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Critical thinking in library and information science: a bibliometric analysis

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Abstract: Critical thinking has long been an important topic in academia and educational sciences. Despite various research in analyzing critical thinking publications in different academic disciplines, no comprehensive research has ever been conducted about bibliometric analysis of publications in this topic in Library and information science (LIS). Bibliometric analysis is a significant tool for a systematic analysis of references related to multiple subjects and disciplines. This research aimed at discussing and defining critical thinking concept in LIS by implementing bibliometric analysis for analyzing and reviewing over publications regarding critical thinking in Library and information science via Web of Science Database (WoS). After standard searching, selecting and screening the relevant results, 105 publications were retrieved from WoS. Publications were analyzed according to number of references and citations per year, key authors, highly cited publications, affiliations, and countries. The frequency of related keywords and the relationship between them were also analyzed by VOSviewer to identify the relationship between keywords in critical thinking in LIS. The results demonstrated that critical thinking, information literacy and library instruction were among the most frequent keywords utilized in different publications and had the strong relationship with each other.
Keywords: Critical thinking, Library and information science, library instruction, bibliometric analysis, information literacy

1. Introduction

In a technology driven world, searching and finding the proper information in various resources, often media and information databases, require different skills and knowledge. One of the pre-requisite conditions of a researcher is having information literacy skills. The ability to search, find and use the information is necessary for daily life and research. In addition to information literacy, assessment and evaluation of the necessary information is of a high

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importance. The reason is quite obvious, as there is an information deluge and a huge amount of disinformation in media and social networks, as well as in academic databases; thus, it is indispensable for a researcher to be equipped with modern tools, knowledge and experience to distinguish between what is appropriate or not. The Organization for Economic Co-operation and Development (OECD) (2024) published a report and examined the significance of adopting a thorough strategy that can be adapted to national contexts by highlighting the necessity of fostering an atmosphere that supports the growth of trustworthy information. In order to achieve this, people must be given the tools to think critically, identify and counteract misinformation, and organize all facets of society to create comprehensive and empirically supported policies that can uphold information integrity. In other words, evaluation and assessment of the retrieved information requires a different skill which is called critical thinking.

Related ideas like problem solving, decision making, reasoning, informal logic, or just thinking are frequently associated with critical thinking. Despite the fact that these terms are frequently used interchangeably, experts use them in very different contexts. Although thinking is involved in all of these mental processes, proponents of the critical thinking movement would maintain that critical thinking is distinct from all of these related ideas as well as from simple thinking and aims to find the best answer (Gibson, 1995).

Critical thinking is a topic that has a long history and dates back to thousand years ago originates in Socrates and Plato way of thinking and dispositions. Socrates proved thinking styles as seeking evidence and logical reasons as well as appropriate idea or a true concept (Paul, et al., 1997). In the Middle Ages the critical thinking concept was reflected in Thomas Aquinas writings and works. He believed reasoning is only acceptable if it is categorized in a systematic ways. In Renaissance, a lot of scholars started to critically think about religion, human nature and freedom. Francis Bacon, insisted on empirically investigation of the phenomenon, while Machiavelli critically evaluated the basic for critical political thought in a modern way. In the centuries later, Hobbes and Locke also argued about critical thinking. Human rights and government responsibilities were important in perspectives of Locke, while Hobbes emphasized on naturalistic view of the world be evidence and reasoning. Critical thinking then continued to form a foundation for sociology and anthropology in William Graham Sumner's work. However, the application of critical thinking in educational goal was coined by the American philosopher John Dewey in 1910. In other words, critical thinking has long been used in philosophical literature, various academic disciplines and soon integrated into different concepts in humanities and social sciences. In 1930s, the critical thinking was adopted by myriad of schools and their associations as an educational goal. Also since 1980, taking a critical thinking course has become mandatory for all undergraduate students in the state university system in California (Ennis, 1987). In 1990s, Facione and other researchers developed different standardized tests for critical thinking skills and dispositional capabilities; for details. It is important to mention that Critical thinking is now incorporated into curriculum

and assessment guidelines in educational jurisdictions worldwide (Critical thinking, 2022).

Although there are numerous written texts about critical thinking in educational sciences, in terms of library and information science (LIS), the topic highlighted and gained popularity in 1980's. Therefore, a schematic review over the publications and documents written and published in critical thinking is of a high importance. Thus, the objective of this research is to analyze and review the publications on critical thinking in LIS via WoS database by identifying key authors, citations, keywords and publications. This research starts with the broad review over the history and definitions of critical thinking, continues with a comprehensive review on the concepts and aspects of critical thinking in LIS before a bibliometric analysis over critical thinking literature.

1.1 Critical thinking definitions:

There are various definitions of critical thinking in scientific contexts that each deals with different aspects of critical thinking. It is prominent to mention that Critical thinking term was first appeared in the works of John Dewey, *How we think* that was published in 1910. He called it as reflective thinking and defined it as "the demand for solution of perplexity is the steadying and guiding factor in the entire process of reflection" (Dewey, 2022, p.11).

In 1941, Glaser argued critical thinking as: "an attitude of being prone to reflectively consider questions in a thoughtful way" (Glaser, 1942, p.5). Robert Ennis described the importance of critical thinking in educational curriculum in a college or university (Ennis, 1987). Ennis believes that the ideal critical thinker is able to clarify, find and evaluate the basis for a view, draw wise conclusions from the basis, imagine and integrate imaginatively with promptness, sensitivity, and rhetorical excellence (Ennis, 2011).

Bloom et al. (1956) is frequently recognized as a pioneer in critical thinking for developing taxonomy in six categories which are Knowledge, understanding, application, analysis, synthesis, and evaluation to describe various ways of thinking.

Passmore indicates the philosophy of education and teaching of thinking by emphasizing the critical education (Splitter, 1996). Mark Weinstein (1990) argued on informal logic and critical thinking as a general philosophical framework toward a deeper understanding of the specifics of practice in the various fields. Sharon Bailin et al. (1999, p.2) observed critical thinking as "a conception of skill as an identifiable operation which is generic and discrete".

According to Scriven and Paul, critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action. (Mulnix, 2012)

Sternberg (1986, p.3) defines critical thinking as "the mental processes, strategies and representations people use to solve problems, make decisions, and learn new concepts".
Willingham (2007, p.10) published an important article and wrote that "critical thinking is not a set of skills that can be deployed at any time, any context." He proposes 4 stages for teaching critical thinking which are identifying skills, subject content, sequence and revisiting.
After discussing the definitions of critical thinking from multiple perspectives, critical thinking in LIS context is delineated and reviewed.

