Critical thinking and education: A bibliometric mapping of the research literature (2005–2024)

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This study seeks to offer a comprehensive overview of critical thinking research in education, encompassing key authors, sources, countries, and publications. Analyzing 6122 articles from the Web of Science database published between 2005 and 2024, the study examined authors, sources, countries, documents, and their interrelationships using bibliometric analysis. It identified trends and central themes in critical thinking in education, revealing prominent authors, sources, publications, and countries. The data was used to visually represent connections between authors, sources, and countries. The analysis indicated a consistent increase in studies on critical thinking in education over the last two decades, with a notable surge in 2023. Researchers were increasingly focusing on the correlation between emerging technologies like artificial intelligence and critical thinking. Moreover, publications exploring technology-driven approaches such as online learning, flipped classrooms, and digital storytelling received significant citation counts. The analyses indicate that interest in the relationship between concepts such as motivation and collaboration and critical thinking continues to persist. Additionally, publications that applied theoretical concepts to practical contexts received higher citation rates. Thinking Skills and Creativity emerged as the leading journal in critical thinking in education, with the United States being the predominant country in this field.

Introduction

Over the past decade, the world has experienced considerable changes, especially in fields such as technological progress, the increasing impact of globalization, changing political dynamics, and growing environmental challenges. Educational environments today are undergoing rapid changes compared to the past. This shift has elevated the importance of developing strategies to enhance students' awareness (Momani et al., 2023). Teaching critical thinking is viewed as a key strategy for students to comprehend the evolving nature of education and the contemporary era. Research indicates that educators and policymakers recognize the significance of critical thinking in preparing individuals for life in the 21st century (Halpern, 2002). Consequently, there is a growing trend in interest and research on critical thinking. This trend is primarily driven by political and economic changes (Bean & Melzer, 2021; Davies, 2015; Facione, 2000) as societies require individuals who can adapt to the evolving world. Lucas (2019) emphasizes that critical thinking is important for professionals to navigate the complexities of the ever-changing job market. Similarly,

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Rotherham and Willingham (2010) contend that critical thinking has become a fundamental competency for 21st-century learners. Furthermore, critical thinking not only enhances students' learning experiences but also boosts workplace productivity (Durr et al., 1999). Consequently, both educational institutions and the business sector now recognize the necessity of fostering reasoning skills and critical thinking (Paul & Elder, 2008; Smith, 2020).

There is broad agreement on the significance of critical thinking (Abrami et al., 2008; Butler et al., 2017; Facione, 2000; Halpern, 2002; Marzano et al., 1988; Norris, 1985; Siegel, 1985; Slavin, 2013). However, defining and clarifying critical thinking is complex. The concept and scope of critical thinking can be viewed from different angles. Some scholars argue that the challenge in conceptualizing critical thinking is a barrier to its effective teaching in schools (Radulović & Stančić, 2017). This complexity arises from the multifaceted nature of critical thinking. Facione (2015) highlights that the diverse viewpoints among scholars have led to a rich and diverse body of literature on the subject. This poses a challenge for researchers, as the field of critical thinking research has expanded significantly, inundating researchers with a vast amount of information. Navigating this plethora of research to identify relevant authors, publications, and sources is akin to finding a needle in a haystack. Consequently, determining the current state and keeping abreast of developments in the field can be challenging. A lack of a comprehensive bibliometric analysis, which can map key themes and trends within a field, creates a critical gap in our understanding of critical thinking research.

Bibliometric analyses aid researchers in tracking trends within a field by visually representing data. Unlike traditional literature reviews, bibliometric analysis provides researchers with key indicators based on formal and quantitative data. These indicators encompass country, author, university, and journal productivity, emerging research areas, gaps in the literature, collaborations, and potential opportunities. Additionally, bibliometric analysis can serve as the initial step in a systematic literature review. Therefore, it acts as a valuable resource for researchers seeking to understand the current state of their field. Moreover, bibliometric analysis is a crucial tool for assessing publication performance (institution, country, journal, and so on) (Anninos, 2014).

The literature review revealed several bibliometric studies on the topic. Dong et al. (2022), in their research on critical thinking in the field of education, did not include the Education Scientific Disciplines category in their analysis. This omission may have led to the exclusion of numerous studies focusing on critical thinking within education-related disciplines. In addition, there are bibliometric studies that focus on specific concepts such as physical education (Ridwan et al., 2022), teacher education (Wang & Jia, 2023), primary education (Aktoprak & Hursen, 2022), and higher education (Nuryana et al., 2024). However, no study has been identified that comprehensively addresses the concept of critical thinking within the broader field of education. In the literature, a comprehensive bibliometric study elucidating the intellectual structure of research topic as a whole remains absent. This study aims to bridge this gap. Shafique (2013) defines intellectual structure as the prominent features of an information base that enable an organized and comprehensive understanding of a scientific field or subject. The objective of this study is to fill this knowledge gap by providing quantitatively supported recommendations for selecting and presenting the most relevant articles, authors, and journals to unveil the intellectual structure of critical thinking in education. Additionally, the study aims to offer suggestions for establishing a consistent theoretical framework and visual representation.

Definition and importance of critical thinking

The reflective thinking, introduced by John Dewey in 1933, is often considered a precursor to critical thinking (Aktoprak & Hürsen, 2022). Dewey described reflective thinking as the active, persistent, and attentive review of a belief or knowledge in light of the foundations that support it. Following Dewey's work, critical thinking has been extensively discussed and defined across various disciplines, particularly in education, psychology, and philosophy (Baker et al., 2001). As a result, critical thinking is typically explained from the perspectives of these three disciplines.

The philosophical approach to critical thinking focuses on rationality and sound thinking. The psychological approach emphasizes the processes of learning and teaching, as well as the development of higher-order thinking skills. Finally, the educational approach examines the role and function of critical thinking in learning and development (ten Dam & Volman, 2004). Despite these different perspectives, all three approaches agree that critical thinking skills involve higher-order thinking (Smith, 2020).

Ennis (2011) defines critical thinking as focused on deciding what to believe or do, characterized by reasonable and reflective thinking. The American Philosophical Association defines critical thinking as "the explanation of purposeful, self-regulatory judgment that results in interpretation, analysis, evaluation, and inference, based on evidence, conceptual, methodological, criteria-based, or contextual considerations" (Facione, 1990). Paul and Elder (2012) state that critical thinking is "desiring to make thinking better and thinking about thinking for that purpose." Critical thinking involves analyzing, evaluating, and enhancing thinking by reflecting on thinking processes. It requires prioritizing thinking and being a strong critic of one's own thoughts to improve the quality of thinking (Paul & Elder, 2012).

There are numerous definitions of critical thinking in the literature, but most are related to similar concepts. Based on these concepts, a comprehensive definition of critical thinking can be formulated as "thinking analytically, rationally, and reflectively about existing information, knowledge, evidence, claims, and possible consequences, with systematic doubt as the basic principle in the decision-making process".

Critical thinking plays a crucial role in the development of a free and democratic society (Smith, 2020). Its significance extends beyond political participation, as even fundamental concepts such as freedom, democracy, and ethics can be inadvertently distorted and misunderstood without sufficient thought (Paul and Elder, 2012). Bertrand Russell (1997) suggests that individuals may subconsciously evaluate issues selfishly, leading to a potential disconnect between their intentions and the outcomes of their actions. This highlights the importance of critical thinking in understanding the broader implications of one's attitudes and behaviors.

According to Smith (2020), critical thinking is essential for making sound decisions and taking responsibility in democratic conflicts. It involves not only understanding legal frameworks but also having a deeper understanding of how the system functions. Vieira, Tenreiro-Vieira, and Martins (2011) argue that for a democracy to thrive, individuals within society must possess the ability to think critically. At the core of this argument is critical thinking's capacity to make individuals receptive to change and innovation, enabling them to make informed decisions. Without critical thinking, individuals may base their decisions solely on their beliefs and unconscious biases.

Critical thinking in education

Critical thinking is widely regarded as essential in education for its potential to benefit individuals and societies. Educators largely agree on the importance of critical thinking (Abrami et al., 2008; Butler et al., 2017; Facione, 2000; Halpern, 2002; Marzano et al., 1988; Norris, 1985; Siegel, 1985; Slavin, 2013). However, academic studies have yet to demonstrate widespread implementation of this consensus (Noddings, 2008). Many studies indicate that students face challenges with critical thinking (e.g., Güntaş & Çetin, 2019; Yücel & Köçer, 2018). Tseng (2017) observes that educational institutions often prioritize the transmission of factual knowledge, leaving little room for teaching critical thinking. Challenges such as teachers' lack of education and knowledge, biases, negative attitudes, and time constraints hinder the teaching of critical thinking in schools (Scanlan, 2006; Snyder & Snyder, 2008). As a result, there is a continued rapid development of literature on critical thinking.

Critical thinking holds a significant place among 21st-century skills and is a competency that can be developed through education (Saleh, 2019). While access to information has become easier in today's world, distinguishing accurate and reliable information has become increasingly challenging. Critical thinking enhances individuals' abilities to evaluate, analyze, synthesize information, and generate creative solutions (Halpern, 2002), equipping them to navigate the complexities of the modern world. Education plays a crucial role in fostering these skills and in helping individuals develop other essential 21st-century competencies such as problem-solving, collaboration, and innovative thinking (Care et al., 2018). Instruction focused on critical thinking not only supports active engagement in learning processes but also prepares students to make more informed decisions in both their academic and personal lives (Paul & Elder, 2012).

Critical thinking is considered a crucial trait of modern citizens and is central to efforts to modernize education (Care et al., 2018). It is regarded as a fundamental skill in education for several reasons. Firstly, it fosters intellectual independence, empowering students to question and evaluate information rather than passively accepting it (Paul & Elder, 2008). Teachers strive to cultivate in students a deep understanding of complex concepts, independent thinking, and effective problem-solving skills (Ennis, 1985). Through critical thinking, students can articulate their ideas more clearly and persuasively, back their reasoning with arguments and evidence, and analyze complex problems, assessing potential solutions, thus equipping them with valuable tools for real-world challenges (Halpern, 2002). In recent years, critical thinking has been integrated into education to enhance learning outcomes (Abrami et al., 2008).

