



Profile of Critical Thinking Skills of Grade XI Students on Chemical Bonding Material

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Abstract

This study aims to determine the critical thinking skills of high school students in grade XI in the subject of chemical bonding. The type of research used is quantitative descriptive with a population of 107 students in grade XI IPA, consisting of classes XI A, XI B, and XI C. The research instrument is an essay test consisting of 11 questions compiled based on critical thinking skill indicators. The data were analyzed using descriptive statistics in the form of percentages and categorized into five levels. The results showed that class XI A was dominated by the high (33.3%) and very high (30.5%) categories, class XI B had a distribution in the very high category (33.3%) but also quite large in the low category (27.7%), while class XI C was mostly in the low (34.2%) and very low (31.4%) categories. Analysis of critical thinking aspects shows that the highest achievement is in the aspect of providing simple explanations, while the lowest achievement is in the aspects of summarizing and providing further explanations.

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INTRODUCTION

The world in the 21st century is developing rapidly and becoming increasingly complex, marked by improvements in the quality of life of modern societies. A major transformation occurred when human civilization moved from agrarian societies to industrial societies, and is now moving towards knowledge-based societies. These changes require education systems to focus not only on knowledge acquisition but also on the development of 21st-century skills. In the face of increasingly complex global challenges, education needs to equip students with relevant skills so they can develop their potential and compete amid the rapid advancement of science and technology. This condition poses a major challenge for teachers in designing learning experiences aligned with the dynamics of the times (Pratiwi et al., 2019).

Critical thinking skills are an important aspect of 21st-century skills that students must have. These skills play a major role in helping students face and solve various social, scientific, and practical problems effectively in the future. Students who have these skills can express their ideas and thoughts on various global issues (Sutoyo & Priantari, 2019). Good critical thinking skills enable students not to accept information at face value but to justify their opinions with logical reasoning. These skills also train students to be rational in their decision-making, enabling them to choose the best option (Bayrak & Gürses, 2020).

The development of critical thinking skills in schools continues to face various obstacles (Utami & Priyambodo, 2025). The results of the 2022 Programme for International Student Assessment (PISA) show that Indonesian students' critical thinking skills are still below the international average. This finding indicates that the learning process is not yet fully capable of fostering the critical thinking skills needed. This situation also shows a gap between the idealization of 21st-century education and the reality on the ground (OECD, 2023).

Challenges are also felt in chemistry learning. The abstract and complex nature of chemical concepts often makes them difficult for students, leading to misconceptions. As a result, difficulties in understanding this material can negatively impact students' motivation and interest in learning. Therefore, this condition emphasizes the importance of chemistry learning that is designed not only to convey concepts but also to encourage students to

develop critical thinking skills so they can understand, relate to, and apply chemical concepts in real contexts (Arofah & Rianingsih 2021).

The curriculum has directed learning towards a more contextual approach. However, its implementation in the field has not been fully optimized. Current learning tends to be teacher- centered, emphasizing memorization, and lacking relevance to real life (Yajie & Lestari, 2024; Hafizah & Nurhaliza, 2021). This condition has an impact on the low critical thinking skills of students, as shown in several research results. Research on critical thinking skills has been conducted several times. Research conducted by Joko Setyawan and Siti Patonah (2022) shows that students' critical thinking skills on hydrocarbon compound material are already in the good category. Different results were found in a study by Retno Setianingsih and Fenny Roshayanti (2022). The results of their study showed that students' critical thinking skills in reaction rate material were in the low category with an average score of 36.87.

There has not been much research specifically discussing the profile of critical thinking skills in chemical bonding material. This condition emphasizes the need for further research efforts to address this gap. The results of the study are expected to form the basis for the development of learning designs that can improve learning practices in schools. Therefore, the purpose of this study is to determine the critical thinking abilities of students in each aspect of critical thinking skills of grade XI high school students in chemical bonding material.

METHOD

This type of research is quantitative descriptive research. Quantitative descriptive research is a type of research conducted to provide answers to a problem and obtain broader information about a phenomenon using quantitative approaches. Because it is quantitative in nature, this research uses numerical data to analyze and describe facts, events, or conditions as they are without manipulating the variables under study. In this study, the phenomenon analyzed is students' critical thinking skills in the field of chemistry.