1.2. Critical thinking in library and information sciences:

The importance of critical thinking in LIS originates from philosophical thinking in librarianship and the information professions. It is essential that librarians understand their areas of ignorance. Systematizing one's thoughts can result from reflective thinking or it might be a value that has been created (Alkan, 2008). The concept of critical thinking appeared in library science since 1980's. Although there were some discussions about critical thinking in 1980's, the concept did not get enough attention until 1990's, when the reform in higher education took place. By the 1990s and 2000s, more librarians started to implement critical approach to librarianship (Schroeder & Hollister, 2014).
At first, librarians struggled to precisely define critical thinking and took time to figure out how to incorporate it into their teaching (Cody,2006); while today different aspects of library sciences have made librarians to use emerging and thought-provoking ideas in librarianship contexts (Alkan,2008). Initial researches on implementing critical thinking in library context were about traditional library tasks and duties such as bibliographic instruction and other library services. Sonia Bodi published her article about critical thinking and bibliographic instruction by reviewing the definition of critical thinking (Bodi, 1988). Gibson investigated librarian's activity in facilitating and developing critical thinking through reference services (Gibson, 1989). He also argued the vital need for using critical thinking in library instruction by addressing various controversial issues regarding critical thinking for evaluating the different resources for instructing (Gibson, 1995). Cody (2006) demonstrated various examples and numerous obstacles in defining critical thinking in library instruction. Brown conducted a research and investigated the theoretical models of critical thinking instruction by Ennis with library skill instruction by Kuhlthau and found a strong correlation between critical thinking and library related instructional skills (Brown, 1993).
Another important stage in implementing critical thinking in library science was about successful instructional programs incorporating course curricula by librarians' writings on the topic of critical thinking. Engeldinger (1988) implemented annotated bibliography for instruction of critical thinking. Krest and Carle (1999) from the University of Colorado created a course that introduced students to scientific writing by teaching research, writing and thinking skills by annotated bibliography in library instruction.

Another significant factor in integrating critical thinking in curricular programs is the cooperation between librarians, faculties and instructors. Atton (1994) suggested that it is better that librarians can cooperate with instructors and other colleagues to integrate critical thinking in the curricular programs. Bodi (1992) in her research also studied the cooperation between faculty and librarians in integrating critical thinking in their instruction.

After the 1980's, universities were forced to include critical thinking skills in their information literacy curricula as part of the early 1990s for reforms in higher education. Dickstein and McBride (1998) used listservs and assignments to encourage students' participation and discussion. Another research by Jacobs (2001) measured the online students' discussion as a method of interaction to develop their critical thinking abilities that were not available in a traditional classroom.

Many universities in the United States then created extensive research schedules for the researchers and undergraduate students. Sonntag and Ohr (1996) investigated the model used at California State University for successful planning of information literacy instruction through critical thinking based on observation. The librarians at university were able to help alter the campus's general education curriculum in response to reports from the mid-1980s requesting that universities should teach students how to think critically and solve problems.

In the beginning of the 21st century, many librarians started to discuss the effects of dynamic and quickly evolving technology, as the teaching of critical thinking in information literacy instruction had been significantly impacted by the creation and uptake of new and constantly changing technologies. According to the research by McGuigan (2002), critical thinking in the electronic environment has become a major challenge since there are many obstacles to the process of critically thinking about information resources. Today, more and more educators and librarians are confronted with the difficult task of teaching users how to use the web for scholarly purposes as the number of websites on the Internet grows. Seeking appropriate and authentic information has become a primary concern in academia, so having a better understanding of the information landscape can be invaluable in research. Gainer (2013) contends that students need to be able to develop 21st century literacies, and necessary educational skills; thus, educators should concentrate on critical literacy to help them deal with the deluge of information in digital worlds.

Another major factor is that the Critical thinking in 21st century has been merged with information literacy, and integrating these variables has become an important element in library sciences. There are numerous researches in critical thinking instruction in information literacy courses. Hollis (2019) published an article and distinguished the concept of critical thinking and information literacy by analyzing key articles in both fields. Herro wrote about *bibliographic instruction and critical thinking*. The author persuasively argued that critical thinking and information literacy are related (Herro, 2020).

The important stage in implementing critical thinking in libraries and academia happened when critical thinking was integrated into curricular programs and utilized in educational instructions. Many researches underlined and emphasized the importance of critical thinking in instructional programs and argued that educational institutions should organize a schematic program and arrangements to encourage and enhance critical thinking of students. As a first-year university course, teacher-scholars often successfully integrate critical thinking into reading and writing across the post-secondary curriculum for decades (Thompson, 2011). In other words, Critical thinking and in-depth learning are closely linked to both writing and reading, and assignments that require students to write from sources can be incredibly effective teaching tools (Snyder Broussard, 2017). Critical thinking in library science is considered to be a new phenomenon, as it is about 4 decades that different scholarly publications have been written about this important skill. As it is currently the issue of discussion in academic environments and multiple disciplines, students and library members should recognize the necessity of instructing this skill in higher education, curricular programs and libraries.

2. Literature review

Bibliometric analysis which was first devised in 1960's, encompasses the qualitative analysis of scientific literature by examining the external characteristics of different subjects and special disciplines and involves statistical and mathematical analysis to understand the research status, trends, and contexts (Passas, 2024). Initial research on bibliometric analysis involved the evolution and development of a discipline rather than scientific publications and mainly concentrated on pure and natural sciences (Lei & Liu, 2019).

By analyzing the researches about bibliometric analysis on critical thinking; most of them involve the analysis of critical thinking in educational aspects such as Dong et al., (2023);; Misbah et al. (2022); Hursen (2023); Orhan (2023), while other research are mostly concentrated on Science: Arici & Cengiz (2023); Sefriani et.al (2023), Vallespin(2023) , Zakaria et al. (2023); or elementary and primary education: Aktoprak and Hursen,(2022), Oktaviani et al. (2024). Thus, few researches have been conducted about critical thinking in other sectors.

