The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational and Social Sciences (EPESS), 2025

Volume 41, Pages 90-98

ICETI 2025: International Conference on Education in Technology and Innovation

Trend of Critical Thinking Skill Research in Indonesian Mathematics Education: A Literature Review on Scopus Database

Rindi Antika
Universitas Pendidikan Indonesia
Universitas Maritim Raja Ali Haji

Turmudi Turmudi
Universitas Pendidikan Indonesia

Rizky Rosjanuardi
Universitas Pendidikan Indonesia

Dadang Juandi
Universitas Pendidikan Indonesia

Abstract: Critical thinking skill is one of the goals of 21st century education. The purpose of this study is to review the articles that had been published in Scopus indexed journals since 2013 to 2023 with critical thinking skill as the main focus and Indonesia as the location of study. This research investigate the period of publication, demographics, education level, data collection instrument, and data analysis method of 47 inclusion articles. This article is a Systematic Literature Review (SLR) of 47 research published until 2023 with the help of the Publish or Perish (PoP) application with the Scopus database. This study based on a quantitative descriptive approach using the PRISM protocol, including the identification, screening, eligibility, and included stages. The results has revealed that in the past two years, the number of publications with Scopus indexed that focused on mathematical critical thinking skill had decreased. Senior high school student were mostly chosen as the research subjects; The Java region dominates research location. The most dominant research designed was quantitative. Test and descriptive analysis were the most commonly-used instrument and analysis method. For future researchers, it is recommended to conducting research on mathematical critical thinking skill at the elementary school level, doing research outside Java Island, increasing the heterogenity of research approaches, choosing more data collecting instruments and data analysis techniques.

Keywords: Critical thinking skills, Systematic literature review, Mathematics education

Introduction

The ability to think critically is crucial to develop because critical thinking is one of the essential skills required by every individual in the 21st century (Bellanca, 2010), especially for students as learners in facing various educational challenges in the 21st century. Critical thinking is an invaluable skill that students need for a successful professional and personal life (Ashimova, 2022). The mathematical critical thinking ability in education can help students enhance their understanding of subjects, including mathematics, taught in school by critically evaluating arguments presented in mathematics textbooks, journals, group discussions, and even arguments provided by teachers during learning activities. Mathematical critical thinking ability is one of the higher-order thinking processes that can be used in shaping students' conceptual systems. Furthermore, students' mathematical critical thinking can be developed through meaningful learning experiences. The intended meaningful experiences can take the form of opportunities to express opinions both orally and in writing.

The demands of 21st-century learning, influenced by the rapid and extensive development of science and technology, provide abundant information and positively impact the smoothness of student learning, especially for students with good critical thinking skills. Conversely, if students have low critical thinking skills, they may encounter problems or even be overwhelmed by information as a result of 21st-century learning, leading to the consumption and dissemination of various forms of misinformation. Efforts to minimize these negative impacts involve developing and enhancing the critical thinking skills of individuals, particularly in mathematics education. he ability to think critically in mathematics requires students to organize, interpret, analyze, evaluate, conclude, and interpret information in mathematical learning (Alghafri & Ismail, 2014). Based on the synthesis of several experts' opinions, mathematical critical thinking is a higher-order thinking skill that involves understanding, analyzing, and evaluating every mathematical problem to generate comprehensive and accurate solutions. Kong et al. (2014) proposed that critical thinking abilities can be categorized into five main categories, namely: (1) Hypothesis Identification, which is the ability to recognize underlying ideas or unstated assumptions based on the problem at hand. (2) Induction, which is the ability to explain a relationship between a set of specific examples in order to obtain reliable generalizations for the problem. (3) Deduction, which is the ability to reason about the relationship between a set of general statements in order to reach a logical and certain conclusion for the problem. (4) Explanation, which is the ability to argue for an idea through clarifying causes, context, and consequences regarding the facts among various aspects of the problem. (5)Evaluation, which is the ability to use a set of relevant criteria aimed at determining the quality of arguments and the outcomes that arise for the problem. The Minister of Education and Culture's Regulation No. 20 of 2016 on Competency Standards for Primary and Secondary Education Graduates state that each graduate of primary and secondary school education units must possess six competencies., namely: (1) Creative, (2) Productive, (3) Critical, (4) Independent, (5) Collaborative, (6) Communicative (Kemendikbud, 2016). Based on this description, mathematical critical thinking abilities need more attention.

