Knowledge Mapping of Critical Thinking in English Teaching Based on CNKI Scholar Using CiteSpace

Jing Liu[1,*] & Ahmad Johari bin Sihes[1]

[1]Faculty of Educational Sciences and Technology (FEST), Universiti Teknologi Malaysia (UTM), 81310, Skudai, Johor Bahru, Malaysia

*Correspondence: Faculty of Educational Sciences and Technology (FEST), Universiti Teknologi Malaysia (UTM), 81310, Skudai, Johor Bahru, Malaysia. E-mail: jing-1995@graduate.utm.my

Abstract

English, as one of the most widely used languages globally, serves as a crucial bridge in international economic, cultural and academic exchanges. In recent years, with the expansion of globalization, significant developments have been observed in publications in the field of English teaching, especially emphasizing critical thinking as a key skill for the 21st century. Therefore, a scientific review of the integration of critical thinking in English teaching is needed. This paper analyzes the scientometric features of critical thinking literature published in English teaching from 2020 to 2024. The research papers were sourced from CNKI Scholar, and CiteSpace was used to analyze 756 articles on English critical thinking pedagogy, presenting knowledge maps of authors, publishing institutions, keyword co-occurrence and cluster network analysis. Firstly, the result highlights that critical thinking, junior high school English, senior high school English, English reading teaching were among the most frequently occurring keywords in English critical thinking teaching research. Additionally, this review organizes the research hotspots and main contents in English critical thinking research, covering areas such as its application at various educational stages, content areas, and research perspectives of critical thinking in English teaching. Overall, the paper identifies key features, current trends, gaps, and potential future directions in critical thinking research within English teaching, offering valuable insights and guidance for advancing this field in China.

Keywords: citespace analysis, critical thinking, English teaching, bibliometrics analysis

1. Introduction

Critical thinking plays a vital role in 21st century education (Lamb, Maire & Doecke, 2017), which emphasizes the combination of knowledge, expertise, information literacy, problem solving, flexibility and adaptability, responsibility, and proficiency in the 4Cs, including critical thinking, collaboration, creativity, and communication (Paul & Elder, 2019). Thus, critical thinking ability can enable students to have competitive thinking qualities in the future.

Critical thinking can help students screen, analyze and evaluate a large amount of information and improve their information literacy (Elder & Paul, 2020). In the process of solving problems, critical thinking encourages students to think deeply about the nature of the problem, put forward various solutions and evaluate them, and enhance their ability to solve them (Ennis, 2018). At the same time, critical thinking helps students to put forward different opinions and conduct rational discussions in collaboration, and improve the quality of corporation (Meltzoff & Cooper, 2018). In terms of creativity, critical thinking encourages students to question traditional ideas, challenge conventions, and stimulate innovative thinking (Erdoğan, 2019). In communication, critical thinking enables students to express their views clearly, respond rationally to different opinions, and enhance the effectiveness of communication (Bezanilla, Fernández-Nogueira, Poblete, & Galindo-Domínguez, 2019). Critical thinking is an indispensable part of education in the 21st century and plays a key role in cultivating talents with global competitiveness.

In today's educational environment, critical thinking skills are gaining prominence and are recognized as critical skills for students' academic success and lifelong learning (Brown, 2018). Active efforts by educators and policy

makers to improve critical thinking skills in learners have prompted an increasing amount of research into finding effective ways to cultivate these skills (Yu & Liu, 2018). However, in the face of a vast knowledge base, it is difficult to grasp the complete critical development trends in English teaching if a few articles are carefully read.

In the era of globalization, English as an international language, the importance of its teaching is increasingly prominent (Yu & Liu, 2022). With the advancement of educational reform, China's Ministry of Education has increasingly emphasized the cultivation of students' core competencies (Liu & Pan, 2019). Among these, critical thinking, which is recognized as a key competency, has gained growing importance in the field of education. Critical thinking as an important thinking ability, for students' learning and future development has a vital role (Kim, Raza & Seidman, 2019). The English Curriculum Standards for Senior High Schools (2017 Edition) lists thinking quality as one of the core literacy of English subjects, and critical thinking is an important part of thinking quality (Liu & Pan, 2019). This makes educators pay attention to how to cultivate students' critical thinking in English teaching, so as to better implement the requirements of curriculum standards. In 2020, China continued to strengthen the education reform, emphasizing quality education and the cultivation of innovative talents (Wen & Zhang, 2020). Under this policy background, senior high school English textbooks are also based on curriculum standards (Xue & Li, 2022). Texts and teaching activities in textbooks provide important resources for cultivating students' critical thinking, prompting researchers and teachers to explore how to use textbooks for critical thinking teaching (Zhang, 2022).

In addition, CiteSpace, as a powerful bibliometric tool, can help us understand the current situation and trends of critical thinking in English teaching (Cui, Yu & Hua, 2017). CNKI Scholar Database, as one of the largest academic literature databases in China, provides us with abundant research resources (Feng, Yu, Kong, & Wang, 2024). Therefore, it is of great practical significance to conduct a systematic review on critical thinking in English teaching based on CiteSpace and CNKI Scholar Database.

This paper makes use of CiteSpace to analyze and visually represent English critical thinking teaching research literature in China from 2020 to 2024 to reveal the influential authors and publication institutions, explore keyword co-occurrence, research hotspots, and emerging trends, offering valuable insights for future researchers.

2. Literature Review

2.1 Critical Thinking

Critical thinking is a comprehensive and thoughtful way of thinking that requires individuals to go beyond surface-level information and engage in deep analysis, evaluation, and reasoning. Through critical thinking, people can assess the validity and reliability of the information they receive, allowing them to make more rational and objective judgments. This process involves reflecting on the effectiveness of information, its underlying assumptions, and helping individuals avoid blind acceptance and bias (Elder & Paul, 2020). Core elements of critical thinking include logical reasoning, bias identification, and rational judgment (Elder & Paul, 2020). Dewey, Corita and Eddington (2008) viewed critical thinking as a core component of education, believing it fosters independent thinking in students. Paul and Elder (2019) emphasized that critical thinking is the foundation of rational judgment, while Peter Facione (2011) pointed out that critical thinking is crucial not only in academic settings but also in everyday decision-making. In summary, critical thinking, as a key cognitive skill, not only enhances individuals' analytical abilities but also promotes more rational and objective social interactions.

2.2 Critical Thinking in English Teaching

In the field of English education, the cultivation of critical thinking is widely regarded as a key factor in enhancing students' language comprehension, analytical abilities, evaluative skills, and problem-solving capabilities. Critical thinking not only helps students effectively understand and use language in the classroom, but also encourages them to engage in independent thinking and reflection when confronted with complex issues. In recent years, an increasing number of studies have shown that teaching strategies play a crucial role in the development of critical thinking, especially through interactive methods such as questioning and debating, which can stimulate students' depth and breadth of thinking, thereby enhancing their analytical and evaluative abilities (Facione, 2011). For instance, Bobkina and Stefanova (2016) pointed out that the cultivation of critical thinking can stimulate a deeper understanding of language learning, enabling students to reason and make judgments effectively within complex linguistic environments.