López-González et al. (2023) conducted a systematic review of the published literature on the intersection of critical thinking and media and information literacy by implementing WOS and Scopus. Various research has also published about the literature review on information literacy, for instance: Obasi (2025) highlights the role of media literacy in strengthening CT skills, enabling individuals to critically assess information sources and navigate diverse media environments. Souresh et al. (2022) demonstrate that decoding information effectively shapes public opinion, with CT skills serving as a crucial filter. Multiple studies have examined this link in varied contexts. Orhan (2021) analysed how CT and new media literacy together enhance the ability to identify false information on social media, while Redaelli et al. (2024) confirmed in a randomised study that CT abilities are essential for combating disinformation.

Jackson (2019) noted that the rise of social media has transformed perceptions of published material, challenging conventional CT practices.
However no research has been undertaken solely about analyzing critical thinking publications in library and information science discipline. Thus the authors seek to do a broad and organized review over the publications on critical thinking in Web of Science throughout the years to find a pattern in analyzing different concepts of critical thinking in library and information Science.

3. Research methodology

A bibliometric analysis was implemented with the aim of conducting a systematic assessment about development and direction on different publications about critical thinking in library and information sciences throughout the years in order to gain a broad review over publications and citations, key authors, affiliations, publishers, and regions. Bibliometric analysis sought to establish a promising avenue for researchers to distinguish and comprehensively identify the related publications as well as the evolving and development of critical thinking concept in the field of library and information science. Thus certain questions need to be investigated:
1) What are the numbers of publications and citations as well as their relationship in critical thinking in library and information science throughout the years? Which publications have been cited the most?
2) Which institutions (affiliations), authors, and countries are the most productive in terms of critical thinking in library science publications?
3) What keywords in critical thinking in library and information science have been used more and what are the frequencies of their occurrences? What are the important relationships between these keywords?

3.1 Data collection

For finding the evolution and development of critical thinking in library and information science, the keywords of critical thinking, library and information science were searched in advanced search function in Web of Science database. Topic option, author keywords with research area were preferred in the Web of Science Core Collection; (TS= (“critical thinking”) AND AK= (“critical thinking”) AND SU= (Information Science & Library Science)). All languages, all document types and all years were included in the search of Web of Science (WOS). As a result, 105 document types were found, analyzed and compared in 1989-2025. The retrieved document types included 83 articles, 19 proceeding papers, 6 book chapters, 3 review articles and 1 editorial material. As all the results did not include duplicated issues and irrelevant resources, they were all used for analysis after screening and analyzing the documents.

3.2 Data analysis

For analyzing the first and the second research questions, WOS bibliometric analysis and citation report were implemented. Different results were analyzed based on criteria such as affiliations (institutions), authors, publications, and countries. Excel was also used for organizing data related to research.

For responding to the third question, VOSviewer was utilized for collecting the relevant keywords and finding the relationship between them.

As what discussed above, figure. 1 indicates the data collection and data analysis for the methodology of the research:

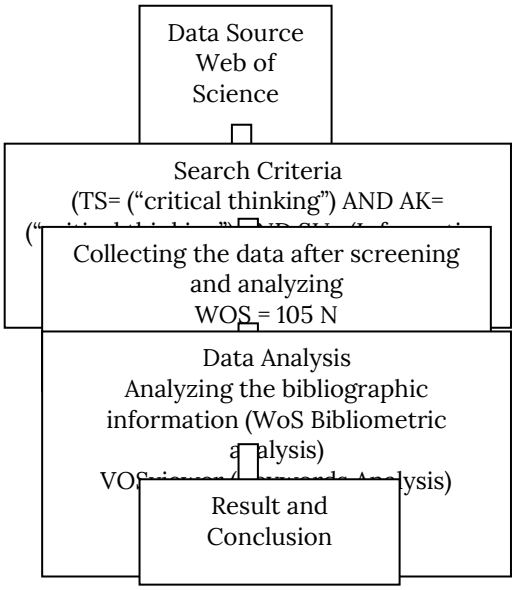

Figure 1. A brief review of the methodology of research created by authors

4. Results and Discussion

4.1 Numbers of publications and citations

Figure.2 demonstrates the relationship between the numbers of publications and citations from the beginning to evolution and development of critical thinking in LIS. The numbers of publications gradually increased from 1989 to 2008 and reached 12 in 2008, while the citations remained almost constant within this period. The notable factor observed is that after 2008, as the numbers of publications decreased, the citations were highly increased between 2009 to 2024, however the numbers of publications dramatically escalated by 2022, which shows researchers’ strong willingness in dealing with the topic of critical thinking in LIS.

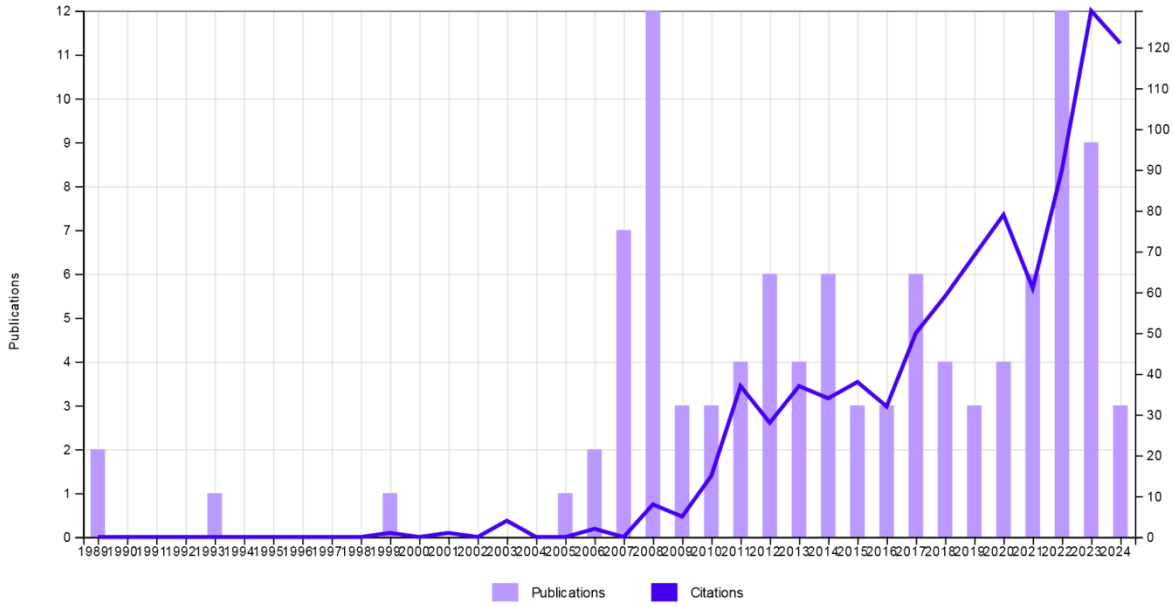

Figure 2. The relationship between the number of publications and citations in critical thinking in library and information science throughout the years extracted via WOS by authors