Research on mathematical critical thinking skills has garnered significant attention in Indonesia, as evidenced by multiple studies such as Elmawati and Juandi (2022), Sumargiyani et al. (2021), Setiana and Purwoko (2020), Andriawan et al. (2018) and Fauzi et al. (2020). Among these, Elmawati and Juandi (2022) conducted a systematic literature review (SLR) focusing on articles indexed by Sinta, a national database. Despite of it, no SLR studies have yet utilized Scopus-indexed articles to analyze mathematical critical thinking skills, highlighting a critical gap in the current research landscape. Thus, this systematic literature review aims to answer: (1) What is the trend of publications related to mathematical critical thinking skills in Indonesia based on the year of publication? (2) What is the trend of publications related to mathematical critical thinking skills in Indonesia based on demographics? (3) What is the trend of publications related to mathematical critical thinking skills in Indonesia based on types of research?(4) What is the trend of publications related to mathematical critical thinking skills in Indonesia based on education level? (5) What is the trend of publications related to mathematical critical thinking skills in Indonesia based on data collecting instruments? (6) What is the trend of publications related to mathematical critical thinking skills in Indonesia based on data analysis method?

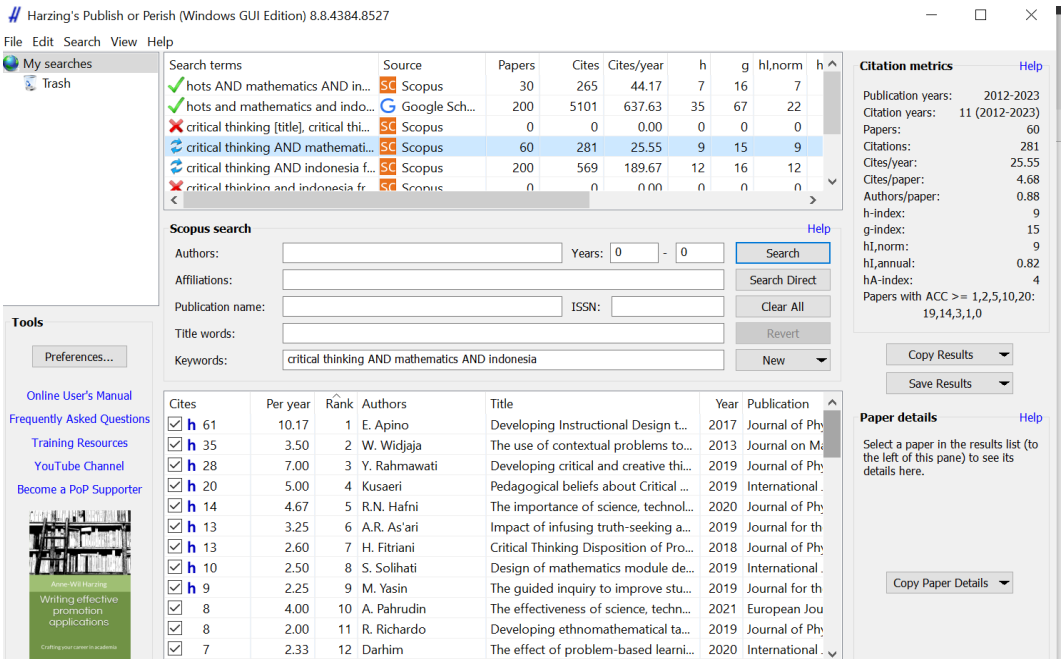

Figure 1. Screenshot of PoP

Method

This article is a Systematic Literature Review (SLR) of 47 research published until 2023 with the help of the Publish or Perish (PoP) application with the Scopus database. This study is based on a quantitative descriptive approach using the PRISM protocol, including the identification, screening, eligibility, and included stages. This study was content analysis with a document scanning method used as the research method. In this study, the articles analyzed were downloaded from the Scopus database. To obtain a list of Scopus indexed articles, the application of Publish or Perish (PoP) was accessed and the word "Critical thinking AND Mathematics AND Indonesia" was used as a keyword in the search. From these steps, 60 Indonesian mathematical articles were obtained. Furthermore, from 60 articles, only artikel with the focus of mathematics learning were selected, STEM and STEAM were included. At this step, 47 articles were obtained: The list of these 47 journals can be seen in Figure 1. This research procedure includes collecting, analyzing, and concluding. The keyword was " Critical thinking AND Mathematics AND Indonesia ". All the data collected was indexed by Scopus. The next step is to the articles sorted by inclusion criteria. Only relevant articles that fulfill the inclusion criteria will be used in this study.