Moreover, teachers play a vital role in this process, not only as transmitters of knowledge but also as guides for thinking. Through designing effective teaching practices, such as guiding students through deep thinking and critical discussions, teachers can help students develop critical thinking skills (Brookfield, 2012). Additionally, the

cultivation of critical thinking also involves reflection, helping students recognize their cognitive biases and weaknesses, thereby improving their problem-solving abilities (Yaacob, Mohd Asraf, Hussain, & Ismail, 2020).

However, despite the evident importance of critical thinking in English education, research also indicates that teachers still face challenges in effectively implementing critical thinking teaching methods in practice (Itmeizeh & Hassan, 2020). Overall, the cultivation of critical thinking is an indispensable part of English education, and through well-designed teaching strategies and active interactions, teachers can effectively promote students' comprehensive development in language comprehension and application.

3. Research Objectives

This study sorts out the relevant researches on "critical thinking in English teaching" in China based on CNKI Scholar Database. With the analysis of CiteSpace, a software tool widely used in scientific literature visualization and analysis (Rawat & Sood, 2021), this study aims to present the bibliometrics review of this field. CiteSpace 6.3.R1 was employed to analyze the literature on critical thinking in English teaching from 2020 to 2024, highlighting the most frequently used keywords and identifying trends in critical thinking research within the domain. Through keyword co-occurrence and clustering analysis, CiteSpace identifies key authors and publication institutions, explores research hotspots and emerging trends, and predicts future research directions, offering valuable insights for prospective scholars. There are five research questions according to the research objectives as follows:

(1) What is the distribution of the influential authors?

(2) What is the distribution of the publication institutions?

(3) What are the most frequent keywords in the research articles in the field of Critical Thinking in English Teaching?

(4) What are the research hotspots in the field of Critical Thinking in English Teaching?

(5) What are the emerging trends in the field of Critical Thinking in English Teaching?

4. Research Methodology

Bibliometrics Analysis provides quantitative analysis of relevant literature in scientific knowledge bases, such as CNKI Scholar (Chen, 2014). Knowledge maps are the main techniques in scientometrics, including scientific literature, tools, and different types of measurement methods that highlight literature patterns and emerging research trends (Wang & Lu, 2020). Thus, the knowledge structure of a research field can be represented through network visualization and statistical analysis of scientific literature. Citespace is a helpful software developed in the context of scientometrics and data visualization (Jing, Ghosh, Sun, & Liu, 2020), which is based on java programming language environment (Huang, Yang, Wang, Wu, Su, & Liang, 2020). It can visualize the structure, regularity and distribution of scientific knowledge, so the visualization results obtained by this method is called scientific knowledge graph (Chen, 2017), which can help researchers quickly understand research hotspots, cutting-edge trends and development threads in a field.

The research data is downloaded from the core collection of CNKI Scholar database and outputs structured data, such as citation information including the name of author, the title of article, the title of source title, publication year, number of citations, and DOI, and bibliographic information covering affiliation, language of article, publisher, editor, abstract, keywords, and funding details.

The term "critical thinking" retrieves data from CNKI Scholar and limits search results using the term "English teaching." As can be seen from Table 1, the search query used to download records from CNKI Scholar are as follows: ((TITLE-ABS-KEY(English Teaching)AND (Critical Thinking) AND PUBYEAR>2020 AND PUBYEAR <2024). In this study, the subject area is "Critical Thinking in English Teaching" and the publication time is "2020-2024" to refine the search query results. 756 articles on critical thinking published in English teaching from 2020 to 2024 were retrieved and analyzed as literature sources. Additionally, the knowledge database was downloaded from CNKI Scholar in the form of Refworks and converted in CiteSpace 6.3.R1. Finally, importing the converted references into CiteSpace, slicing them by 1 year from 2020 to 2024, clicking keywords in etymology and node type, and generating keyword co-occurrence map for further analysis.

Table 1. CNKI Scholar Query

Data Source	CNKI Scholar
Search Query	((TITLE-ABS-KEY(English Teaching) AND (Critical Thinking) AND PUBYEAR $>$ 2020 AND PUBYEAR $<$ 2024)
Time Span	January 2020 - September 2024
Retrieval Time	September 12, 2024 - September 30, 2024
No. of Records	756

CiteSpace provides a visual analysis of the research literature (Zheng, Yuan, Zhu, Zhang, & Shao, 2020), showing the author analysis, publication institutions analysis, keywords co-occurrence analysis and clustering analysis for this study. Figure 1 presents the methodological process using CiteSpace tools. When executing CiteSpace, parameters such as time slice, node type, link and pruning method need to be determined to achieve the research objectives.
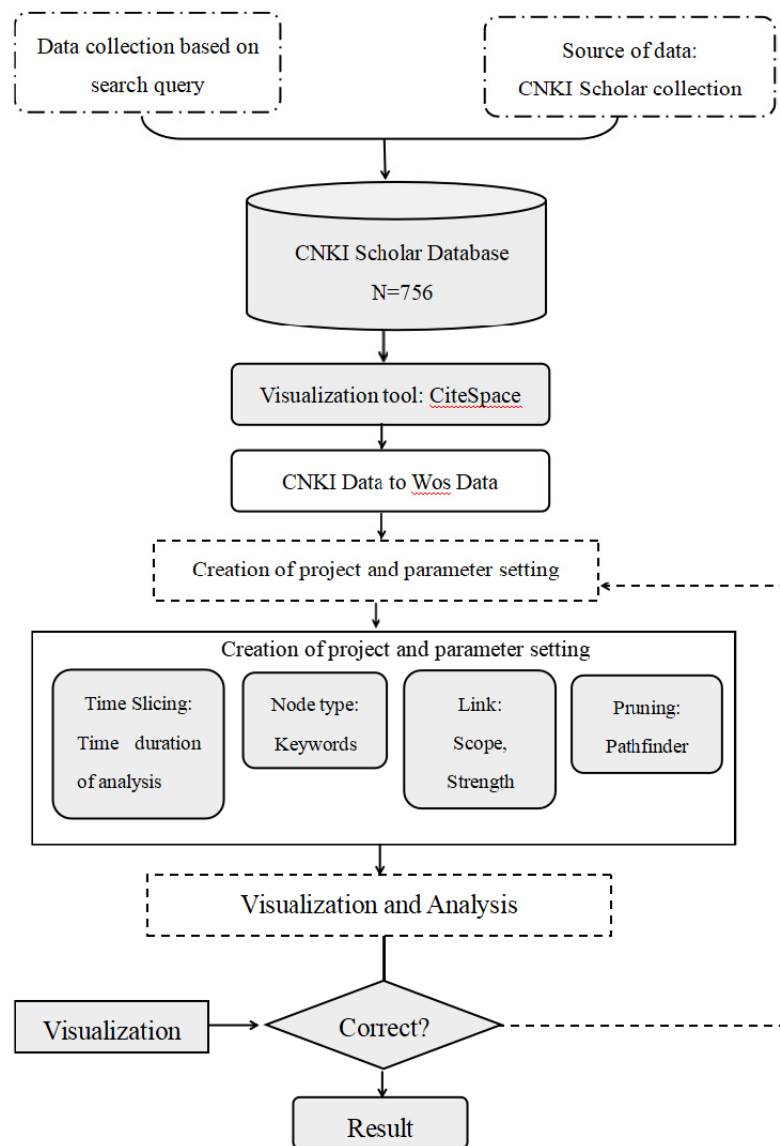

