

BIBLIOMETRIC ANALYSIS OF STUDENT'S CRITICAL THINKING ABILITY IN ELEMENTARY SCHOOL

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Abstract

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One way to get students to think logically is to think critically since elementary school. Practicing critical thinking will have an impact on analyzing problems that exist around them. The aim of this research is to examine the development of research regarding the critical thinking abilities of elementary school students using a qualitative approach to the Computational Bibliometric analysis method using Vosviewer. How to use VOSviewer includes preparing data, importing it into VOSviewer, selecting the type of analysis, and processing visualization. This research includes a quantitative approach using secondary data, and data analysis using a bibliography obtained from previous scientific publications using subject and object keywords, the research subject is bibliometric analysis while the research object is a collection of research articles about primary school students critical thinking abilities. Data analysis in this research was collected using publish from the Google Scholar database with a range of 1,000 journals from 2021 to 2025. The results of this research on critical thinking of elementary school students has increased every year. The implications of this research examine more innovative and contextual learning approaches, such as project and inquirybased learning. Research for the period 2021 to 2024 focuses more on developing critical thinking skills to be integrated into the applicable curriculum, including the independent curriculum, therefore the results of this research determine the critical thinking abilities of elementary school students, but matters related to computational thinking, inquiry and independent curriculum are still little discussed so this could be an opportunity for further research.

Keywords: Bibliometrics, Critical Thinking, Elementary School

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INTRODUCTION

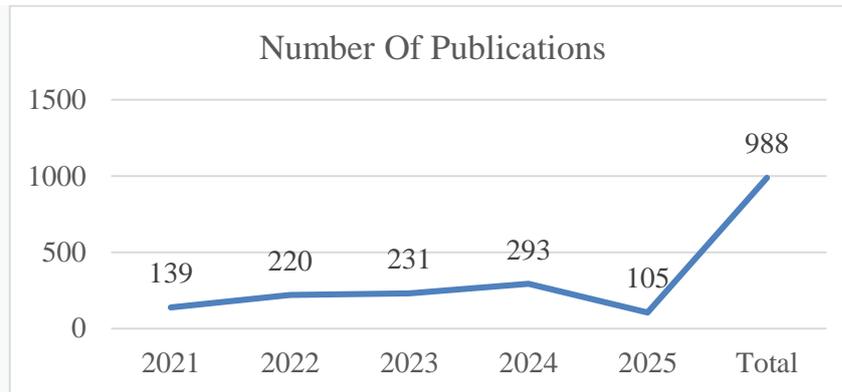
Education is the main foundation in building the character and civilization of a nation (Gutama 2023). Everyone needs education as a basic need, and is also the first step towards the formation of human beings who are expected to be able to develop in various sectors so that they are able to compete and answer the problems of the current century, namely the 21st era (Qirani et al. 2023). Critical thinking skills are really needed in solving problems or in trying to find solutions to problems and being able to differentiate sharply, select, identify, study and develop them in a more perfect direction so that students can make decisions and provide better solutions (Marwah Sholihah and Nurrohmatul Amaliyah

2022). Critical thinking skills in elementary school students are something that must be developed (Kusuma, Handayani, and Rakhmawati 2024). This is because critical thinking skills will train students to observe, analyze and evaluate information or opinions before deciding to accept or reject the information (Firdausi, Yermiandhoko, and Surabaya 2021). Thus, learning in schools should train students to explore abilities and skills in searching for, processing and evaluating various information critically (Salsabilla 2023).

Critical thinking ability is a metacognitive ability with reflective judgment that is used to increase opportunities and produce logical conclusions in arguments and solutions to problems (Muzayyanah, Natalia, and Bhakti 2022). Then (Kartikasari, Nugroho, and Heru Muslim 2021) argue that critical thinking can be understood as the activity of analyzing ideas or thoughts in a more specific direction, distinguishing them sharply, selecting, identifying, studying and developing them in a more perfect direction. People who are able to think critically are people who are able to conclude what they know, know how to use information to solve problems, and are able to search for relevant sources of information to support problem solving (Wahyuni, Widiastuti, and Santika 2022). To improve students' ability to master 21st century skills, it is necessary to design educational activities in schools that can foster creativity and critical thinking (Ardiansya et al. 2024). The reason why critical thinking skills are important for elementary school students is to face and respond to the explosion of information in the digital era (Juliyantika and Batubara 2022).