Inclusion Criteria

The inclusion criteria had been defined to make review boundaries were: (1) Articles dealing with the problems of mathematics learning, STEM, or STEAM; (2) Article was indexed by Scopus; (3) Articles whose research was carried out in Indonesia; (4) Articles published until 2023.

Data Source

The data were collected by utilizing the Publish or Perish (PoP) application with databases from Scopus. The data is sorted using inclusion criteria which will determine which research will be included in the relevant collection of research that has been selected (Stapić et al., 2012). The articles that fulfil the inclusion criteria will be used in the Study (Juandi & Tamur, 2020; Jesson et al., 2011).

Table 1. The aspect and categories used for content analysis in the study

Aspect	Categories	
Types of Research	A.1	Quantitative
	A.2	Qualitative
	A.3	Mixedmethod
	A.4	R&D
	A.5	Literature Review
Research Subject	B.1	Elementary
	B.2	Junior High School
	B.3	Senior High School
	B.4	Undergraduated
	B.5	Postgraduated
	B.6	Teacher
	B.7	All Education Level
Data Collection Instrumens	C.1	questionnaire sheet
	C.2	observation sheet
	C.3	test sheet
	C.4	interview sheet
	C.5	Documentation
	C.6	Unidentified
Data Analisys Method	D.1	descriptive analisys (mean, percentage)
	D.2	N-Gain
	D.3	T-Test
	D.4	Anova
	D.5	Ancova
	D.6	Corellation
	D.7	Regresion
	D.8	Unidentified
	D.9	Others

Research Instrument

The instrument used for this current study were a set of inclusion criteria and a guideline of content analysis that contain related aspects under observation (Table 1.). Those aspects included (1) the period of publication; (2) demographics; (3) types of research; (4) research subjects; (5) data collection instruments; and (6) data analysis methods. The classification framework for the categories (e.g., research design, data collection instruments, and analysis methods) shown in Table 2 were adapted from Fauzi and Pradipta's (2018).

Data Analysis

The articles were classified into specific categories based on certain aspect that met the defined category. The decision was based on information that was shared by the authors in abstract, method, and discussion parts. Furthermore, the data that had been collected were presented in the form of bar chart and pie chart.

Results and Discussion

The results presented in 6 parts include the year of publication, demographic, types of research, education level, data collecting instruments, and data analysis method. The result based on the number of publications is presented in Figure 2.

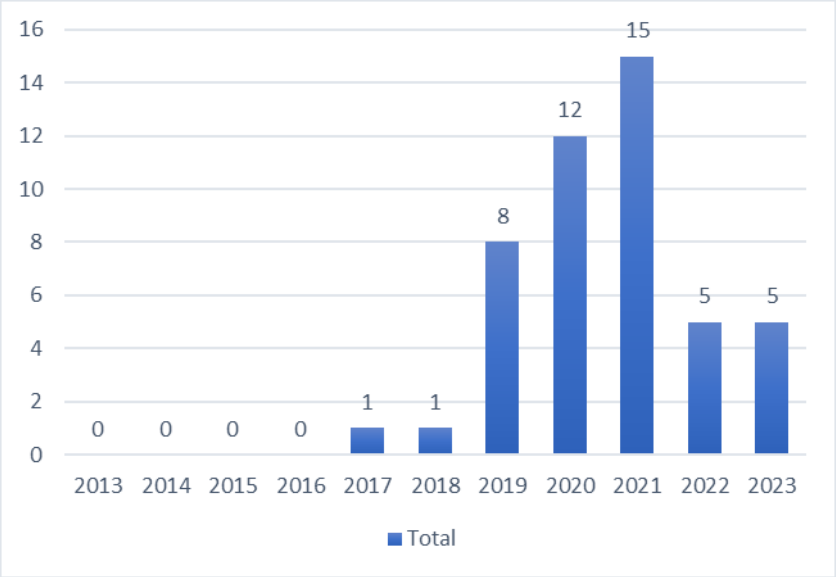

Figure 2. Trend of the number of research with critical thinking skill in mathematics education in Indonesia in 10 years

