

A Systematic Literature Review of Research Trends on Critical Thinking Skills

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Abstract. Human resources that can face the challenges of increasingly rapid and dynamic development must have high intellectual skills. High intellectual skills are characterized by critical thinking skills, creativity competitiveness, and the ability to communicate ideas and solve any problems. Intellectual skills, especially critical thinking skills, are the demands of human resources in the 21st century. In recent years, the development of critical thinking skills-based research has been rapid. Critical thinking skills research has produced many theoretical and empirical findings. Many trends and issues have emerged, proving the complexity and dynamics of critical thinking skills research. This study aims to provide an overview of the latest research on critical thinking skills. The development of recent research on critical thinking skills in recent years can be illustrated through a bibliometric approach. The bibliometric approach was applied to uncover the most common keywords and terms and their interactions through compound word analysis. The Scopus database was selected for the period 2011 to 2021; 2,855 documents were obtained, and then the publications each year, the most researched topics, and the development of interest in these topics were identified. The research results show that from 2011 to 2020, there was a significant increase in research on critical thinking skills, while there was a decline from 2020 to 2021. Research topics that are closely related to critical thinking skills are higher-order thinking skills. The topic of critical thinking has a close relationship with education, curriculum, and educational measurement. Research on critical thinking skills with innovative learning models, such as inquiry learning and discovery learning models, has not been widely studied. Even though a lot of research on critical thinking skills has been carried out, there is still a need to develop research on critical thinking skills in various frameworks.

1 Introduction

In addition to offering a host of conveniences, the swift advancement of science and technology necessitates qualified personnel to stay up to date. Knowledge is insufficient, as

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demonstrated by the evolving perspectives on education presented in 21st Century Skills [1]. A person needs critical, creative, and innovative thinking skills to overcome a variety of challenges in the workplace [2]. Merely grasping and applying information is insufficient. All knowledge learned by secondary school students will eventually become outdated and be replaced by new, more current information. One of the things that need to be done to prepare students for the workforce of the future is to equip them with critical thinking skills to give them a way of thinking [3,4]. The ability to think critically is a prerequisite for future competitiveness. Education is a crucial component to successfully prepare human resources to compete in the future [5].

Pursuing intelligence-related issues alone is insufficient as part of the educational process. To ensure that they develop to their full potential, students' various potentials and those of other learning subjects must also receive proportionate attention. In Indonesia, education typically focuses solely on cognitive skills. Without having to comprehend the material they are learning; students have to memorize the information [6]. Critical thinking skills are not fostered by the way the teaching and learning process is implemented in the classroom [7,8]. One of the most essential intellectual or basic capitals for every individual and a vital component of human maturity is the ability to think critically. Thus, students at all educational levels must learn how to think critically [9,10].

The 21st century will see a demand for human resources in the age of technological advancement, particularly in the area of high-level thinking skills [11,12]. The development of critical thinking skills is important for students' future success in solving social, scientific, and practical problems [13-15]. Critical thinking skills are an intellectual process that involves the construction of concepts, description, implementation, and assessment of all information obtained from the observation process, with the results serving as a basis for measurement [16,17].

There have been many studies on critical thinking skills using various research methodologies in the past few years, but there has been very limited literature based entirely on bibliometric analysis. Given the volume of articles on critical thinking skills that have been published worldwide, it is imperative to implement a methodology that incorporates a statistical foundation for all extant scientific literature. This will enable the assessment of the current state of research and the contributions made by scholars at every university and across diverse scientific domains, thereby facilitating the creation of maps of new directions for study. The distribution of the quantity of publications and citations of different scientific documents can be seen through bibliometric analysis [18]. Indicators included in the study in this regard include the h-index, impact factors, citations of published publications, identification of research groups and authors, scientific activity parameters, and information consumption [19].