Critical theory carried out in previous research focuses a lot on how an individual student responds to the environment in which he or she is educated, such as a student having a critical attitude towards the use of technology in learning methods carried out by educators (Modern and Fajarni 2022). To conduct this research, researchers used qualitative methods by conducting interviews with students and educators. In this research, critical theory is used regarding the development of the use of theory in previous research, so that this research does not only focus on one object but observes all critical research on students in elementary schools. The use of critical theory for students experiences development starting from critically responding to a problem, to critically responding to individual behavior when using certain learning methods (Sholahudin 2020). The results of this research show critical theory in students along with generational development, meaning that each generation has different critical characteristics.

According to (Fitria et al. 2022) it is explained that "Bibliometric analysis is a form of meta-analysis of research data. Bibliometric analysis is an effective method for identifying and evaluating research trends in a particular field (Firdausi, Warsono, and Yermiandhoko 2021). This tool allows data to be systematically analyzed and relevant information to be extracted, allowing researchers to obtain a holistic picture of the current situation in their field of expertise (Jaya et al. 2024). Bibliometric analysis is a statistical tool used to map the state of scientific knowledge, helping to identify important information needed for research purposes, opportunities, and strengthening research or scientific publications. Bibliometric analysis can be concluded as a systematic search to find an overview of trends that have the opportunity to find research that is relevant to developments. The number of publications regarding student criticism in elementary schools can be seen from the table below.



This bibliometric analysis was conducted with the aim of finding out the publication trend study, in addition to also knowing the growth of publisher citation patterns. Bibliometric analysis with several keywords was conducted using VOSviewer so that it can be better understood by readers and researchers in the future. Bibliometric analysis can help in reviewing various previous studies that have the same theme, in this description it is focused on research related to the influence of the Problem Based Learning model which is currently one of the recommended learning models to be applied in classroom learning that uses the Merdeka Curriculum. Furthermore, in 21st century learning, it is also emphasized that there are four important skills to be mastered, namely critical thinking, creative thinking, communication, and collaboration.

Apart from that, (Putu et al. 2022) discusses bibliometric analysis of research trends in digital technology-based learning in elementary schools with the result that the newest topics according to the network map are related to pandemic, covid, distance learning, and assessment. Second, the Covid-19 pandemic has had a major impact on research and scientific publications. Third, this topic, which is still little discussed, is a great opportunity for research or renewable research related to e-learning, challenges, strategies, motivation, digital educational games, and others. From the descriptions above, it appears that there has been no research on bibliometrics that discusses critical thinking skills in elementary schools, so this is an opportunity for researchers to discuss it. Therefore, the researcher aims to find out research trends related to students' critical thinking skills in elementary schools in the period 2021 to 2025, find out the visualization of inter-key network mapping in VOSviewer software, and find recommendations for future research opportunities regarding critical thinking skills in elementary schools

RESEARCH METHOD

This research is quantitative by using descriptive and analyzing and mapping data in a field using bibliometrics, using the Publish or Perish application to search for 1000 articles from Google Scholar as the research population (Ardiansya et al. 2024; Hakim Azis 2020; Huynh, De Mello, and Li 2025; Indriyanti, Fauziah, and Nuryadin 2023). This research used 340 published articles as samples, taken from relevant sources using the keyword "Critical Thinking, Elementary School". The selected articles are publications published within the last 5 years from 2021 to 2025. This research uses VOSviewer to analyze three types of visualization, namely network visualization, overlay visualization, and density visualization (Ateş and Korkmaz 2025). Map network visualization is used to determine clusters and the relationship between study topics and keywords. An overlay visualization is used to show the year of completion of the study topic. Meanwhile, density visualization is used to investigate research problems that are rarely researched and are already saturated (Qirani et al. 2023). Bibliometric analysis in this research was used to