The number of article publications indicated how frequent research was conducted in certain periods. Alluding to the graph shown in Figure 1, the articles that reviewed could be found since 2017. No specific pattern of shift occurred to the number of publications from year to year. Referring to Figure 1, the number of publications since 2019 had increased higher than those in previous years. The number of publications in 2022 had decreased. The number of publications about critical thinking skill indicated the number of researchers who were fervent to investigate mathematical critical thinking skill.

The distribution of types of research is presented in Figure 3. Figure 3 highlights the predominance of quantitative methodologies in studies investigating critical thinking skills. Most studies used quantitative methods, very few used qualitative or mixed methods approaches, which shows an opportunity for methodological diversity in future research This aligns with prior research by Fauzi (2018), Goktas et al. (2012), and Uzunboylu and Asiksoy (2014), who observed a persistent preference for quantitative designs in educational research over qualitative alternatives. While qualitative approaches remain relatively nascent in educational contexts (Sharma, 2013; Fauzi, 2018), recent studies by Fauzi (2018), Shakouri (2014), and Mohajan (2018) note a gradual shift toward their adoption, particularly in social and education-related inquiries.

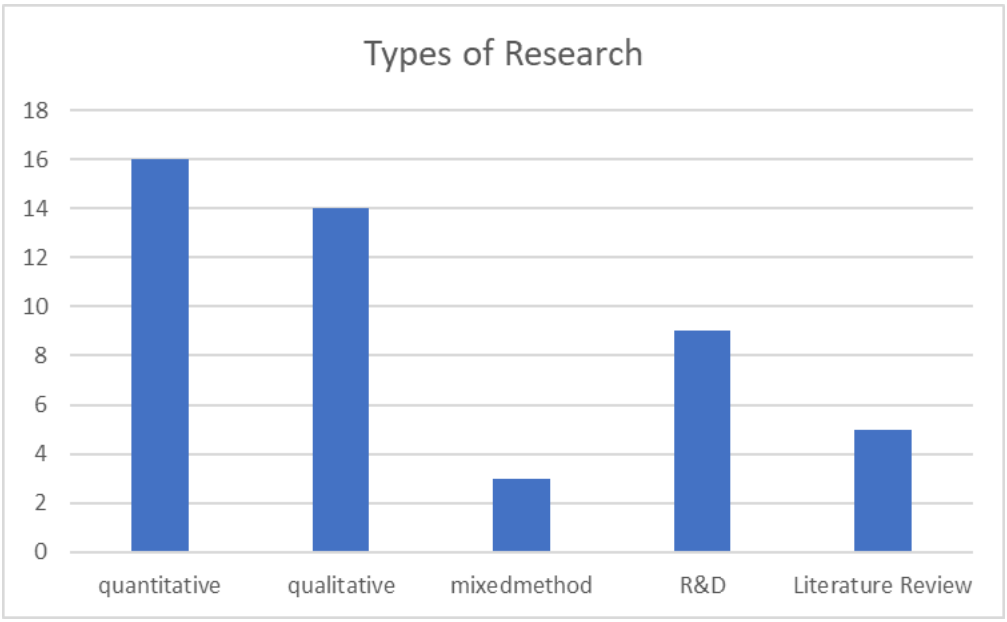

Figure 3. The distribution of research based on types of research

Qualitative methods are distinguished by their capacity to elucidate phenomena with depth and nuance, offering rich, context-specific insights. Consequently, the limited application of qualitative frameworks in existing literature presents a strategic opportunity for future researchers to leverage these methodologies, particularly in understudied areas such as mathematical critical thinking. The demographic distribution of research subjects is presented in Figure 4

