Development and Rasch Validation of a Critical Thinking Scale for Adolescents in the Post-Truth Era

Hanun Qurrata 'Aynayya Firdausi, Wahyu Nanda Eka Saputra*, Sri Tutur Martaningsih, Agus Ria Kumara, Agus Supriyanto

Universitas Ahmad Dahlan, Yogyakarta, Indonesia
*Corresponding author, email: wahyu.saputra@bk.uad.ac.id

https://doi.org/10.17977/um065.v7.i4.2027.13

Article history
Submitted: 18 July 2026
Revised: 28 September 2026
Accepted: 14 October 2026
Published: 16 October 2026

Keywords
Adolescents
Critical thinking
Rasch model

Abstract
Critical thinking is an essential competency for adolescents in the post-truth era, particularly when responding to complex digital information. This study developed and evaluated a critical thinking instrument for adolescents using the Rasch Model, involving 758 students from senior high schools and vocational high schools in Yogyakarta. The instrument was constructed based on four indicators: interpretation, analysis, evaluation, and drawing conclusions. Data were analyzed using Winstep to assess item quality, reliability, difficulty, item fit, and unidimensionality. The results showed very high item reliability (0.99) with a 10-item fit, although participant reliability was low (0.40). Raw variance was explained by 24.9%, indicating acceptable unidimensionality. The implications of this study are that the developed instrument can be utilized by teachers and counselors as a tool to map students' initial critical thinking abilities, thereby enabling the design of learning programs that are more targeted and data-driven.

1. Introduction

In the post-truth era, one essential trait that adolescents must possess is critical thinking, which requires them to be more discerning when receiving information disseminated on social media. Critical thinking is a skill that demands individuals analyze, evaluate, and interpret information logically before making decisions or drawing conclusions (O'Reilly et al., 2022; Raj et al., 2022; Zwiers & Crawford, 2023). Critical thinking enables individuals to weight the truth, examine meaning, and determine a course of action rationally and responsibility (Geng, 2021). In an educational context, learning activities are designed to bring about changes in students' knowledge, behavior, attitudes, skills, and habits, so that the learning process can achieve its intended goals (Utami et al., 2020). In line with this, critical thinking serves as the foundation for the development of intellectual competencies that enable students not only to passively receive knowledge but also to construct understanding through reflective reasoning (Alsaleh, 2020; Chusni et al., 2020). Therefore, critical thinking plays a vital role in shaping a mindset that is adaptive to the changes and complexities of modern life's challenges (Shiraev & Levy, 2024; Tang et al., 2020).

The problems that arise when adolescents have low levels of critical thinking include being easily influenced by misinformation and having poor problem-solving skills. In addition, adolescents tend to follow group decisions due to difficulties in expressing their opinions assertively (Ghifaa Rina et al., 2026). The low level of critical thinking among school-aged adolescents is a major concern because it is essential for facing the challenges of a digital ages and globalization, however, many students demonstrate moderate to low levels of critical thinking, particularly in the areas of analysis, drawing conclusions, and evaluation (Lin & Shih, 2022; Patandung, 2023). In the school context, adolescents' critical thinking skills are often hindered by internal factors such as a tendency to rely on rote memorization and weak argumentation skills, as well as external factors such as monotonous teaching methods and a lack of open discussion (Bissonnette et al., 2021; Davies et al., 2023; Merma-Molina et al., 2022). The concept of critical thinking encompasses the ability to analyze information, evaluate arguments, make rational decisions, and maintain an open-minded attitude (Li et al., 2024; Nippold & Marr, 2022). The consequences of low critical thinking skills among adolescents can include susceptibility to misinformation, ill-considered decision-making, and low levels of active participation in social and academic life (Bissonnette et al., 2021; Patimah & Nasywa, 2025).

Critical thinking is one of the 21 st-century skills that plays a vital role in both education and the workplace, encompassing the ability to analyze, evaluate, and solve problems in a reflective manner. A number of previous studies have shown an increased focus on critical thinking research, particularly in the fields of higher education, mathematics, and science, with an emphasis on developing critical thinking skills through various learning

© 2026 The Author(s)
This is an Open Access article under the Creative Commons Attribution-ShareAlike 4.0 International License
ISSN: 2797-3174

models and assessment instrument (Dong et al., 2023; Khusna et al., 2024; Wan Hussain et al., 2025; Wicaksono et al., 2024). Nevertheless, most studies still focus on skills rather than critical thinking dispositions or attitudes and tend to be conducted at the secondary and higher education levels (Andreucci-Annunziata et al., 2023; Lopez et al., 2023). The emerging research gap lies in the scarcity of studies on the development of instruments capable of measuring critical thinking, the limited research at the elementary education level, and the need for more comprehensive and context-appropriate measurement instruments (Aktoprak & Hursen, 2022; Ayala et al., 2024; Lopez et al., 2023). Thus, efforts to develop critical thinking instruments that integrate dispositional aspects and can be applied at various educational levels are an important step toward addressing this gap (Andreucci-Annunziata et al., 2023; Ayala et al., 2024; Lopez et al., 2023; Wicaksono et al., 2024).