Nevertheless, bibliometric analysis is not covered in the vast majority of published research on "critical thinking skills" in literature. By filling in the literature gaps in the field, this research will make it easier for future researchers to conduct related studies. Investigating publications of bibliometric views on "critical thinking skills" is the goal of this study. In other words, the study presents publications on "critical thinking skills" based on bibliometric indicators and offers a fresh viewpoint on the subject of social research. By illuminating those who will work in this field in the future, this research also aims to contribute to the creation of a roadmap. The Scopus database in question was examined in this instance utilizing the keywords "critical thinking skills" and the following criteria: documents by year, documents by affiliation, documents by author, documents by source per year, documents by country or territory, documents by type, documents by finding sponsor, and documents by subject area. The documents are ordered from the highest to lowest citation. Thus, even though many studies have been done, the study concludes that "critical thinking skills" should be integrated

into different frameworks. Thus, it is possible to test research and development in the area of "critical thinking skills."

2 Methodology

The bibliometric tools were initially applied by information scientists to study the distribution and growth of published scientific articles [20,21],2. A statistical method of assessing documents that makes use of quantitative analysis is called bibliometrics [22,23]. The scientific community and the general public will gain from the simpler management and processing of publication metadata into more insightful information, which is made possible by bibliometric mapping [24]. Examples of such insights include keyword visualization to identify research topics or clusters across multiple disciplines or mapping authors from specific journals to determine the geographic coverage of authors. As part of the study evaluation approach, bibliometric analysis—also known as scientometrics—uses a distinct way for analyzing research methodologies that are retrieved from different papers [25]. The bibliometric technique can assist you in identifying potential technical patterns or research areas by using author keywords, title keywords, and keywords plus [26].

The journal's growth experience is used to evaluate the research findings. Articles about critical thinking skills were found using the following search parameters. The researchers focus on the article's title because it raises a particular point that is essential to the goal of the report and the field of study. The search was conducted in October 2021. Numerous results, including author, title, abstract, country/territory, citation, author affiliation, and references, were provided by Scopus. Based on our search, we discovered 2,855 documents that contain our keywords. 820 Conference Papers and 2,035 Articles are the two categories into which Scopus documents are divided.

Many indicators of bibliometric analysis outcomes are discussed in this article. Scientometrics, another name for bibliometric analysis, is an area of study that looks into the most recent literary developments to inspire and direct further research. An exhaustive list of all the publications made by the source. The number of citations this publication has received is listed in full here. Citation documents are used to calculate the citations obtained, divided by publications. This study's bibliometric approach makes use of contemporary technology from the fields of statistics, database administration, and information engineering. Using a bibliometric methodology, critical thinking skills research from 2011 to 2021 was quantitatively and visually examined using the VOSviewer program.

3 Results and Discussion

The article titles, abstracts, and keywords "critical thinking skills" served as the search criteria for the Scopus data sources from which the bibliometric data were retrieved. Additionally, the document categories available for publication are conference papers and articles, with the publication from 2011 to 2021. Up to 2,855 documents about critical thinking skills were discovered in the search results. Next, the articles are arranged in order of lowest to highest citation from the publications. Table 1 displays the published articles that receive the most citations in the following manner.

Table 1. The articles published about critical thinking skills

No	Title	Authors	Year	Source title	Cited by
1	Strategies for Teaching Students to Think Critically: A Meta-Analysis	Abrami, P.C., Bernard, R.M., Borokhovski, E., (...), Wade, C.A., Persson, T.	2015	Review of Educational Research	211
2	Developing information literacy and critical thinking skills through domain knowledge learning in digital classrooms: An experience of practicing flipped classroom strategy	Kong, S.C.	2014	Computers and Education	208
3	An integrated critical thinking framework for the 21 st century	Dwyer, C.P., Hogan, M.J., Stewart, I.	2014	Thinking Skills and Creativity	169
4	Promotion of critical thinking by using case studies as teaching method	Popil, I.	2011	Nurse Education Today	144
5	Pedagogy for developing critical thinking in adolescents: Explicit instruction produces greatest gains	Marin, L.M., Halpern, D.F.	2011	Thinking Skills and Creativity	129
6	The educational theory basis of team-based learning	Hrynychak, P., Batty, H.	2012	Medical Teacher	118
7	The effectiveness of problem-based learning on development of nursing students' critical thinking: A systematic review and meta-analysis	Kong, L.-N., Qin, B., Zhou, Y.-Q., Mou, S.-Y., Gao, H.-M.	2014	International Journal of Nursing Studies	112
8	The study on integrating WebQuest with mobile learning for environmental education	Chang, C.-S., Chen, T.-S., Hsu, W.-H.	2011	Computers and Education	105
9	Multiple-choice exams: An obstacle for higher-level thinking in introductory science classes	Stanger-Hall, K.F.	2012	CBE Life Sciences Education	97
10	Improving junior high schools' critical thinking skills based on test three different models of learning	Fuad, N.M., Zubaidah, S., Mahanal, S., Suarsini, E.	2017	International Journal of Instruction	92

