Full research paper

A DIMENSIONAL ANALYSIS OF JUNIOR HIGH SCHOOL STUDENTS' CRITICAL THINKING SKILLS

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ABSTRACT
Critical thinking skills (CTS) are essential competencies for 21st-century students; however, empirical evidence indicates that their development remains suboptimal. This study aimed to map the CTS profile of junior high school students in Bali Province, Indonesia, and to examine differences across CTS dimensions. A survey design was used, involving 403 students selected through multistage random sampling from public and private schools across eight regencies and one city in Bali Province, Indonesia. Data were collected using a content-free CTS test developed by the authors, which demonstrated content validity and high reliability (Cronbach's α = 0.920). The data were analysed using descriptive statistics and repeated-measures analysis of variance after assumption testing. The results showed that students' overall CTS remained low, with average mastery below 60%. Significant differences were found across dimensions: evaluation and interpretation had the highest scores, whereas analysis and explanation had the lowest. These findings provide a provincial-level empirical basis for developing more targeted strategies, assessments, and educational policies to strengthen CTS.

KEYWORDS
Bali Province, critical thinking skills, educational assessment, junior high school students, responsibility in education

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Highlights

- *CTS among junior high school students in Bali were generally low.*
- *Evaluation and interpretation scores exceeded those for analysis and explanation..*

INTRODUCTION
In the 21st century, critical thinking skills (CTS) have become an essential foundation in education, as life is increasingly complex and rapidly changing (Kim and Jeon, 2019; Mahanal et al., 2019). CTS help individuals analyse information in depth (Mutakinati et al., 2018; Hacioglu and Gulhan, 2021), identify weaknesses in arguments objectively and avoid being easily misled (Changwong et al., 2018; Sasson et al., 2018; Alsaleh, 2020), and make rational decisions in complex work and personal situations (Seibert, 2021). Amid technological advances and the information explosion, CTS enable individuals to sort through diverse data sources more carefully (Gurcay and Ferah, 2018), consider different perspectives when forming fair judgements (Ulger, 2018), and develop innovative solutions to problems that do not always have a single answer (Ulger, 2018; Wechsler et al., 2018). In other words, CTS are not only about "right or wrong" answers, but also about the quality of reasoning, learning resilience, and adaptability in a rapidly changing environment.

Conversely, individuals who lack CTS are vulnerable to information manipulation through deception, indoctrination, brainwashing, hate speech, and fake news (Marin and Copeland, 2022). This vulnerability arises when information is received without adequate analysis and verification. Misleading opinions can easily influence individuals, especially when framed in emotional and persuasive ways. Ultimately, decisions may be made on the basis of emotion rather than logic and evidence, potentially harming both individuals and others. Furthermore, without CTS, individuals also tend to have difficulty addressing complex problems that require in-depth analysis and reflection in both academic and social settings.

This situation becomes even more concerning in the context of basic education, particularly junior high school, which is a crucial phase in shaping students' thinking. At this level, students are required not only to understand subject matter but also to reason, analyse, and solve problems presented across various subjects. At the same time, junior high school students are among the age groups vulnerable to the negative influence of the vast flow of information on social media (Höttecke and Allchin, 2020; Shu et al., 2020; Wong et al., 2021). Without CTS, they risk becoming victims of digital fraud and information manipulation and may become involved in spreading hoaxes that can harm themselves and their environment (Zubair et al., 2019). Therefore, strengthening CTS among junior high school students is an urgent need in the current context of education and digital literacy.

Various studies have evaluated students' CTS at different educational levels, and their findings are consistent: students' CTS remain relatively low. This phenomenon is a global concern because it directly affects young people's readiness to face the challenges of the 21st century. Low CTS have been reported in several countries, including Nigeria (Chinaka et al., 2018), the United States (Reynders et al., 2020), Vietnam (An-Le and Hockey, 2021), the Netherlands (Ritter and Mostert, 2017), and the United Kingdom (Nejmaoui, 2018). A similar situation has also been found in Indonesia. Various studies have shown that students' CTS have not reached the expected level (Fuad et al., 2017; Mutakinati et al., 2018; Basri et al., 2019; Pratama et al., 2019; Saputri et al., 2019; Amin et al., 2020; Sumarni and Kadarwati, 2020; Saenab et al., 2021). The consistency of these findings demonstrates that low CTS are not merely a local issue but a systemic challenge that must be understood through robust and representative profile mapping.