For answering the second part of the question about the mostly cited publications, all references with the highest citations were sorted and organized. Identifying the highly cited publications is usually contributed to better understanding of research areas, as well as increasing the accessibility and visibility of the research. Table 5, at the end of the article shows the important publications on critical thinking based on citations. For instance the research titled, *Information Literacy: Essential Skills for the Information Age* by Eisenberg with 90 citations is the most highly cited publication. The second highly cited publication is, *A longitudinal study of changes in learners' cognitive states during and following an information literacy teaching intervention* by Walton and Hepworth with 62 citations.

The key factor in analyzing these two articles is attributed to information literacy as an important element in critical thinking. Assessing and evaluating critical thinking as well as teaching, skills and students are also other related topics in analyzing the importance of critical thinking in the most highly cited publications.

4.2 Institutions (affiliations), authors, and countries

4.2.1 The highly cited Institutions (affiliations),

University affiliations and the number of works that are published by each academic institution are noteworthy. In focusing on university affiliations, both the number of publications and citations were taken into consideration. In table 1, universities were ranked based on their citations. The numbers of publications were limited from 4 to 2 publications. Universities with one publication were excluded.

As the affiliation table displays, Loughborough and Staffordshire Universities with 87 citations have the highest rank followed by California State University with 79 and University of Ohio by 48 citations respectively. Cleaveland State University with 42, Pennsylvania Commonwealth University by 40, Oregon University by 32 and Fahrenheit University by 30 citations are in the next places. This means that these universities are highly recognized and have a wide reputation for research in critical thinking in library and information science. Thus, knowing the affiliations and research institutions can be distinguishing by various researchers. As it can be observed from the table 1, majority of affiliations in critical thinking in library and information science are from the USA universities.

	Institutions (Affiliations)	Citations	Number of Publications
1	Loughborough University	87	2
2	Staffordshire University	87	4
3	California State University System	79	2
4	University System of Ohio	48	4
5	Cleveland State University	42	2
6	Pennsylvania Commonwealth System of Higher Education	40	2
7	Oregon State University	32	2
8	Fahrenheit Universities	30	2
9	Gdansk University of Technology	30	2
10	Florida State University	28	3
11	State University System of Florida	28	3
12	University of Louisville	20	2
13	California State University Long Beach	19	2
14	Oakland University	17	2
15	Complutense University of Madrid	12	2
16	University of Northern Iowa	8	2
17	Washington State University	8	2

18	University of Sevilla	5	2
19	University of British Columbia	3	2
20	University of British Columbia Okanagan	3	2

Table. 1 Institutions' ranking based on the numbers of publications and citations based on WOS created by authors

4.2.2 The highly cited authors

For finding the productive authors, the citations related to each author were analyzed and considered as important factor in this regard. As table 2 shows, Eisenberg by 90, Walton by 87, Kucharska by 49, Bowers by 46 and Goodsett by 42 are among the top cited authors in the field of critical thinking in LIS.

Author	Citation
Eisenberg, MB	90
Walton, G	87
Kucharska, W	49
Bowers, CVM	46
Goodsett, M	42
Wissinger, CL	34
Nussbaum, EM	29
Deitering, AM	29
Gaozhao, D	24

Table. 2 The most productive authors with number of citations based on WOS organized by authors

Figure. 3, illustrates the most productive authors by using density visualization. For this analysis the whole citations for each author were ranked according to VOSviewer and the highly cited authors were selected.

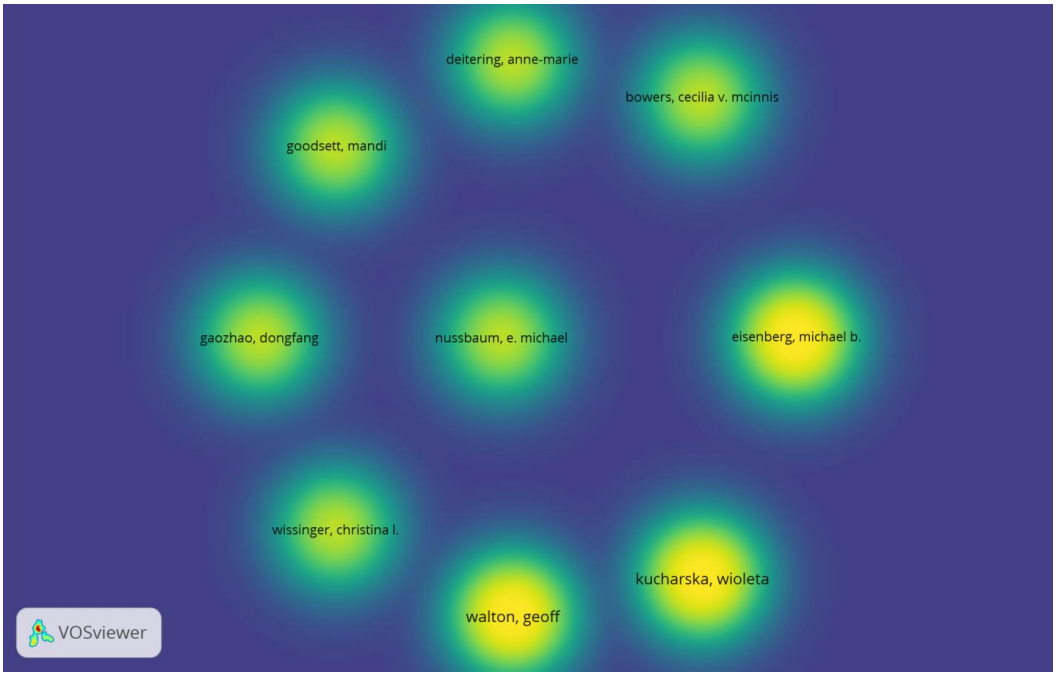

Figure 3. Density map of the most productive authors based on citations by VOSviewer

4.2.3 Productive Countries

According to table 3, the USA ranked at the first place with 56 publications and 615 citations, followed by the UK with 7 publications and 108 citations. China also ranked at the third place by 49 citations with Greece and Spain by 33 and 25 in terms of citations respectively.