This study aims to develop a valid, reliable instrument for measuring critical thinking skills that is appropriate for the school learning context. The Rasch model was used to obtain more specific information about the quality of the critical thinking scale instrument. Furthermore, the Rasch model is widely used in the development of psychological instruments because it provides more detailed information regarding item and respondent characteristics (Arikunto et al., 2023). The development of this instrument is expected to help educators identify and assess students' critical thinking skills more accurately. The results of this study are expected to serve as a basis for planning more effective learning strategies and to support the strengthening of critical thinking skills within the educational curriculum (Dewi et al., 2024; Mukhlis et al., 2023; Mulyono et al., 2023; Nasution et al., 2020).

2. Method

This study focused on developing and testing the validity of an instrument to measure students' critical thinking skills in the post-truth era. The instrument developed includes four main indicators: the ability to interpret, analyze, evaluate, and draw conclusions. The instrument was validated using Rasch analysis, which provides information regarding item fit, difficulty level, item discrimination, and item information function. Rasch analysis is considered effective in producing accurate and measurable statistical data. Furthermore, this approach also provides comprehensive information regarding the reliability of the critical thinking assessment instrument to ensure that it meets the criteria for a reliable and trustworthy measurement tool.

This instrument for measuring critical thinking skills was tested using Rasch analysis. The instrument, which has undergone a validation process, includes four core indicators: interpreting, analysis, evaluating, and concluding that are based on the framework of critical thinking skills proposed by Petter A. Facione in 1990. Table 1 presents the initial design of the critical thinking scale.

Table 1. Critical Thinking Scale

Indicator	Statement Item	
	Favorable	Unfavorable
Interpreting	I identify the intentions and purposes of someone speaking about specific information (1) I can describe the information I have obtained to others (2)	I respond to others speaking to me with lighthearted banter (8)
Analyzing	I gather data to determine the truth of a piece of information (9) I solve a problem by identifying its root causes (10)	I immediately accept information presented to me (3)
Evaluating	I ask my teacher about the accuracy of the information I receive (4) I verify the accuracy of information by reading books (5)	I am swayed by information whose accuracy has not been verified (11)
Drawing Conclusions	I convey information based on multipple sources from the mass media (12)	I share information I obtain from social media (6) I trust the information I read on social media (7)

This study followed several scientific steps to develop a valid and reliable critical thinking assessment tool. First, the researchers identified students' critical thinking ability as the variable to be measured. Next, the researchers conducted a literature review, designed the instrument structure, developed test items, and had experts evaluate them. Next, the researchers pilot-tested the instrument by asking students to complete a survey via Google Forms. The collected data were then screened to determine which data were suitable for analysis. Subsequently, the researchers analyzed the data using the Rasch model to assess item fit and determine the extent to which each item effectively measures students' basic critical thinking skills.

This study involved 758 students from Muhammadiyah Senior High School and Muhammadiyah Vocational High School located in Yogyakarta. Participants were selected using stratified random sampling. Table 2 presents details on the characteristics of the selected participants.

© 2026 The Author(s)
This is an Open Access article under the Creative Commons Attribution-ShareAlike 4.0 International License
ISSN: 2797-3174

Table 2. Research Participants

No	Locations	N
1	School A	101
2	School B	85
3	School C	53
4	School D	102
5	School E	69
6	School F	30
7	School G	67
8	School H	62
9	School I	39
10	School J	97
11	School K	53
	Totals	758

Based on Table 2, this study involved 758 students from Muhammadiyah schools in Yogyakarta City, consisting of seven Muhammadiyah senior high schools and four Muhammadiyah vocational high schools. The largest number of participants came from Muhammadiyah Senior High School 4 Yogyakarta (102 students), while the smallest came from Muhammadiyah Senior High School 6 Yogyakarta (30 students). Overall, most research subjects came from Muhammadiyah high schools, totaling 507 students (66.89% of the total sample), while students from Muhammadiyah vocational high schools numbered 251 (11%). These findings indicate that the research sample encompasses various Muhammadiyah schools with a relatively varied and representative distribution of participants. Sampling focused on Muhammadiyah schools to obtain a group of respondents with relatively homogeneous characteristics, so variations in the data would better reflect the influence of the variables under study rather than differences in characteristics between school types.

