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Analysis of Students' Critical Thinking Skills Improvement in Static Fluid Material

[1]Syarifah Mudaimah Awwaliyah, [2]Muhammad Minan Chusni*
Sunan Gunung Djati State Islamic University, Bandung City, West Java, Indonesia

*Korespondensi: minan.chusni@uinsgd.ac.id

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ABSTRACT

This study stems from the problem of students' low critical thinking skills in physics learning, particularly in static fluid material. This study aims to analyze the level of students' critical thinking skills based on critical thinking indicators. The researcher positioned himself as an observer who examined students' critical thinking skills through a quantitative approach with a descriptive method. Data collection was carried out using an essay test compiled based on critical thinking skill indicators, namely elementary clarification, basic support, inferring, advanced clarification, and strategy and tactics. Supporting data were obtained through observation and interviews to strengthen the analysis results. Data were analyzed by calculating the average value for each indicator and categorizing them into critical thinking skill levels. The results showed that students' critical thinking skills were in the very low category with an average score of 15.93. The indicator with the highest achievement was advanced clarification, while the lowest indicator was strategy and tactics. These findings indicate that students still experience difficulties in conducting analysis, drawing conclusions, and determining problem-solving strategies.

INTRODUCTION

Critical thinking skills are one of the key competencies students need to face the demands of 21st-century learning. These skills include the ability to analyze information, evaluate arguments, and draw logical conclusions based on available evidence (Facione, 2020). In science learning, particularly physics, critical thinking skills play a crucial role because students are not only required to understand concepts but also to be able to apply them to solve problems related to everyday life (OECD, 2021). Therefore, developing critical thinking skills is a primary focus of the learning process.

Physics, as a branch of science, is characterized by a deep conceptual understanding and analytical thinking skills. One topic with a relatively high level of complexity is fluid statics. This topic encompasses the concepts of hydrostatic pressure, Pascal's law, and Archimedes' law, which are frequently encountered in various real-life phenomena. However, various studies indicate that students still experience difficulties in comprehensively understanding these concepts and connecting them to contextual situations (Rahmawati et al., 2021; Pratama & Hidayat, 2022). This condition indicates that students' critical thinking skills have not yet developed optimally.

Several previous studies have revealed that students' critical thinking skills in Indonesia remain low, particularly in terms of inference and the ability to design problem-solving strategies (Nugraha et al., 2021; Sari & Mulyani, 2023). This low achievement is thought to be due to the learning process, which still focuses on rote mastery of material and does not fully encourage students to actively engage in higher-order thinking activities (Fitriani & Sari, 2021). Furthermore, students tend to be less accustomed to dealing with questions that require in-depth analysis, evaluation, and reasoning skills.

These findings are also supported by international studies, which show that Indonesian students' critical thinking skills are still relatively low compared to other countries (OECD, 2022). This indicates a gap between global competency demands and actual conditions on the ground. Therefore, systematic efforts are needed to identify and analyze students' critical thinking skills as a basis for designing more effective and meaningful learning.

Critical thinking skills can be measured using specific indicators, as proposed by Ennis, including the ability to provide basic explanations, build basic skills, draw conclusions, provide further explanations, and determine strategies and tactics (Putri & Rusdiana, 2022). By analyzing each indicator, educators can gain a clearer picture of students' critical thinking skills.

Based on this description, this study aims to analyze the improvement of students' critical thinking skills in static fluids. The results are expected to provide comprehensive information regarding students' critical thinking skill profiles and serve as a basis for developing more innovative learning strategies oriented toward higher-order thinking skills.

METHOD

This research employed a quantitative approach with descriptive methods. Quantitative approaches are used to obtain numerical data, which are then analyzed using simple statistics to illustrate students' critical thinking skills (Sugiyono, 2019). The descriptive method was

chosen because this study aimed to describe and analyze the profile of critical thinking skills without providing special treatment to the research subjects (Creswell, 2020).

The research was conducted at a high school (SMA), with 30 11th-grade students participating in the 2026/2027 academic year. Subjects were selected using a purposive sampling technique, based on specific considerations consistent with the research objectives (Etikan & Bala, 2020).

The primary instrument used in this study was an essay-based critical thinking skills test. The preparation of the instrument refers to the indicators of critical thinking skills according to Ennis, namely: (1) providing basic explanations (elementary clarification), (2) building basic skills (basic support), (3) making conclusions (inferring), (4) providing further explanations (advanced clarification), and (5) arranging strategies and tactics (strategy and tactics) (Putri & Rusdiana, 2022).

In addition to tests, this study also used supporting instruments in the form of observation sheets and interview guides. Observations were conducted to determine the implementation of the learning process and student engagement during the activities, while interviews were used to gather more in-depth information regarding the difficulties students experienced in completing critical thinking skills-based questions (Rahmawati et al., 2021).