Countries	Number of Publications	Citations
Usa	56	615
England	7	108
Peoples R China	6	49
Greece	1	33
Spain	7	25
Hungary	1	21
Singapore	1	11

India	2	7
Bulgaria	1	7
Canada	4	6
Taiwan	1	6
Brazil	2	5
South Africa	2	5
Ireland	1	4
Israel	1	3
Cuba	2	2
Australia	1	1

Table 3. Ranking of countries based on citations in critical thinking within library science created by authors

As the numbers of critical thinking citations were dramatically increased from 2009 to 2024 according to figure 2 discussed earlier, the patterns and distributions of the citations throughout a period of 15 years among countries were compared. Therefore, overall visualizations of citations for productive countries were also analyzed and identified according to Figure 4.

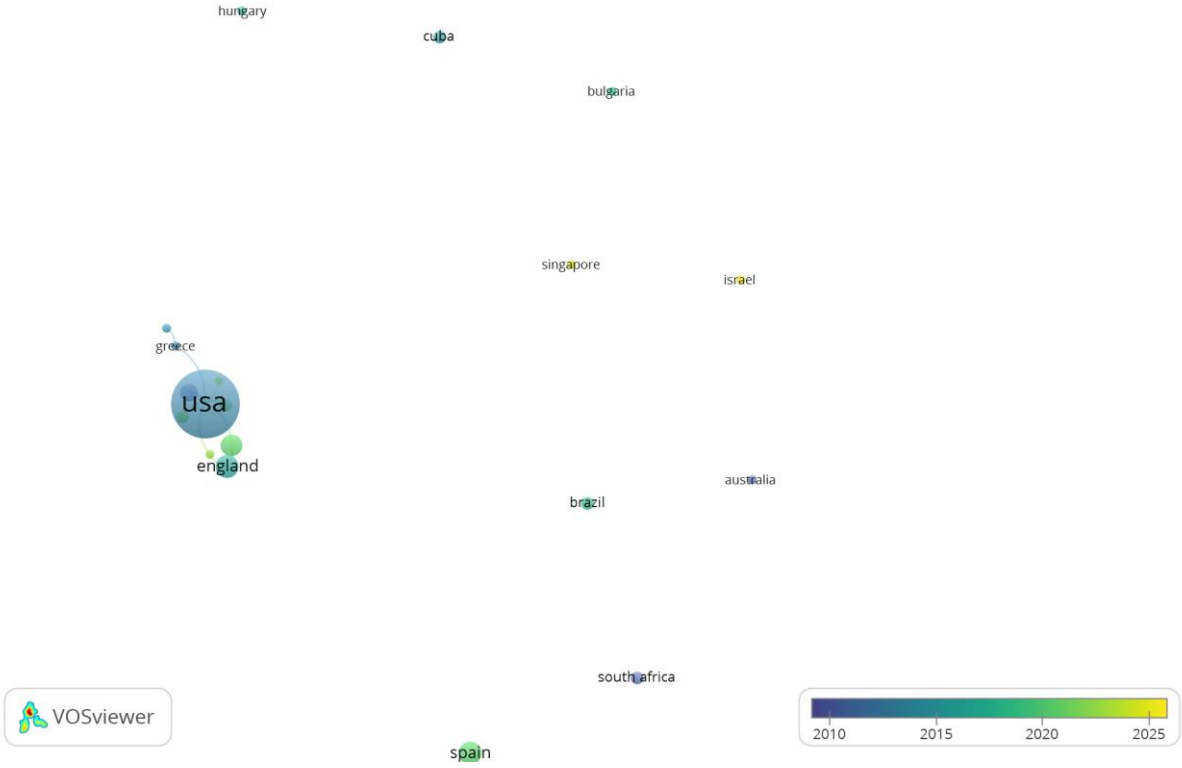

Figure 4. Overally visualization of the productive countries based on citations within the duration of 15 years: VOSviewer

Colors indicate the evolution and development of critical thinking within 15 years period from 2010 to 2025 in different countries. As this figure shows some countries were active in terms of citations from 2010 up to 2015 such as the USA, Greece, South Africa and Cuba distinguished by purple, while others were more productive within 2015 to 2020 such as Spain, China and the UK that were identified by green and blue colors. Ultimately, Israel and Singapore by yellow color are considered as the highly cited countries in 2025.

4.3 Frequency of keyword occurrences and the relationship between keywords

High frequency keywords represent the scientific hotspots, and keywords are used to draw attention to a publication's content. Keyword analysis is a crucial tool for researching popular subjects. Table 4 indicates the most frequent keywords and occurrences found via a VOSviewer.

Totally 214 keywords with one occurrence found that were gathered in Table 4. Critical thinking is considered as the highest ranking keyword with 97 occurrences, followed by information literacy with 53, library instruction by 11, and students by 8. The results demonstrate that critical thinking, information literacy and library instruction are among the highest used keywords in different area of research in critical thinking in LIS.

Table 4.

Rank	Keywords	Occurrences
1	Critical thinking	97
2	Information literacy	53
3	Library instruction	11
4	Students	8
5	Skills	7
6	Instruction	6
7	Fake news	6
8	Media literacy	6
9	Behavior	5
10	Web	5
11	disinformation	5
12	Information literacy instruction	5

Frequency of the keywords occurrences, created by authors based on the analysis by VOSviewer

For finding a relationship and gaining a more profound and lucid comprehension of critical thinking trends in LIS, a keyword co-occurrence map which is known as the frequency of keywords appearing simultaneously in all papers was implemented by VOSviewer that shows the proximity and frequency of keywords, providing information about the knowledge structure of the field. By using each keyword as a node or circle and each co-occurrence of a pair of words as a link or curve, a keyword co-occurrence network was created. A node's size indicates how frequently a corresponding keyword occurs; the larger the node, the more frequently the keywords are used in publications.

Figure 5 demonstrates that on the one hand critical thinking has a strong and close connection to information literacy and library instruction, however, has a weak relationship with web and behavior; as the relationship between two keywords is shown by the curve or line; while a thicker line indicates a stronger relationship.

It is noteworthy to mention that the cluster to which a node belongs is indicated by its color. Keywords in a cluster are more relevant if nodes be closer to one another. As the VOSviewer shows keywords are divided to 4 clusters.