Critical thinking is not an innate ability but rather requires education for its development. Facione (2015) suggests that critical thinking emerges as a result of education, acquired gradually and intentionally. Massa (2014) asserts that every individual can learn critical thinking. Therefore, experts widely acknowledge the need to teach critical thinking. There is also a consensus that teaching this skill should commence in early childhood (Aktoprak & Hürsen, 2022). However, the debate primarily centers on the methodology of teaching critical thinking, with general principles being largely agreed upon.

Some authors advocate for a concerted effort to extend beyond the curriculum to effect changes in teachers' practices and the education system itself to promote critical thinking skills (Paul, 2005). Others believe that thinking skills should be integrated into the curriculum and cognitive domain, with critical thinking guiding the program (Lai, 2011; Willingham, 2008). Developing skills and applying them to real-life problems enhances efficient thinking, thereby improving students' quality of critical thinking, problem-solving, and decision-

making skills (de Bruin et al., 2007; Halpern, 1998). The literature contains numerous approaches, methods, and techniques for teaching critical thinking. However, Radulović and Stančić (2017) argue that the dominant approach is cognitive and rationalist, individualistic, instrumentalist, and decontextualized, focusing on the implementation of specific programs and methods. Nevertheless, it cannot be concluded that there is a consensus on this issue.

Many approaches in the literature are classified based on certain characteristics, generally considering the relationship between the content and the teaching of critical thinking. Views on how critical thinking should be taught can be explained in four categories (Lorencová et al., 2019):

(1) General Approach: Critical thinking is taught separately from the presentation of subject content.
(2) Infusion Approach: The content is important, and critical thinking is integrated into the subject teaching, with the principles of critical thinking being explained.
(3) Immersion Approach: Critical thinking is integrated into subject teaching, but its principles are not explicitly stated. The subject is important and provokes thinking.
(4) Mixed Approach: Both the specific treatment of critical thinking in the subject and the teaching of the principles of critical thinking are included.

This study

Critical thinking is a skill that receives significant attention in the field of education, with researchers frequently exploring its meaning and methods of instruction. The literature on critical thinking in education covers a wide range of topics, including flipped classes, blended learning, online learning, social media, and current events. This broad scope of literature presents researchers with a comprehensive and diverse body of work to engage with.

In the modern world, concepts and topics undergo rapid changes in meaning and scope. A concept or topic can be understood differently than it was a few years ago. Technological advancements, especially in areas like artificial intelligence, often lead to new insights and understandings of concepts, which in turn influence the direction of scientific research. As a result, researchers face increasing difficulty in staying abreast of and gaining a precise understanding of the current state of their respective fields. Researchers often require resources that can help them focus and navigate this evolving landscape.

The analysis of critical thinking in education has revealed a lack of comprehensive analysis in the existing literature. This bibliometric study on critical thinking in education is designed to address this gap. The research aims to provide a broad overview of research on critical thinking in education, focusing on the progression and current state of studies in this field. The findings of this study can contribute to both educators teaching critical thinking and researchers in the field. Educators can explore globally trending approaches based on the study's results and consider incorporating them into their classroom practices. Researchers, on the other hand, can identify how approaches to critical thinking have evolved in a changing world, paving the way for the development of new research topics.

The study utilizes data from the Web of Science (WoS) database spanning the years 2005 to 2024, including publication and citation metrics. The research aims to track developments in the field of critical thinking and educational research by examining production, citation, journals, and influential works. Furthermore, prominent authors, scholarly collaborations, institutions, and countries have also been taken into consideration.

The results of this research can serve as a focal point for researchers studying critical thinking in education. The study will reveal the leading authors, publications, sources, and countries in this field, providing researchers with valuable information to guide their own work. Additionally, by uncovering current trends in the field, this research may offer insights into new avenues for research, helping researchers to further advance our understanding of critical thinking in education.

In the next stage of the study, the methodology will be outlined first. This section will describe how the data were collected and the methods used for analysis. Following the methodology section, the research results and discussions will be presented, including prominent sources, publications, authors, countries, and trends in the field of critical thinking in education. Subsequently, the current results and discussions will be discussed to provide insights and implications for future research and practice.

Method

The primary objective of this study is to examine the characteristics of publications and identify research trends in the field of critical thinking in education using bibliometric analysis. The recent surge in scientific journals and research studies has made it challenging for researchers to stay updated with the literature in their fields. Bibliometric analysis has become a crucial tool for understanding trends as it enables the processing and filtering of large amounts of data. Bibliometric methods reveal the relationships between disciplines, fields, and publications, providing visual maps of these relationships (Župič & Čater, 2015). This analysis quantifies, tracks, and analyzes academic publications, identifying influential authors, top journals, research methodologies, and summarizing research findings (Pradana et al., 2023). The goal of this study was to examine and visualize the landscape of critical thinking in education and offer insights for future research. Using bibliometric methodology, this investigation analyzed literature on critical thinking in education using metadata from the WoS Core Collection database from 2005 to 2024. Bibliometric methods are ideal for exploring the field's evolution and cumulative scientific knowledge by processing large volumes of unstructured data (Donthu et al., 2021).

Bibliometric analysis is a valuable tool for understanding research patterns, shifts, and accomplishments within a specific research field. It helps identify the most prolific contributors, organizations, and nations contributing to knowledge in that area (Aria & Cuccurullo, 2017). Bibliometrics offers a range of techniques and measures for examining the structure and dynamics of scholarly discourse (Borgman & Furner, 2002). It reveals intellectual connections within the scientific knowledge cluster (Li & Xu, 2022) and assists in identifying cyclical development patterns in research topics, as noted by Pinto et al. (2019). In this study, care has been taken to follow the steps depicted in Figure 1 below (Anninos, 2014):
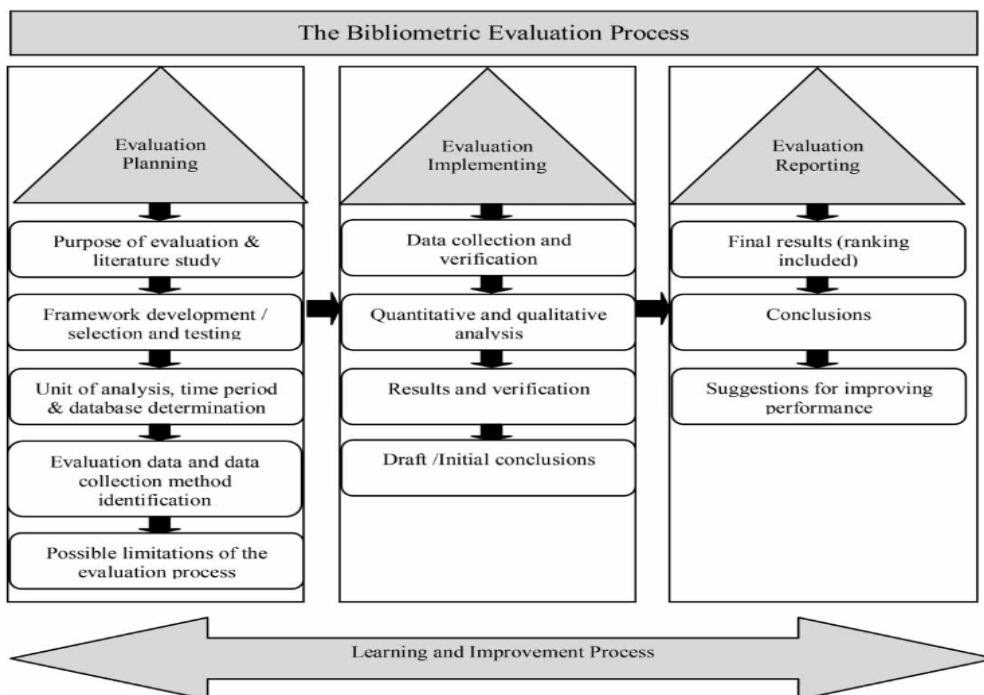
Figure 1. The bibliometric evaluation process

During the bibliometric evaluation process, the research objective was first determined, and selection criteria were established accordingly. In this context, the analysis unit determined for the WoS database is presented under the data collection section. The process of data limitation, time period, and the analyses to be conducted on the database were defined. Possible limitations of the study also emerged during this phase. Subsequently, the data were collected, and bibliometric analyses were performed. The obtained results were validated by being cross-checked using two separate software tools. Finally, during the reporting phase, tables and figures were created, and the results were discussed in relation to the existing literature.

Data Collection

The global increase in scientific publications is a notable development, but it also means researchers must navigate through a larger volume of potentially lower-quality publications, including those from predatory journals, which can be time-consuming. As a result, researchers need tools to filter high-quality publications from the rest. One of the most reliable sources for this purpose is the Web of Science, which is widely regarded as the most dependable tool for tracking changes and developments in a field. The Web of Science is the most recognized and popular database for analyzing scientific papers (Zhu & Liu, 2020). Therefore, this study's data collection process utilized the Web of Science Core Collection.

I identified key terms as "critical thinking" to identify studies focusing on critical thinking in education. Consequently, I conducted a search on WOS with these terms in titles, abstracts, and author keywords on 03/27/2024. The query i used was: "(((((TI=("critical thinking")) OR AB=("critical thinking")) OR AK=("critical thinking"))". Then I limited the search to the "SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, and ESCI"

indexes and "Education Educational Research and Education Scienctific Disciplines" categories.

As a result of the query, 21.692 publications were retrieved. The categories "Education Educational Research" and "Education Scientific Disciplines" were selected. It was found that there was a total of 10.825 publications in these two categories. The publication language was set to English, leaving 10.054 publications. When the search was limited to articles only, 6.569 publications remained. Finally, the time period from 2005 to 2024 was selected, and the remaining 6.122 publications were included in the analysis.

When the previously prepared dataset was loaded into the Bibliometrix program, it was found that a total of 6122 documents were produced by 13804 authors from 937 different sources. Out of these documents, 1783 were produced by a single author. The dataset contains 12020 keywords and 181474 references. The rate of international co-authorship is 11.53%. The annual publication growth rate is 4.58%. The average number of co-authors per document is 2.59, and the average number of citations is 11.35. The table with the data is presented below:

Table 1 Main Information About Data

Main Information About Data	
Timespan	2005:2024
Sources (Journals, Books, etc)	937
Documents	6122
Annual Growth Rate %	4,58
Document Average Age	6,72
Average citations per doc	11,35
References	181474
Document Contents	
Keywords Plus (ID)	3331
Author's Keywords (DE)	12020
Authors	13804
Authors of single-authored docs	1621
Authors Collaboration	
Single-authored docs	1783
Co-Authors per Doc	2,59
International co-authorships %	11,53

Data Analysis

In this study, I conducted bibliometric analyses and visualized the results using two different software programs. These programs are VosViewer and Bibliometrix. Both software programs are open-source and free to use. VosViewer is an open-access tool that allows for the analysis and visualization of collected data through simple operations. VosViewer can present authors, journals, universities, institutes, and keywords as networks and clusters. Lines and distances between networks and clusters show the connections. Bibliometrix, on the other hand, is a library that runs on R and can perform similar operations. The Bibliometrix package is one of the most powerful tools available for conducting bibliometric analyses. This package provides a set of functions for analyzing, visualizing, and interpreting bibliometric data. I ran Bibliometrix using R Studio, which makes the R language more user-friendly.