Figure 1. Visualization and the Analysis Process of CiteSpace

5. Findings

5.1 Overview of the Authors and Institutions

This section provides an overview of the key authors and institutions contributing to research on critical thinking in English education. By analyzing authorship patterns and institutional affiliations, we identify leading contributors, collaborative networks, and regional strengths within the field. This overview highlights influential researchers and research hubs, offering insights into the academic landscape and guiding future collaboration opportunities in English teaching and critical thinking studies.

5.1.1 The Influential Author Analysis

Co-occurrence analysis can identify the collaboration and co-citation relationship between core authors and researchers in a discipline or field (Lozano, Calzada-Infante, Adenso-Díaz, & García, 2019). However, since researchers are currently scattered and the co-citation rate is not obvious, thus, CiteSpace is used to calculate the number of the influenced authors instead of their collaboration network. Table 2 covers the top 5 authors in the number of articles, namely WanLi (4), ShangKun (3), WangHui (2), LiYang (2) and LiuNa (2). Overall, Wan Li's publication frequency of 4 is the highest among all authors during the period of 2020 to 2024.

Table 2. The Top 5 Authors with the Highest Number of Published Articles

No.	Frequency	Year	Authors
1	4	2022	Wan Li
2	3	2021	Shang Kun
3	2	2021	Wang Hui
4	2	2020	Liu Yang
5	2	2022	Liu Na

5.1.2 The Analysis of Research Institutions and Collaborative Networks

Citespace software was used to analyze 756 articles from the publishing institutions to understand the research status and actual contributions of the publishing institutions to critical thinking in English teaching, as seen in Table 3. From the table, it can be seen that Southwest University has the most articles, Shanxi Normal University ranks second, followed by Liaocheng University, Chongqing Normal University, Harbin Normal University, Northwest Normal University, Shanghai Normal University, Guangzhou University.

Table 3. The Top 10 Research Institutions with the Highest Number of Published Articles

No.	Frequency	Year	Research institutions
1	23	2020	Southwest University
2	8	2020	Shanxi Normal University
3	6	2020	Liaocheng University
4	6	2020	Chongqing Normal University
5	6	2020	Harbin Normal University
6	6	2021	Northwest Normal University
7	6	2020	Shanghai Normal University
8	6	2021	Guangzhou University
9	5	2020	Guangdong Normal University of Technology
10	5	2021	Bohai University

5.2 Keyword Analysis of Critical Thinking in English Teaching Based on CiteSpace

5.2.1 The Statistical Analysis of Keywords

Keyword is a high generalization of the topic of an article, and its frequency, relevance and emergence can reveal the research hotspots, internal relations and importance of the field (Liang, Li, Zhao, Wang, Zhu, & Chen, 2017). The table of top 20 high frequency keywords is showed below.

Table 4. The Top 20 High Frequency Keywords

Rank	Count	Centrality	Year	Key Words
1	419	1.24	2020	Critical Thinking
2	147	0.08	2020	*"Reading Teaching"*
3	93	0.08	2020	Junior High School English
4	87	0.07	2020	High School English
5	69	0.24	2020	Critical Thinking Ability
6	55	0.11	2020	Thinking Quality
7	50	0.05	2020	Primary School English
8	46	0.1	2020	English Teaching
9	45	0.02	2020	English Reading Teaching
10	31	0.03	2020	Cultivating Strategy
11	30	0.04	2020	*"English Reading"*
12	26	0.01	2020	*"Critical Reading"*
13	24	0.06	2020	*"College/ University English"*
14	22	0.04	2020	Core Quality
15	15	0.05	2020	Critical Mindset
16	14	0.01	2020	*"High School English Reading"*
17	14	0.02	2020	Teaching Strategy
18	12	0.07	2020	College/Univerisity English Teaching
19	11	0.04	2021	Writing after Reading Task
20	9	0.04	2020	*"Thinking Ability"*

This section uses CiteSpace software to analyze key concepts related to "critical thinking in English teaching" in 756 articles published between 2020 and 2024. Table 4 shows the top 20 keywords with the highest frequency of occurrence, the number of occurrences and centrality are equal to or greater than 9 and 0.01, respectively. Among them, the frequency of critical thinking is the highest (419), followed by reading teaching (147), junior high school English (93), senior high school English (87), critical thinking ability (69), thinking quality (55), primary school English (50), English teaching (46), English reading teaching (45), training strategies (31), English reading (30), critical reading (26), college English (24), and Core Literacy (22).

However, the quotation marks shown in italics in Table 4 distinguish overlapping keywords such as "English reading teaching" (220),"English reading"(49),"reading teaching"(49),"critical reading"(26), and "high school English reading", which must be merged. In addition, "college/university English teaching" and "college/university English", "critical thinking ability" and "thinking ability" also need to be merged.

5.2.2 The Analysis of Merged Keywords

Keywords are the core representation of articles and research hot topics (Liang, et al., 2017). After merging similar keywords, a revised Table 5 is obtained. By analyzing the merged keywords, the research hotspots in the field of critical thinking in English teaching can be more clearly discovered. Table 5 shows the top 10 keywords with the highest frequency of occurrence. Specifically, the top ten keywords following critical thinking (431) are English reading teaching (245), high school English (109), junior high school English (103), critical thinking ability (97), thinking quality (62), primary school English (58), English teaching (46), college/university English (36) and cultivating strategy (30).

