating students. This test will include items that assess the five indicators outlined by Ennis, namely providing simple explanations, building basic skills, concluding, providing advanced explanations, and organizing strategies and tactics (Ennis, 2011). The critical thinking skills test consists of five questions with one question for each indicator of critical thinking skills. This assessment will provide quantitative data on students' levels of critical thinking, allowing researchers to categorize participants based on their skills. Questionnaire: a questionnaire instrument will be used, namely a self-assessment questionnaire to collect data on students' communication during science lessons. With indicators of communication skills by Por Chang, namely Expressing, Evaluating, Responding, Negotiating (Chang et al., 2011). This self-assessment questionnaire data will help provide insight into students' communication skills in learning situations.

Furthermore, the test and questionnaire data were analyzed using percentages to determine each indicator of critical thinking and communication skills using the formula (Nuraini, 2017):

$$score = \frac{score\ obtained}{maximum\ score}\ x100\%$$

Then the values obtained are converted using the critical thinking skill and communication categories (Nuraini, 2017):

Tabel 1. Critical Thinking Skill and Communication Category

Percentage	Category
85,00% – 100%	Very high
70,00% – 84,99%	High
55,00% – 69,99%	Medium
40,00% – 54,99%	Low
0% – 39,99%	Very low

Results and Discussion

The assessment of critical thinking skills in junior high school students in natural science learning produced interesting findings. Data collected through the Critical Thinking Skills Test showed varying levels of ability on the five indicators defined by Ennis. Overall, these findings indicate that although students have a sufficient understanding of critical thinking skills, there are significant areas that need improvement. The percentage of students who met expectations for each indicator is as follows: providing simple explanations (65%) in the medium category, building basic skills (51%) in the low category, concluding (45%) in the low category, providing advanced explanations (41%) in the low category, and organizing strategies and tactics (28%) in the very low category (Figure 1).
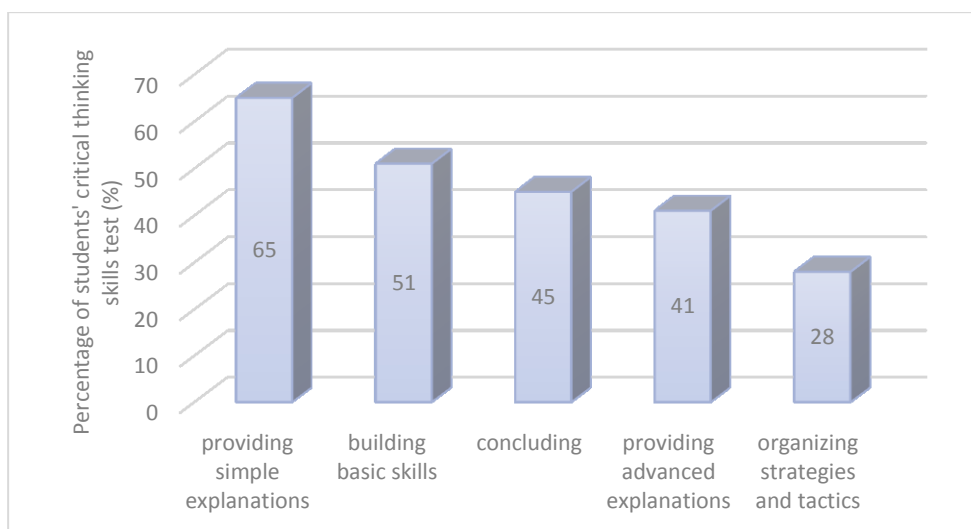
Figure 1. Percentage of students' critical thinking skills test