Table 1 shows that Abrami, P.C., Bernard, R.M., Borokhovski, E., (...), Wade, C.A., Persson, T. (2015), whose work "Strategies for Teaching Students to Think Critically: A Meta-Analysis" was cited 211 times, is the author with the highest citation count.

The following techniques were applied in this study to assess articles published in the Scopus database: using the VOSviewer analysis tool and Scopus analysis. The parts that follow provide the study's conclusions. The researchers looked at the Scopus categories of the 2,855 studies that emerged via online scanning. The categories used include documents by year, documents by country/territory, documents by author, documents by affiliation, keyword co-occurrences analysis, and author collaboration analysis.

3.1 Research Growth and Geographical Distribution

The total number of documents obtained from Scopus data was 2,855; these documents were limited to 2011-2021, as can be seen in Figure 1. Publications rose from 2011 and 2020 before declining in 2021. Nonetheless, there was a notable rise in publications between 2017 and 2020. 2020 saw the most number of publications—530—than any other year. The largest donor in Figure 2 is the United States. Indonesia and Malaysia submitted 773 and 130 documents, respectively, for the second and third places. For the fourth and fifth papers, Australia and Turkey submitted 102 and 96 documents, respectively.

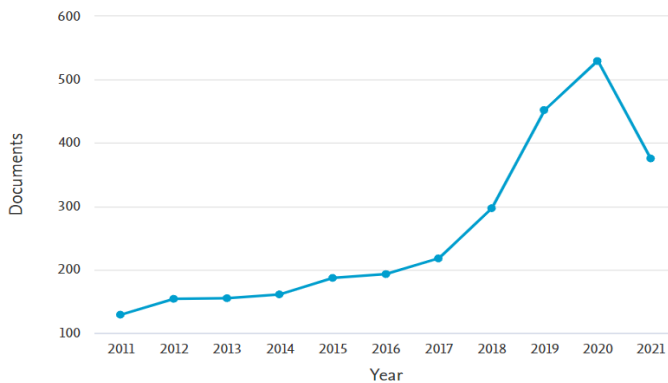


Fig. 1. Research Growth from Critical Thinking Skills

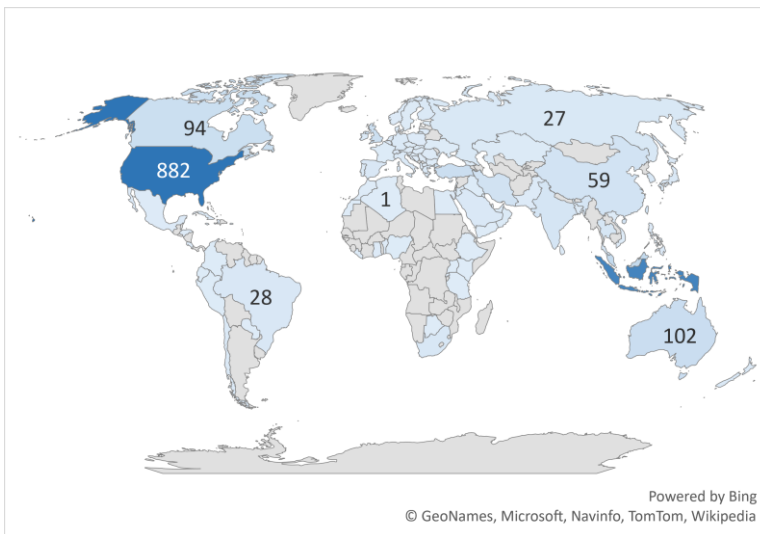


Fig. 2. Geographical Distribution

3.2 Subject Area and Affiliation

The data show the ten affiliates who have the most number of documents. The highest affiliation is Universitas Pendidikan Indonesia, which has 109 documents. Universitas Negeri Malang comes in second with 96 documents, while Universitas Sebelas Maret comes in third with 75 documents. Clearly, documents by affiliation are shown in Figure 3.