Centrality is also called mediating centrality (Chen, 2017). The higher the centrality, the more the relevance between the keyword and other keywords, belonging to the core of domain research (Chen, 2017). When the mediating centrality is greater than 0.1, this node is called key node (Cui et al., 2017). The data in the table indicates that the keywords with centrality greater than 0.1 are: critical thinking, English reading teaching, high school English, junior high school English, critical thinking ability, thinking quality, primary school English, college English and

cultivating strategy. And key words "critical thinking" ranked first, with centrality of 0.7, followed by "primary school English" centrality of 0.42,"college English" centrality of 0.39,"thinking quality" centrality of 0.37,"critical thinking ability" centrality of 0.31,"high school English" centrality of 0.29,"English reading teaching" centrality of 0.22,"English teaching centrality of 0.21," English teaching centrality of 0.22,"English teaching centrality of 0.37," critical thinking ability of 0.31. The centrality of Junior high school English is 0.12.

Table 5. Top 10 High Frequency Merged Keywords

Rank	Count	Centrality	Year	Key Words
1	431	0.7	2020	Critical Thinking
2	245	0.22	2020	English Reading Teaching
3	109	0.29	2020	High School English
4	103	0.12	2020	Junior High School English
5	97	0.31	2020	Critical Thinking Ability
6	62	0.37	2020	Thinking Quality
7	58	0.42	2020	Primary School English
8	46	0.21	2020	English Teaching
9	36	0.39	2020	College/University English
10	30	0.08	2020	Cultivating Strategy

Thus, critical thinking, primary school English, college English, thinking quality, critical thinking ability, high school English, these 5 keywords appeared on the shortest path in the whole network map of visual analysis, the more important their influence and importance are in the field of critical thinking in English teaching.

5.2.3 Co-occurrence Aalysis of Keywords

Keyword co-occurrence analysis plays an important role in scientometric analysis (Cui et al., 2017). Keyword co-occurrence analysis is initiated by setting the following parameters in CiteSpace: (i) study period January 2020 to September 2024, year per slice:1, (ii) node type: keyword, (iii) selection criteria: g-index, scale factor:5, (iv) pruning method: pathfinder, which is shown in table 6.

Table 6. Parameter Setting of CiteSpace on Keyword Co-occurrence Analysis

Time slicing	January 2020 to September 2024
Year per slice	1
Node type	Keyword
Selection Criteria	g-index with scale factor $k = 5$
Pruning	pathfinder
The rest settings	default

Figure 2 below shows a keyword co-occurrence network studied in the field of English teaching with critical thinking. Each circle, node, describes a keyword, the size of the circle indicates the number of keyword occurrences, and keywords with high incidence and centrality are important research topics in the field of critical thinking in English Teaching.

As shows in Figure 2, N=107, E=162, Density=0.0286, "N" represents the number of nodes, "E" represents the number of segments (density), a total of 107 nodes are generated, that is, 107 keywords are identified, and the density is 0.0286. Through the analysis of Figure 2, it can be seen that the research field of critical thinking in English teaching is significantly related to the research fields of English reading teaching, high school English, junior high school English, critical thinking ability, thinking quality, primary school English, college English and cultivating strategies.

5.3 Analysis of Research Hotspots

Research hotspots refer to the development prospects and research value in a certain field (Chen, 2016). Keywords

are the core of literature contents. The co-occurrence analysis results of keywords point to the main development trends and research hotspots in a certain field (Zheng et al., 2020). On the basis of knowledge map research, the top 10 important keywords with co-occurrence frequency are sorted based on Table 5. Through the statistics and sorting of the relevant literature corresponding to the important nodes in the keyword map, it is found that scholars have carried out a lot of research on the hot issues of critical thinking in English teaching, and the hot topics in this field are summarized as: the application of critical thinking in different educational stages of English teaching, the main research content of critical thinking and the research perspective of critical thinking in English Teaching.
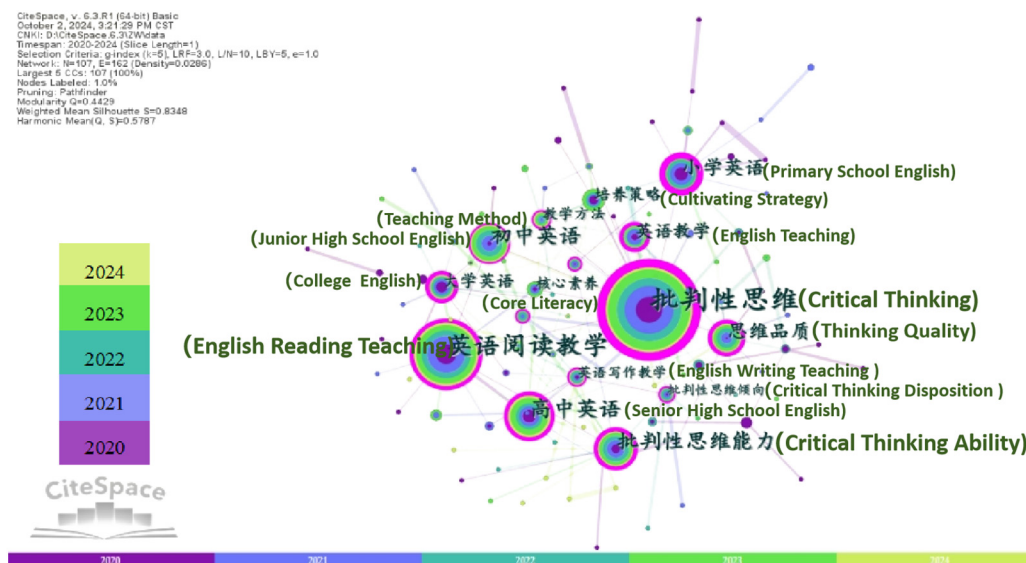

Figure 2. Keyword Co-occurrence Analysis for Critical Thinking in English Teaching

5.3.1 The Application of Critical Thinking in Different Educational Stages of English Teaching

In CiteSpace Knowledge Map, critical thinking plays an important role in different English teaching stages (Zheng et al., 2020). At the primary school English teaching level, it focuses on cultivating basic critical thinking skills and is committed to stimulating students' interest and curiosity in learning (Wang, 2023; Zhou, 2023; Chen, 2024; Wang, 2024). At the junior English teaching stage, it further deepens the organic integration of language learning and critical thinking (Ju, 2024; Zhang, 2024; Zhan, 2024). In senior high school English teaching, emphasis is placed on improving critical reading and writing skills, which not only serve the college entrance examination, but also effectively cultivate students' comprehensive quality (Gao, 2020; Jiang, 2021; Chen, 2022). In college or university English teaching, critical thinking is deeply integrated with professional English learning, and academic writing and research skills are highly emphasized (Zhao, 2023; Kong, 2024). Generally speaking, from primary school to university, critical thinking cultivation is closely integrated with English teaching, which strongly supports students' language learning and comprehensive quality improvement.