This study used the Rasch model with Winstep software. The Rasch model allows researchers to analyze the relationship between respondents and test items simultaneously. This analysis is based on two main factors: the respondents' ability or level of agreement, and the difficulty level of each item. Various psychometric analysis tools were used, including summary statistics that assess respondent quality, instrument quality, and how respondents interact with each item. Developing and validating this instrument provides information on item difficulty (which items are easiest and hardest for respondents to agree with), item fit (the suitability of items), and unidimensionality (to ensure the instrument measures the intended construct).

3. Results and Discussion

3.1. Results

The validation of the critical thinking instrument was one of the main focuses of this study and its findings. Through Rasch analysis, this study produced four main descriptions of the data analysis related to construct validity. The first description covers the quality of the instrument and the quality of the respondents, as well as the interaction between respondents and items. Second, the research findings also identified the items that respondents found easiest and most difficult to agree with. The third finding involved determining which items were classified as "fit" or "misfit". Finally, the last finding assessed the instrument's ability to measure the intended construct. These steps confirm the instrument's reliability in measuring students' level of critical thinking.

The first section provides a description of the descriptive statistics. The data were obtained from a Rasch analysis conducted using Winstep software. The summary statistics provide a comprehensive overview of the instrument's quality form the respondents' perspective, as well as the relationship between individuals and test items. The analysis results show that the Pearson Measure represents the respondents' average scores on the critical thinking scale. As Shown in the table, the logit value of the Pearson measure is +0.60. According to the criteria in the Rasch model, a Pearson measure value above with the statements presented in the instrument. The descriptive statistics are detailed in Table 3.

Table 3. Description Summary Statistics

No	Information	Coefficient
1	The person measure	0.60
2	Cronbach's Alpha	0.50
3	Person reliability	0.40
4	Item realiability	0.99
5	Raw variance explained by measure	24.9%
6	Unexplain variance	24.0%
7	MEAN	0.60
8	S.D.	0.65

© 2026 The Author(s)
This is an Open Access article under the Creative Commons Attribution-ShareAlike 4.0 International License
ISSN: 2797-3174

Cronbach's alpha was used to assess the overall reliability of the interaction between respondents and the items. Based on Table 3, a Cronbach's alpha value of 0.50 falls into the low category according to the Rasch model. The person reliability value of 0.40 is also considered weak, indicating that the consistency of respondents' answers on the critical thinking instrument still needs improvement. In contrast, item reliability reached 0.99, which falls into the very high category, indicating that the instrument's items are of very high quality and can optimally distinguish respondents' abilities.

The unidimensionality of the instrument was assessed to determine whether the measurement tool truly measures a single construct, namely critical thinking ability. The raw variance explained by the measure (24.9%) meets the minimum threshold of 20%; however, the unexplained variance (24.0%) is relatively high, suggesting the possibility of other dimensions. The mean value of 0.60 logits and a standard deviation of 0.65 logits indicate that respondents' ability is slightly higher than the difficulty level of the items, which have moderate ability variation; thus, the instrument remains capable of distinguishing ability levels among respondents. Overall, this instrument is suitable for assessing differences in respondents' abilities. Table 4 presents data related to item measure and item fit order. Item measure indicates the difficulty level of a statement for respondents, while item fit order ranks statements from most to least consistent with the Rasch model, allowing assessment of each statement's quality.

Table 4. Item measure and item fit order

Item number	Coefficient of MEASURE	Coefficient if INFIT MNSQ	Annotation
3	0.95	1.15	Misfit
6	0.80	1.26	Misfit
8	0.74	1.21	Fit
7	0.33	0.91	Fit
5	0.20	1.09	Fit
12	0.08	1.03	Fit
11	-0.15	0.38	Fit
2	- 0.46	0.71	Fit
4	-0.50	0.94	Fit
9	-0.62	0.80	Fit
10	-0.63	0.84	Fit
1	-0.74	0.59	Fit

Table 4 shows the variation in item difficulty among respondents. The first part of the table highlights the most detailed and complex items. Based on the item measure, item 3, with a logit of 0.95, is the most difficult to agree with, indicating greater cognitive effort or personal reflection. Conversely, item 1, with a logit of -0.74, is the easiest to agree with, indicating a stronger alignment with the respondents' experiences or perspectives. These differences in difficulty levels provide insight into how respondents interact with the content of the items.