Although many studies report low CTS, research that maps the CTS profile of Indonesian students in greater depth still has limitations, particularly in terms of location coverage, the number of participants, and the quality of the instruments used. Himmatussolihah et al. (2020) studied students' CTS in Surakarta, Indonesia, but included only three 10th-grade high school students, making the findings difficult to generalise. Furthermore, the test used (Cornell Critical Thinking Test/CCTT Level X) did not explain its validity and reliability. Kamsinah et al. (2020) analysed junior high school students' CTS in South Kalimantan, Indonesia, but the sample size was not specified. The instrument, an essay-based approach, covered only temperature and heat, making its scope narrow. Azmi et al. (2022) studied junior high school students' CTS in Palembang, Indonesia, but only in one school, limiting generalisability. The test development indicators were based on Ennis, but the test's validity and reliability were not reported. Saphira and Prahani (2022) described the CTS profile of high school students in Surakarta, Indonesia, but their sample was limited to 10th-grade science students, making it less representative. The test was developed for parabolic motion, and its validity and reliability were also not reported. Fitriani et al. (2022) examined CTS among high school students in Bengkulu, Indonesia, but the study was also limited to a single school. Although they used Ennis indicators, the instrument's validity and reliability were not reported. In general, these studies show a similar pattern of limitations: the number of schools and participants was small, and the instruments did not meet measurement-quality reporting standards, thereby reducing the accuracy of CTS mapping for the broader population. Most instruments were also content-bound and limited to specific subject matter, reducing their suitability for broader profiling of students' CTS.

Given these limitations, no research has yet mapped the CTS profile of junior high school students in Bali Province, Indonesia, using a standardised, content-free CTS test. Therefore, the novelty of this study lies in its province-wide coverage of Bali Province and its stratified random sample from all regencies/cities. Unlike previous research, which has generally been limited to a single school or city, this study seeks to provide a comprehensive picture of junior high school students' CTS at the provincial level, thereby offering a stronger basis for planning development, improving learning, and strengthening critical literacy in schools.

The instrument used in this study was developed in the authors' previous work and has demonstrated content validity and high reliability (α = 0.920) (Redhana and Sudiana, 2015), thus ensuring stronger measurement quality. Furthermore, this study analysed CTS across five main dimensions (evaluation, interpretation, analysis, inference, and explanation) and employed robust statistical approaches, including repeated-measures ANOVA and pairwise comparison tests, to accurately identify differences among CTS dimensions. The use of a proportional conversion-based score classification system also facilitates interpretation on a 0–1 scale.

Beyond its cognitive importance, the present study is also relevant to issues of efficiency and responsibility in education and science. From the perspective of educational efficiency, mapping students' CTS across dimensions provides an evidence-based basis for designing more targeted instructional interventions, assessment practices, and teacher support. Without such a profile, schools and policymakers may implement broad and resource-intensive programmes that are less effective because they do not address students' actual areas of weakness. From the perspective of responsibility, CTS are essential for preparing students to evaluate information carefully, justify claims with evidence, and respond to social and scientific issues in a rational and ethically responsible manner. In this sense, identifying students' CTS profile is not only a measurement task but also a step towards more efficient educational decision-making and more responsible educational practice.

Therefore, this study contributes not only to the assessment literature on CTS but also to the broader agenda of improving efficiency and responsibility in education by providing a provincial-level evidence base for targeted and accountable pedagogical action. Accordingly, this study addressed two research questions: (a) What is the CTS profile of junior high school students in Bali Province, Indonesia? and (b) Are there differences in students' CTS across dimensions?

The remainder of this manuscript is organised as follows. The next section reviews the relevant literature on CTS and their dimensions. The subsequent section explains the materials and methods of the study, followed by the results, discussion, and conclusion.