VosViewer and Bibliometrix are software programs with various advantages at different

points. Therefore, I used both for the analyses in my study. I conducted co-authorship analysis, source citation analysis, and country citation analysis using VosViewer. I performed all other analyses using Bibliometrix. I prepared all the tables using Bibliometrix. I conducted all these analyses to determine trends related to critical thinking in education.

In this study, I conducted extensive analysis using two separate software tools. To ensure clarity, I structured the results and discussion section as follows:

(1) Literature Review Analyses: Most relevant sources; most local cited sources, core sources by Bradfords' law, sources local impact, source citation analyses
(2) Author Analyses: Most local cited authors, authors' local impact
(3) Document Analyses: Most global cited documents, most local cited references
(4) Keyword Analyses: Most frequent words, trend topics, keyword analysis
(5) Network Analyses: Co-Occurence network, co-citation network, co-citation analysis

Results and discussions

Publishing trend in critical thinking in education research

Publication counts by year can provide information about the quantitative growth of the subject, as well as the most representative institutions, countries, and journals (Bautista-Bernal et al., 2021). Figure 2 demonstrates the production trends. The number of publications on critical thinking in the field of education has shown an increase almost every year over the past twenty years. Publications in the field can be divided into two phases. The first phase extends from 2005 to 2015. In this phase, an increase in the number of publications is observed every year. In the second phase, covering the years 2015 to 2024, there is a short decrease for one year followed by a consistent increase in the number of publications. Particularly, there is a significant increase in 2023. The analyses in this study were conducted in the first period of 2024. Therefore, I edited the image below to exclude 2024. Research on critical thinking in education shows a strong trend of development.
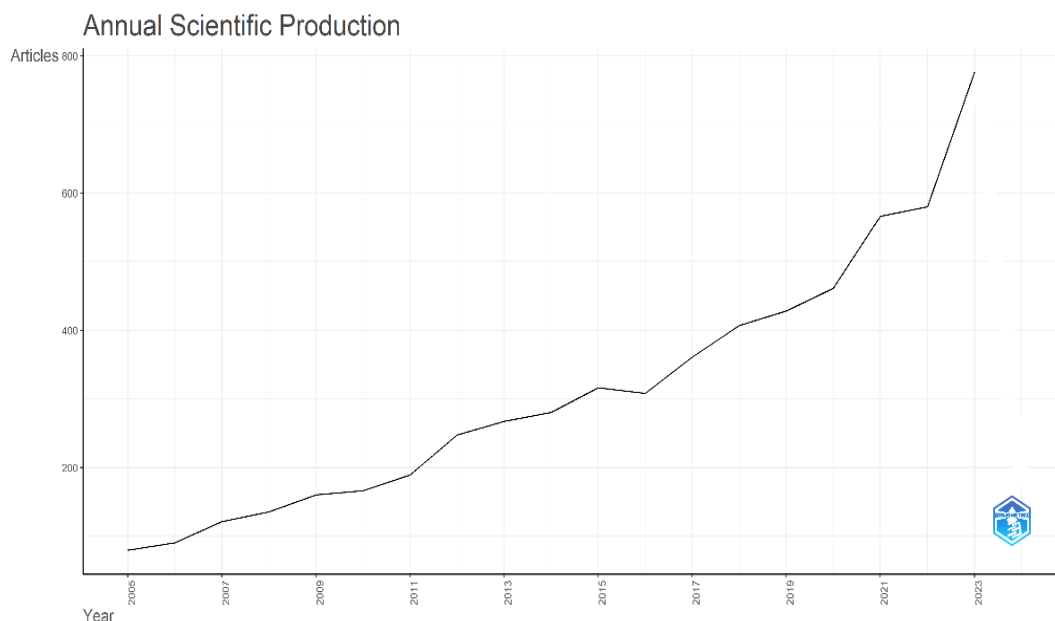

Figure 2. Annual scientific production

Most relevant sources

The source analysis shows researchers the leading journals where they can publish. Fig. 3. lists the top ten journals most relevant to critical thinking in education. The source that has produced the most documents on the research topic is "Thinking Skills and Creativity." In the past twenty years, 206 publications on the subject have been published in this journal. It is followed by "Nurse Education Today" with 174 publications and "Journal of Chemical Education" with 135 publications.

The sources can be categorized into two main groups:

The first group consists of journals that directly focus on a specific field, mostly related to health education, such as "Nurse Education Today" and "American Journal of Pharmaceutical Education." The second group includes journals directly related to educational sciences, such as "Education Sciences" and "Frontiers in Education."

"Thinking Skills and Creativity," on the other hand, is listed as a unique source that solely focuses on thinking skills. The journal 'Thinking Skills and Creativity' can be considered an educational journal as it focuses on the learning and teaching of thinking skills. However, since it does not focus on the education of any specific field or educational level, it can be regarded as a more comprehensive resource. Being a source that focuses solely on thinking skills, "Thinking Skills and Creativity" can be considered as a fundamental source for researchers working on critical thinking in education in any field.
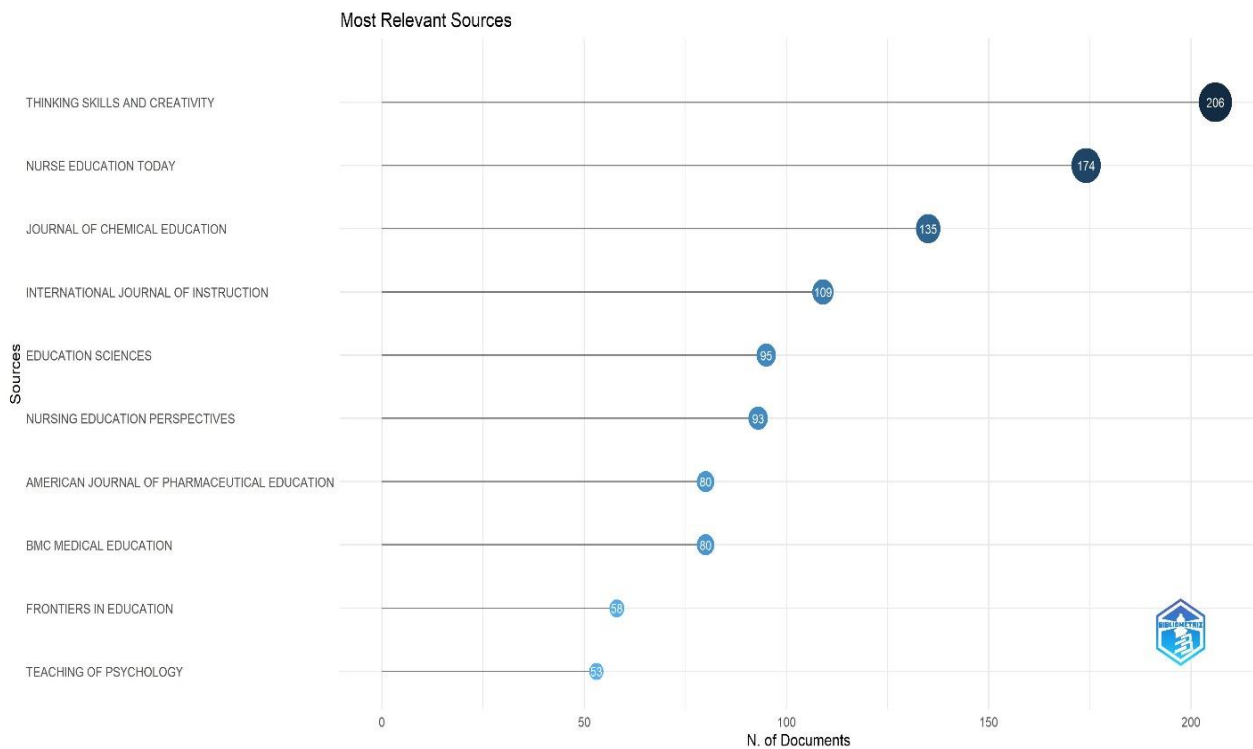

Figure 3. Most relevant sources

The source citation analysis

When conducting the source citation analysis, I used the following parameters on VosViewer: Minimum number of documents/citations of a source=30. This aimed to identify the most effective sources on critical thinking. As a result of the analysis, I found that "Thinking Skills and Creativity" with 206 publications and 3208 citations, "Nurse Education Today" with 174 publications and 3587 citations, and "Journal of Chemical Education" with 135 publications and 1656 citations were the leading sources. The sources in the blue cluster are related to health education. The red cluster focuses on publications related to thinking education. The yellow cluster primarily focuses on the relationship between thinking and education. The purple cluster includes resources related to technology and thinking education. When considering the links between the sources presented in Fig. 4, it is understood that the central source is also "Thinking Skills and Creativity." Therefore, this journal has the strongest relationship with various source clusters in the field of critical thinking in education.