The findings on students' communication skills through the five-indicator self-assessment questionnaire described by Por Chang vary widely. The percentage of achievement for each communication skill indicator is Expressing 45% (Low), Evaluating 42% (Low), Responding 59% (Medium), Negotiating 49% (Low) (Figure 2).
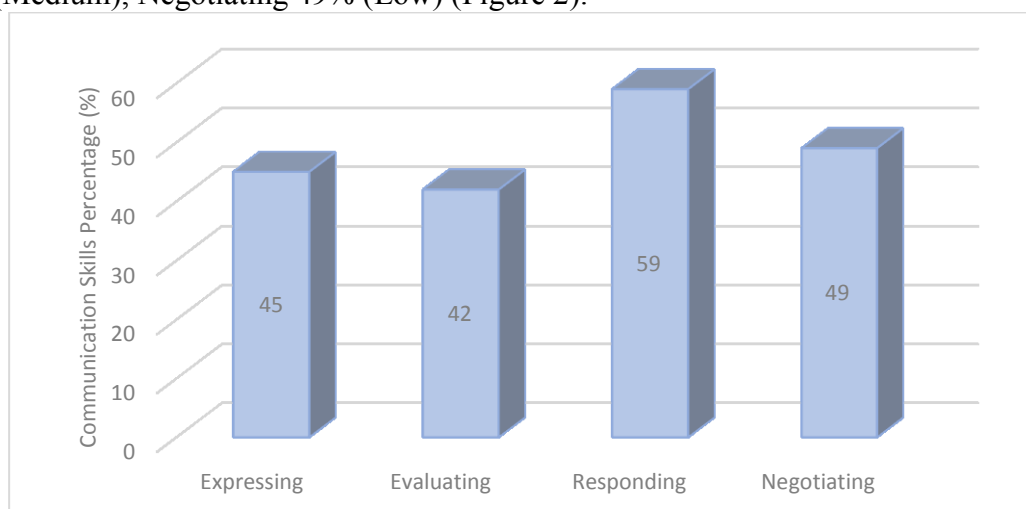

Figure 2. Communication Skills Percentage

The results of this study provide a clear picture of the critical thinking and communication skills possessed by junior high school students in the context of natural science learning (IPA). The data show that students have varying levels of proficiency in the five critical thinking indicators set by Ennis. Communication skills according to the data obtained have almost the same value for the four indicators according to Por Chang.

1) Critical Thinking Skills

The first indicator is providing simple explanation. Students' critical thinking skills develop gradually through habitual practice, such as answering questions that require explanation (Purwanti, 2023). This first indicator obtained results of 65% of students who were able to provide a simple explanation which was classified as a moderate category. In this indicator, 48 out of 73 students were able to answer the questions asked correctly. It can be seen that some students are able to explain the basic concept of the questions given where students are asked to provide an explanation of the diseases that arise due to hypertension.

However, there are still some students who only mention the disease without providing an explanation. This indicator of providing a simple explanation reflects students' dependence on memorizing and providing short answers rather than deeper understanding and critical analysis of students (Suhendra & Wahyuningtyas, 2024).

The second indicator builds basic skills. The characteristics of a person who has critical thinking skills in this indicator by utilizing relevant information to find a solution to a problem (Astari & Sumarni, 2020). The data obtained for the indicator of building basic skills shows that 51% of students can consider the information provided. The third indicator is that students are in the low category, as many as 37 students can answer the questions given. Students are given data on the amount of hemoglobin based on different genders and age, students can absorb information and see the truth of the information provided according to what they have learned. The need for students to process information sources is very important in critical thinking (Ariadila et al., 2023).

The third indicator concludes. Students can make conclusions by providing correct and complete answers (Rosmalinda et al., 2021). This indicator obtained 45% of students in concluding with a low category. as many as 33 students were able to conclude correctly while 40 other students were unable to conclude. Students were given data on 10 diseases related to the circulatory system in Indonesia, students were asked to conclude the data based on the identification of the causes of the disease. Students have not been able to conclude from the data presented. Students need to be accustomed to identifying data so that students can conclude data.

