CREATE: Contemporary Research in Education and Teaching **E-ISSN: 3164-8940**
Volume 1 | Issue 1 | 2026 https://doi.org/10.47945/create.v1i1.3354

Students' Critical Thinking Skills at Junior High School: An Analysis of Science Teachers' Perceptions and Students' Written Responses

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ABSTRACT

Critical thinking is a core competence targeted by the Indonesian curriculum through the critical reasoning dimension of the Pancasila Student Profile, yet empirical evidence continues to indicate that lower-secondary students have not developed it adequately. Most previous studies have examined either students' test performance or teachers' perceptions separately, leaving limited evidence on how the two perspectives converge or diverge within the same classroom context. This study aimed to (1) describe a science teacher's perception of students' critical thinking skills and (2) profile students' critical thinking based on their written responses, using Facione's six core skills as a common analytical framework. A descriptive qualitative design was employed at SMP Negeri 1 Kabupaten Sorong, Southwest Papua. Participants were the Grade IX science teacher and 66 students from classes IX G (n = 34) and IX H (n = 32). Data were collected through observation, semi-structured interviews, a six-item essay test, and documentation of final science examination scores, and were analysed through data condensation, data display, and conclusion drawing. Both data sources indicated that students' critical thinking was generally at a low level. The weakest aspects were evaluation, inference, explanation, and self-regulation; students' responses tended to restate information, offer single-reason arguments, and draw subjective conclusions. A discrepancy emerged in interpretation, which the teacher rated as fairly good while students' written responses showed limited clarification of meaning. These findings suggest the need for instruction that explicitly engages students in argumentation, reasoned judgement, and reflective self-monitoring.

Keywords: Critical Thinking; Facione Framework; Science Education; Teacher Perception.

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Article History: Received: 14 April 2026 | Accepted: 12 May 2026 | **Homepage**: https://e-jurnal.iainsorong.ac.id/index.php/great
Citation: Nisa, D. C., & Afifi, E. H. N. (2026). Students' Critical Thinking Skills at Junior High School: An Analysis of Science Teachers' Perceptions and Students' Written Responses. CREATE: Contemporary Research in Education and Teaching, 1(1), 1–8. https://doi.org/10.47945/create.v1i1.3354

I. INTRODUCTION

Twenty-first-century competency frameworks developed by various international organizations consistently position critical thinking (CT), together with collaboration, communication, and creativity, as a core competence that needs to be integrated into national curricula (Voogt & Pareja Roblin, 2012). In Indonesia, this demand is formalized in the Merdeka Curriculum through the critical reasoning dimension of the Pancasila Student Profile, which includes the elements of acquiring and processing information and ideas, analyzing and evaluating reasoning, and reflecting on thoughts and thinking processes when making decisions (Badan Standar, Kurikulum, dan Asesmen Pendidikan [BSKAP], 2022). Nevertheless, international achievement results indicate that these curricular expectations have not yet been fully realized: Indonesian students' average science literacy score in PISA 2022 (383) remained far below the OECD average (485) (OECD, 2023). Science literacy is not identical to critical thinking, but both require the ability to interpret data and evaluate evidence; therefore, this gap provides relevant initial context for the present study. (Voogt & Pareja Roblin, 2012O; ECD, 2023)

Conceptually, Ennis (1993) defines critical thinking as reasonable, reflective thinking focused on deciding what to believe or do. Ennis (1996) subsequently operationalized this idea into six FRISCO elements: focus, reason, inference, situation, clarity, and overview. The Delphi consensus led by Facione (1990) provides a formulation more widely used in assessment, defining critical thinking as purposeful, self-regulatory judgment reflected in six core cognitive skills: interpretation, analysis, evaluation, inference, explanation, and self-regulation. These two frameworks complement one another; however, Facione's framework was selected in this study because its six skills can serve as a common analytical language for examining both teachers' perceptions and students' performance. In science education, Bailin (2002) emphasizes that critical thinking cannot be reduced to a generic procedure because the quality of reasoning depends on an understanding of disciplinary criteria and contexts. Conversely,

Halpern (1998) shows that CT skills can be taught and transferred across contexts when instruction includes dispositions, skill training, recognition of argument structures, and metacognitive monitoring. The tension between these domain-specific and domain-general perspectives is important for interpreting findings obtained through content-free instruments, (Ennis, 1993), and Facione, 1990)).