The population in this study consisted of all 11th-grade science students in the odd semester of the 2025/2026 academic year at a high school in Sleman Regency: 36 students in Class XI A, 36 in XI B, and 35 in XI C. As all population members served as research subjects, the sample size equaled the population size (107 students). This approach was chosen to ensure that the research results accurately reflect the actual conditions of the population.

Research data was obtained through a written test administered after classroom learning. The test instrument consisted of essay questions with five main questions on chemical bonding, each with sub-questions for a total of 11. Questions were based on critical thinking aspects per Ennis (2011), adapted to chemical bonding, including providing simple explanations, determining bases for decisions, offering further explanations, and drawing conclusions. The question grid included:

Table 1 Question Framework

No	Critical Thinking Aspect	Question Number
1	Providing a simple explanation	3, 6, 11
2	Determining the basis for decision making	4
3	Concluding	2, 9
4	Providing further explanation	1, 10, 5, 7, 8

Data analysis in this study was conducted using quantitative descriptive statistical techniques with the help of Microsoft Excel. The data from the critical thinking skills test was first scored based on the scoring guidelines that had been compiled. The scores obtained were then added up for each student and converted into percentages using the following formula:

$$N = \frac{\text{score obtained}}{\text{maximum score}} \times 100\%$$

The percentage obtained is then used to classify students' critical thinking skills into five categories, namely very low, low, moderate, high, and very high. The criteria for the percentage categories of students' critical thinking skills are shown in Table 2.

Table 2 Critical Thinking Skills Percentage Categories

Percentage	Category
$81.25 < N \leq 100$	Very High
$71.50 < N \leq 81.25$	High
$62.50 < N \leq 71.25$	Moderate
$43.75 < N \leq 62.50$	Low
$0 < N \leq 43.75$	Very low

FINDINGS AND DISCUSSION

Findings

The study was conducted on August 26-27, 2025, with students from classes XI A, XI B, and XI C as subjects. The students' critical thinking skills for each aspect were analyzed. The results were then categorized into five levels, namely very high, high, moderate, low, and very low. The results of the analysis can be seen in Table 3.

Table 3 Students' critical thinking skills based on critical thinking aspects and indicators

No	Aspect	Percentage (%)	Category
1	Providing simple explanations	69.45	Fair
2	Determining the basis for decision making	61.80	Low
3	Concluding	66.15	Moderate
4	Providing further explanation	58.60	Low

Discussion

Analysis of the aspects and indicators of students' critical thinking shows that the aspect of providing simple explanations achieved the highest score. This aspect is classified as adequate with a score of 69.45%. This result shows that most students are able to explain basic scientific concepts. This finding is in line with the research by Retno Setianingsih and Fenny Roshayanti (2022), which reported that the aspect of providing simple explanations had the highest achievement in critical thinking skills. The aspect of determining the basis for decision making had different results, namely it was categorized as low with a percentage of 61.8%. This low result indicates that students still find it difficult to use scientific concepts as a basis for decision-making. This ability requires a more complex reasoning process, as students must consider various alternatives and then choose the most appropriate decision based on scientific reasoning. The same results were obtained in a study by Ardiyanti & Nuroso (2021). The study stated that this aspect was also in the low category.

The aspect of drawing conclusions scored 66.15% and was classified as adequate. This shows that students are able to draw conclusions from information when the data is presented explicitly. Students still have difficulty drawing conclusions from the relationships between concepts. These findings are in line with the research by Rahayu et al. (2019), which reported an achievement of 54% in the moderate category. Students are still accustomed to memorizing, so they are not well-trained in drawing conclusions. The aspect of providing further explanation scored 58.6% and was classified as low. This result indicates that students are not yet optimal in identifying logical relationships between concepts or providing more in-depth further explanations. Research by Ridho et al. (2020) also highlights the low aspect of further explanation. This is because students are not yet able to make further decisions due to their weak mastery of concepts.

Overall, the results of this study imply the need for a shift in learning strategies from conventional methods to more constructive and active approaches. The use of strategies such as problem-based learning, group discussions, and the use of interactive media is highly recommended because they directly stimulate and develop aspects of critical thinking that are still low. In addition, teachers also need to conduct periodic evaluations and reflections to determine the effectiveness of the methods applied and adjust them to the needs of students. Sharpened critical thinking skills will create an interactive, collaborative, and meaningful learning atmosphere, enabling students to connect the material with real-life situations (Dilonia et al., 2025).