Red cluster is focused on the strong relationship between critical thinking, information literacy and library instruction and a weak relationship to web and information literacy instruction.

Green cluster indicates the connection of critical thinking to combat misinformation and fake news in media and emphasizes on the relationship between critical thinking and media literacy.

Blue cluster shows the importance of critical thinking in evaluating and assessment of students and information behavior, while the yellow cluster implies critical thinking instruction and critical thinking skills that are necessary in information literacy sector.

Totally the findings of these clusters can contribute to better understanding of critical thinking scopes in important topics in library and information science. Strong and weak connections of critical thinking to other areas of research can be attributed to different conceptual frameworks of critical thinking and theoretical aspects of this subject as well as the numbers of the published resources in this field.

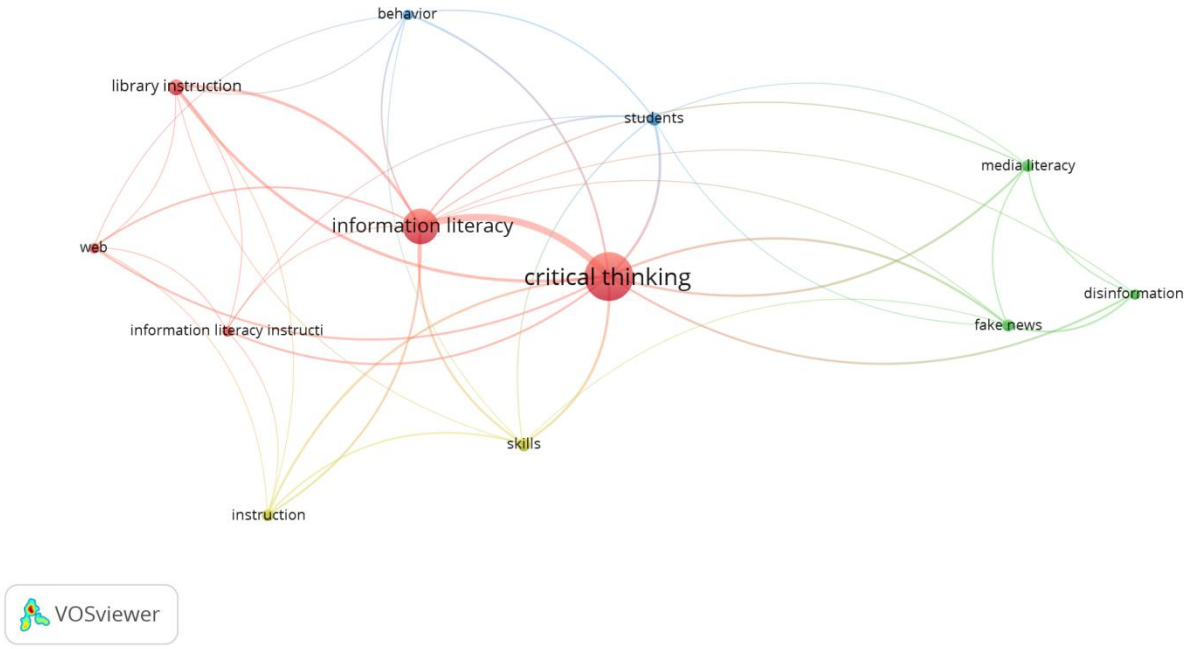

Figure.5 a keyword co-occurrence map relationship between conceptual framework of critical thinking by VOSviewer

5. Discussion:

To sum up, bibliometric study on critical thinking in library science indicated various attributes related to different publications. By searching related keywords in topic search box in WOS, different aspects of this subject such as key authors, affiliations, universities, publications as well as countries discovered and compared. The numbers of publications and the evolution and development of critical thinking in LIS indicate a dramatic rise in various years, while citations were highly increased between 2009 to 2024. The references with the most citations were also arranged and classified according to the publications that were most frequently cited. Finding the most referenced papers often helps researchers better understand their fields of study and makes their work more accessible and visible. Important subjects in studying the significance of critical thinking in the most highly referenced papers include teaching, skills, students, and assessing and evaluating critical thinking.

In terms of affiliation, both the number of publications and citations were taken into consideration. The majority of affiliations in critical thinking in library and information science are from the UK and the USA universities. For finding the highly referenced authors, each author's complete citations were rated using

VOSviewer by density graphics to show which writers are the most productive. The evolution and development of critical thinking within 15 years period in different countries from 2010 to 2025 were also analyzed and compared.
The high frequency of the keyword occurrences and their relationship are often considered as scientific hotspots which were used to highlight the content of publications and studying popular topics in this research. VOSviewer also implemented as a keyword co-occurrence map, which shows the proximity and frequency of keywords appearing simultaneously in all papers. This map provides information about the field's knowledge structure. A keyword co-occurrence network was developed by representing each term as a node or circle and each pair of words as a connection or curve that the size of a node reflected how frequently a matching keyword may occur.
Ultimately, discovering the relevant topics and highly related keywords can contribute to better understanding of critical thinking scopes and topics in library and information science. Therefore, it is important that multiple aspects of critical thinking in relation to specific and other fields of library and information science be taken into consideration.

6. Conclusion:

This research sought to provide a broad and comprehensive review of critical thinking in LIS. For reaching this purpose a chronological history and definitions of critical thinking were reviewed and compared by analyzing various perspectives of well-known authors and scholars such as Dewey, Glaser and Robert Ennis.
According to the relevant literature, critical thinking was firstly published in library context as a meaningful concept to deal with the bibliographic instructions in libraries. Integrating information literacy with critical thinking was also an important milestone in implementing this skill in library science, after librarians realized the necessity of philosophical thinking in library profession. Teaching and instructing users on how to think critically were another important stage in implementing critical thinking in libraries, as librarians soon realized the importance of teaching this skill to their audience. Another alternative and a huge transformation about critical thinking was the process of integrating critical thinking in curricular programs in higher educational institutes where libraries contributed to teaching and instructing modern programs that made users familiar with multiple skills of a critical thinker.
Due to the importance of critical thinking in LIS; a bibliometric analysis was conducted to represent a comprehensive overview of the important research in this field. WOS bibliometric analysis and VOSviewer were utilized to gain an insight through the evolution and development of research in critical thinking from almost the beginning 1980s up to the present. The relationship between number of publications and citations indicates a steady increase in both citations