Empirical evidence in Indonesia consistently portrays junior high school students' critical thinking skills as inadequate, although the profiles of weakness differ across studies. Rosmalinda et al. (2021) reported that the critical thinking skills of 32 eighth-grade students in solving PISA-type problems were low (58.1%), with the most prominent weaknesses in interpretation and inference. A broader survey of 403 junior high school students in Bali likewise found average mastery below 60%, but the greatest weaknesses were in analysis and explanation, whereas evaluation and interpretation were relatively stronger (Redhana et al., 2026). In contrast, Purnomo et al. (2023) found that most of 16 seventh-grade students demonstrated high critical thinking skills on environmental pollution topics. These differences suggest that the profile of critical thinking skills is strongly influenced by the indicator framework, task type, and sample context. From an assessment perspective, Putri et al. (2021) showed that science assessment instruments analyzed using Facione's framework met only 29.91% of the criteria, with interpretation, evaluation, and explanation being the least frequently accommodated. This finding suggests that students' low performance may be related to limited opportunities to practice these skills in everyday tasks and assessments.Purnomo et al. (2023)Putri et al. (2021)

Teachers occupy a central position because their beliefs and perceptions influence instructional decisions. Zohar et al. (2001) found that nearly half of the interviewed secondary school teachers considered higher-order thinking instruction less appropriate for low-achieving students, although subsequent research showed that low-achieving students also made meaningful progress when engaged in higher-order thinking tasks (Zohar & Dori, 2003). In the Indonesian context, Anggraeny and Khongput (2022) reported that teachers understand critical thinking as a combination of skills, dispositions, and knowledge, but its classroom implementation remains limited to a certain extent. Junior high school science teachers have also been reported to use contextual problems, collaborative discussion, scaffolding, and reflective questions to facilitate Facione's six skills, although that study only portrayed reported practices and did not directly measure student achievement (Wati et al., 2026). From the student perspective, Mursabdo (2022) found that students' perceptions of teachers' pedagogical competence significantly influenced junior high school students' science critical thinking skills in Central Jakarta.Zohar & Dori, 2003Anggraeny dan Khongput (2022)Wati et al., 2026Mursabdo (2022)

A synthesis of the literature reveals two gaps. First, there is a methodological gap: the studies above generally measure students' performance (Redhana et al., 2026; Rosmalinda et al., 2021) or examine teachers' perceptions and practices (Anggraeny & Khongput, 2022; Wati et al., 2026) separately. Consequently, there is still limited evidence regarding the extent to which teachers' judgments of students' critical thinking skills align with students' actual performance in the same classroom, even though such alignment is important for the accuracy of teachers' instructional decisions. Second, there is a contextual gap: to the authors' knowledge, studies of critical thinking at the junior high school level remain concentrated in Java and Bali, while evidence from Southwest Papua remains limited. Therefore, this study aimed to (1) describe science teachers' perceptions of Grade IX students' critical thinking skills and (2) profile students' critical thinking skills based on their written responses, using Facione's six skills as a common analytical framework. This study is expected to provide contextual evidence from SMP Negeri 1 Kabupaten Sorong and offer a way of examining the alignment between teachers' perceptions and students' performance as a basis for designing science instruction that more explicitly develops critical thinking

II. RESEARCH METHODS

This study employed a descriptive qualitative design to obtain an in-depth understanding of students' critical thinking skills from two sources, namely teachers' perceptions and students' written responses. The study was conducted at SMP Negeri 1 Kabupaten Sorong, Southwest Papua Province, from August to September 2026. Participants consisted of two Grade IX science teachers with more than five years of teaching experience and 66 Grade IX students from classes IX G (n = 34) and IX H (n = 32). Participants were purposively selected, particularly the Grade IX science teachers, because they directly taught both classes, allowing their perceptions to be compared with students' responses from the same classes.