In the second part of the analysis, Table 4 presents the Rasch model and item fit order to identify items that fit the model and those that do not (misfit). This method compares the sum of the MEAN and S.D. values with the MNSQ INFIT value if the logit exceeds the sum of the MEAN and S.D., the item in categories as a misfit. Based on Table 4, the optimal value is 1.25 (0.60 + 0.65). The analysis results indicate misfit items, namely item 3 with 0.95 and item 6 with 0.80, because their MNSQ INFIT values exceed the threshold. The next section presents the variable maps. Variable maps illustrate the distribution of respondents' ability and the difficulty level of the items.

Based on the analysis in Figure 1, this map was generated using Rasch analysis in Winsteps, showing respondents' ability on the left and item difficulty on the right. Based on the map, majority of respondents have a logit above the average of 0, indicating their ability to answer the instrument's item well. Item 3, with a logit of 0.95, was the most difficult for respondents to agree with, while item 1, with a logit of -0.74, was the easiest for respondents to agree with.

© 2026 The Author(s)
This is an Open Access article under the Creative Commons Attribution-ShareAlike 4.0 International License
ISSN: 2797-3174

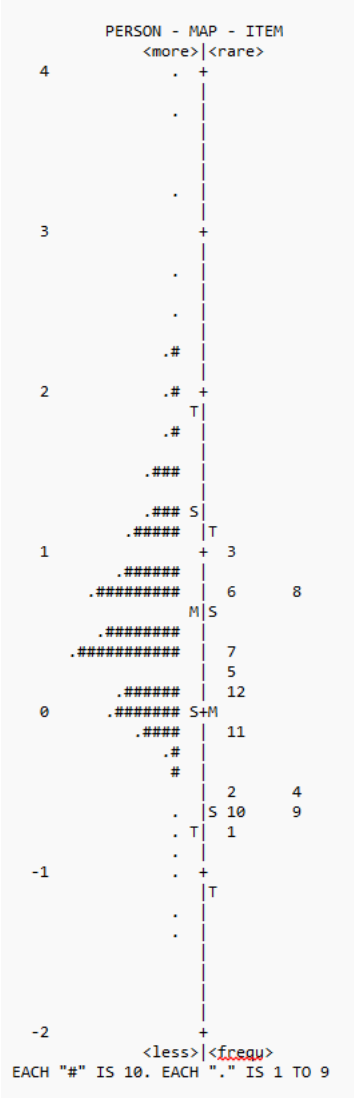


Figure 1. Variable Maps

3.2. Discussion

Based on a Rasch analysis using Winstep, the Adolescent Critical Thinking Scale in the Post-Truth Era demonstrated very high item reliability (0.99), indicating that the hierarchy of item difficulty levels is relatively stable based on the responses of 758 participants. However, a person reliability of 0.40 and a Cronbach's Alpha of 0.50 suggest that the instrument's ability to distinguish participants' levels of critical thinking remains limited. This suggests that the instrument's limitations are more closely related to the items' sensitivity in capturing variation in respondents' abilities and the alignment of item difficulty with participants' abilities. Therefore, at this stage, the instrument is better used as an initial assessment and needs evaluation considering item characteristics, respondents' abilities, and the structure of the construct being measured (Mohammadi et al., 2022; M. P. Rodríguez-Rojas et al., 2024).

Other findings indicate that the respondents' average ability level was +0.60 logits, higher than the average item difficulty level. This suggests that most items were relatively easy for the respondents, meaning the instrument is not yet optimal for assessing participants with higher levels of critical thinking ability. This mismatch in item-person targeting may contribute to low person reliability because the instrument is less sensitive in distinguishing participants with similar or higher abilities. Therefore, item characteristics need to be tailored to the target population to make the measurement more relevant and informative (Liu et al., 2026; Martínez-Huamán et al., 2025). Future development should include items with higher cognitive demands, such as evaluating the quality of evidence, comparing information sources, identifying biases or weaknesses in arguments, providing reasons for decisions, and drawing conclusions based on evidence.

The distribution of item difficulty levels indicates variation in cognitive demands. Item 3 is the most difficult (+0.95 logit), while item 1 is the easiest (-0.74 logit), suggesting that each item requires a different level of critical thinking. More difficult items can encourage participants to consider evidence and evaluate

© 2026 The Author(s)
This is an Open Access article under the Creative Commons Attribution-ShareAlike 4.0 International License
ISSN: 2797-3174

information before drawing conclusions, whereas items that are too easy are less effective at distinguishing participants with higher critical thinking abilities. Therefore, scale development must account for gradations in difficulty and variations in cognitive demands so that participants' abilities at various levels can be measures more effectively (Mohammadi et al., 2022; M. P. Rodríguez-Rojas et al., 2024). The addition of further items should consider not only quantity but also the diversity of cognitive demands to ensure a more even distribution of difficulty and more precise measurement.