review publications related to elementary school critical thinking skills to identify research trends, concepts and keywords needed in the form of bibliometric mapping (Ateş and Korkmaz 2025). Data was collected via the Publish or Perish application from the Google Scholar database. Based on the Google Scholar database obtained, it is saved in RIS form for visualization analysis in Vosviewer. The data is also saved in CSV form for later analysis of tables and graphs in Microsoft Excel (Hakim Azis 2020).

RESEARCH RESULTS AND DISCUSSION

Research Results

From search results on Google Scholar, 1,000 articles were found. Next, the citation data is analyzed using the Publish or Perish application and the results are displayed in the following table:

Tabel 1. Citation Metriks

Result	Explanation
Keyword	<i>critical thinking, elementary school</i>
Year of Publication	2021-2025
Year of Citation	4 (2021-2025)
Article	988
Number of citation	77745
Citations per year	19436.25
Citations per yer	78.69
Citations per article	442.24
H Index	99
G Index	252
Individual H Index	66
Annual H Index	16.50
Ha Index	55

Spurce: author's data processing

Article searches were carried out with a publication period of 2021 to 2025 using the keywords "critical thinking, elementary school". Searches were limited to a maximum of 1,000 articles, which resulted in a total of 77,745 citations, with an average of 19,436.25 citations per year and 78.69 citations per article. The average number of authors per article was 442.24, while the H-index value was recorded at 99 and the G-index at 252. Trends in scientific publications regarding critical thinking skills in elementary schools from 2021 to 2025 show that there are 988 articles indexed by Google Scholar. Researchers took the 10 articles with the most citations.

Tabel 2. Data Publikasi Sitasi terbanyak

No	Penulis	Judul artikel	Tahun	Sitasi
1	Dasopang, M.D.	Effectivity of Interactive Multimedia with theocentric to the analitical thinking skill of elementary school student in science learning	2022	681
2	Yanti, E., Utari, M., & Putra, S.	The impact of collaborative learning on learners' critical thinking skill	2021	323
3	Ramdani, A., Jufri,	Analysis of students' critical thinking skills in terms of gender using science teaching	2021	284

	A.W. & Gunawan, G.	materials based on the 5E learning cycle integrated with local wisdom		
4	Sutiani, A.	Implementation of an inquiry learning model with science literacy to improve student critical thinking skills	2021	256
5	Arisoy, B. & Aybek, B.	The effect of subject-based critical thinking education in mathematics on students' critical thinking skills and virtues	2021	176
6	Sari, R., Sumarni, S.	Increasing students critical thinking skills and learning motivation using inquiry mind map dkk.	2021	162
7	Lestari, F.P., Ahmadi, F., & Rochmad, R.	The implementation of mathematics comic through contextual teaching and learning to improve critical thinking ability and character	2021	135
8	Nasution, I.S. & Nasution, S.	Student critical thinking skills in the implementation of discovery learning and inquiry-based learning	2023	119
9	Rini, E.F. & Aldila, F.T	Practicum activity: analysis of science process skills and students' critical thinking skills	2023	90
10	Sidiq, Y. Ishartono, N. & Dessty, A.	Improving elementary school students' critical thinking skill in science through hots-based science questions: A quasy-experimental study	2021	87

Judging from the results of the development of publications regarding elementary school students' critical thinking skills from 2021 to 2025, a total of 988 publications were published in Google Scholar via the Publish or Perish application in the following table:

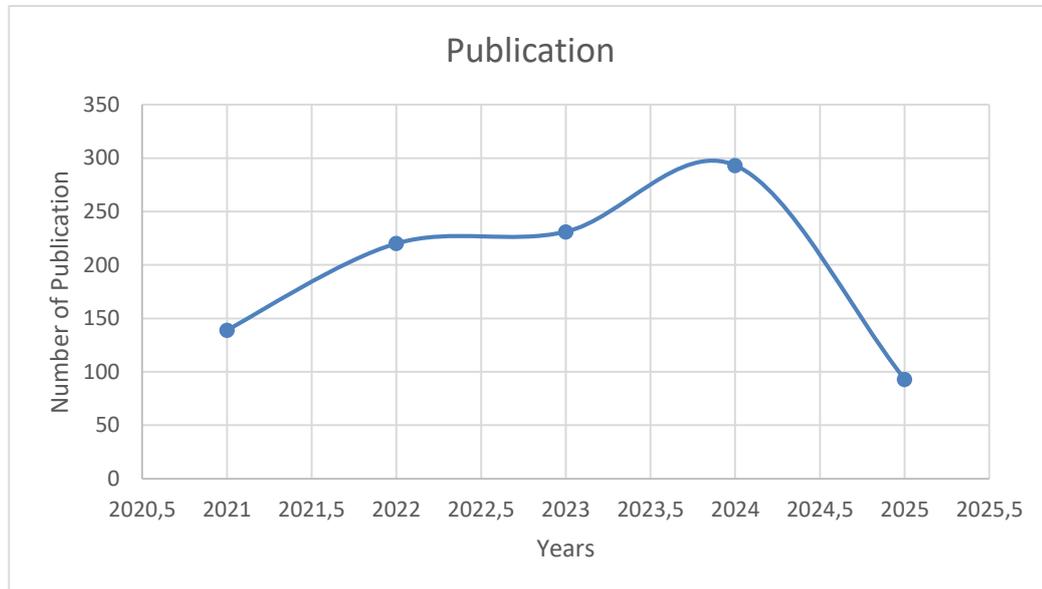
Tabel 3. Publication Development

Year	Number of Publications
2021	139
2022	220
2023	231
2024	293
2025	105
Total	988

Based on table 2 above, there are 139 publications in 2021, 220 publications in 2022, 231 publications in 2023, 293 publications in 2024 and 105 publications in 2025. The explicit finding obtained is that research using bibliometrics cannot clearly describe the critical level of facts carried out by students, because it only tests and processes data based on previous research.

Discussion

Grafik 1. Publication Development



Graph 1 shows that the development of publications on critical thinking skills from 2021 to 2025 has experienced a consistent increase. So it was found that the highest publication was in 2024 and the lowest was in 2025. The VOSviewer application is used to visualize bibliometric maps with full counting carried out with a minimum number of occurrences of a keyword of 10 times resulting in 129 keywords and 38 thresholds. With the VosViewer application, 38 items, 6 clusters, 180 links and 456 total link strengths were found. A total of 38 items divided into 6 clusters can be seen in the following description:

- a. Cluster 1 has 9 items marked in red, namely character, character education, elementary school child, elementary school level, higher order, higher order thinking skill, hot, independent curriculum, primary school.
- b. Cluster 2 has 8 items marked in green, namely 21st century, communication, computational thinking, context, elementary education, participant, quality, systematic review.
- c. Cluster 3 has 6 items marked in blue, namely application, creative thinking skills, critical thinking abilities, critical thinking disposition, elementary student, influence.
- d. Cluster 4 has 6 items marked in yellow, namely case study, differences, public elementary school, science learning, elementary school, student critical thinking.
- e. Cluster 5 has 5 items marked in purple, namely critical thinker, educator, effort, learner, systematic literature review.
- f. Cluster 6 has 4 items marked in light blue, namely 21st century skills, Inquiry, Learning model, Social study.

Links between keywords are shown in each existing cluster. Nodes (spheres) are given for each term with color circles. The size of the circle for each term varies depending on the frequency of appearance of the term. The size of the circle nodes shows the relationship with the appearance of the term in the title and abstract. The more often the term is found, the larger the label size (Rahim and Awaliyah 2023). This research uses mapping visualization analysis which consists of three parts with different functions and

objectives, namely network visualization, overlay visualization and density visualization (Ateş and Korkmaz 2025).