The fourth indicator is providing advanced explanation. Defining terms to provide more detailed explanations is a support for critical thinking skills in problem solving (Amarila, 2021). The results obtained from the data are that 41% of students can provide more detailed definitions of terms. This indicator is included in the low category, more than half of the students have not been able to define terms in detail. Students are given terms for circulatory system disease, many students are still unfamiliar with these terms. Teachers need to provide scientific reading to students so that students have broader insights to define more detailed terms (Adawiyyah & Irvani, 2022).

The fifth indicator is organizing strategies and tactics. Critical thinking skills highlight the importance of setting strategies and tactics in providing concrete solutions. In this fifth indicator, data was obtained that 28% of students could set strategies and tactics, but the indicator had the lowest level compared to the other indicators. Where students who can set strategies and tactics are 21 students out of 73 students. This indicator is in the very low category. where students are presented with data on normal red blood cells that humans have in the body and those that are not normal, students are asked to set strategies to normalize abnormal red blood cells. Students still cannot set strategies in providing solutions in carrying out the actions to be taken (Ridho et al., 2020).

2) Communication Skills

The first indicator of communication skills is expressing. The data obtained was 45% in the moderate category. 45% of students stated that they often use graphs or mathematical symbols to explain the contents of the data. However, some students are still unable to express data in the form of graphs or mathematical symbols. The expression of the data shown will bring new experiences for students in improving their communication skills (Rambe et al., 2022).

The second indicator is evaluating. Evaluation is an indicator of communication skills where students can judge other people's opinions correctly based on facts from data. The data

obtained was 42% of students could judge other people's opinions. This indicator is in the moderate category where 31 students can judge other people's opinions. However, there needs to be a habit of students in judging other people's opinions based on the facts and knowledge they have learned. The importance of students in judging other people's opinions based on facts, so that students can filter the information obtained (N. Anggraeni et al., 2022).

The third indicator is responding. Responding is an indicator of responding to a question or statement from a friend. From the data obtained, 59% of students can respond to questions or statements from teachers or other students. This indicator is in the moderate category. However, there are still many students who are not willing to give their opinions in responding to statements from teachers or other friends. Even though it is in the moderate category, students need to get used to communicating to respond to a problem. Students are less brave in expressing their opinions or responding to questions or statements from teachers or other students (Ramadina & Rosdiana, 2021).

The fourth indicator is negotiating. Negotiating is being able to accept opinions from other friends or from teachers. This indicator obtained 49% with a moderate category. Students can accept opinions from others well and discuss opinions received from others well, but there are some students who are less able to accept other people's opinions by defending their opinions. Differences of opinion during discussions are common, but many cannot accept these differences of opinion (AL Fazri et al., 2021). There needs to be a habit of open discussion to accommodate other people's opinions so that students can accept opinions from others.

The finding that students' critical thinking and communication skills are in the low category indicates that current learning is not optimal in developing 21st century skills. This reinforces the importance of implementing an active and collaborative learning approach to support the development of students' higher-order thinking and communication skills. These results encourage teachers to use more interactive learning methods, such as discussions, debates, and projects. Schools also need to support teacher professional development through training, as well as reviewing the curriculum to focus more on strengthening critical thinking and communication skills.

Conclusion
In conclusion, the results of this study indicate that the level of critical thinking and communication skills of junior high school students has a significant gap in science learning. Critical thinking skills that have five indicators with critical thinking skills test results with an average in the low category. The percentage associated with each of the five indicators indicates the need for training in critical thinking skills questions related to students' daily lives so that students not only memorize but can face the challenges of the future world of work. Students communication skills with four indicators with an average have a low category. The percentage associated with each of the four indicators indicates the need for good and correct communication training in accordance with the existing facts, so that students gain confidence in facing the future world of work.

Recommendation
The recommendations this research for teachers to use active learning methods and training in critical thinking questions and good communication habits. Recommendations for further research are the need for the development of strategies, methods, and learning models to improve students' critical thinking and communication skills.

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