Beyond difficulty distribution, items that misfit the Rasch model also provide important information for instrument development. Items 3 and 6, which show signs of a misfit, do not necessarily need to be removed, but may indicate that participants' responses are influenced by content characteristics or the way the items are understood. For items related to the reception and dissemination of information, participants' responses may reflect not only critical thinking skills but also their experience with social media, information-seeking habits, and media and information literacy (Orosz et al., 2024). Therefore, these misfits should be addressed through content analysis, cognitive interviews, or testing on a different sample to ensure the items align with the construct being measured. These findings can then serve as the basis for refining the wording and context of the items so that the tasks presented truly represent the construct of critical thinking.

The limitations of unidimensionality must be understood because critical thinking involves several interrelated processes and dispositions. The results of the study show that the raw variance explained by the measure was 24.9% and the unexplained variance in the first contrast was 24.0%, indicating that the main construct can still be identified, although there is residual variation that warrants attention. Disposition of critical thinking among high school students may include systematic-analyticity, open-mindedness, confidence in reasoning, reflective skepticism, and truth-seeking, whereas, among Peruvian adolescents, specific contexts supported a unidimensional structure (Liu et al., 2026; Martínez-Huamán et al., 2025). These differences suggest that population characteristics, cultural context, and construct definitions can shape the structure of critical thinking. Therefore, this study's unidimensionality findings should be examined through construct validation, rather than treated solely as a technical limitation of Rasch analysis.

These findings are particularly relevant in the post-truth era, when adolescents face a rapid and diverse flow of digital information, making the ability to evaluate source credibility, examine evidence, and distinguish reliable information increasingly important (Orosz et al., 2024). Among adolescents, the ability to recognize misinformation is linked to information evaluation processes and individual cognitive characteristics, while the development of the Media and Information Literacy for Critical Thinking protocol emphasizes information evaluation, misinformation, reflection, and decision-making in the use of social media (Orosz et al., 2024; Viguer & Picó-Garcés, 2025). Therefore, a critical thinking scale should incorporate authentic situations that require participants to evaluate sources, examine and compare evidence, and make reasoned decisions. Thus, the "post-truth" context serves not only as a theoretical backdrop but must also be reflected in the characteristics of the items developed.

The unidimensionality results also indicate the need to reconsider combining critical thinking skills and dispositions into a single instrument. Critical thinking skills relate to the cognitive processes involved in analyzing and evaluating information, whereas dispositions refer to an individual's tendency to apply those processes when facing a problem (Liu et al., 2026). Although interrelated, the two are not always the same construct, as dispositions can encompass openness to alternative ideas, confidence in reasoning, reflective skepticism, and the pursuit of truth (Liu et al., 2026). Therefore, this study's finding of unidimensionality can serve as a basis for evaluating whether skills and dispositions should be maintained as a single construct or analyzed as separate dimensions. Further testing through factor analysis, multidimensional Rasch modeling, or other construct validation approaches is needed to determine the most appropriate instrument structure.

In practice, this instrument can be used as an initial assessment in guidance and counseling services to identify students' needs in dealing with academic and digital information. The result can serve as a basis for designing services related to information or arguments. However, because the test's reliability is still low, the measurement results should not be used as the sole basis for making consequential individual decisions; rather, they should be supplemented with observations, interviews, performance tasks, or other relevant assessments. Furthermore, using instruments developed in accordance with the characteristics of the adolescent population is more important for generating information that is more relevant to students' development and context (Liu et al., 2026; Martínez-Huamán et al., 2025).

Based on the overall findings, future development of the instrument should focus on improving item-person targeting, adding items with a higher level of difficulty, revising items that show misfit, and conducting a more comprehensive test of the credibility of sources, evaluating evidence supporting a claim, identifying flaws in reasoning, and determining which information needs to be verified before being shared- all in line with the information literacy needs of adolescents in the digital environment (Orosz et al., 2024). Future research should also involve a more diverse group of participants and conduct DIF analysis to identify potential differences in item functioning across groups. Such development is expected to result in an instrument with a more

© 2026 The Author(s)
This is an Open Access article under the Creative Commons Attribution-ShareAlike 4.0 International License
ISSN: 2797-3174

appropriate item hierarchy, more accurate ability to distinguish between participants, a clearer construct structure, and greater sensitivity to the characteristics of adolescents' critical thinking in a digital information environment.