Figure 2. Visualization of the Elementary School Critical Thinking Ability Network

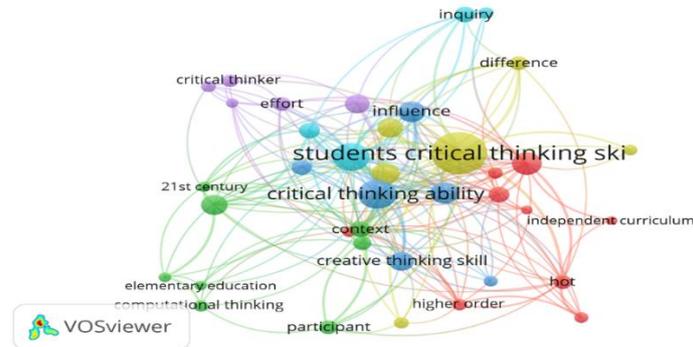


Figure 2 shows the relationship between terms visualized in the form of an interconnected network. Through this visualization, it can be seen that each cluster represents a certain research theme with the dominant topic being related to students' critical thinking skills. From the clusters that appear in the network visualization, it can be seen that research on critical thinking abilities in elementary schools generally focuses on several main keywords such as critical thinking abilities, creative thinking skills, and elementary education (Marwah Sholihah and Nurrohmatul Amaliyah 2022).

Figure 3. Overlay Visualization

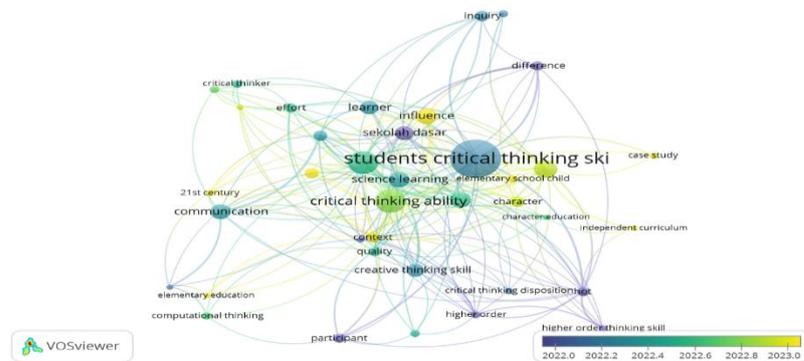
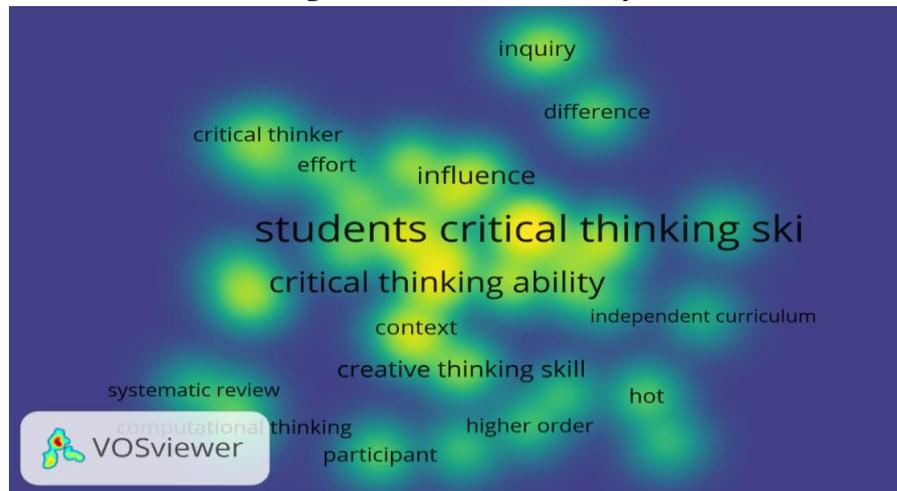