LITERATURE REVIEW

CTS have been conceptualised in various ways in the educational literature. This section reviews the relevant literature and theoretical perspectives that inform the present study. A deeper understanding suggests that CTS are not simply a collection of discrete cognitive skills but rather a form of disciplinary and reflective knowledge. Ontologically, CTS are often understood as a set of observable abilities, such as evaluating, interpreting, and analysing (Song and Cai, 2024; Rahmasari and Susilo, 2025). However, epistemologically, CTS concern how individuals construct, justify, and validate knowledge in specific contexts (Dai, 2025). This epistemological perspective positions CTS as a reasoning practice rooted in evidence-based justification rather than merely surface cognitive performance (Pfister, 2025).

Drawing on Ennis's operationalisation and Facione's taxonomy of skills, this study positions the five dimensions of CTS—evaluation, interpretation, analysis, inference, and explanation—as interrelated epistemic practices (Utami et al., 2019a; Martínez Barrio et al., 2025). Interpretation is understood as the process of constructing meaning from available data or evidence (Utami et al., 2019b); analysis as the ability to break down information into its components and identify relationships between propositions (Sujatha Priyadharsini, 2025); inference as drawing justifiable conclusions from existing premises (Susandi, Sa'dijah and As'ari, 2019); evaluation as assessing the credibility of sources, arguments, and criteria used (Castle, 2011); and explanation as the ability to articulate reasoning structures and justifications coherently (García Medina et al., 2020). Thus, CTS are not only about "what" answers students provide, but also about "how" and "why" those answers are constructed.

Understanding CTS as an epistemic practice has important methodological implications. First, CTS measurement instruments must assess not only the accuracy of final answers but also the underlying justification process to ensure construct validity (Sujatmika et al., 2025). Second, comparisons of CTS across contexts, for example across regions, schools, or curricula, need to consider local epistemic cultures, including classroom discourse patterns, assessment methods, and curricular emphases that may facilitate or constrain certain critical thinking practices (Fadillah and Tanjung, 2025). In the context of Indonesian education, particularly at the junior high school level, learning practices that remain predominantly oriented towards memorisation and single-answer responses can hinder the development of CTS dimensions such as analysis and explanation (Billah and Masykuri, 2021).

Based on this rationale, the instrument development and interpretation of the results in this study were explicitly linked to epistemic criteria. The item design and scoring rubric were intended to capture variations in students' reasoning practices, not only their mastery of specific content. This approach allows differences in scores across CTS dimensions to be interpreted as reflecting authentic variations in students' critical thinking practices rather than artefacts of differences in material context or question format. With this theoretical framing, the study not only maps students' CTS levels descriptively but also provides conceptual meaning to the patterns of differences that emerge across CTS dimensions.

This epistemic perspective also helps explain the relevance of CTS to efficiency and responsibility in education and science. Critical thinking supports responsibility because it enables learners to assess evidence, question unsupported claims, and justify decisions in ways that are intellectually accountable and socially responsible. In contemporary education, this is especially important in helping students respond critically to misinformation, biased reasoning, and scientifically weak claims. At the same time, a dimensional understanding of critical thinking supports educational efficiency. When educators know which dimensions are relatively strong and which remain underdeveloped, learning strategies, assessment designs, and professional development efforts can be directed more precisely. Thus, the measurement of critical thinking dimensions is not only theoretically meaningful but also practically relevant for making educational interventions more targeted, resource-conscious, and responsible.

MATERIALS AND METHODS

Research design

This study employed a cross-sectional survey design to examine the profile of junior high school students' CTS, with students serving as the unit of analysis. A survey method was selected to obtain a comprehensive and accurate depiction of students' actual conditions in a natural educational context. As a descriptive study, the survey aimed to describe the sample's characteristics systematically and accurately. The findings from the sample were subsequently generalised to the broader population.