5.3.2 The Main Research Contents on Critical Thinking in English Teaching

Through the co-occurrence analysis of keywords based on Figure 2, it is found that the main contents of critical thinking research in English teaching include the cultivation strategies and teaching methods of critical thinking. Firstly, the critical thinking cultivating strategy focuses on how to cultivate students' critical thinking ability in English teaching, such as problem-oriented strategy and group discussion (Du, 2020; Zhang, Yang & Jin, 2021; Ma, 2022; Hu, 2024). Secondly, the teaching methods of critical thinking mainly focus on how to integrate critical thinking into English teaching, such as task-based approach and project-based learning approach (Yu, 2021; Wu, 2022).

5.3.3 The Main Research Perspectives on Critical Thinking in English Teaching

Based on the Figure 2 of the co-occurrence analysis of keywords, the critical thinking cultivation in English teaching in China is mainly discussed from three theoretical perspectives: linguistics, pedagogy and psychology. Among them, linguistic perspective focuses on the relationship between English language characteristics and critical thinking, such

as the influence of English discourse on critical thinking (Gan, 2020; Li, 2021; Jiang, 2023). Pedagogical perspective focuses on the relationship between English teaching methods and critical thinking cultivation, such as question-based teaching method and project-based learning method (Yu, 2021; Wu, 2022). Psychological perspective focuses on the relationship between students' cognitive development and critical thinking, such as students' thinking mode, Cognitive level to critical thinking (Zhao, 2023).

5.4 Emerging Trends for Critical Thinking in English Teaching

5.4.1 Clustering Analysis for Critical Thinking in English Teaching

According to the Figure 3, through cluster analysis, Modularity Q is 0.5823, greater than 0.3, which means cluster structure is obvious, and Weighted Mean Silhouette S is 0.8547, greater than 0.5, which means cluster reasonable. It can be found that critical thinking research in English teaching mainly focuses on the following areas: critical thinking in English teaching in primary schools, junior high school, high school, college and university. At the same time, it is also found that some cutting-edge topics, such as critical thinking and deep learning. These topics will become important directions for critical thinking research in English teaching in the future.
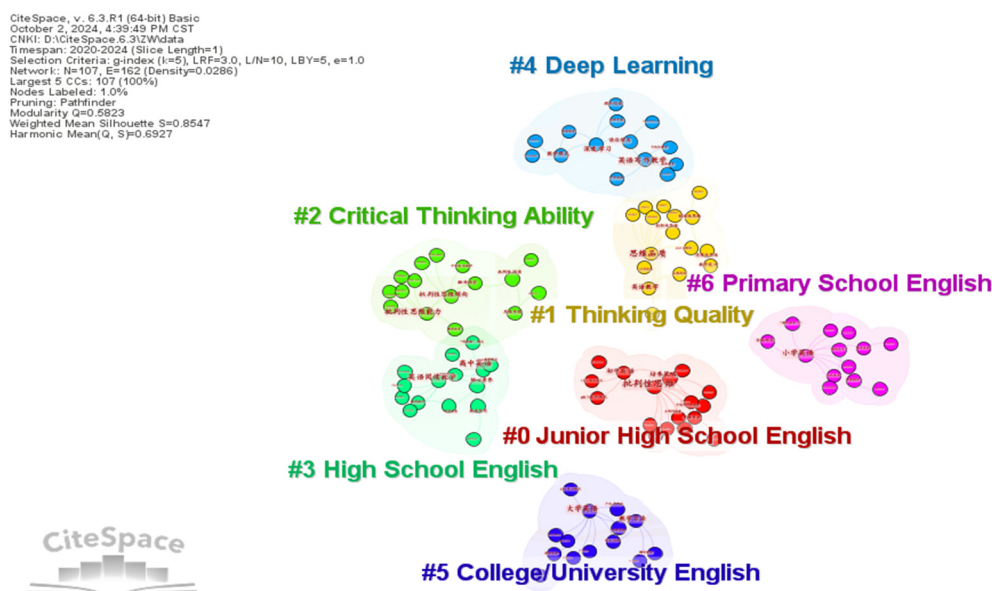

Figure 3. Keyword Clustering Analysis for Critical Thinking in English Teaching

5.4.2 Time Line Map Analysis for Critical Thinking in English Teaching

The timeline view function in Citespace mainly depicts the relationship between keyword, clusters and the span of time clusters (Zheng et al., 2020). As shown in Figure 4, setting the time slice interval to 1 year and switching to timeline visualization atlas can clearly see the evolution process of critical thinking into hotspots of each cluster in English teaching. The ordinate axis is time and the horizontal axis is a cluster. The node represents the earliest time when the keyword appears and the larger the node, the higher the attention and the number of articles.

Cluster #0 is Junior high school English. From 2020 to 2024, researchers have never stopped paying attention to critical thinking in junior high school English teaching.

Cluster #1 is thinking quality, which has been paid attention to since 2020. Critical thinking, creative thinking, logical thinking and personalized teaching are the focus of researchers.

Cluster #2 is critical thinking ability, focusing on creative thinking cultivation ability, cultivation strategies and teaching strategies from 2020.

Cluster #3 High School English starts to pay attention from 2020, and the focus gradually shift to research on practical application level, such as teaching mode design, problem-oriented method, piece-and-splice method and flipped classroom.

Cluster #4 Deep Learning is focused on from 2020 to 2024, researchers have been pay attention to deep reading,

writing instruction, reading and writing continuation, smart classes, and teaching models.

Cluster #5 focuses on college or university English teaching from 2020 to 2023, focusing on college English teaching, teaching strategies, ability development and applied value research.
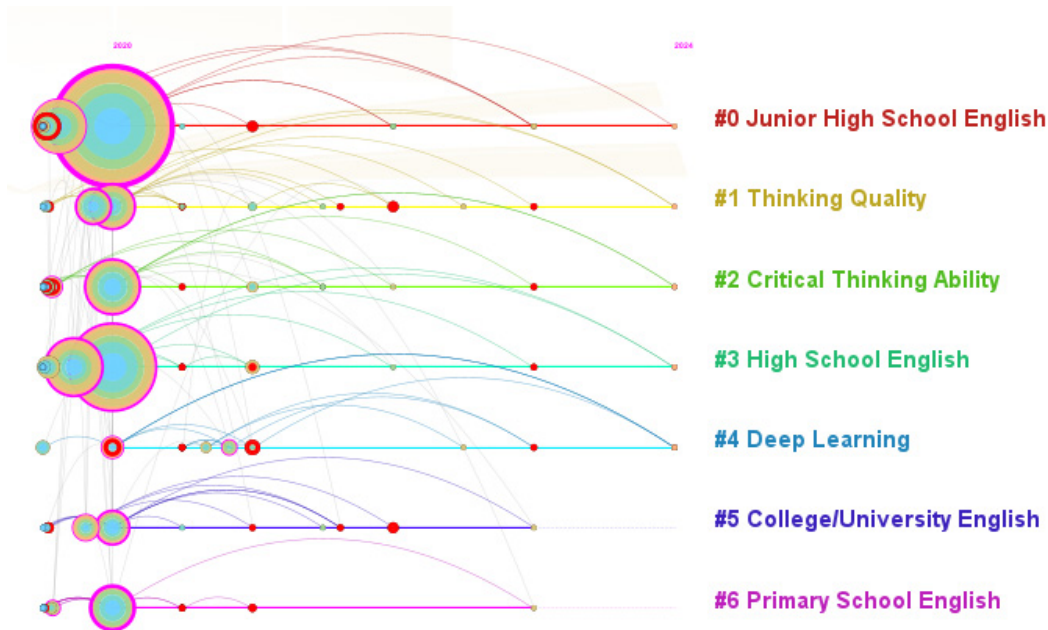