Data were collected in three stages. The first stage involved preliminary observation to obtain a general overview of the learning context. The second stage consisted of semi-structured interviews with the science teachers using an interview guide developed based on Facione's (1990) six core skills; each skill was explored through questions concerning how students demonstrated (or had not demonstrated) the skill during learning and task completion. The third stage involved administering a six-item critical thinking essay test, with each item representing one of Facione's skills (Table 1). The essay format was selected because open-ended responses allow the spontaneous application of thinking skills to be observed more clearly than multiple-choice formats (Ennis, 1993; Ku, 2009). The items were developed using everyday situations close to students' experiences (content-free), as also used in the measurement of junior high school students' critical thinking by Redhana et al. (2026). Instrument validation was based on expert review and scoring rubrics for teachers' and students' responses that had been prepared. As supporting data, the researchers collected documentation of the final semester science examination scores for both classes.Ku, 2009

Table 1. Blueprint of the critical thinking essay test and examples of dominant student responses

Skill	Sub-indicator	Test item
Interpretation	Clarifying meaning; identifying problems; categorizing information	"Group study is not important because we can study on our own." What does this statement mean?
Analysis	Identifying reasons; describing cause and effect relationships.	Why are there students who do not like group study? Explain your reasons!
Evaluation	Assessing the strength of reasons; testing the validity of arguments	"A student says that cheating is not a problem as long as one is not caught." is this statement correct?
Inference	Drawing conclusions; making logical conjectures	"In class, there is a student who often does not complete assignments and rarely pays attention to the teacher's explanation." The conclusion can you draw from this situation?
Explanation	Explaining reasons; communicating the thinking process	In your opinion, why do students need to pay attention to the teacher's explanation during lessons? Explain your reasons!
Self-regulation	Recognizing limitations of an answer; reviewing the results of one's thinking	When the teacher returns your test results and your score is low, what should you do regarding your study approach? Explain!

*The responses presented are the most frequent response patterns for each item, not the responses of all students.

Data were analyzed following the interactive model of Miles et al. (2014), comprising data condensation, data display, and conclusion drawing and verification. During the condensation stage, interview transcripts and essay responses were deductively coded into Facione's six skill categories. During the display stage, the coding results were organized into a matrix juxtaposing teachers' perceptions and students' response patterns for each skill (Table 2), enabling patterns of convergence and divergence to be identified. Conclusions were drawn based on patterns consistent across both data

sources. Data trustworthiness was pursued through method and source triangulation by comparing interview, essay test, and documentation data (Carter et al., 2014). To strengthen credibility and dependability, the coding procedure was documented in detail and examined by more than one rater (Nowell et al., 2017). School research permission and participant consent were obtained before data collection, and participants' identities were kept confidential.

III. RESULTS AND DISCUSSION

Teachers rated students' interpretation skills as fairly good: most students were considered able to understand problems in learning activities and test questions, although some still had difficulty grasping the essence of a problem. Analysis skills were perceived as varied. According to the teachers, some students were able to relate previously learned concepts to problems, particularly during group discussions, but many answered immediately without describing the steps used to solve the problem. Regarding evaluation, teachers considered students' skills not yet optimally developed because students rarely rechecked their answers and were not accustomed to assessing the validity of the reasons they used.

Regarding inference, teachers stated that some students were able to draw conclusions from available information, but these conclusions were rarely supported by strong reasons. Difficulties were also evident in explanation. Teachers noted that only a few students were able to provide logical and coherent reasons, whereas most gave brief answers without explanation. In self-regulation, teachers considered students unable to monitor and reflect on their own thinking; students rarely reflected on the mistakes they made and were not accustomed to developing problem-solving strategies.

Overall, students' responses to the six essay items were general and did not yet demonstrate in-depth reasoning. For the interpretation item, most students merely repeated the statement without explaining its meaning or the assumptions underlying it (for example, "group study is not important"). This pattern indicates that students had not independently clarified meaning or identified the problem. For the analysis item, most students mentioned a single reason, namely that not all friends were willing to cooperate, without elaborating cause-and-effect relationships or considering other reasons. For the evaluation item, most students judged cheating to be wrong, but this judgment was based only on a general norm ("cheating is not good") without examining the reasoning in the statement being evaluated.