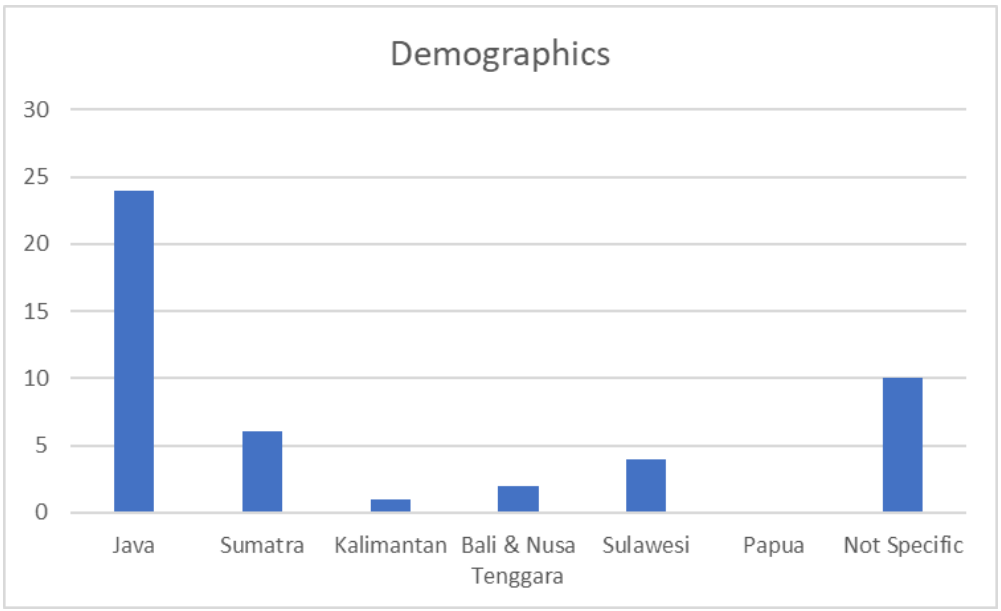

Figure 4. The distribution of research based on demographic

In figure 4, research on mathematical mathematical critical thinking skill is dominated by Java Island, no studies were found from Papua. This imbalance highlights the need for inclusive research across all regions of Indonesia. Based on research by Ariati and Juandi (2022) and Khairunnisa et al. (2022), research on mathematical abilities dominates in Java and at least in Papua. Therefore, research needs to be carried out in various provinces in Indonesia related to mathematical critical thinking skill.

The distribution of levels of research subjects is presented in Figure 5. In figure 5, senior high school students were the most common subjects. Very few studies involved elementary students, even though early development of critical thinking is crucial. At the junior high school level, there are 9 articles, at the college

level, there are 10 articles. Meanwhile, at the elementary school level, there are 3 publications of articles related to mathematical critical thinking skill.