and publications throughout the years. In terms of productive authors and countries, number of citations were analyzed and compared with each other.
In terms of keywords and the frequency of their occurrences, critical thinking, information literacy and library instruction had the most frequency. The relationship between keywords revealed strong intersection between critical thinking and information literacy in related to library instruction.
As higher education and academia will be more complex with the latest technological and structural transformation in holding courses and offering emerging credits for students in the future; it is absolutely vital that critical thinking courses can be merged with other programs as a complimentary and obligatory credits with the purpose of educating undergraduate and graduate students to think critically and not to judge and accept ideas and concepts without collecting genuine facts and reasons. As, evaluating and assessing resources in research in order to find the originality and reliability of the relevant references can contribute to productivity and authenticity in research and publications, thus, critical thinking can lead researchers to become independent thinkers, not to accept ideas immediately and without profound thoughts.
In discussing future research, it is important that multi-database analyses for assessing two or more bibliometric databases should be implemented to get comparative results.
As a qualitative content analysis of high-impact papers is of a high importance, the bibliometric measurement cannot capture content quality or context of the publications, thus, it is also suggested that a research on the content quality of the high impact published papers regarding critical thinking be investigated.
It is also proposed that regional differences and longitudinal evolution of thematic clusters on critical thinking be taken into account. As thematic clusters involve topics related to various aspects of critical thinking, thus different keywords might have strong connections to topics of critical thinking.

Rank	Title of publication	Author	year	Total Citatio
1	Information Literacy: Essential Skills for the Information Age	Eisenberg, Michael B.	2008	90
2	A longitudinal study of changes in learners' cognitive states during and following an information literacy teaching intervention	Walton, Geoff; Hepworth, Mark	2011	62
3	Interdisciplinary Synergy: A Partnership Between Business and Library Faculty and Its Effects on Students' Information Literacy	Bowers, Cecilia V. McInnis et al	2009	46
4	Best practices for teaching and assessing critical thinking in information literacy online learning objects	Goodsett, Mandi	2020	35
5	Privacy Literacy: From Theory to Practice	Wissinger, Christina L.	2017	34

6	Information Literacy for Undergraduate Business Students: Examining Value, Relevancy, and Implications for the New Century	Conley, Theresa M.; Gil, Esther L.	2011	31
7	Tacit knowledge acquisition & sharing, and its influence on innovations: A Polish/US cross-country study	Kucharska, Wioleta; Erickson, G. Scott	2023	30
8	Putting the pieces together: Online argumentation vee diagrams enhance thinking during discussions	Nussbaum, E. Michael et al	2007	29
9	Step by Step through the Scholarly Conversation: A Collaborative Library/Writing Faculty Project to Embed Information Literacy and Promote Critical Thinking in First Year Composition at Oregon State University	Deitering, Anne-Marie; Jameson, Sara	2008	29
10	Using Bloom's Taxonomy to Teach Critical Thinking Skills to Business Students	Nentl, Nancy; Zietlow, Ruth	2008	27
11	Using assignment data to analyse a blended information literacy intervention: A quantitative approach	Walton, Geoff; Hepworth, Mark	2013	25
12	Flagging fake news on social media: An experimental study of media consumers' identification of fake news	Gaozhao, Dongfang	2021	24
13	The bright side of information: ways of mitigating information overload	Koltay, Tibor	2017	21
14	Do mistakes acceptance foster innovation? Polish and US cross-country study of tacit knowledge sharing in IT	Kucharska, Wioleta	2021	19
15	Advancing Critical Thinking and Information Literacy Skills in First Year College Students	Alfino, Mark et al	2008	16
16	One-shot Wikipedia: an edit-sprint toward information literacy	Oliver, John Thomas	2015	15
17	A call to action for librarians: Countering conspiracy theories in the age of QAnon	Beene, Stephanie; Greer, Katie	2021	15
18	A Bridge to FARS and Information Literacy for Accounting Undergraduates	Cunningham, Nancy A.; Anderson, Sherri C.	2005	14
19	Information Literacy in Subject-Specific Vocabularies: A Path to Critical Thinking	Taylor, Linda Heichman	2008	14
20	Designing a writing intensive course with information literacy and critical thinking learning outcomes	Armstrong, Jeanne	2010	13

Table 5. The 20 most highly cited papers extracted via WOS by authors

References:

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

Alkan, N. (2008). The importance and influence of philosophical thinking for librarians. Library Philosophy and Practice (e-journal). 207.Retrieved from:https://digitalcommons.unl.edu/libphilprac/207

Arici, F., & Cengiz, E. (2023). An examination of articles on critical thinking in science education: an analysis using bibliometric mapping. *Egitim Bilim ve Arastırma Dergisi*, *4*(2), 539-567. Retrieved from: https://doi.org/10.54637/ebad.1362232

Atton, C. (1994). Using critical thinking as a basis for library user education. *The Journal of Academic Librarianship*, *20*(5-6), 310-313. Retrieved from: https://doi.org/10.1016/0099-1333(94)90069-8

Bailin, S., Case, R., Coombs, J. R., & Daniels, L. B. (1999). Common misconceptions of critical thinking. *Journal of curriculum studies*, *31*(3), 269-283. Retrieved from: https://doi.org/10.1080/002202799183124

Benjamin, B. S., Bloom, B. B. M., & Krathwohl, D. R. (1956). Taxonomy of educational objectives. *New York: McKey New York*.

Bodi, S. (1988). Critical thinking and bibliographic instruction: the relationship. *Journal of Academic Librarianship*, *14*(3), 150-153.

Bodi, S. (1992). Collaborating with faculty in teaching critical thinking: the role of librarians. *Research Strategies*, *10*(2), 69-76

Brown, A. F. (1993). Commonalities in critical thinking skills instruction and library skills instruction. Master of library science research paper, Kent State University, 1-37. Retrieved from: https://files.eric.ed.gov/fulltext/ED363342.pdf

Cody, D. E. (2006). Critical thoughts on critical thinking. *The Journal of Academic Librarianship*, *32*(4), 403-407. Retrieved from: https://doi.org/10.1016/j.acalib.2006.03.007

Dewey, J. (2022). How we think. DigiCat. Retrieved from: https://pure.mpg.de/rest/items/item_2316308/component/file_2316307/contet

Dickstein, R., & McBride, K. B. (1998). Listserv lemmings and fly-brarians on the wall: a librarian–instructor team taming the cyberbeast in the large classroom. *College & research libraries*, *59*(1), 10-17. Retrieved from: https://doi.org/10.5860/crl.59.1.10

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).1-12 Retrieved from: https://doi.org/10.1016/j.heliyon.2023.e16934

Engeldinger, E. A. (1988). Bibliographic instruction and critical thinking: the contribution of the annotated bibliography. *RQ*, 195-202.