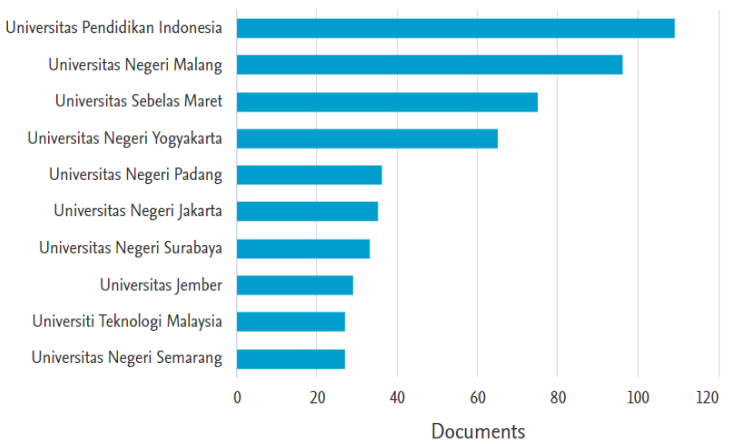


Fig. 3. Distribution Document by Affiliation

3.3 Author of the Most Documents

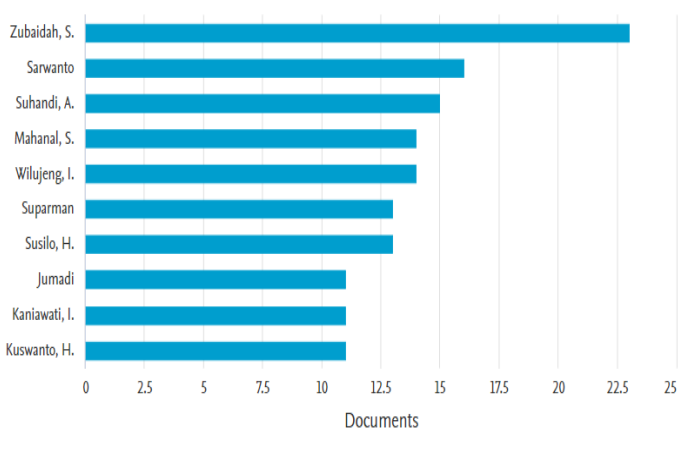


Fig. 4. Distribution Documents by Author

3.4 Keyword Co-occurrences Analysis

The author performed a co-occurrence keyword analysis with VOSviewer software. Coexistence keywords represent areas of interest for scientific research and offer extra support for scientific investigation [27]. This study assesses the strength of phrases and counts the number of keywords from a research document that appear simultaneously in the

articles evaluated in order to analyze the content, patterns, and trends of a collection of documents [24,28]. The comprehensive and user-friendly bibliometric map that VOSviewer offers is one advantage of using it [29,30]. The size of the circle has a positive correlation with the term's appearance in the title and abstract. Consequently, the weight of the item determines the size of the circle and the product label. An item's weight increases with its label and circle size [31]. The distance between the two points indicates their respective strengths. Generally speaking, the longer the distance, the stronger the relationship. When two keywords are separated by a line, it means that they appear together [32]. The strength of the connection between two nodes determines how frequently they appear together. It is possible to show a numerical indicator of the connection between the two nodes [33]. Figure 5 provides an illustration of the most important terms used by Scopus authors. Keywords that are related (for example, those that are presented in the same color) are frequently provided together. Figure 5 shows that research topics are closely related to critical thinking skills and higher-order thinking skills. The topic of critical thinking has a close relationship with education, curriculum, and educational measurement.