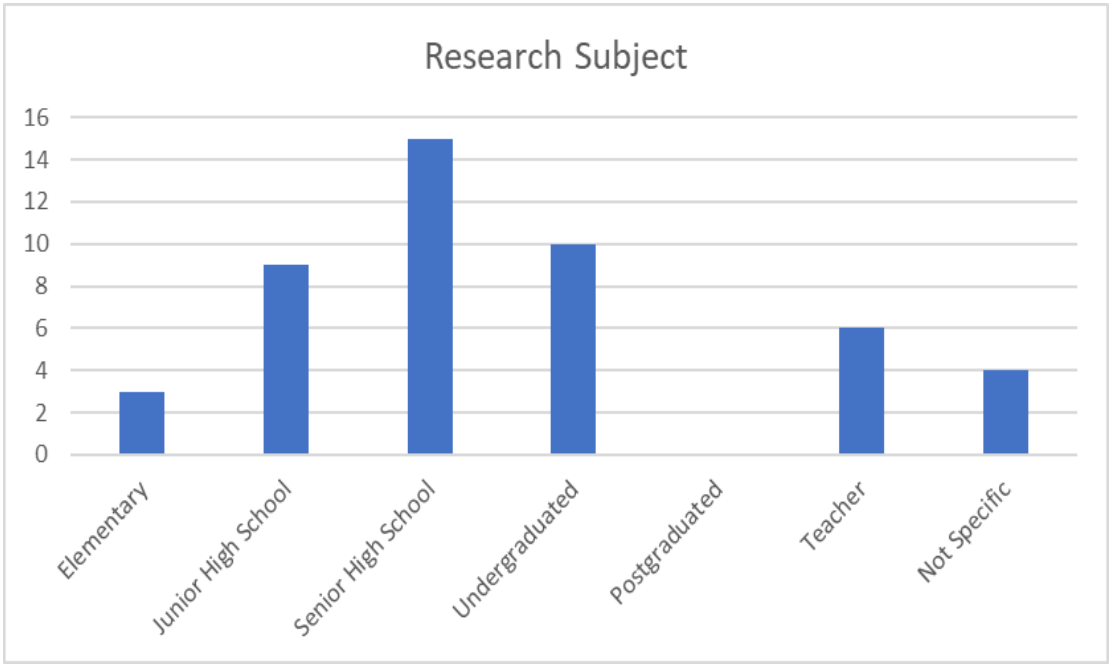

Figure 5. The distribution of research based on research subjects

The distribution of data collection instruments is presented in Figure 6

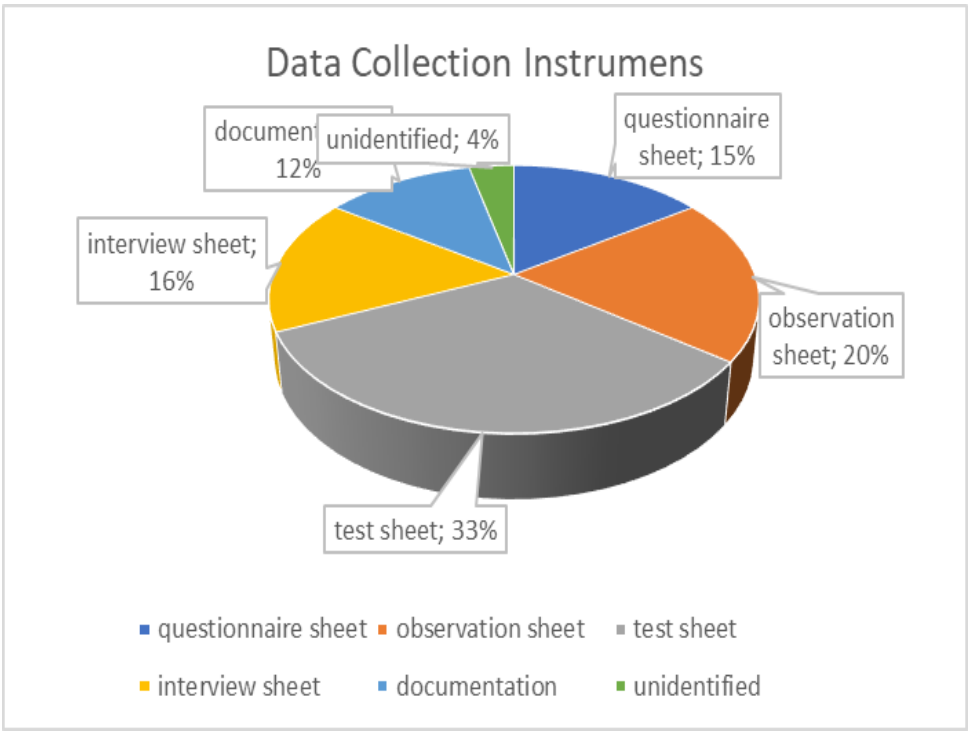

Figure 6. The distribution of research based on data collection instruments

In Figure 6, the most common data collection tool was the test, followed by observation and questionnaires. However, many studies didn't report validation procedures, which is a concern for reliability. Researchers need an instrument to help them collect the data. Students' mathematical critical thinking skills could be measured by instruments developed by previous researchers. Based on the graph shown in Figure 6, tests have been the most commonly used instrument to collect the data about mathematical critical thinking skill. Data collection by test is deemed more objective than questionnaires and observation. According to figure 6, some researchers did not

inform what instruments were used to collect the data about mathematical critical thinking skill in their papers. Some who made use of test as the main technique of data collection did not inform whether the instrument had been tested in terms of validity and reliability. It is key point that validity and reliability of instruments are to be tested before being used to collect any data (Bajpai & Bajpai, 2014; Fauzi, 2018). In other words, the information about validity and reliability is considered crucial to convince target readers. The distribution of data analysis method is presented in Figure 7