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

Ennis, R. H. (2011). The nature of critical thinking: an outline of critical thinking dispositions and abilities. University of Illinois, *2*(4),1-8. Retrieved from:https://education.illinois.edu/docs/default-source/faculty-documents/robert-ennis/thenatureofcriticalthinking_51711_000.pdf

Gainer, J. (2013). 21st century mentor texts: developing critical literacies in the information age. *Journal of Adolescent & Adult Literacy*, 57(1), 16-19 Retrieved from: https://doi.org/10.1002/JAAL.210

Gibson, C. (1989). Alternatives to the term paper: an aid to critical thinking. *The Reference Librarian*, *10*(24), 297-309. Retrieved from: https://doi.org/10.1300/J120v10n24_24
Gibson, C. (1995). Critical thinking: implications for instruction. *RQ*, *35*(1), 27-35.
Glaser, E. M. (1942). An experiment in development of critical thinking. *Teachers College Record*, *43*(5), 1-18. Retrieved from: https://doi.org/10.1177/016146814204300507
Herro, S. J. (2000). Bibliographic instruction and critical thinking. Journal of Adolescent & Adult Literacy,43(6),554-558.
Hollis, H. (2019). Information literacy and critical thinking: different concepts, shared conceptions. University of Borås, Sweden. Retrieved from: https://discovery.ucl.ac.uk/id/eprint/10074076/8/Hollis%20Hollis2019CoLIS.pdf
Hursen, C. (2023). Examination of studies on critical thinking in teacher education: a bibliometric analysis. *Revista Romaneasca Pentru Educatie Multidimensionala*, *15*(3), 288-311. Retrieved from: https://doi.org/10.18662/rrem/15.3/767
Jacobs, M. (2001). Speakeasy studio and cafe: information literacy, web-based library instruction, and technology. *Information Technology and Libraries,* 20:66-71
Krest, M. & Carle D. O. (1999). Teaching scientific writing: a model for integrating research, writing & critical thinking. American Biology Teacher. 61(3):223-227. Retrieved from: https://doi.org/10.2307/4450655

Lei, L., & Liu, D. (2019). Research trends in applied linguistics from 2005 to 2016: a bibliometric analysis and its implications. *Applied Linguistics*, *40*(3), 540-561 Retrieved from: https://doi.org/10.1093/applin/amy003

López-González, H.; Sosa, L.; Sánchez, L.; Faure-Carvallo, A. (2023). Media and information literacy and critical thinking: a systematic review. *Revista Latina de Comunicación Social*, 81, 399-423. Retrieved from: https://doi.org/10.4185/rlcs.2023.1939
McGuigan, G. S. (2002). Exorcising the ghost from the machine: confronting obstacles to critical thinking through library instruction. *Internet reference services quarterly*, *7*(3), 53-62. Retrieved from: https://doi.org/10.1300/J136v07n03_07
Misbah, M., Hamidah, I., Sriyati, S. I. T. I., & Samsudin, A. C. H. M. A. D. (2022). A bibliometric analysis: research trend of critical thinking in science education. *Journal of Engineering Science and Technology*, *17*, 118-126.
Mulnix, J. W. (2012). Thinking critically about critical thinking. *Educational Philosophy and theory*, *44*(5), 464-479. Retrieved from: https://doi.org/10.1111/j.1469-5812.2010.00673.x
OECD (2024), Facts not fakes: tackling disinformation, strengthening information integrity. OECD Publishing, Paris. Retrieved from: https://doi.org/10.1787/d909ff7a-en
Oktaviani, A. M., Marini, A., & Supena, A. (2024). Publication trends and development of critical thinking concepts in elementary education: a bibliometric review. *Exploration in Early Childhood Research*, *1*(1), 355-367
Orhan, A. (2023). Bibliometric analysis of the studies on critical thinking in educational research: an insight from the last four decades (1980-2022). *International Journal of Research in Education and Science*, *9*(2), 329-350
Passas, I.(2024). Bibliometric analysis: the main steps. Encyclopedia, 4,1014–1025. Retrieved from: https://doi.org/10.3390/encyclopedia4020065

Schroeder, R., & Hollister, C. V. (2014). Librarians' views on critical theories and critical practices. *Behavioral & Social Sciences Librarian*, *33*(2), 91-119 Retrieved from: https://doi.org/10.1080/01639269.2014.912104

Sefriani, R., Rahmadani, A. F., Jalinus, N., Refdinal, R., Novrita, S. Z., & Widyastuti, R. (2023). Critical thinking skills in learning physics: a bibliometric analysis using vosviewer. *At-Tajdid: Jurnal Pendidikan dan Pemikiran Islam*, *7*(2), 355-362 Retrieved from: http://dx.doi.org/10.24127/att.v7i2.3028

Snyder Broussard, M. (2017) Reading, research, and writing: teaching information literacy with process-based research assignments. Chicago : Association of College and Research Libraries, a division of the American Library Association,1-140.

Sonntag, G., & Ohr, D. M. (1996). The development of a lower-division, general education, course-integrated information literacy program. *College & Research Libraries*, *57*(4), 331-338 Retrieved from: https://doi.org/10.5860/crl_57_04_331

Splitter, L. (1996). John Passmore: on teaching to be critical. *Inquiry: critical thinking across the disciplines*, *15*(3), 1-16.

Sternberg, R. J.(1986). Critical thinking: its nature, measurement, and improvement. National Institute of Education.1-37. Retrieved from: https://files.eric.ed.gov/fulltext/ED272882.pdf

Thompson, C. (2011). Critical thinking across the curriculum: process over output. *International Journal of Humanities and social science*, *1*(9), 1-7.

Vallespin, M. R. (2023). Mapping the landscape of critical thinking in science education: a bibliometric analysis of influential works, contributors, trends, and global Impact. International Journal of Multidisciplinary Research and Publications (IJMRAP), 6(5), 25-29

Weinstein, M. (1990). Towards a research agenda for informal logic and critical thinking. *Informal logic*, *12*(3),1-23. Retrieved from: https://doi.org/10.22329/il.v12i3.2609

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