Sources local impact

Sources' Local Impact analysis was conducted on the WOS database. The term "local" refers to the WOS records used in this study. When the impacts of sources are examined, it can be seen that Nurse Education Today (h-index=34; g-index=47; total citation=3587), Thinking Skills and Creativity (h-index=31; g-index=48; total citation=3208), and Computers & Education (h-index=28; g-index=47; total citation=3172) journals have similar values.
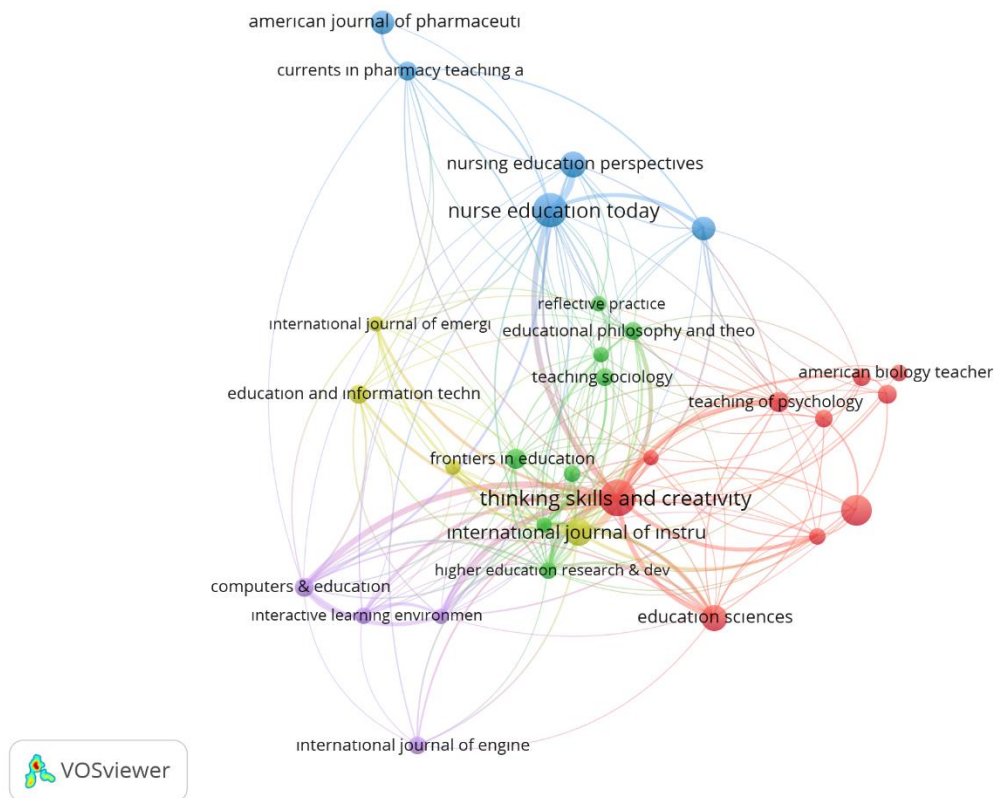

Figure 4. Clusters formed as a result of source analysis

Therefore, it is clear that these three journals are the most influential sources in the field of the research.

Considering Table 2, it can be seen that most of the journals listed focus on specific, limited areas. For example, Nurse Education Today at the top of the list is entirely focused on nursing education, while Computers & Education focuses on the use of computers in education. Thinking Skills and Creativity and Studies in Higher Education, on the other hand, looks different from other journals. These sources are more comprehensive journals. Studies in Higher Education only publishes studies conducted on higher education. Therefore, it can be said that critical thinking is more addressed in sources focusing on specific areas of education. For researchers investigating critical thinking in education regardless of the level or field, it is clear from the table below that Thinking Skills and Creativity is the main source.

Table 2. Sources' local impact

Source	h_index	g_index	m_index	Total Citation	Number of Product
Nurse Education Today	34	47	1,7	3587	174
Thinking Skills and Creativity	31	48	1,722	3208	206
Computers & Education	28	47	1,4	3172	47
American Journal of Pharmaceutical Education	24	35	1,2	1486	80
Journal of Chemical Education	22	32	1,158	1656	135
Nursing Education Perspectives	22	36	1,1	1498	93
Academic Medicine	18	27	1	1480	27
Bmc Medical Education	18	28	1,059	975	80
Studies in Higher Education	18	32	0,9	1078	32
Cbe-Life Sciences Education	17	29	1	914	29

Most local cited authors

In the analysis of Most Local Cited Authors, I used citation numbers to evaluate the impact of authors in the WOS database used in the study on critical thinking in education. Dwyer is the author who has received the most citations in the documents in this dataset over the past twenty years, with 153 citations. He is followed by Abrami and Bernard with 144 citations each. The table below lists the most influential authors in the WOS database used in the study.
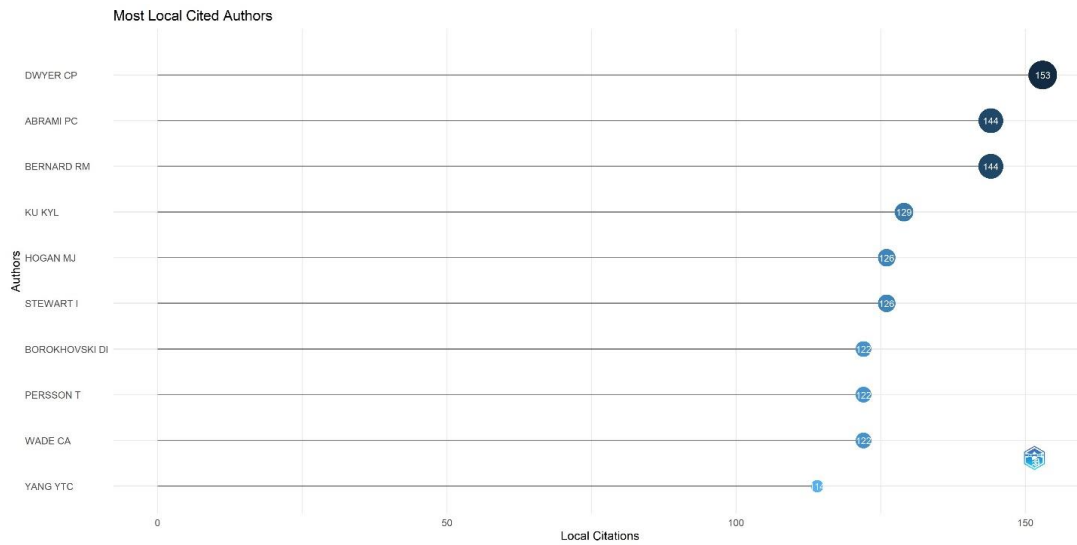
Figure 5. Most local cited authors

Authors' Local Impact

In the Authors' Local Impact analysis, I considered various criteria in the WOS database to determine the effectiveness of authors. When the impact of authors in this dataset is analyzed, Hwang is seen at the top with an h-index of 15, a g-index of 31, and a total of 976 citations. He is followed by Yang with an h-index of 11, a g-index of 13, and a total of 841 citations, and Pascarella with an h-index of 9, a g-index of 11, and a total of 519 citations. Following them, with similar values, are Chang (h-index=8; g-index=9; total citations=353), Dwyer (h-index=7; g-index=7; total citations=417), Fung (h-index=7; g-index=7; total citations=148), and Wang (h-index=7; g-index=11; total citations=125).

Table 3. Authors' local impact

Element	h_index	g_index	m_index	Total Citations	Number of Products
Hwang G. J.	15	31	1,5	976	35
Yang Y. T. C.	11	13	0,55	841	13
Pascarella E. T.	9	11	0,5	519	11
Chang S. C.	8	9	1,143	353	9
Dwyer C. P.	7	7	0,538	417	7
Fung D.	7	7	0,538	148	7
Wang Y.	7	11	0,368	125	14
De bruin L. R.	6	6	0,75	114	6
Elen J.	6	9	0,5	162	9
Hogan M. J.	6	6	0,462	358	6

Most global cited documents

The analysis of Most Global Cited Documents considers the references of the publications in the dataset and determines the most cited studies in these publications. It evaluates the works regardless of whether they are indexed in the WOS. The most cited work on the research topic, regardless of whether it is indexed, is Carini et al. (2006) with 746 citations. This study, titled "Student Engagement and Student Learning: Testing the Linkages" focuses on the relationship between student engagement and academic

performance. It is followed by Broadbent and Poon (2015) with 705 citations and Binkley (2012) with 688 citations. Broadbent and Poon examined the impact of critical thinking on grades, while Binkley aimed to define 21st-century skills. Additionally, two publications in the list (Shea & Bidjerano, 2009; Yang & Wu, 2012) focus on the impact of online systems on critical thinking. Moreover, Noddings (2012) and Abrami et al. (2015) touch on teaching critical thinking and strategies. The table 4 below shows the most influential works in the references of the studies in the dataset:

Table 4. Most global cited documents

Paper	DOI	Total Citations	Normalized TC
Carini R.M., 2006, Res High Edu	10.1007/s11162-005-8150-9	746	26,49
Broadbent J., 2015, Int High Edu	10.1016/j.iheduc.2015.04.007	705	40,75
Binkley M., 2012, Assessment and Teaching of 21st Century Skills	10.1007/978-94-007-2324-5_2	688	32,07
Lee A., 2008, Stud High Edu	10.1080/03075070802049202	333	11,49
Shea P., 2009, Comput Edu	10.1016/j.compedu.2008.10.007	326	10,94
Kumagai A.K., 2009, Aca Med	10.1097/ACM.0b013e3181a42398	316	10,61
Abrami P.C., 2015, Rev Edu Res	10.3102/0034654314551063	314	18,15
Noddings N, 2012, Oxf Rev Edu	10.1080/03054985.2012.745047	294	13,70
Srinivasan M., 2007, Aca Med	10.1097/01.ACM.0000249963.93776.aa	285	11,69
Yang Y.T.C., 2012, Comput Edu	10.1016/j.compedu.2011.12.012	282	13,14

Most local cited references

In the dataset used in this study from the WOS, the references with the most citations are Facione (1990) with 349 citations, Halpern (1998) with 205 citations, and Abrami (2008) with 184 citations.