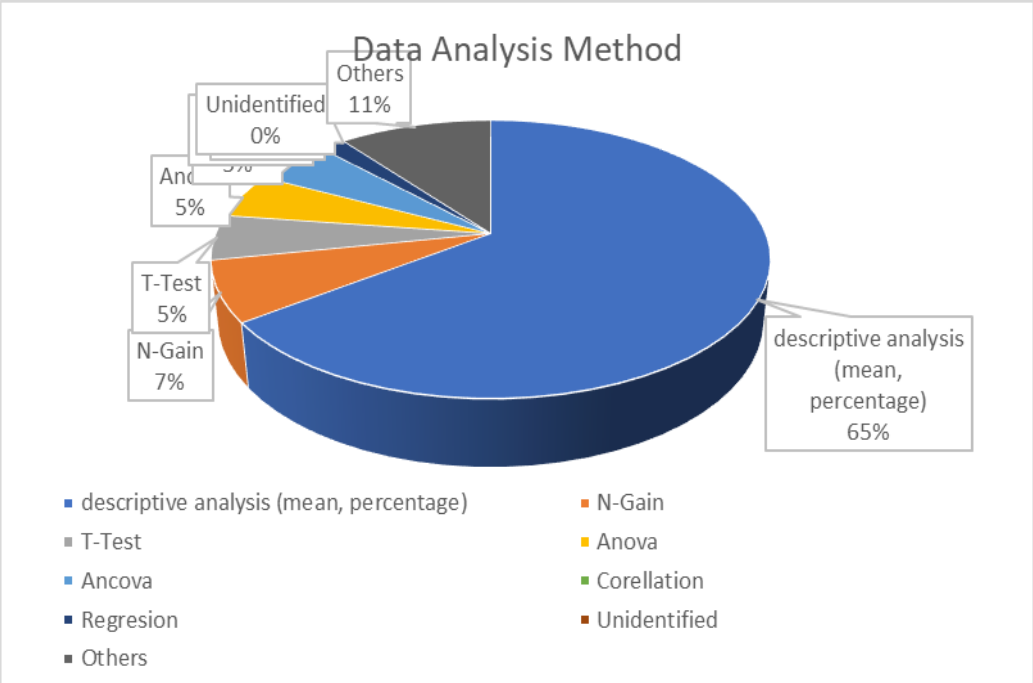

Figure 7. The distribution of research based on data analysis method

Referring to the graph shown in Figure 7, descriptive statistics were used in 65% of studies. More advanced analyses like regression and ANOVA were rare. Again, this shows room for improvement in methodological rigor.

Conclusion

This study reviewed 47 articles that had been published in Scopus indexed journals since 2013 to 2023 with critical thinking skill as the main focus and Indonesia as the location of study.The trend has been found that there was a decrease in the number of publications in the past two years. Senior high school student were mostly chosen as the research subjects; The Java region dominates research location. The most dominant research designed was quantitative. Test and descriptive analysis were the most commonly-used instrument and analysis method.

Recommendations

For future researchers, it is recommended to conduct research on mathematical critical thinking skill at the elementary school level, doing research outside Java Island, increasing the heterogenity of research approaches, choosing more data collecting instruments and data analysis techniques

Scientific Ethics Declaration

* The authors declare that the scientific ethical and legal responsibility of this article published in EPESS Journal belongs to the authors.

Conflict of Interest

* The authors declare that they have no conflicts of interest

Funding

*This work was supported and funded by Indonesian Education Scholarship (BPI), Center for Higher Education Funding and Assessment (PPAPT), and Indonesian Endowment Fund for Education (LPDP). The authors express their sincere gratitude for their invaluable assistance and financial support.

Acknowledgements or Notes

* This article was presented as an oral presentation at the International Conference on Education in Technology and Innovation (www.iceti.net) held in Trabzon/Türkiye on May 01-04, 2025

References

Alghafri, A. S. R., & Ismail, H. N. B. 2014. The effect of integrating creative and critical thinking on schools students' thinking. *International Journal of Social Science and Humanity, 4*(6), 518-525.

Andriawan, A., Setiawati, A. S., Sari, I. P., & Chotimah, S. (2018). Analisis kemampuan berpikir kritis matematis siswa smp pada materi pythagoras. *JPMI (Jurnal Pembelajaran Matematika Inovatif), 1*(4), 559.