Population and sample

The population of this study consisted of all junior high school students in Bali Province, Indonesia, across both public and private schools. The total population was N = 188,999 students (Badan Pusat Statistik, 2024), distributed across eight regencies and one city. The sample size was estimated using Slovin's formula (McMillan, 2016), which is commonly applied in large-population survey research to determine the minimum required sample based on a specified margin of error. The formula is presented as follows:

$$n = \frac{N}{1 + Ne^2} = \frac{154{,}378}{1 + 154{,}378 \cdot (0.5)^2} = 384 \qquad (1)$$

where n = sample size, N = population size, and e = margin of error. In this study, a 5% margin of error (e = 0.05) was used, which aligns with standard practice in educational survey research.

Using this formula, the minimum required sample size was n = 384. However, to strengthen proportional representation across all regencies and the city in Bali Province, and to minimise the risk of sampling bias, the final sample comprised 403 students. This approach ensured that the sample adequately reflected the demographic and geographic distribution of the broader population.

Sampling techniques

A multistage random sampling technique was used to select the research sample from the large target population. This technique was chosen because it can accommodate regional diversity and variation in student characteristics in Bali Province. In the first stage, clusters were determined based on eight regencies and one city. In the second stage, schools in each cluster were randomly selected using cluster random sampling. After the schools had been determined, the third stage involved randomly selecting class levels from each school. This selection process helped ensure proportionality, so that the sample reflected the population distribution fairly. Thus, the study's results can describe students' CTS profiles more accurately and representatively. The sample structure is shown in Table 1.

Characteristics	Full sample	Percentage (%)
Gender		
Boys	178	44.17
Girls	225	55.83
Grade		
Seventh	143	35.48
Eighth	182	45.16
Ninth	78	19.36
Age		
11 years	3	0.75
12 years	91	22.58
13 years	170	42.18
14 years	108	26.80
15 years	31	7.69
Regencies/City		
Badung	57	14.14
Bangli	25	6.20
Buleleng	73	18.11
Denpasar	74	18.36
Gianyar	47	11.66
Jembrana	29	7.20
Karangasem	45	11.17
Klungkung	18	4.47
Tabanan	35	8.68

Table 1: Sample structure (source: own calculation)

Research instruments

The research instrument used in this study was a CTS test. This test was developed by the authors in previous studies. The CTS test blueprint is shown in Table 2. The test demonstrated content validity and had a Cronbach's alpha reliability coefficient of 0.920 (Redhana and Sudiana, 2015).

Dimensions	Item numbers (k)	Number of questions
Evaluation (CTS1)	1 – 10	10
Interpretation (CTS2)	11 – 20	10
Analysis (CTS3)	21 – 30	10
Inference (CTS4)	31 – 41	11
Explanation (CTS5)	42 – 50	9

Table 2: CTS test blueprint (source: own calculation)

Data collection

The paper-based test was distributed to schools and administered by the teachers who taught the sampled classes (the units of analysis). Before distributing the test to the students, the teachers were trained in how to administer it. The test was administered over 90 minutes. The test administration procedure required students to read the instructions first, check the number of questions, and then begin the test. Students could answer the questions in any order, from the easiest to the most challenging. While students were answering the questions, the teacher supervised them to ensure that they completed the test honestly. After the test administration, the teacher collected the tests and the students' answer sheets. The researcher collected the tests and students' answer sheets from the teachers the next day.

Data analysis

The data obtained in this study consisted of scores from the junior high school students' CTS test. These scores represent each student's level of mastery of CTS based on the test results. Furthermore, students' average scores were analysed and classified according to the score conversion guidelines. The classification guidelines are presented in detail in Table 3 as a reference for interpreting students' CTS achievements.

The raw score for each student on each CTS dimension was converted to a proportional score ranging from 0 to 1 to standardise interpretation across dimensions with different item counts. The conversion was performed using the following formula:

$$\text{Proportional score} = \frac{\text{Student´s row score}}{\text{Maximum possible score}} \qquad (1)$$

Mean score	Category
0.00 – 0.20	Very low
0.21 – 0.40	Low
0.41 – 0.60	Moderate
0.61 – 0.80	High
0.81 – 1.00	Very high

Table 3: Guidelines for converting mean scores into categories (scale of 0–1) (source: own calculation)

This proportional transformation is widely used in educational measurement because it produces comparable scores across dimensions with unequal numbers of items and facilitates interpretation using a standard scale (0–1). The category labels in Table 3 were based on these proportional scores.