3.2.1. Implications

The development of a critical thinking scale based on the Rasch Model is expected to produce a measurement tool that is more equitable, accurate, and easily adaptable across contexts, thereby benefiting teachers, counselors, and policymakers in initial diagnosis for monitoring development and evaluating the effectiveness of critical thinking learning interventions (Fajari & Chumdari, 2021; Khusna et al., 2024). Thus, the use of the Rasch Model not only strengthens the psychometric foundation of the instrument but also provides more reliable empirical data for designing learning strategies, guidance, and policies that support the sustainable development of critical thinking in adolescents (Andreucci-Annunziata et al., 2023; Rahmawati et al., 2025; M.-P. Rodríguez-Rojas et al., 2024).

3.2.2. Limitations

Although this study provides strong empirical evidence, several limitations warrant attention. The study sample was limited to students at Muhammadiyah high schools and vocational high schools in the Yogyakarta region therefore, generalizing the findings to a broader adolescent population should be done with caution. These limitations include differences in cultural and religious backgrounds, school types, and regional characteristics. Additionally, the instrument was tested only on a limited scale and in a limited geographic area. Therefore, future research should include a larger sample, more diverse participant criteria, and broader geographic and cultural contexts to strengthen the instrument's external validity.

4. Conclusion

This study produced a critical thinking instrument for adolescents in the post-truth era, developed using the Rasch Model and shown to have strong psychometric quality. The analysis results showed very high item reliability, with most items falling into the 'fit' category, enabling the instrument to map students' critical thinking abilities in the areas of interpretation, analysis, evaluation, and drawing conclusions. Although the test-taker reliability and unidimensionality of the instrument still need improvement, and there are several items that require refinement, this instrument has the potential to be used as a tool for the initial assessment of critical thinking skills and can be utilized by educators and school counselors in designing more targeted instruction and guidance counseling services.

Author Contributions

All authors contributed equally to this paper. All authors have read and approved the final manuscript.

Funding

No funding support was received.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethics and Consent Declarations

We are provide a clear justification in accordance with applicable regulations or institutional guidelines. Additionally, state whether consent for publication was obtained where relevant, particularly if any identifiable information is included.

Data Availability

The datasets generated during and/ or analyzed during the current study are available from the corresponding author on reasonable request.

Declaration on AI Use

AI were used only to improve readability and language under strict human oversight; no content, ideas, analyses, or conclusions were generated by AI.

Acknowledgment

The authors thank Universitas Ahmad Dahlan, particularly the Master's Program in Guidance and Counseling, for the academic support and facilities provided during the preparation of this article. We also thank all parties who contributed, provided feedback, and offered support, enabling the completion of this article.

© 2026 The Author(s)
This is an Open Access article under the Creative Commons Attribution-ShareAlike 4.0 International License
ISSN: 2797-3174

References

Aktoprak, A., & Hursen, C. (2022). A bibliometric and content analysis of critical thinking in primary education. *Thinking Skills and Creativity, 44*, Article 101029. https://doi.org/10.1016/j.tsc.2022.101029

Alsaleh, N. J. (2020). Teaching critical thinking skills: Literature review. *The Turkish Online Journal of Educational Technology, 19*(1), 21–39.

Andreucci-Annunziata, P., Riedemann, A., Cortés, S., Mellado, A., del Río, M. T., & Vega-Muñoz, A. (2023). Conceptualizations and instructional strategies on critical thinking in higher education: A systematic review of systematic reviews. *Frontiers in Education, 8*, Article 1141686. https://doi.org/10.3389/feduc.2023.1141686

Arikunto, S., Saputra, W. N. E., Khoirunnisa, D. A., & Sawai, R. P. (2023). Development and validation of teacher competency perception scale in Indonesia: The Rasch analysis. *Journal of Professional Teacher Education, 1*(1), 11–21. https://doi.org/10.12928/jprotect.v1i1.491

Ayala, E., Fuertes, W., & Jarrin, F. (2024). Critical thinking skills in research process: A literature review. An input to propose a new measurement instrument to gauge critical thinking. *International Journal of Religion, 5*(11), 1–14. https://doi.org/10.61707/pwy5df19

Bissonnette, M., Chastenay, P., & Francoeur, C. (2021). Exploring adolescents' critical thinking aptitudes when reading about science in the news. *Journal of Media Literacy Education, 13*(1), 1–13. https://doi.org/10.23860/JMLE-2021-13-1-1

Chusni, M. M., Saputro, S., Suranto, & Rahardjo, S. B. (2020). Review of critical thinking skill in Indonesia: Preparation of the 21st century learner. *Journal of Critical Reviews, 7*(9), 1230–1235. https://doi.org/10.31838/jcr.07.09.223