Figure 4. Time Line Map for Critical Thinking in English Teaching

Cluster #6 English teaching in primary schools lasts from 2020 to 2023, and researchers begin to pay attention to picture book teaching and efficient classroom construction.

In summary, through cluster analysis and time line map analysis, it is clear that the current research focuses on junior high school English, thinking quality, critical thinking ability, senior high school English, and deep learning.

5.4.3 Keywords with the Strongest Citation Bursts

Emerging words are key terms whose keywords suddenly increase in a certain period or whose frequency of use increases significantly (Zheng et al., 2020). Emerging words can show the phased frontier research fields integrated into critical thinking in English teaching (Chen, 2017). Firstly, according to the list below, the citation bursts of keyword is presented. The higher the strength, the stronger the keywords citation burst. Then, the trial value is adjusted to "5", as shown in Figure 5, which contains five different numerical categories: Keywords, Year, keyword prominence value (Strength), beginning year (Begin), and ending year (End).

Keywords	Year	Strength	Begin	End	2020 - 2024
Critical Reading	2020	2.89	2020	2020	
Academic English	2020	1.44	2020	2020	
Picture Book Reading	2020	1.08	2020	2020	
Reading strategy	2021	2.26	2021	2021	
High order Thinking	2021	1.35	2021	2021	
English Picture Book	2022	1.72	2022	2024	
Logic Thinking	2022	1.72	2022	2024	
English Writing Teaching	2020	1.48	2022	2022	
Writing after Reading	2021	1.49	2023	2024	
Cultivating Strategy	2020	1.08	2023	2024	

Figure 5. Top 10 Keywords with the Strongest Citation Bursts

The top 10 keywords are obtained from the analysis of English critical thinking teaching literature, among which, as shown in the Figure 5, the order of emergence is: critical reading, academic English, picture book reading, reading strategy, higher-order thinking, English picture book, logical thinking, English writing teaching, writing after reading task, and cultivating strategy. From the influence cycle of emerging words, English picture books and logical thinking have the longest influence cycle (3 years), cultivating strategy and writing after reading task last 2 years, and most of the others are concentrated in 1 year.

Moreover, from the perspective of the emerging year of keywords, critical reading, academic English and picture book reading have appeared since 2020, and the popularity has lasted for one year. From 2021, reading strategy and high-order thinking have become hot in the field of critical thinking research in English teaching. From 2022, English picture books, logical thinking, English writing teaching have become the focus of researchers. From 2023, cultivation strategies and writing after reading task are the most emergent, and researchers are gradually focusing on cultivation strategy and new teaching task "Writing after Reading" to explore critical thinking in English teaching.

6. Discussion

This study utilizes the CNKI Scholar database and employs the visualization software CiteSpace as a research tool to analyze the knowledge map of critical thinking within English teaching research from 2020 to 2024. This section provides the summary of findings drawn based on each research question.

6.1 What is the Distribution of the Influential Authors?

Firstly, from the perspective of the published authors, Wan Li, Shang Kun, Wang Hui, Liu Yang, Liu Na, are the influential authors in the field of critical thinking research in English teaching. From 2020 to 2024, critical thinking researchers in English teaching in China have not formed a close academic team, lacked strong leaders, achieved low mutual recognition, and have not yet formed a broad academic consensus.

6.2 What is the Distribution of the Publication Institutions?

Secondly, from the perspective of publishing institutions, there is no extensive and close academic cooperation network among research institutions, which is scattered geographically, among which Southwest University has the largest number of publications, showing a strong centrality and occupying an important position, followed by Chongqing Normal University, Shanghai Normal University, Shanxi Normal University and Liaocheng University.

6.3 What are the Most Frequent Keywords in the Research Articles in the Field of Critical Thinking in English Teaching?

Moreover, through analyzing the co-occurrence analysis of keywords, Critical thinking, English reading teaching, English for high school and English for junior high school are the most frequently used keywords in the study of critical thinking in English teaching from 2020 to 2024.

6.4 What are the Research Hotspots in the Field of Critical Thinking in English Teaching?

First of all, Critical thinking research in English teaching can be divided into four educational stages, including primary school, junior high school, senior high school, and college or university school. Junior high school and senior high school are the main research objects, in which students' critical thinking ability can be cultivated through various teaching activities (Ju, 2024; Zhang, 2024; Zhan, 2024; Gao, 2020; Jiang, 2021; Chen, 2022). Primary school and university stage are relatively second, but they are also being valued (Wang, 2023; Zhou, 2023; Chen, 2024; Wang, 2024;Zhao, 2023; Kong, 2024). Students' critical thinking ability can be cultivated through interesting activities and academic activities respectively. The research in different stages contributes to the improvement of English teaching quality and students' comprehensive quality.

Moreover, the cultivating strategies for integrating critical thinking into English curriculum reflects the continuing challenge facing China's education system: balancing content knowledge with skill development (Hu, 2024; Kong, 2024). Effective integration requires careful consideration of curriculum design and coordination, which, as the Du (2020) suggests, is still in the stage of active experimentation and improvement. The prominence of teaching methods as a major theme highlights the consensus in the educational research community on the need for innovative teaching methods. Various methods documented in the literature, such as group discussion, problem-based learning, task-based learning and project-based learning approach, indicate a shift in teaching methods towards more interactive and student-centered teaching methods (Du, 2020; Zhang, Yang & Jin, 2021; Ma, 2022; Hu, 2024; Yu, 2021; Wu, 2022). This shift suggests that critical thinking skills are increasingly seen as not just an outcome to be

evaluated, but an indispensable process to be cultivated through an immediate and engaging learning experience.