These scores were processed using descriptive and inferential statistics. To answer the first research question "*What is the profile of the CTS of junior high school students in Bali Province, Indonesia?*", the data were processed using descriptive statistics, with the results presented as means and standard deviations. To answer the second research question—whether students' CTS differed across dimensions—the data were analysed using repeated-measures ANOVA. Before the ANOVA was carried out, assumption tests, including the normality test and Mauchly's test of sphericity, were conducted. If the sphericity assumption was violated, the Greenhouse–Geisser correction was applied. All tests were conducted using SPSS (IBM Corp.) at a significance level of 5%.

RESULTS

Profile of students' CTS

Table 4 presents the profile of students' CTS across dimensions and overall. The overall mean score was 0.453 (45.3%), indicating that students' CTS remained below 60%. Across dimensions, CTS1 had the highest mean score, at 0.528 (52.8%), followed by CTS2, at 0.502 (50.2%); CTS4, at 0.469 (46.9%); CTS3, at 0.393 (39.3%); and CTS5, at 0.373 (37.3%). These results show variation in students' performance across the five CTS dimensions.

Dimensions	*k*	Mean	*SD*
CTS1	10	0.528 (52.8%)	0.207
CTS2	10	0.502 (50.2%)	0.204
CTS3	10	0.393 (39.3%)	0.190
CTS4	11	0.469 (46.9%)	0.225
CTS5	9	0.373 (37.3%)	0.200
Overall	50	0.453 (45.3%)	0.205

Note. k = number of items; Mean = sample mean score; SD = standard deviation

Table 4: Profile of students' CTS by dimension and overall (scale of 0–1) (source: own calculation)

Differences across CTS dimensions

As shown in Table 4, mean scores differed across CTS dimensions. The highest mean score was found in CTS1 (0.528; 52.8%), whereas the lowest mean score was recorded for CTS5 (0.373; 37.3%). To examine whether these differences were statistically significant, repeated-measures analysis was conducted after assumption testing.

Before the repeated-measures analysis, assumption testing was conducted. The results of the Shapiro–Wilk test are presented in Table 5. All CTS dimensions yielded p-values below 0.05. However, the skewness and kurtosis values remained within an acceptable range, so the analysis proceeded to the sphericity test.

CTS Dimension	*n*	*W* Statistic	*p*-value
CTS1	403	0.961	< 0.001
CTS2	403	0.950	< 0.001
CTS3	403	0.950	< 0.001
CTS4	403	0.947	< 0.001
CTS5	403	0.934	< 0.001

Table 5: Results of the Shapiro–Wilk normality test for CTS dimensions (source: data processed using SPSS (IBM Corp.))

Table 6 presents the results of Mauchly's test of sphericity. The test was not significant, $W = 0.963$, $\chi^2(9) = 15.303$, $p = 0.083$, indicating that the sphericity assumption was met.

After the assumptions had been examined, repeated-measures ANOVA and pairwise comparison tests were conducted to examine differences in mean scores across dimensions. Table 7 shows that the differences were statistically significant, $F(4, 1608) = 88.922$, $p < 0.001$, with an effect size of $\eta p^2 = 0.181$.

To identify which dimensions differed significantly, Bonferroni-adjusted pairwise comparisons were performed. The results are presented in Table 8.

Effect	Mauchly's *W*	χ^2	*df*	*p*-value
CTS dimensions	0.963	15.303	9	0.083

Table 6: Mauchly's test of sphericity for CTS dimensions (source: data processed using SPSS (IBM Corp.))

Effect	*df*	*F*	*p*-value	ηp^2
CTS dimensions	(4, 1608)	88.922	< 0.001	0.181

Table 7: Repeated-measures ANOVA results for CTS dimensions (sphericity assumed) (source: data processed using SPSS (IBM Corp.))