For the inference item, most students concluded that a student who did not complete assignments and did not pay attention to the teacher was lazy. This conclusion was subjective because other possible causes, such as difficulty understanding the material or factors outside school, were not considered. For the explanation item, some students stated that paying attention to the teacher was necessary "in order to understand the lesson," without elaborating their thinking process or the cause-and-effect relationship. For the self-regulation item, the dominant response was an intention to "study harder," without reflection on weaknesses in previous learning strategies or specific steps for improvement. Although these patterns were dominant, not all students responded in the same way. Table 2 summarizes the comparison between teachers' perceptions and students' response patterns.

Table 2. Comparison matrix of teachers' perceptions and students' written response patterns

Skill	Science Teachers' Perceptions	Students' Written Response	Convergence
Interpretation	Fairly good; some students still have difficulty understanding problems	Repeating statements without clarifying meaning	Divergent
Analysis	Varied; some can relate concepts during group discussions, but many answer directly without elaboration	One simple reason; cause-and-effect relationships are not elaborated	Partially convergent

Skill	Science Teachers' Perceptions	Students' Written Response	Convergence
Evaluation	Not yet optimal; rarely recheck answers or assess the validity of reasons	Normative judgment without logical consideration	Convergent
Inference	Some can draw conclusions, but without strong reasons	Alternative explanations are not considered	Convergent
Explanation	Only a few students provide logical and coherent reasons; most answer briefly	Brief answers; thinking processes are not explained	Convergent
Self-regulation	Rarely reflect on mistakes or develop strategies	General resolution without reflection on learning strategies	Convergent

The mean final semester science examination score for class IX G was 69.00 and for class IX H was 66.59. These scores describe overall science learning achievement but are not a direct measure of critical thinking skills. Accordingly, these achievements were categorized as low because they fell below the school's applicable minimum mastery criterion (KKM) of 75, while nearly 60 percent of the final examination items required higher-order thinking skills. The main finding of this study is that both teachers' perceptions and students' written responses indicate that critical thinking skills remain low, particularly in evaluation, inference, explanation, and self-regulation. Both data sources also show a similar pattern: students were able to provide answers, but these answers were rarely accompanied by tested reasons, consideration of alternatives, or reflection on their thinking processes. Within Facione's (1990) framework, this pattern indicates that students had only produced judgments, whereas the elements of purposeful and self-regulated judgment were not yet evident.Facione (1990)

These findings reinforce previous reports that Indonesian junior high school students' critical thinking skills remain inadequate (Redhana et al., 2026; Rosmalinda et al., 2021), although the profiles of weakness are not entirely the same. As in the study by Rosmalinda et al. (2021), interpretation and inference were among the weaker aspects. In contrast, Redhana et al. (2026) found that interpretation and evaluation were relatively the strongest aspects, whereas Purnomo et al. (2023) even reported high critical thinking skills. These differences are likely attributable to differences in instruments, including standardized tests with many items, PISA-type problems, or one essay item per skill as used in this study. Differences in indicator frameworks and sample sizes may also play a role. Because only one item represented each skill, the profile obtained in this study should be interpreted as an indication of tendencies rather than a stable diagnosis of each skill, Rosmalinda et al., (2021)

The divergence in interpretation provides insights that would not have been obtained had only one perspective been examined. Teachers rated students' interpretation as fairly good, whereas written responses showed that students generally only repeated the statement. At least two explanations are possible. First, teachers may assess interpretation based on students' ability to understand instructions or routine questions, whereas the essay item required clarification of more abstract meanings and assumptions. Second, teachers' perceptions may be more optimistic regarding skills that are rarely measured explicitly. Putri et al.'s (2021) finding that interpretation is among the indicators least frequently accommodated in science assessment instruments supports the second possibility. However, this explanation remains tentative and requires testing through classroom observation and analysis of teachers' assessment documents.