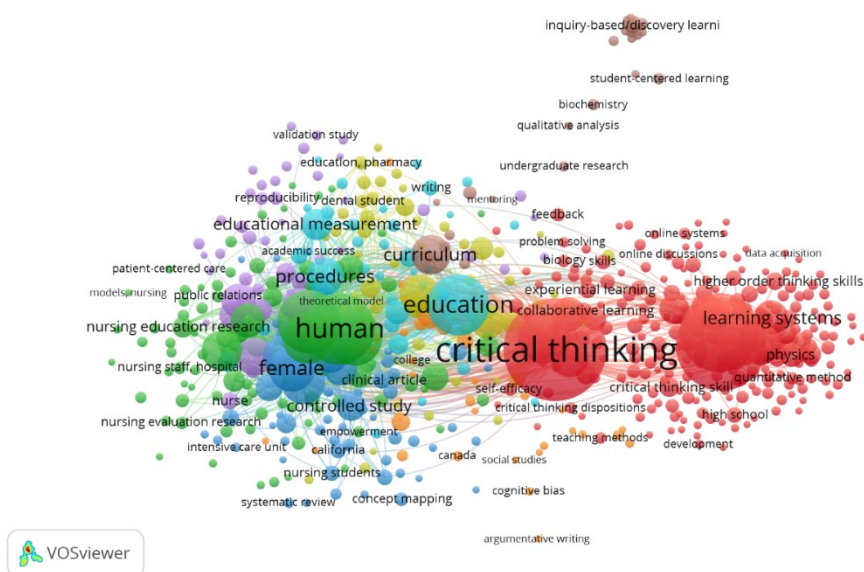


Fig. 5. Keywords Co-occurrences Network Visualization

VOSviewer can show density visualizations (see Figure 6). The density of items within that node determines the color of a node on the keyword density visualization board. Put another way, the nodes' color is determined by the number of items present in the node environment. The red area shows the frequency of keywords, while the green area shows the frequency of keywords [32]. In contrast, keywords are less common in green areas and more common in red areas. The research focus is depicted in Figure 6. The keywords are critical thinking, education, human, and learning systems.

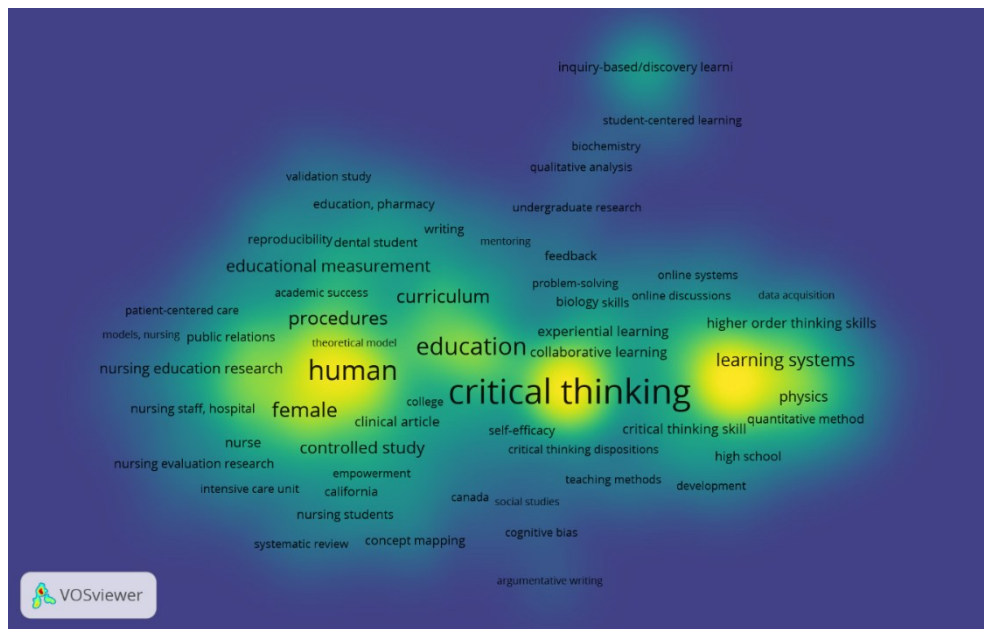


Fig. 6. Keywords Co-occurrences Density Visualization

3.5 Author Collaboration Analysis

Since research is rarely conducted alone, collaborative writing is crucial in this context [34]. Therefore, collaboration between researchers and institutions is necessary in terms of concepts, financing, resources, and equipment, as well as opportunities to exchange specific knowledge, expertise, and technological know-how. Based on this study, there is a strong connection among the seven authors. Each author has a different link. Figure 7 shows that seven authors collaborated with other authors. Authors who have collaborated with other authors include Sarwanto and M. Masykuri.