Davies, M., Xie, Y., & Girard, P. (2023). Valuing adolescent students' street smarts to foster critical thinking. *European Journal of Education, 58*(3), 447–461. https://doi.org/10.1111/ejed.12567

Dewi, A. K., Prayitno, B. A., & Mahardiani, L. (2024). Development of an environment-based critical thinking skills test instrument for class VII middle school science learning. *Jurnal Penelitian Pendidikan IPA, 10*(8), 5759–5767. https://doi.org/10.29303/jppipa.v10i8.7748

Dong, M., Li, F., & Chang, H. (2023). Trends and hotspots in critical thinking research over the past two decades: Insights from a bibliometric analysis. *Heliyon, 9*(6), Article e16934. https://doi.org/10.1016/j.heliyon.2023.e16934

Fajari, S. L. E. W., & Chumdari. (2021). Critical thinking skills and their impacts on elementary school students. *Malaysian Journal of Learning and Instruction, 18*(2), 161–187. https://doi.org/10.32890/mjli2021.18.2.6

Geng, H. (2021). Redefining the role of teachers in developing critical thinking within the digital era. In *Proceedings of the 2021 International Conference on Modern Educational Technology and Social Sciences (ICMETSS 2021)* (pp. 18–21). Atlantis Press. https://doi.org/10.2991/assehr.k.210824.005 Atlantis Press

Ghifaa Rina, S., Muyana, S., & Supriyanto, A. (2026). Dampak tekanan teman sebaya terhadap terbentuknya kemampuan asertif remaja Gen Alpha. *Jurnal Kajian Teori dan Praktik Kependidikan, 11*(3), 138–147. https://doi.org/10.17977/um027v11i32026p138-147

Khusna, A. H., Siswono, T. Y. E., & Wijayanti, P. (2024). Research trends in critical thinking skills in mathematics: A bibliometric study. *International Journal of Evaluation and Research in Education, 13*(1), 18–30. https://doi.org/10.11591/ijere.v13i1.26013

Li, S., Wang, Z., & Sun, Y. (2024). Relationship between thinking dispositions, working memory, and critical thinking ability in adolescents: A longitudinal cross-lagged analysis. *Journal of Intelligence, 12*(6), Article 52. https://doi.org/10.3390/jintelligence12060052

Lin, W.-L., & Shih, Y.-L. (2022). Developmental trends of different creative potentials in relation to adolescents' critical thinking abilities. *Thinking Skills and Creativity, 43*, Article 100979. https://doi.org/10.1016/j.tsc.2021.100979

Liu, W., Ma, H., Ma, S., Chen, Y., & Li, G. (2026). The development and validation of a critical thinking disposition scale for high school students. *Acta Psychologica, 262*, Article 106055. https://doi.org/10.1016/j.actpsy.2025.106055

Lopez, M. Y., Mendoza, E. R., Lumpas, R. S., & Lopez, M. A. A. (2023). Critical thinking research: A scoping review on research gaps. *The Normal Lights, 17*(1). https://doi.org/10.56278/tnl.v17i1.1921

Martínez-Huamán, H., Turpo-Chaparro, J. E., & Abanto-Ramírez, C. D. (2025). Psychometric properties of the critical thinking disposition scale in Peruvian adolescents. *Frontiers in Education, 10*, Article 1537797. https://doi.org/10.3389/feduc.2025.1537797

Merma-Molina, G., Gavilán-Martín, D., & Urrea-Solano, M. (2022). Actively open-minded thinking, personality and critical thinking in Spanish adolescents: A correlational and predictive study. *International Journal of Instruction, 15*(2), 579–600. https://doi.org/10.29333/iji.2022.15232a

Mohammadi, M., Abbasian, G. R., & Siyyari, M. (2022). Adaptation and validation of a critical thinking scale to measure the 3D critical thinking ability of EFL readers. *Language Testing in Asia, 12*, Article 24. https://doi.org/10.1186/s40468-022-00173-6

Mukhlis, M., Suwandi, S., Rohmadi, M., & Setiawan, B. (2023). Higher order thinking skills in reading literacy questions at vocational high schools in Indonesia. *International Journal of Language Education, 7*(4). https://doi.org/10.26858/ijole.v7i4.37603

© 2026 The Author(s)
This is an Open Access article under the Creative Commons Attribution-ShareAlike 4.0 International License
ISSN: 2797-3174