Facione (1990) compiled the efforts of numerous experts in various fields regarding the teaching and assessment of critical thinking. The report, known as the Delphi Report, is considered a foundational source for the conceptual basis of the field of critical thinking. Additionally, the publications listed can be classified into theoretical publications, publications on critical thinking education and strategies, publications on general education and psychology, and publications on methods and research techniques:

(1) Theoretical publications: Facione (1990), Ennis (1989), Ennis (1987)
(2) Publications on critical thinking education and teaching methods: Halpern (1998), Abrami et al. (2008), Abrami et al. (2015)
(3) Publications on educational psychology: Vygotsky (1978), Freire (1976)
(4) Publications on methods and research techniques: Braun & Clarke (2006), Cohen (1988)

The most impactful studies published in the WOS in the field of critical thinking in education are listed in the table below:

Table 5. Most local cited references

Authors	Year	Cited References	Citations
Facione P.A.	1990	Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction (The Delphi Report)	349
Halpern D.F.	1998	Teaching critical thinking for transfer across domains: Disposition, skills, structure training, and metacognitive monitoring.	205
Abrami P.C. et al.	2008	Instructional interventions affecting critical thinking skills and dispositions: A stage 1 meta-analysis	184
Vygotsky L.S.	1978	Mind in society: Development of higher psychological processes	178
Ennis R.S.	1989	Critical thinking and subject specificity: Clarification and needed research	145
Braun V. & Clarke V.	2006	Using thematic analysis in psychology	141
Ennis R.S.	1987	A taxonomy of critical thinking dispositions and abilities.	138
Cohen J.J.	1988	Statistical power analysis for the behavioral sciences	130
Abrami P.C. et al.	2015	Strategies for teaching students to think critically: A meta-analysis	122
Freire P.	1976	Education: The practice of freedom	122

Most frequent keywords

The concepts of critical thinking, thinking, and education, which are likely to be present in every publication, have been excluded from the analysis. The most frequently occurring keywords in the dataset are learning (261), higher education (237), assessment (173), active learning (160), and curriculum (140). In the last twenty years, higher education, assessment in education, critical thinking skills and instructional programs have been frequently studied topics in critical thinking research in education. Additionally, active learning, problem-based learning, and teacher education have also been frequently addressed.

Figure 6 Most frequent keywords

This analysis focuses on the most used keywords in the last twenty years. However, just because a keyword has been more researched in the past does not mean it is still being studied today. Therefore, while these keywords reveal the most studied topics in critical thinking in education, they do not provide us with information about current trends. Researchers are interested in what the current trends are. The subject of trends, however, is addressed in the

Trend topics The plot resulting from the trend topics analysis of the dataset is shown below. The analysis indicates that studies on EFL (English as a Foreign Language) students have been at the forefront in recent years. The inclusion of the concepts of artificial intelligence and ChatGPT, which are related to new technological developments, following the term EFL students in the table highlights the prominence of these concepts in critical thinking research in recent years. Researchers are examining how technological developments are affecting critical thinking in education, with artificial intelligence (AI) being among the top topics. This view indicates that research on AI in critical thinking in education is at the forefront. Topics that address fundamental issues in education, such as methods and techniques, as well as various aspects of learning such as distance education, are losing their prominence in the literature on critical thinking in education. As a result of this analysis, it can be said that innovative topics in education, especially artificial intelligence, are gaining weight in research on critical thinking in education.

Co-occurence network

Co-occurrence Network analysis was used to identify keywords that appear together in studies, which helps classify keywords. To conduct a more sensitive analysis, the parameters were set as follows: "Repulsion Force=0.1; Minimum Number of Edges=1". As a result, the visual below was created. Fig. 8 shows three clusters represented by three different colors. Therefore, we can say that there are three general research clusters in the critical thinking literature.

The red cluster, which is clustered around critical thinking, is named as the main cluster. It
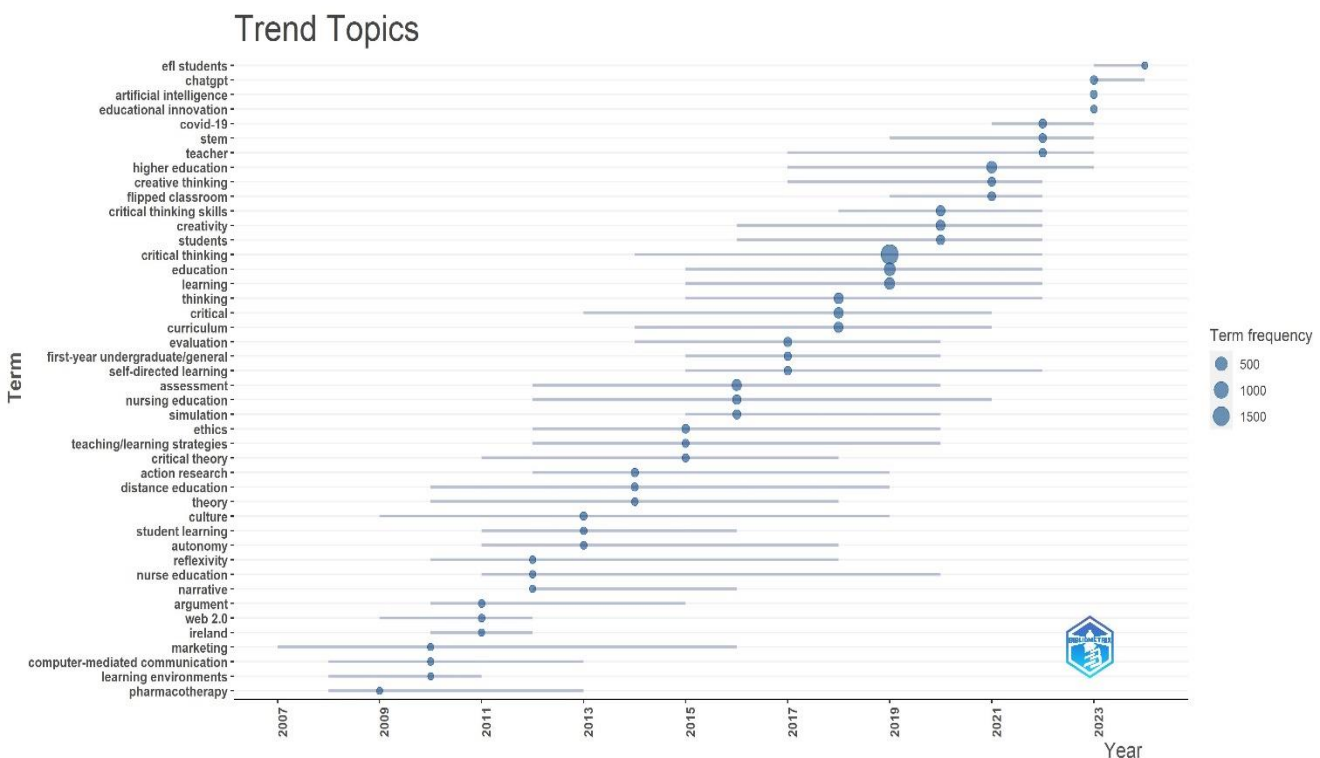

Figure 7 Trend topics

includes the concepts of general education and critical thinking. This cluster includes fundamental concepts such as learning, teaching, skills, attitudes, motivation, as well as

concepts related to different methods such as online learning and flipped classroom. There is no consensus on what critical thinking is, nor on how it should be taught, and debates on this issue have been ongoing for many years. How educators teach critical thinking often depends on their own perceptions of what critical thinking entails (Scanlan, 2006). Moreover, whether critical thinking should be taught as a standalone course or integrated within other courses remains a topic of discussion. For instance, the Delphi Report, compiled by Facione (1990), states that critical thinking is independent of disciplines but emphasizes that its teaching requires knowledge from various disciplines. The diverse approaches to defining and teaching critical thinking may have led researchers to focus for years on its relationship with methods such as flipped classrooms and online learning. For this reason, the red cluster presents the general framework of research on critical thinking in education that has been conducted for many years.

The blue cluster, named 21st Century Skills and teacher education, contains elements representing skills related to 21st Century Skills and teacher education. This cluster includes concepts such as collaboration, creativity, and communication, which are addressed in 21st Century Skills and teacher education. Therefore, the blue cluster consists of studies that consider critical thinking as part of 21st Century skills and teacher education.

The green cluster, named Nursing Education, is directly related to nursing education. The concepts in this cluster encompass topics related to health education.
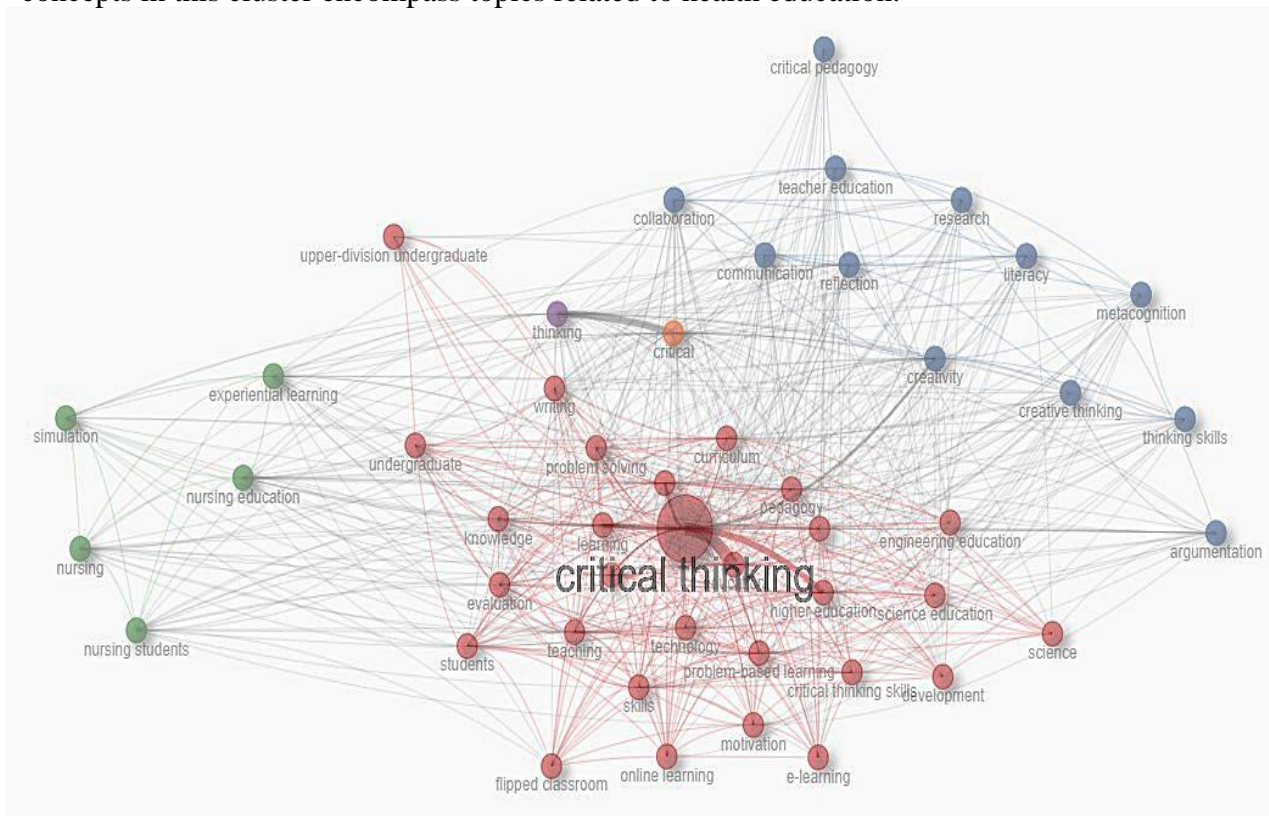

Figure 8 Co-occurence network

Co-citation network

Co-cited literature often represents the fundamental knowledge and significant research advances of a particular field (Rawat and Sood, 2021). Co-citation analysis allows to examine the knowledge base of existing literature by identifying co-citation relationships (Huang et al., 2020). Co-citation network analysis aims to identify networks of co-cited references, providing a more nuanced analysis than simple citation counts. The analysis revealed three main thematic clusters represented by different colors in Figure 9. The orange cluster represents a theme where pioneering authors such as Diane Halpern, Robert H. Ennis, Peter Facione, and John E. McPeck are central. These authors are distinguished by their representation of key ideas in the critical thinking literature. Particularly, Facione's publication of the Delphi Report, which outlined consensus views on critical thinking, has solidified these works as central to the cluster, receiving significant co-citations.