Furthermore, Critical thinking in English teaching has three perspectives. Linguistic perspective, which focuses on the use and structure of language (Gan, 2020; Li, 2021; Jiang, 2023). Psychological perspective, which focuses on the relationship between students' psychological state and critical thinking in English learning (Zhao, 2023) . Pedagogical perspective, which focuses on the influence of pedagogic environment on the cultivation of critical thinking in English teaching (Yu, 2021; Wu, 2022). These three perspectives provide multiple approaches and directions for the further study of critical thinking in English teaching.

6.5 What are the Emerging Trends in the Field of Critical Thinking in English Teaching?

By analyzing the clustering analysis of keywords, the most repeated research topics in critical thinking research based on English teaching are identified, and CiteSpace visualization tool is used to analyze the research keywords in 6 clusters to identify the latest and hot research areas. Based on the clustering analysis of the network from 2020 to 2024, it is found that cluster #0 junior high school English, cluster #1 thinking quality, cluster #2 critical thinking ability, cluster #3 senior high school English have an average citation year of 2022, describing important research areas in the field of critical thinking in English teaching, while cluster #4 deep learning identifies the latest research trends in the field of critical thinking in English Teaching.

Besides, it is evident that from the emerging words analysis that the number of studies on "training strategies" and "new teaching task: Writing after Reading" in exploring critical thinking in English teaching has increased sharply after 2023, which reflects the deep concern and active exploration of how to effectively improve students' critical thinking ability in the field of English education. This trend not only highlights the importance attached to the cultivation of students' higher-order thinking ability in the current educational reform, but also puts forward the urgent need to innovate and optimize the traditional English teaching model in order to integrate and strengthen the cultivation of critical thinking in a wider range of teaching practices.

Overall, the results of this study offer a comprehensive overview of the research landscape, including key authors, influential publication institutions and keywords co-occurrence analysis, research hotspots related to the application of critical thinking across four educational stages, two main contents, and three research perspectives. Additionally, emerging trends are identified, providing valuable insights for scholars and researchers working on deep learning, training strategies, and writing tasks based on reading, guiding future research directions.

7. Conclusion

This paper employs bibliometric analysis to explore the knowledge map of critical thinking in English teaching in China from 2020 to 2024. Using CiteSpace for network visualization, the study examines key aspects including influential authors, publication institutions, keyword co-occurrence, research hotspots, and emerging trends. The findings reveal that critical thinking research in English teaching has gained significant attention and development during this period. The research primarily focuses on critical thinking at four different educational stages from primary school, junior high school to senior high school and college or university school, emphasizing cultivation strategies and teaching methods, and three research perspectives form linguistic, pedagogical and psychological perspectives. In addition, emerging trends are identified as deep learning, training strategies, and writing tasks based on reading. However, there are some limitations to this study. First, it focuses on bibliometric data from 2020 to 2024, which may not fully capture long-term trends or the evolution of critical thinking research in English teaching over a broader time. Additionally, the analysis is centered on research in China, which may limit the generalizability of the findings to other countries or regions. Despite these limitations, this study provides valuable insights for researchers and educators, offering support for the continued integration of critical thinking into English education.

References

Bezanilla, M. J., Fernández-Nogueira, D., Poblete, M., & Galindo-Domínguez, H. (2019). Methodologies for teaching-learning critical thinking in higher education: The teacher's view. *Thinking skills and creativity, 33*, 100584.

Black, M. (2018). *Critical thinking: An introduction to logic and scientific method*. Pickle Partners Publishing.

Bobkina, J., & Stefanova, S. (2016). Literature and critical literacy pedagogy in the EFL classroom: Towards a model of teaching critical thinking skills. *Studies in second language learning and teaching, 6*(4), 677-696.

Brown, K. (2018). *Education, culture and critical thinking*. Routledge.

Chen, C. (2014). The citespace manual. *College of Computing and Informatics, 1*(1), 1-84.

Chen, C. (2016). *CiteSpace: a practical guide for mapping scientific literature* (pp. 41-44). Hauppauge, NY, USA: Nova Science Publishers.

Chen, C. (2017). Science mapping: a systematic review of the literature. *Journal of data and information science, 2*(2), 1-40.

Chen, H. (2024). Strategies for cultivating critical thinking in primary school English teaching. Primary Students (Monthly), (01), 136-138. https://doi.org/CNKI:SUN:XISZ.0.2024-01-047

Chen, M. (2022). Examples of cultivating critical thinking in integrated reading and writing teaching in high school English. *Fujian Basic Education Research*, (05), 81-83. https://doi.org/CNKI:SUN:ZXSD.0.2022-05-022

Cui, X. P. M., Yu, X., & Hua, W. (2017). How is CiteSpace used and cited in the literature? An analysis of the articles published in English and Chinese core journals. In *Proceedings of the 16th International Conference on Scientometrics and Informetrics* (pp. 1741-1746). Wuhan, China.

Dewey, J., Corita, S. M., & Eddington, A. S. (2008). Critical thinking. *In A primer on natural resource science* (pp. 65-78). Texas A&M University Press.

Du, J. (2020). *Research on teaching strategies for cultivating students' critical thinking in junior high school English reading* [Master's thesis, Southwest University]. Link.

Elder, L., & Paul, R. (2020). *Critical thinking: Tools for taking charge of your learning and your life*. Foundation for Critical Thinking.

Ennis, R. H. (2018). Critical thinking across the curriculum: A vision. Topoi, 37, 165-184.

Erdoğan, V. (2019). Integrating 4C skills of 21st century into 4 language skills in EFL classes. *International Journal of Education and Research, 7*(11), 113-124.

Facione, P. A. (2011). Critical thinking: What it is and why it counts. *Insight assessment, 1*(1), 1-23.

Feng, X., Yu, L., Kong, W., & Wang, J. (2024). Frontier hotspots and trend evolution of cultural and creative design in China—an empirical research on CNKI-based bibliometrics. *Library Hi Tech, 42*(1), 203-226.

Gan, Y. (2020). Exploration of strategies for cultivating critical thinking in high school English text reading teaching. *English Teacher*, (18), 152-154. https://doi.org/CNKI:SUN:YJJS.0.2020-18-043

Gao, J. (2020). Exploration of integrated teaching of reading and writing in high school English under thematic contexts: A case study of BNU Compulsory 3 Unit 9 Wheels. *Overseas English*, (09), 40-42. https://doi.org/CNKI:SUN:HWYY.0.2020-09-020

Hu, S. (2024). Research on strategies for cultivating critical thinking in high school English reading under the new college entrance examination framework. *Campus English*, (38), 24-26. https://doi.org/CNKI:SUN:XYYY.0.2024-38-008

Huang, C., Yang, C., Wang, S., Wu, W., Su, J., & Liang, C. (2020). Evolution of topics in education research: A systematic review using bibliometric analysis. *Educational Review, 72*(3), 281-297.