Before use, the test instruments were first tested for validity and reliability. Validity testing was conducted using content validity through expert judgment to ensure the items matched the critical thinking skills indicators (Azwar, 2021). Meanwhile, reliability testing was conducted to determine the instrument's consistency in measuring the same skills (Sugiyono, 2019).

Data collection techniques were carried out in three stages: (1) administering the critical thinking skills test to students, (2) observing during the learning process, and (3) interviewing several students to obtain supporting data.

Data analysis was conducted descriptively by calculating the average score of students' critical thinking skills for each indicator. The scores obtained were then categorized into five categories: very low, low, sufficient, high, and very high. This categorization aims to provide a clearer picture of students' critical thinking skills (Putri & Rusdiana, 2022).

RESULT AND DISCUSSION

Based on the results of the students' critical thinking skills test on static fluids, the average score was **15,93**, which is in **the very low category**. Students' critical thinking skills achievement for each indicator is presented in the following table.

Table 1. Results of Students' Critical Thinking Skills Test

No	Critical Thinking Skills Indicators	Average Results	Category
1	*Elementary Clarification*	20,34	very low
2	*Basic Support*	15,17	very low
3	*Inferring*	13,45	very low
4	*Advanced Clarification*	22,41	very low

5	*Strategy and Tactics*	8,28	very low
	Average	**15,93**	**Very Low**

Based on Table 1, all critical thinking skill indicators are in the very low category. The indicator with the highest score is advanced clarification, with a score of 22,41, while the indicator with the lowest score is strategy and tactics, with a score of 8,28.

These results indicate that students still experience difficulties in understanding concepts deeply, processing information, and solving problems requiring higher-order thinking skills in the static fluid material.

The results show that students' critical thinking skills are in the very low category, with an average score of 15,93. This finding indicates that students' higher-order thinking skills have not yet developed optimally. These results align with research indicating that students' critical thinking skills in physics learning are still in the low to very low category, particularly in the analysis and conclusion-drawing aspects (Fitriani & Sari, 2021; Nugraha et al., 2021).

The elementary clarification and advanced clarification indicators have relatively higher scores than the other indicators, although they are still in the very low category. This indicates that students tend to be better able to understand basic information or re-explain previously learned concepts, but still struggle when faced with more complex thinking processes. According to Facione (2020), the ability to provide basic explanations is the initial stage of critical thinking and is generally easier to achieve than in-depth analysis.

Conversely, the inferring and strategy and tactics indicators showed the lowest scores. Low performance in these indicators indicates that students have difficulty drawing conclusions and determining systematic problem-solving strategies. This aligns with the findings of Sari and Mulyani (2023), who stated that inferencing is one of the most difficult aspects of critical thinking because it requires the ability to integrate information and reason logically.

Low performance in the strategy and tactics indicators also indicates that students are not yet accustomed to planning effective problem-solving steps. According to Nugraha et al. (2021), this ability is closely related to learning experiences that involve active problem-solving activities. If students are rarely given problems that require problem-solving strategies, this ability tends to be stunted.

In the context of static fluids, students' low critical thinking skills can also be caused by difficulties connecting concepts to real-world phenomena. Concepts such as hydrostatic pressure and buoyancy require in-depth understanding and strong analytical skills. However, research shows that students still struggle to relate these concepts to contextual situations (Rahmawati et al., 2021).

Furthermore, the teacher-centered learning process is also a contributing factor to low critical thinking skills. Learning that does not actively involve students in discussion, analysis, and problem-solving tends to hinder the development of higher-order thinking skills (Fitriani & Sari, 2021). Therefore, innovations in learning are needed that can encourage students to be more active and critical.

Several studies have shown that the implementation of innovative learning models such as problem-based learning, inquiry learning, and blended learning can significantly improve students' critical thinking skills (Pratama & Hidayat, 2022; Utami & Wibowo, 2024). This learning model provides students with the opportunity to be directly involved in the problem-solving process, thereby honing their analytical, evaluation, and decision-making skills.

Thus, the results of this study indicate that students' critical thinking skills in static fluids still need to be improved through the implementation of more innovative, interactive learning strategies oriented toward developing higher-order thinking skills.

CONCLUSION

Based on the research results, it can be concluded that students' critical thinking skills in static fluids are in the very low category, with an average score of 15.93. All critical thinking skill indicators elementary clarification, basic support, inferring, advanced clarification, and strategy and tactics show very low achievement.

The indicator with the highest score is advanced clarification, while the indicator with the lowest score is strategy and tactics. This indicates that students still experience difficulties in higher-order thinking processes, particularly in drawing conclusions and systematically determining problem-solving strategies.

These low critical thinking skills indicate that the ongoing learning process has not fully developed students' higher-order thinking skills. Therefore, improvements are needed through the implementation of more innovative, interactive learning models and strategies oriented toward developing critical thinking skills, such as problem-based learning, inquiry, or blended learning. Therefore, the results of this study are expected to serve as a basis for educators in designing more effective learning to improve students' critical thinking skills, particularly in static fluids.

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