Comparison	Mean Difference	*t*	*p*-value	Cohen's *dz*
CTS1 – CTS2	0.026	2.75	0.062	0.137
CTS1 – CTS3	0.135	13.17	< 0.001	0.656
CTS1 – CTS4	0.059	5.72	< 0.001	0.285
CTS1 – CTS5	0.157	14.76	< 0.001	0.735
CTS2 – CTS3	0.109	10.86	< 0.001	0.541
CTS2 – CTS4	0.033	3.22	0.014	0.160
CTS2 – CTS5	0.130	11.98	< 0.001	0.597
CTS3 – CTS4	−0.076	−7.61	< 0.001	−0.379
CTS3 – CTS5	0.021	1.99	0.377	0.099
CTS4 – CTS5	0.097	9.88	< 0.001	0.492

Table 8: Bonferroni-adjusted pairwise comparisons among CTS dimensions (source: data processed using SPSS (IBM Corp.))

The pairwise comparisons showed that most pairs of CTS dimensions differed significantly. The largest mean differences were found between CTS1 and CTS5 and between CTS1 and CTS3. By contrast, the comparisons between CTS1 and CTS2 and between CTS3 and CTS5 were not statistically significant. Overall, CTS1 and CTS2 had the highest mean scores, CTS4 occupied an intermediate position, and CTS3 and CTS5 had the lowest mean scores.

DISCUSSION

The results of this study indicate that the CTS of junior high school students in Bali Province remain relatively low. These findings reflect not only weak numerical achievement but also more fundamental epistemic challenges in everyday learning practices. CTS, which encompass the abilities to evaluate, interpret, analyse, draw inferences, and explain, require complex and multilevel cognitive processes. Persistently low average scores across these dimensions suggest that students are not yet accustomed to engaging in learning activities that demand in-depth reasoning, reflection, and evidence-based justification.

Students' low CTS can be understood as a consequence of learning environments that remain predominantly oriented towards memorisation and superficial understanding. Instructional practices that emphasise information reproduction while providing limited opportunities for exploration, analysis, and logical argumentation may hinder the development of CTS, particularly in the analysis and explanation dimensions, which require explicit elaboration of reasoning (Soufi and See, 2019). Importantly, CTS are not innate abilities but a set of skills that can be systematically taught, practised, and developed through appropriate instructional design (Papadopoulos and Bisiri, 2020; Bezanilla et al., 2021; Saenab et al., 2021).

The findings of this study are consistent with previous research in Indonesia, which has reported low CTS across different educational levels (Basri et al., 2019; Saputri et al., 2019; Marni et al., 2020; Sarwanto et al., 2021; Suryanti and Nurhuda, 2021). This consistency suggests that limited CTS are not merely an individual student issue but a systemic challenge related to curriculum design, instructional strategies, and assessment practices. Similar patterns have also been reported internationally, including in Malaysia (Ismail et al., 2019), the Netherlands (Van der Zanden et al., 2019), Australia (Gunawardena and Wilson, 2021), Spain (Cáceres et al., 2020), and Turkey (Palavan, 2020), indicating that the development of CTS remains a global concern in modern education.

Further analysis of differences across CTS dimensions provides important insights. The evaluation and interpretation dimensions yielded higher scores than analysis and explanation, indicating that students are relatively more capable of assessing information and understanding explicit meanings than of deconstructing arguments or articulating their own reasoning. Evaluation tasks may still be approached intuitively, relying on experience or explicit cues. In contrast, analysis and explanation require higher levels of metacognitive awareness and the ability to communicate reasoning logically and coherently.

Low achievement in the analysis and explanation dimensions also reflects students' limited exposure to open-ended reasoning tasks. When classroom assessments predominantly consist of multiple-choice questions with a single correct answer, students have few opportunities to explain their reasoning, connect concepts, or defend arguments. Consequently, their ability to analyse relationships among ideas and articulate justified explanations remains underdeveloped. These findings support the view that CTS can develop only when students are consistently engaged in cognitively demanding tasks that encourage reflection and reasoning (Gunawardena and Wilson, 2021; Li et al., 2023).