Ariati, C., & Juandi, D. (2022). Kemampuan penalaran matematis: systematic literature review. *LEMMA: Letters Of Mathematics Education, 8*(2), 61–75.

Ashimova, N., & Turekhanova, A. (2022). Development of critical thinking of students in the learning process. *InterConf, 13*(109), 110.

Bajpai, N., & Bajpai, S. (2014). Goodness of measurement: Reliability and validity. *International Journal of Medical Science and Public Health, 3*(2), 112–115.

Bellanca, J. A. (Ed.). (2010). *21st century skills: Rethinking how students learn*. Solution Tree Press.

Elmawati, & Juandi. D. (2022). Mathematical critical thinking ability in Indonesia: systematic literature review (slr). *Symmetry: Pasundan Journal of Research in Mathematics Learning and Education, 7*(2), 210-221.

Fauzi, A. (2018). Research methods and data analysis techniques in education articles published by Indonesian biology educational journals. *JPBI (Jurnal Pendidikan Biologi Indonesia), 4*(2), 123–134.

Fauzi, F. A., Ratnaningsih, N., & Nimah, K. (2020). Analisis kemampuan berpikir kritis matematis peserta didik ditinjau dari gaya berpikir gregorc. *Journal of Authentic Research on Mathematics Education (JARME), 2*(2), 96–107.

Kemdikbud. (2019). *Pentingnya 4C untuk Menghadapi Abad 21*. GTK.Kemdikbud.Go.Id.

Khairunnisa, A., Gozali, S. M., & Juandi, D. (2022). Systematic literature review: Kemampuan pemahaman matematis siswa dalam menyelesaikan masalah matematika. *Jurnal Cendekia : Jurnal Pendidikan Matematika, 6*(2), 1846–1856.

Kong, L. N., Qin, B., Zhou, Y. Q., Mou, S. Y., & Gao, H. M. (2014). The effectiveness of problem-based learning on development of nursing students' critical thinking: A systematic review and meta-analysis. *International Journal of Nursing Studies, 51*(3), 458-469.

Mohajan, H. K. (2018). Qualitative research methodology in social sciences and related subjects. *Journal of Economic Development, Environment and People, 7*(1), 23–48.

Setiana, D. S., & Purwoko, R. Y. (2020). Analisis kemampuan berpikir kritis ditinjau dari gaya belajar matematika siswa. *Jurnal Riset Pendidikan Matematika, 7*(2), 163–177.

Shakouri, N. (2014). Qualitative research: Incredulity toward metanarrativity. *International Journal of English Language & Translation Studies, 2*(1), 21–28.

Sharma, A. (2013). *Qualitative research in education: A user's guide*. SAGE Publications.

Stapić, Z., López, E. G., Cabot, A. G., Ortega, L. de M., & Strahonja, V. (2012).Sumargiyani, Istiandaru, A., & Ainurrahman, M. A. (2021). Analisis kemampuan berpikir kritis matematis mahasiswa calon guru matematika menggunakan soal limit fungsi berbasis hots. *AdMathEdu, 11*(1), 19–28

Sumargiyani, Istiandaru, A., & Ainurrahman, M. A. (2021). Analisis kemampuan berpikir kritis matematis mahasiswa calon guru matematika menggunakan soal limit fungsi berbasis hots. *AdMathEdu, 11*(1), 19–28.

Author(s) Information

Rindi Antika
Universitas Pendidikan Indonesia
Universitas Maritim Raja Ali Haji
Bandung, West Java, Indonesia
Contact e-mail: *rindiantika89@upi.edu*

Turmudi Turmudi
Universitas Pendidikan Indonesia
Bandung, West Java, Indonesia

Rizky Rosjanuardi
Universitas Pendidikan Indonesia
Bandung, West Java, Indonesia

Dadang Juandi
Universitas Pendidikan Indonesia
Bandung, West Java, Indonesia

To cite this article:

Antika, R., Turmudi, T., Rosjanuardi, R., & Juandi, D. (2025). Trend of critical thinking skill research in Indonesian mathematics education: A literature review on Scopus database. *The Eurasia Proceedings of Educational and Social Sciences (EPESS), 41,* 90-98.