The purple cluster, on the other hand, consists of authors such as Matthew Lipman, Benjamin Bloom, and Paulo Freire. This group likely represents major schools of thought within the literature on critical thinking in education, as these authors are central to this cluster and are co-cited frequently. Lastly, the blue cluster, led by Vygotsky, signifies another thematic area within the literature. This cluster likely represents discussions on how Vygotsky's theories intersect with or influence the discourse on critical thinking in education.
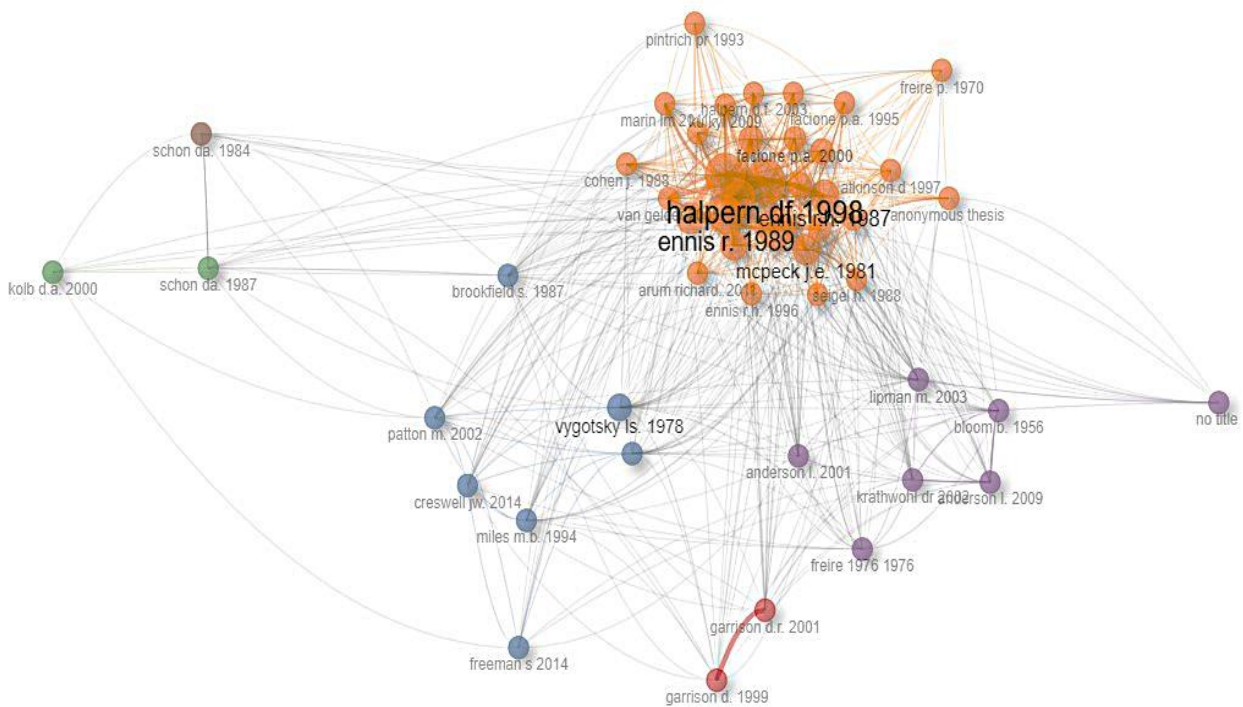

Figure 9 Co-citation network

Country citation analyses

When conducting the country citation analysis, I used the following parameters: Minimum number of documents/citations of a source=30. The analysis showed that the most productive country in the field with 2087 publications is the USA, followed by Australia with 409 publications and China with 357 publications. The countries with the highest number of

citations are the USA with 29209 citations, Australia with 6869 citations, the UK with 4792 citations, and China with 4070 citations. It is clear that the USA is the leading country in critical thinking in education by a wide margin. This is an expected outcome, as the United States consistently ranks first globally in terms of publication volume and impact across nearly all scientific fields (ULAKBİM, 2015). The U.S. maintains its position as a leading country in scientific publication production, extending this dominance to research on critical thinking as well.
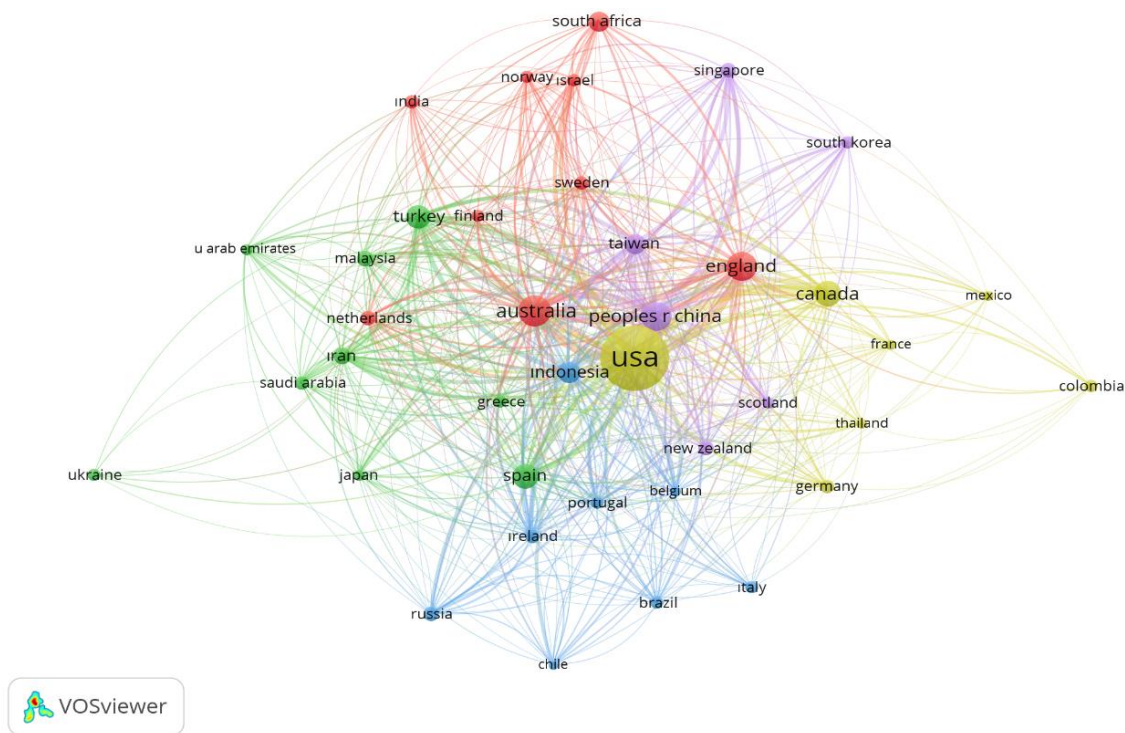

Figure 10. Country citation analyses

Conclusions, future directions and limitations

This study utilized a systematic review of research on the critical thinking in the field of education using visualization and bibliometric methods. I identified trends in publication, countries, organizations, and authors, as well as collaboration patterns among organizations, countries and authors. I also tried to determine frontier journals and authors.

My research, based on 6122 articles published between 2005 and 2024 in the Web of Science Core Collection database, provides a general overview of critical thinking in education. The analysis process included an examination of publications, keywords, sources, references, authors, countries, and their relationships. The first significant result obtained during this process is the increasing interest in the field.

The analysis of data from WOS indicates that interest in critical thinking in education will continue. I have determined that studies focusing on critical thinking in education have increased year by year. Analysis shows a small decrease only between 2015 and 2016, but the rate of increase has risen since 2016. This increasing trend peaked in the year 2023. The Western education system considers the development of critical thinking as the ultimate goal of education (Wang & Jia, 2023). Leading universities such as Cambridge and Harvard

consider critical thinking tendency as one of their core values (Sun, 2011). The association of critical thinking with economic prosperity (Durr et al., 1999), the need for critical thinking in the job market (Lucas, 2019), and the fact that critical thinking has become one of the key competencies of the 21st century is among the reasons for this. Therefore, researchers' interest in critical thinking in education is increasing.

For researchers working in the field of critical thinking in education, there seem to be plenty of publication opportunities. These sources are mostly grouped in the fields of education sciences and the education of various disciplines (such as nursing education or chemistry education). Considering all source analyses, it can be said that the journal "Thinking Skills and Creativity" holds a special place. I have seen that this journal ranks prominently in all analyses conducted. Furthermore, its focus on thinking skills without specializing in a particular area sets it apart. Therefore, this journal could be the primary source in the field of critical thinking in education. However, critical thinking in education is also extensively addressed in sources related to nursing education and education sciences. For example, "Nurse Education Today" is one of the journals that has published a lot of articles on critical thinking. Similarly, "Computers & Education," which focuses on computer use in education, and "Journal of Chemical Education," which limits its scope to chemistry education, are among the key sources in the field of critical thinking in education.