From an educational perspective, these findings have important implications. Teachers need to design instruction that emphasises not only content mastery but also students' thinking processes. Instructional approaches such as problem-based learning and project-based learning offer strategic alternatives by providing opportunities for students to analyse authentic problems, engage in discussion, and explain proposed solutions (Ulger, 2018; Seibert, 2021). In addition, assessment practices should be expanded to include essays, case analyses, or mini-projects that allow students to demonstrate their reasoning processes rather than merely selecting answers. At the policy level, these findings reinforce the importance of implementing the Independent Curriculum (Curriculum Merdeka) in ways that genuinely promote higher-order thinking skills, supported by sustained teacher professional development, adequate resources, and a school culture that values CTS.

These findings also have implications for efficiency and responsibility in education and science. In terms of efficiency, the dimensional differences identified in this study suggest that educational interventions should not be designed uniformly across all aspects of CTS. Because students showed relatively stronger performance in evaluation and interpretation but weaker performance in analysis and explanation, instructional emphasis can be directed more strategically towards the dimensions that require greater reinforcement. This would allow schools and teachers to use limited time, assessment opportunities, and professional resources more effectively. In terms of responsibility, strengthening CTS is part of education's obligation to prepare students to engage with knowledge claims in a careful, evidence-based, and ethically aware manner. In an era of widespread misinformation and rapid circulation of unverified content, promoting CTS is closely related not only to responsible educational practice but also to the broader responsibility of science education and schooling.

Overall, this study not only maps the level of CTS among junior high school students in Bali Province but also identifies specific dimensions that require greater instructional attention. The primary value of these findings lies in providing an empirical foundation for more targeted and meaningful educational interventions. By recognising that students' main weaknesses lie in analysis and explanation, educators and policymakers can design learning and assessment strategies that more effectively support the development of rational, reflective, and responsible thinking, which are essential capabilities in 21st-century education.

This research makes several significant contributions to educational studies and practice. It offers a comprehensive provincial-level mapping of students' CTS using a standardised, content-free instrument, providing a more representative picture than prior studies limited to smaller contexts. In addition, the dimension-based analysis deepens understanding of patterns of strength and weakness in students' CTS, thereby informing more focused instructional and policy interventions at the junior high school level.

Despite these contributions, several limitations should be considered when interpreting the findings. The study is limited to the geographical context of Bali Province, and the results should therefore be interpreted within the local educational context. Moreover, the cross-sectional design captures CTS at a single point in time and does not allow conclusions about development or causality. Finally, although the instrument demonstrated high reliability, reliance on written test performance may not fully capture students' CTS as enacted in authentic learning situations. Future research could address these limitations by expanding regional coverage, adopting longitudinal designs, and using qualitative or mixed-methods approaches.

CONCLUSION

This study shows that the CTS of junior high school students in Bali Province are generally still in the low category, with an average mastery level below 60%. Dimension-based analysis revealed significant differences among CTS dimensions, with evaluation and interpretation performing better than analysis and explanation. These findings indicate that students tend to be more capable of assessing and understanding information explicitly but still experience difficulties in conducting in-depth analytical reasoning and articulating their thought processes logically and structurally. This pattern reflects a more fundamental epistemic challenge in everyday learning practices, particularly in learning and assessment that remain predominantly oriented towards memorisation and single answers.

By providing a comprehensive provincial-level mapping of CTS using a standardised, content-free instrument, this study offers a strong empirical basis for developing more targeted and responsible learning strategies, assessments, and educational policies to strengthen junior high school students' CTS. In the context of 21st-century education, which is complex and characterised by massive information flows, strengthening CTS is no longer merely a normative goal but a fundamental need to equip the younger generation with rational thinking skills. Accordingly, the study contributes to the promotion of both efficiency and responsibility in education by providing empirical evidence that can guide more targeted resource allocation, more focused instructional improvement, and more accountable efforts to strengthen students' CTS.

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