Itmeizeh, M., & Hassan, A. (2020). New approaches to teaching critical thinking skills through a new EFL curriculum. *International Journal of Psychosocial Rehabilitation, 24*(7), 8864-8880.

Jiang, L. (2021). A study on teaching English writing after reading under the framework of core competencies. *Campus English*, (36), 130-131. https://doi.org/CNKI:SUN:XYYY.0.2021-36-063.

Jiang, Y. (2023). Practical strategies for cultivating students' critical thinking skills in elementary school English text teaching. *Foreign Language Teaching in Primary and Secondary Schools (Primary Section)*, (05), 54-59. https://doi.org/CNKI:SUN:HXXW.0.2023-05-010.

Jing, X., Ghosh, R., Sun, Z., & Liu, Q. (2020). Mapping global research related to international students: A scientometric review. *Higher Education, 80*, 415-433.

Ju, Q. (2024). Exploring junior high school English writing teaching methods oriented towards cultivating critical thinking. *Success*, (16), 141-142. https://doi.org/CNKI:SUN:CHCA.0.2024-16-066.

Kim, S., Raza, M., & Seidman, E. (2019). Improving 21st-century teaching skills: The key to effective 21st-century learners. *Research in Comparative and International Education, 14*(1), 99-117.

Kong, Y. (2024). Research on cultivating critical thinking skills in college English reading teaching from the perspective of moral education in foreign language courses. *Cai Zhi*, (15), 158-161. https://doi.org/CNKI:SUN:CAIZ.0.2024-15-041.

Lamb, S., Maire, Q., & Doecke, E. (2017). Key skills for the 21st century: An evidence-based review.

Li, C. (2021). Developing critical thinking skills in elementary school English text teaching. *Primary School Teaching Design*, (18), 18-20. https://doi.org/CNKI:SUN:XXJX.0.2021-18-007.

Liang, W., & Fung, D. (2021). Fostering critical thinking in English-as-a-second-language classrooms: Challenges and opportunities. *Thinking Skills and Creativity, 39*, 100769.

Liang, Y. D., Li, Y., Zhao, J., Wang, X. Y., Zhu, H. Z., & Chen, X. H. (2017). Study of acupuncture for low back pain in recent 20 years: a bibliometric analysis via CiteSpace. *Journal of pain research*, 951-964.

Liu, J., & Pan, M. (2019). English language teaching in China: Developing language proficiency frameworks. *Second handbook of English language teaching*, 415-432.

Lozano, S., Calzada-Infante, L., Adenso-Díaz, B., & García, S. (2019). Complex network analysis of keywords co-occurrence in the recent efficiency analysis literature. *Scientometrics, 120*, 609-629.

Ma, L. (2022). Strategies for designing problems in high school English reading teaching based on cultivating critical thinking skills. *Journal of Changchun Education Institute*, (06), 134-138. https://doi.org/CNKI:SUN:CCJB.0.2022-06-016.

Meltzoff, J., & Cooper, H. (2018). *Critical thinking about research: Psychology and related fields*. American psychological association.

Paul, R., & Elder, L. (2019). *The miniature guide to critical thinking concepts and tools*. Rowman & Littlefield.

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.

Wang, S. (2024). Strategies for cultivating critical thinking in primary school English reading teaching. *Good Parents*, (07), 51-52. https://doi.org/CNKI:SUN:HJZH.0.2024-07-015.

Wang, W., & Lu, C. (2020). Visualization analysis of big data research based on Citespace. *Soft Computing, 24*(11), 8173-8186.

Wang, Y. (2023). Research on strategies for cultivating critical thinking skills in primary school English teaching. *Overseas English*, (07), 205-207+210. https://doi.org/CNKI:SUN:HWYY.0.2023-07-064.

Wen, Q., & Zhang, H. (2020). China going global: Challenges and responses in English as a foreign language teaching and teacher education. In *English language teaching and teacher education in East Asia: Global challenges and local responses* (pp. 1113–1134). Cambridge University Press.

Wu, Q. (2022). *Practical research on fostering critical thinking tendencies in high school English reading through project-based teaching methods* [Master's thesis, Inner Mongolia Normal University]. China National Knowledge Infrastructure (CNKI).

Xue, E., & Li, J. (2022). *Rural Education Reform in China: A Policy Mapping Perspective*. Springer Nature.

Yaacob, A., Mohd Asraf, R., Hussain, R. M. R., & Ismail, S. N. (2020). Empowering learner' reflective thinking through collaborative reflective learning. *International Journal of Instruction*.

Yu, A. (2021). Elementary English conversation teaching based on critical thinking tasks. *Anhui Educational Research*, (10), 66-67. https://doi.org/CNKI:SUN:AHJY.0.2021-10-036.

Yu, X., & Liu, C. (2018). Curriculum reform of college English teaching in China: From English for general purposes to English for specific purposes. *ESP Today, 6*(2), 140-160.

Yu, X., & Liu, C. (2022). Teaching English as a lingua franca in China: Hindrances and prospects. *English Today, 38*(3), 185-193.

Zhan, T. (2024). The influence of critical thinking on junior high school English writing. *Campus English*, (20), 118-120. https://doi.org/CNKI:SUN:XYYY.0.2024-20-039.

Zhang, L. (2024). Junior high school English reading teaching aimed at cultivating critical thinking. *Pudong Education*, (08), 77-82. https://doi.org/CNKI:SUN:PUDO.0.2024-08-013.

Zhang, S., Yang, J., & Jin, H. (2021). Strategies for cultivating critical thinking skills in high school English reading teaching. *Journal of Heilongjiang Institute of Technology (Comprehensive Edition)*, (10), 138-141. https://doi.org/10.16792/j.cnki.1672-6758.2021.10.026

Zhang, X. (2022). Investigating student teachers' perceptions of English as a lingua franca and its teaching in mainland China. *Asian Englishes, 24*(3), 247-262.

Zhao, Y. (2023). College English writing teaching and the cultivation of critical thinking skills. *English Square*(35), 88-91. https://doi.org/10.16723/j.cnki.yygc.2023.35.014

Zhao, Y. (2023). *Correlation between critical thinking tendencies, metacognitive strategies, and high school students' performance in post-reading writing* [Master's thesis, Inner Mongolia Normal University].

Zheng, C., Yuan, J., Zhu, L., Zhang, Y., & Shao, Q. (2020). From digital to sustainable: A scientometric review of smart city literature between 1990 and 2019. *Journal of Cleaner Production, 258*, 120689.

Zhou, L. (2023). Strategies for cultivating students' critical thinking in primary school English teaching. Foreign Language Teaching in Primary and Secondary Schools (Primary Section), (12), 24-30. https://doi.org/CNKI:SUN:HXXW.0.2023-12-005

Competing interests

The authors declare no competing interest.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Sciedu Press.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.