Figure 3. This overlay visualization shows trending topics or research keywords at any given time (Ouhaichi, Spikol, and Vogel 2023). Based on the visualization in Figure 3, research on critical thinking skills in elementary schools focuses on the topic of change over time. The blue color indicates that the keyword is widely used in 2022, while the yellow color indicates that the keyword appears more frequently in more recent research, namely 2023. Previous research focused more on the definition and measurement of critical thinking skills in general, as well as how critical thinking skills are integrated in traditional learning, while the latest research tends to examine more innovative and contextual learning approaches, such as project and inquiry-based learning, for students' critical thinking abilities. Recent research also focuses more on developing critical thinking skills to be integrated into the applicable curriculum, including the independent curriculum.

Figure 4. Visualisasi Density



Density visualization depicts the brighter the yellow color and the larger the circle surrounding the keyword that appears in the research article (Muchtarom et al. 2023). Based on the density visualization above, it can be seen that many studies use the term students' critical thinking skills. Then conversely, if the yellow color fades, the amount of research on the term will decrease (Puspitasari and Aimah 2024). In the picture above, it can be seen that research related to the terms students critical thinking skills, critical thinking abilities and creative thinking skills has a high amount of research, while research related to computational thinking, inquiry, independent curriculum is still little discussed. This could be an opportunity for research development in the future by applying it to several schools or comparing elementary school students.

Conceptual Framework and Newness from Previous Research

1. Based on bibliometrics and overlay visualization, most previous research focuses on:

- Definition and measurement of critical thinking in general.
- Traditional learning is definition-based, without a contextual approach.
- Implementation of classic learning methods such as lectures or simple observations.
- Theoretical study of critical thinking without a new curriculum-based approach

2. **Contestual Changes**

- Research trends begin to shift post-2022, especially with the emergence of the Merdeka Curriculum
- Recent research (2021-2025) places more emphasis on;
 1. Project-based approach.
 2. Inquiry as a learning method.
 3. Integration of higher order thinking skills (HOTS) into elementary school learning.
 4. Use of digital media such as interactive multimedia.

3. **Renewality**

The novelty in this research can be formulated as follows:

- Using a bibliometric approach supported by VOSviewer to visually analyze and map publications based on keywords.
- Shows an evidence-based trend that the focus of research is currently shifting from general to specific measurement:

- a. Contextual Curriculum: Independent Curriculum, Character Education, and local integration.
- b. New Teaching Strategies: Inquiry, HOTS-based, and collaborative.
- c. Research Topics with Minimal Exploration: such as computational thinking, independent curriculum, and social studies in elementary school.

4. CONCEPTUAL MODEL

[Previous Research]



General Definitions & Measurement



[Lack Of Curriculum Context & Application]



[Current Research]



Shift to:

- Contextual Approach (Independent Curriculum)
- Innovative Models (Inquiry,HOTS,Project)
- Bibliometric Visualization
- Use of VOSviewer
- New Focus (Computattional Thingking, Social Study)

CONCLUSION

Previous research mostly tested students' critical thinking skills, which is the ability to analyze information, evaluate evidence and make rational decisions, while recent research tends to examine more innovative and contextual learning approaches, such as project-based learning and inquiry, for students' critical thinking skills. Recent research also focuses more on developing critical thinking skills to be integrated into the applicable curriculum, including the independent curriculum. Research related to computational thinking, inquiry, independent curriculum is still little discussed. The topics that are still being discussed are great opportunities for research or renewable research. Data collection was carried out between 2021 and 2025. Based on the research results, it can be concluded that research on school students' critical thinking abilities is influenced by each individual's skills in being critical of something, therefore there is a need to develop research on student critical thinking with several more innovative methods with the aim of measuring students' critical level. This research resulted in the fact that research topics experience changes and developments every year

SUGGESTIONS/RECOMMENDATIONS

Future research hopes to use data from more than 5 years and must compare with other methods to be able to find more varied findings. So that the research results will add insight into research with similar themes.

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