CONCLUSION

Based on the analysis results, students' critical thinking skills showed variations across each aspect. The aspects of providing simple explanations and drawing conclusions were categorized as adequate, with scores of 69.45% and 66.15%, respectively. These results indicate that students were able to understand basic concepts and draw conclusions when information was presented clearly. However, different results were found in the aspects of determining the basis for decision-making and providing further explanations, which were categorized as low. The percentage scores for these two aspects were 61.8% and 58.6%, respectively. Students still had difficulty applying scientific concepts as a basis for decision-making and establishing logical relationships between concepts.

REFERENCES

- Ardiyanti, F., & Nuroso, H. (2021). Analisis Tingkat Keterampilan Berpikir Kritis Siswa Kelas XI MIPA dalam Pembelajaran Fisika. *Jurnal Pendidikan Fisika Dan Terapannya*, 4(1), 21–26.

- Arofah, S & Rianingsih. (2021). Meta analisis efektivitas multimedia interaktif untuk meningkatkan cognitive skill peserta didik dalam belajar kimia meta analysis study of the effectiveness of interactive multimedia to improve student's cognitive skill in learning chemistry. *In UNESA Journal of Chemical Education*, 10(1), 84-93.
- Bayrak, R., & Gürses, A. (2020). Teaching of the subject of solids through Problem-Based Learning approach. *World Journal of Education*, 10(3), 47-56.
- Dilonia, A., Melki, R. A., & Gusmaneli, G. (2025). Strategi pembelajaran inovatif untuk meningkatkan kemampuan berpikir kritis peserta didik. *Inovasi Pendidikan dan Anak Usia Dini*, 2(2), 7-24.
- Hafizah, E., & Nurhaliza, S. (2021). Implementasi Problem Based Learning (PBL) terhadap kemampuan literasi sains p. *Quantum: Jurnal Inovasi Pendidikan Sains*, 12(1), 1–11.
- OECD. (2023). *PISA 2022 results: Volume I and II – Country notes: Indonesia*. OECD Publishing.
- Pratiwi, S. N., Cari, C., & Aminah, N. S. (2019). Pembelajaran IPA abad 21 dengan literasi sains siswa. *Jurnal Materi Dan Pembelajaran Fisika (JMPF)*, 9(1), 34-42.
- Rahayu, S. J., Sukarmin, & Karyanto, P. (2019). Analysis of junior high school students' critical thinking skills profile in Surakarta. *Journal of Physics: Conference Series*, 1233(1).
- Ridho, S., Ruwiyatun, R., Subali, B., & Marwoto, P. (2020). Analisis kemampuan berpikir kritis siswa pokok bahasan klasifikasi materi dan perubahannya. *Jurnal Penelitian Pendidikan IPA*, 6(1), 10–15.
- Safitri, L., & Hidayati, N. (2024). Profil tingkat kemampuan berpikir kritis siswa pada materi pencemaran lingkungan kelas VII SMPN 3 Lirik tahun ajar 2023/2024. *Journal of Social Humanities and Education*, 3(3), 226–243.
- Setianingsih, R., & Roshayanti, F. (2022). Kemampuan berpikir kritis peserta didik pada pembelajaran kimia dalam pokok bahasan laju reaksi di SMA Negeri 1 Bantarbolang. *Jurnal Penelitian dalam Bidang Pendidikan dan Pengajaran*, 16(1), 5–9.
- Setyawan, J., & Patonah, S. (2022). Profil kemampuan berpikir kritis siswa pada pokok bahasan senyawa karbon kelas XI SMA Negeri 2 Mranggen. *Jurnal Inovasi Pembelajaran di Sekolah*, 3(2), 166-180.
- Sutoyo, & Priantari, I. (2019). Discovery learning meningkatkan kemampuan berpikir kritis siswa discovery learning enhancing student's critical thinking. *Discovery Learning*, 4(1), 31-45.
- Utami, F.A. & Priyambodo, E. (2025). Profile of High School Students' Critical Thinking Skills in Chemistry Subjects. *Indonesian Journal of Chemical Education*, 2(2): 87-91
- Yajie, M. U., & Lestari, N. (2024). Upaya meningkatkan aktivitas belajar siswa melalui model pembelajaran kooperatif tipe STAD (Student Team Achievement Division) pada tema 4 'Berbagai pekerjaan' kelas IV UPT SPF SDN 101981 Galang. *Journal on Education*, 6(3), 16685–16694.