In the WOS database, Christopher P. Dwyer, who is the most cited author, is interested in the theoretical aspects of critical thinking. His work, "An integrated critical thinking framework for the 21st century," has received a lot of citations. Dwyer's other works, such as "Critical thinking: Conceptual perspectives and practical guidelines," also receive a lot of citations. Critical thinking is a skill that enables individuals to adapt to a changing world. Therefore, researchers are very interested in Dwyer's efforts to apply conceptual knowledge to practical areas.

Philip C. Abrami and Robert M. Bernard, who rank second and third on the list, are known for their meta-analysis studies on critical thinking and learning. Abrami, Bernard, and others' works, such as "Strategies for teaching students to think critically: A meta-analysis" and "Instructional interventions affecting critical thinking skills and dispositions: A stage 1 meta-analysis," receive a lot of citations in the field of critical thinking in education. These results may indicate that researchers are more interested in practical aspects, such as how to teach critical thinking. Therefore, trends in the field of critical thinking in education seem to focus on practical issues, such as teaching critical thinking.

Advancements in technology are transforming education. Therefore, technology-related topics are often discussed in the context of critical thinking in education. Gwo-Jen Hwang and Ya-Ting C. Yang, who rank highly in the Authors' Local Impact analysis (considering h-index and g-index values), are interested in digital storytelling, distance learning, mobile learning, and technology-enhanced flipped classrooms. Various authors identified through the Most Global Cited Documents analysis (such as Shea & Bidjerano, 2009; Yang & Wu, 2012) have studied the impact of online systems on critical thinking. These results may indicate that researchers are also curious about the relationship between new technologies and critical thinking. Teaching critical thinking skills that are suitable for the needs of the era is one of the topics that attract interest in the field. This is clearly evident in the analyses of trends in critical thinking in education.

The study results indicated an increasing trend in technology-focused studies (espacially on

artificial intelligence) on critical thinking in education. This indicates that educators and researchers consider artificial intelligence to be important for critical thinking in education in the future. Every day, we encounter news about artificial intelligence surpassing new thresholds. Educators are increasingly realizing the potential of artificial intelligence to change education (Kohnke et al., 2023). Artificial intelligence will be an important research topic in improving the effectiveness of education (Susnjak, 2022). Therefore, it is not surprising that artificial intelligence stands out in the context of critical thinking in education. The 21st century is an era of rapid changes. Among the key drivers of this acceleration are the advancements in information and communication technologies (ICT) and the transition to an information society (Křeménková et al., 2021). ICT has paved the way for discovering new methods of teaching and learning (Díaz et al., 2011, as cited in Křeménková et al., 2021). Various studies have revealed that integrating these technologies into education provides opportunities not only for enhancing digital literacy but also for developing 21st-century skills, including critical thinking (Varier et al., 2017). Some research further suggests that higher-order thinking skills can be strengthened through technology (Spektor-Levy & Granot-Gilat, 2012). Artificial intelligence (AI), the most discussed technology of the past decade, is now considered a necessity in education (Ahmad et al., 2023). AI is actively employed in areas such as teaching, feedback, grading, analysis, and virtual reality (Tahiru, 2021). New technologies, particularly AI, are rapidly finding applications in educational processes.

To become effective problem solvers and critical thinkers, 21st-century students must utilize technology (P21, 2016). Consequently, integrating AI into teaching and learning processes is essential for progress. Technological advancements bring both new challenges and opportunities for teaching and fostering critical thinking. A question increasingly raised in the literature is whether AI might hinder human thinking (Moustaghfir & Brigu, 2024). The ability of technologies like AI to perform certain cognitive tasks could lead to intellectual laziness. As dependence on this technology grows, it is possible for individuals to become lazier, restrict their cognitive activities, and ultimately experience a decline in thinking capacity (Ahmad et al., 2023). The deterioration of unused abilities is a natural aspect of human behavior. Research findings indicate that the widespread use of AI may result in losses in individuals' thinking and decision-making skills. In particular, reduced use of mental abilities like critical thinking and problem-solving is expected to create challenges (Stahl, 2021). Therefore, preserving and enhancing human intelligence, especially critical thinking, has become even more crucial in the age of AI (Moustaghfir & Brigu, 2024). When education is restructured with the support of AI, it is imperative to prioritize thinking skills. This appears to be a paradox that education must address. The increasing focus on AI in critical thinking research in recent years could be a reflection of this paradox.

For quite some time, critical thinking has been regarded as a fundamental objective of education (Care et al., 2018; Halpern, 2002; Facione, 2000). Despite the evolving landscape, including advancements like artificial intelligence, interest in critical thinking has not waned; rather, it has shifted attention to new aspects of critical thinking research. This evolving focus revolves around the methods of teaching critical thinking in the context of these advancements. Hence, it is plausible to suggest that studies on critical thinking will see a rise in the future.

The main shortcoming of this study is the restricted nature of the data available. In this study, only the WOS data covering the years 2005 to 2024 was utilized. This may have excluded some publications related to critical thinking in education. Many publications on the subject can be found in different indexes and databases. In this study, the indexing of the publication in WOS was established as a criterion for determining the quality of the publication.

Publications written in languages other than English were also not included in the research. Some high-quality publications may not be indexed in WOS or may be written in a language other than English. Additionally, the inclusion criteria focusing solely on articles may have excluded other academic writings such as influential books, book chapters, or conference papers on the subject.

References

Abrami, P. C., Bernard, R. M., Borokhovski, E., Waddington, D. I., Wade, C. A., & Persson, T. (2015). Strategies for teaching students to think critically: A meta-analysis. *Review of Educational Research, 85*(2), 275-314. https://doi.org/10.3102/0034654314551063

Abrami, P. C., Bernard, R., Borokhovski, E., Wade, A., Surkes, M. A., Tamim, R. M., & Zhang, D. (2008). Instructional interventions affecting critical thinking skills and dispositions: A stage 1 meta-analysis. *Review of Educational Research*, *78*(4), 1102–1134. https://doi.org/10.3102/0034654308326084

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

Anninos, L. N. (2014). Research performance evaluation: some critical thoughts on standard bibliometric indicators. *Studies in Higher Education*, *39*(9), 1542–1561. https://doi.org/10.1080/03075079.2013.801429

Aria, M., & Cuccurullo, C. (2017). Bibliometrix : An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, *11*(4), 959–975. https://doi.org/10.1016/j.joi.2017.08.007

Baker, M., Rudd, R., & Pomeroy, C. (2001). Relationships between critical and creative thinking. *Journal of Southern Agricultural Education Research, 51*(1), 173-188.

Bautista-Bernal, I., García, C. Q., & Lara, M. M. (2021). Research trends in occupational health and social responsibility: A bibliometric analysis. *Safety Science*, *137*, 105167. https://doi.org/10.1016/j.ssci.2021.105167

Bean, J. C., & Melzer, D. (2021). *Engaging ideas: The professor's guide to integrating writing, critical thinking, and active learning in the classroom*. John Wiley & Sons.

Binkley, M., Erstad, O., Herman, J., Raizen, S., Ripley, M., Miller-Micci, M., & Rumble, M. (2012). Defining 21 Century skills. In P. Griffin, B. McGaw, E. Care (Eds.) *Assessment and Teaching of 21st Century Skills*. Springer.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101.

Broadbent, J., & Poon, W. L. (2015). Self-regulated learning strategies & academic achievement in online higher education learning environments: A systematic review. *The internet and higher education*, 27, 1-13. https://doi.org/10.1016/j.iheduc.2015.04.007

Borgman, C. L., & Furner, J. (2002). Scholarly communication and bibliometrics. *Annual Review of Information Science and Technology*, *36*(1), 2–72. https://doi.org/10.1002/aris.1440360102

Butler, H. A., Pentoney, C., & Bong, M. P. (2017). Predicting real-world outcomes: Critical thinking ability is a better predictor of life decisions than intelligence. *Thinking Skills and Creativity*, *25*, 38–46. https://doi.org/10.1016/j.tsc.2017.06.005

Care, E., Kim, H., Vista, A., & Anderson, K. (2018). Education System Alignment for 21st Century Skills: Focus on Assessment. *The Brookings Institution*. https://files.eric.ed.gov/fulltext/ED592779.pdf

Carini, R. M., Kuh, G. D., & Klein, S. P. (2006). Student engagement and student learning: Testing the linkages. *Research in Higher Education, 47*(1), 1-32. https://doi.org/10.1007/s11162-005-8150-9

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Routledge.

Davies, M. (2015). A model of critical thinking in higher education. In *Higher education* (pp. 41–92). https://doi.org/10.1007/978-3-319-12835-1_2

De Bruin, W. B., Parker, A. M., & Fischhoff, B. (2007). Individual differences in adult decision-making competence. *Journal of Personality and Social Psychology*, *92*(5), 938–956. https://doi.org/10.1037/0022-3514.92.5.938

Dewey, J. (1933). *How we think, A restatement of the relation of reflective thinking to the educative process*. D.C. Heath & Co Publishers.

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). https://doi.org/10.1016/j.heliyon.2023.e16934

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, *133*, 285–296. https://doi.org/10.1016/j.jbusres.2021.04.070

Durr, C. R., Lahart, T. E., ve Maas, R. M. (1999). Improving critical thinking skills in secondary math and social studies classes (ERIC Document Reproduction Service No. ED 434 016). https://files.eric.ed.gov/fulltext/ED434016.pdf

Ennis, R. H. (2011). *The nature of critical thinking: An outline of critical thinking dispositions and abilities*. https://education.illinois.edu/docs/default-source/faculty-documents/robert-ennis/thenatureofcriticalthinking_51711_000.pdf

Ennis, R. H. (1987). Critical thinking and the curriculum. *Thinking skills instruction: Concepts and techniques*, 40-48.

Ennis, R. H. (1985). A logical basis for measuring critical thinking skills. *Educational Leadership, 43*(2), 44-48.

Facione, P. A. (2015). Critical thinking: What it is and why it counts. Insight Assessment. https://d1wqtxts1xzle7.cloudfront.net/71022740/what_why98-libre.pdf

Facione, P. A. (2000). The disposition toward critical thinking: its character, measurement, and relationship to critical thinking skill. *Informal Logic*, *20*(1). https://doi.org/10.22329/il.v20i1.2254

Facione, P. (1990). *Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction (The Delphi Report)*. https://philarchive.org/archive/faccta

Freire, P. (1976). *Education: The practice of freedom*. Writers and Readers Publishing Cooperative.

Güntaş, S. & Çetin, E. (2019). A study on critical thinking skills of university students: The North Cyprus Example. *International Journal of Arts & Social Studies, 2*(2), 32-42.