The response patterns for the inference and self-regulation items also warrant attention. The conclusion that a friend who does not complete assignments is "lazy" indicates a tendency to draw conclusions from limited information without considering alternative explanations, even though this ability is central to inference in Facione's (1990) formulation. The response "study harder" to the self-regulation item reflects an intention rather than metacognitive monitoring. Halpern (1998) positions metacognitive monitoring—checking accuracy and progress toward goals—as a component that enables

critical thinking skills to transfer. The absence of this component may explain why students had not linked low scores to an evaluation of their learning strategies.

Why do these patterns emerge? The data in this study are not sufficient to establish their causes with certainty, but the literature offers several plausible explanations. First, skills that are rarely practiced and assessed tend not to develop; limited demands for interpretation, evaluation, and explanation in science assessment instruments (Putri et al., 2021) may lead students to become accustomed to giving brief answers. Second, argumentation and critical discussion remain relatively uncommon in science learning, even though opportunities for collaborative argumentation improve students' conceptual understanding and scientific reasoning skills (Osborne, 2010). Teachers' observations that students' analytical skills were more apparent during group discussions are consistent with this argument. Third, teachers' beliefs about students' readiness may limit the frequency of higher-order thinking tasks, as reported by Zohar et al. (2001). This third explanation was not directly examined in the present study and therefore merits attention in future research.Putri et al., 2021Osborne, 2010Zohar et al. (2001)

Theoretically, this study shows that Facione's framework can be used as a common analytical language to compare teachers' perceptions and students' performance, allowing convergence and divergence between the two to be mapped for each skill. The findings also remind us that performance on content-free tasks does not automatically represent reasoning within the science domain. As emphasized by Bailin (2002), the quality of critical thinking in science depends on mastery of disciplinary criteria and contexts. Therefore, claims about "critical thinking in science learning" require instruments that incorporate science contexts. In addition, final semester science examination scores can only be treated as contextual information, not as evidence of critical thinking skills, because critical thinking assessment requires tasks specifically designed to elicit these skills (Ennis, 1993; Ku, 2009).Ku, 2009

Practically, these findings direct teachers to design instruction that explicitly develops critical thinking. The meta-analysis by Abrami et al. (2015) showed that critical thinking instruction is effective across educational levels ($g+ = 0.30$), particularly when it combines dialogue, authentic problems, and mentoring. For SMP Negeri 1 Kabupaten Sorong, this principle can be translated into science discussions based on phenomena that require students to compare reasons, test alternative conclusions, and explain their thinking processes, accompanied by rubrics that provide feedback on the quality of reasoning rather than only the correctness of answers. Because low-achieving students also benefit from higher-order thinking tasks (Zohar & Dori, 2003), such tasks should be provided to all students. The practices of other Indonesian junior high school science teachers who use scaffolding and reflective questions (Wati et al., 2026) may serve as references, particularly for developing self-regulation through structured post-examination reflection.

This study has several limitations. Data were obtained from one school, and teachers' perceptions were drawn from two science teachers; therefore, the findings are not intended to be generalized. Each skill was represented by only one content-free essay item, and the scoring rubric and inter-rater agreement were not reported. In addition, students' perceptions of their own critical thinking skills were not collected. Future studies are recommended to use several science-contextualized items for each skill, analytical rubrics with inter-rater reliability testing, more systematic classroom observations, and larger numbers of teachers and schools.

IV. CONCLUSION

This study shows that the critical thinking skills of Grade IX students at SMP Negeri 1 Kabupaten Sorong remain generally low according to both science teachers' perceptions and students' written

responses. Both data sources most consistently indicate weaknesses in evaluation, inference, explanation, and self-regulation. Students tended to provide brief answers, untested single reasons, subjective conclusions, and learning resolutions without reflection on strategies. The discrepancy between teachers' assessments and students' responses in interpretation indicates that teachers' perceptions need to be calibrated with evidence of student performance obtained through specially designed tasks. Based on these findings, science teachers are recommended to integrate phenomenon-based discussion and argumentation, tasks requiring consideration of alternative explanations, and structured reflection into instruction and assessment. Further research is needed to test these findings using science-contextualized instruments, reliable rubrics, and a broader participant scope

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