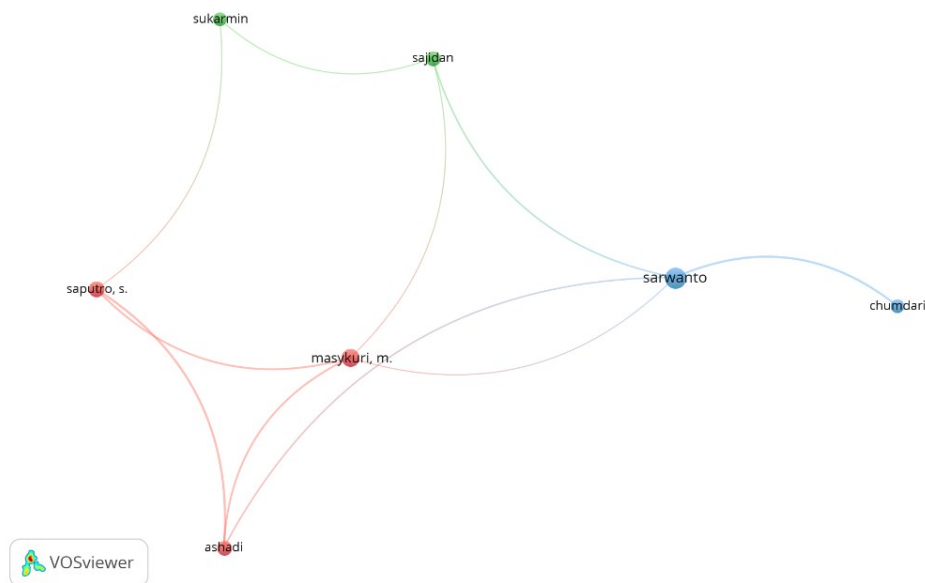


Fig. 7. Author Collaboration Network Visualization

4 Conclusion

Numerous academic papers on critical thinking skills released between 2011 and 2021 are examined in this study. This study uses specific bibliometric markers to support earlier research models using the Scopus database. A total of 2,855 papers containing bibliometric data were found in the Scopus database. The findings indicate that the research trend on critical thinking skills grew between 2011 and 2020 before declining in 2021. However, there was a notable increase in publications from 2017 to 2020. With 530 documents published, 2020 was the year with the most publications. The highest contributor is the United States of America. Indonesia and Malaysia contributed 773 and 130 documents, respectively, for the second and third places. For the fourth and fifth documents, Australia and Turkey contributed 102 and 96 documents, respectively. Universitas Pendidikan Indonesia has the highest affiliation, with 109 documents. Second place goes to Universitas Negeri Malang with 96 documents, followed by Universitas Sebelas Maret in third place with 75 documents. Keywords Co-occurrences Network Visualization shows research topics are closely related to critical thinking skills, which are higher-order thinking skills. The topic of critical thinking has a close relationship with education, curriculum, and educational measurement. Author Collaboration Network Visualization shows that the authors who have many collaborations with other authors are Sarwanto and M. Masykuri.

Notwithstanding the benefits discussed in this article, there are certain drawbacks that researchers should take into account. This study's drawback is that to produce the initial list of academic papers that Scopus has indexed, it depends on specific keywords. Nonetheless, this approach has been widely employed in previous bibliometric studies. Scopus is one of the biggest online databases for scientific papers, but it does not have access to every source. Moreover, there isn't a single search query that works for all scholarly articles in a given field. This study represents the current state of knowledge on critical thinking skills in the scientific literature despite these shortcomings.

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