Halpern, D. F. (2002). *Thought and Knowledge: An Introduction to Critical Thinking, 4th edition*. https://openlibrary.org/books/OL28509166M/Thought_and_Knowledge

Halpern, D. F. (1998). Teaching critical thinking for transfer across domains: Disposition, skills, structure training, and metacognitive monitoring. *American Psychologist*, *53*(4), 449–455. https://doi.org/10.1037/0003-066x.53.4.449

Huang, L., Chen, K., & Zhou, M. (2020). Climate change and carbon sink: a bibliometric analysis. *Environmental Science and Pollution Research International*, *27*(8), 8740–8758. https://doi.org/10.1007/s11356-019-07489-6

Kohnke, L., Moorhouse, B. L., & Zou, D. (2023). ChatGPT for language teaching and learning. *RELC Journal*, *54*(2), 537–550. https://doi.org/10.1177/00336882231162868

Křeménková, L., Plevová, I., Pugnerová, I.M. & Sedláková, E. (2021). Information and communication technology and critical thinking in university students. *World Journal on Educational Technology, 13*(4), 902-910. https://doi.org/10.18844/wjet.v13i4.6275

Lai, E. R. (2011). Critical Thinking: A Literature Review. *Pearson's Research Report (2011)*, pp. 2-44

Li, B., & Xu, Z. S. (2022). A comprehensive bibliometric analysis of financial innovation. *Ekonomska Istraživanja/Ekonomska IstražIvanja*, *35*(1), 367–390. https://doi.org/10.1080/1331677x.2021.1893203

Lorencová, H., Jarošová, E., Avgitidou, S., & Dimitriadou, C. (2019). Critical thinking practices in teacher education programmes: a systematic review. *Studies in Higher Education*, *44*(5), 844–859. https://doi.org/10.1080/03075079.2019.1586331

Lucas, K. (2019). Chinese graduate student understandings and struggles with critical thinking: A narrative-case study. *International Journal for the Scholarship of Teaching and Learning*, *13*(1). https://doi.org/10.20429/ijsotl.2019.130105

Marzano, R. J., Brandt, R. S., Hughes, C. S., Jones, B. F., Presseisen, B. Z., Rankin, S. C. ve Suhor, C. (1988). *Dimensions of thinking: A framework for curriculum and instruction*. The Association for Supervision and Curriculum Development.

Massa, S. (2014). The development of Critical thinking in Primary School: The role of teachers' beliefs. *Procedia: Social & Behavioral Sciences*, *141*, 387–392. https://doi.org/10.1016/j.sbspro.2014.05.068

Momani, M. a. K. A., Alsmadi, M. A., Samardali, M. F. S., & Abdalazez, A. M. a. A. (2023). A bibliometric analysis of the increasing knowledge base on the role of thinking teaching strategy in sciences teaching. *Research in Science & Technological Education*, 1–23. https://doi.org/10.1080/02635143.2023.2204424

Moustaghfir, S., & Brigui, H. (2024). Navigating critical thinking in the digital era: An informative exploration. *International Journal of Linguistics, Literature and Translation, 7*(1), 137-143. https://doi.org/10.32996/ijllt.2024.7.1.11x

Noddings, N. (2012). The caring relation in teaching. *Oxford Review of Education, 38*(6), 771-781. https://doi.org/10.1080/03054985.2012.745047

Noddings, N. (2008). All our students thinking. *Educational Leadership, 65*(5), 8-13.

Norris, S. P. (1985). Synthesis of research on critical thinking. *Educational leadership, 42*(8), 40-45.

Nuryana, I., Sugeng, B., Soesilowati, E., & Andayani, E. S. (2024). Critical thinking in higher education: a bibliometric analysis. *Journal of Applied Research in Higher Education, 16*(5), 2216-2231. https://doi.org/10.1108/JARHE-08-2023-0377

Paul, R. (2005). The state of critical thinking today. *New Directions for Community Colleges, 2005*(130), 27-38.

Paul, R. & Elder, L. (2012). *Kritik düşünce-Yaşamınızın ve öğrenmenizin sorumluluğunu üstlenmek için araçlar* [Critical thinking: Tools for taking charge of your learning and your life] (Trans: E. Aslan, G. Sart). Nobel.

Paul, R., & Elder, L. (2008). Critical thinking: The nature of critical and creative thought. *Journal of Developmental Education, 31*(3), 34-35.

Pinto, M., Fernández-Pascual, R., Caballero-Mariscal, D., Sales, D., Guerrero, D. & Uribe, A. (2019). Scientific production on mobile information literacy in higher education: a bibliometric analysis (2006–2017). *Scientometrics 120*, 57–85. https://doi.org/10.1007/s11192-019-03115-x

Pradana, M., Elisa, H. P., & Syarifuddin, S. (2023). Discussing ChatGPT in education: A literature review and bibliometric analysis. *Cogent Education, 10*(2). https://doi.org/10.1080/2331186x.2023.2243134

Radulović, L., & Stančić, M. (2017). What Is Needed to Develop Critical Thinking in Schools? *CEPS Journal*, *7*(3), 9–25. https://doi.org/10.26529/cepsj.283

Rawat, K. S., & Sood, S. K. (2021). Knowledge mapping of computer applications in education using CiteSpace. *Computer Applications in Engineering Education*, *29*(5), 1324–1339. https://doi.org/10.1002/cae.22388

Ridwan, M., Suherman, W. S., Haryanto, H., & Putranta, H. (2022). Mapping critical thinking research in physical education: A review of the publishing or perish literature and bibliometric analysis. *Revista iberoamericana de psicología del ejercicio y el deporte, 17*(5), 279-285.

Rotherham, A. J., & Willingham, D. T. (2010). "21st-Century" skills: Not new, but a worthy challenge. *American Educator, 34*(1), 17–20.

Russell, B. (1997). *Sorgulayan Denemeler* [Sceptical Essays] (Trans: N. Arık). Tübitak Yayınları.

Saleh, S. E. (2019). Critical thinking as a 21st century skill: conceptions,implementation and challenges in the EFL classroom. European Journal of Foreign Language Teaching, 4(1). https://doi.org/10.5281/zenodo.2542838

Scanlan, J. S. (2006). *The effect of Richard Paul's universal Elements and Standards of Reasoning on twelfth grade composition* [Phd Thesis]. Alliant International University.

Shafique, M. (2013). Thinking inside the box? Intellectual structure of the knowledge base of innovation research (1988–2008). *Strategic Management Journal*, *34*(1), 62–93. https://doi.org/10.1002/smj.2002

Shea, P., & Bidjerano, T. (2009). Community of inquiry as a theoretical framework to foster "epistemic engagement" and "cognitive presence" in online education. *Computers & Education, 52*(3), 543-553.

Siegel, H. (1985). Educating reason: Critical thinking, informal logic, and the philosophy of education. Part two: Philosophical questions underlying education for critical thinking. *Informal Logic, Spring&Fall 7*(2-3), 69-81.

Slavin, R. (2013). *Eğitim psikolojisi: Kuram ve uygulama* [Educational psychology: Theory and practice] (Trans. Ed. G. Yüksel). Nobel Akademik Yayıncılık.

Smith, M. A. (2020). *Is critical thinking really critical? A research study of the intentional planning for the teaching of critical thinking in the middle grades* [PhD Thesis, National Louis University]. https://digitalcommons.nl.edu/cgi/viewcontent.cgi?article=1501&context=diss

Snyder, L. G., & Snyder, M. J. (2008). Teaching critical thinking and problem solving skills. *The Delta Pi Epsilon Journal, L*(2), 90-99.

Sun, Y. Z. (2011). Toward a critical thinking-oriented curriculum for English majors. *Foreign Languages in China, 3*, 49–58.

Susnjak, T. (2022). *ChatGPT: The end of online exam integrity?*. https://doi.org/10.48550/arXiv.2212.09292

Ten Dam, G., & Volman, M. (2004). Critical thinking as a citizenship competence: teaching strategies. *Learning and Instruction*, *14*(4), 359–379. https://doi.org/10.1016/j.learninstruc.2004.01.005

Tseng, S. S. (2017). *Improving and assessing students' CT through concept mapping and concept maps*. https://athenaeum.libs.uga.edu/handle/10724/38129

ULAKBİM. (2015). Dünya, Ülkeler ve Gruplar Bilimsel Yayın Sayısı [World, Countries, and Groups Scientific Publication Count] (2010-2015). https://cabim.ulakbim.gov.tr/wp-content/uploads/sites/4/2016/07/D%C3%BCnya-%C3%9Clkeler-ve-Gruplar-Bilimsel-Yay%C4%B1n-Say%C4%B1s%C4%B1-2010-2015.pdf

Vieira, R. M., Tenreiro-Vieira, C., & Martins, I. P. (2011). Critical thinking: Conceptual clarification and its importance in science education. *Science Education International*, *22*(1), 43–54. https://files.eric.ed.gov/fulltext/EJ941655.pdf

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard university press.

Wang, D., & Jia, Q. (2023). Twenty years of research development on teachers' critical thinking: Current status and future implications——A bibliometric analysis of research articles collected in WOS. *Thinking Skills and Creativity*, *48*, 101252. https://doi.org/10.1016/j.tsc.2023.101252

Willingham, D. T. (2008). Critical thinking: Why is it so hard to teach? *Arts Education Policy Review*, *109*(4), 21–32. https://doi.org/10.3200/aepr.109.4.21-32

Yang, Y. T. C., & Wu, W. C. I. (2012). Digital storytelling for enhancing student academic achievement, critical thinking, and learning motivation: A year-long experimental study. *Computers & education, 59*(2), 339-352.

Yücel, A. G., & Köçer, M. (2018). The effect of controversial issues on the development of social studies teacher candidates' critical thinking levels. *Journal of Social Sciences of Mus Alparslan University, 7*(3), 129-139. http://dx.doi.org/10.18506/anemon.468137

Zhu, J., & Liu, W. (2020). A tale of two databases: the use of Web of Science and Scopus in academic papers. *Scientometrics*, *123*(1), 321–335. https://doi.org/10.1007/s11192-020-03387-8

Župič, I., & Čater, T. (2014). Bibliometric methods in management and organization. *Organizational Research Methods*, *18*(3), 429–472. https://doi.org/10.1177/1094428114562629

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Data availability

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