Mulyono, Y., Suranto, Yamtinah, S., & Sarwanto. (2023). Development of critical and creative thinking skills instruments based on environmental socio-scientific issues. *International Journal of Instruction, 16*(3), 691–710. https://doi.org/10.29333/iji.2023.16337a

Nasution, Y. S., Syahputra, E., & Mulyono. (2020). The development of learning instrument using problem based learning model to improve critical thinking of junior high school students. *Budapest International Research and Critics in Linguistics and Education (BirLE) Journal, 3*(3), 1501–1508. https://doi.org/10.33258/birle.v3i3.1223

Nippold, M. A., & Marr, E. (2022). Philosophy for adolescents: Using fables to support critical thinking and advanced language skills. *Language, Speech, and Hearing Services in Schools, 53*(3), 786–802. https://doi.org/10.1044/2022_LSHSS-21-00142

O'Reilly, C., Devitt, A., & Hayes, N. (2022). Critical thinking in the preschool classroom: A systematic literature review. *Thinking Skills and Creativity, 46*, Article 101110. https://doi.org/10.1016/j.tsc.2022.101110

Orosz, G., Faragó, L., Paskuj, B., & Krekó, P. (2024). Strategies to combat misinformation: Enduring effects of a 15-minute online intervention on critical-thinking adolescents. *Computers in Human Behavior, 159*, Article 108338. https://doi.org/10.1016/j.chb.2024.108338

Patandung, Y. (2023). Adolescence students' critical thinking skills in the context of Christian education. *International Journal of Asian Education, 4*(3), 150–156. https://doi.org/10.46966/ijae.v4i3.349

Patimah, L., & Nasywa, A. A. (2025). Critical thinking analysis of the perspective of Islamic education psychology study of teenager development. *EDUSOSHUM: Journal of Islamic Education and Social Humanities, 5*(3), 505–514. https://doi.org/10.52366/edusoshum.v5i3.153

Rahmawati, A. S., Hamidah, I., Samsudin, A., & Rochintaniawati, D. (2025). Review of relevant literature about critical thinking skills in a science perspective. *Jurnal Penelitian Pendidikan IPA, 11*(5), 56–67. https://doi.org/10.29303/jppipa.v11i5.9687

Raj, T., Chauhan, P., Mehrotra, R., & Sharma, M. (2022). Importance of critical thinking in education. *World Journal of English Language, 12*(3), 126–133. https://doi.org/10.5430/wjel.v12n3p126

Rodríguez-Rojas, M.-P., Ramírez-Segura, A.-M., Valenzuela-Mora, P., Dampuré, J., & Riveros Munévar, F. (2024). Critical thinking evaluation scale: Design and validation in a Colombian population. *SAGE Open, 14*(4). https://doi.org/10.1177/21582440241297418

Shiraev, E. B., & Levy, D. A. (2024). *Cross-cultural psychology: Critical thinking and contemporary applications*. Routledge. https://doi.org/10.4324/9781003354567

Tang, T., Vezzani, V., & Eriksson, V. (2020). Developing critical thinking, collective creativity skills and problem solving through playful design jams. *Thinking Skills and Creativity, 37*, Article 100696. https://doi.org/10.1016/j.tsc.2020.100696

Utami, S. R., Saputra, W. N. E., Suardiman, S. P., & Kumara, A. R. (2020). Peningkatan self-regulated learning siswa melalui konseling ringkas berfokus solusi. *Counsellia: Jurnal Bimbingan dan Konseling, 10*(1), 1–13. https://doi.org/10.25273/counsellia.v10i1.4730 13.

Viguer, P., & Picó-Garcés, M. J. (2025). Development and validation of an intervention protocol to promote media and information literacy for critical thinking in adolescents' use of social media. *Social Sciences & Humanities Open, 12*, Article 101807. https://doi.org/10.1016/j.ssaho.2025.101807

Wan Hussain, W. N. H., Mohd Fadzil, H., & Mohd Shahali, E. H. (2025). Critical thinking in science education: A bibliometric analysis. *International Journal of Education, Psychology and Counseling, 10*(57), 257–282. https://doi.org/10.35631/ijepc.1057016

Wicaksono, A. G., Sunarno, W., Saputro, S., & Prayitno, B. A. (2024). A systematic literature review of research trends on critical thinking skills. *SHS Web of Conferences, 182*, Article 01002. https://doi.org/10.1051/shsconf/202418201002

Zwiers, J., & Crawford, M. (2023). *Academic conversations*. Routledge. https://doi.org/10.4324/9781032680514

© 2026 The Author(s)
This is an Open Access article under the Creative Commons Attribution-ShareAlike 4.0 International License
ISSN: 2797-3174