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A bibliometric and systematic review of case-based learning research on critical thinking in preservice teachers

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Abstract

Background: The growing emphasis on higher-order thinking skills has positioned case-based learning (CBL) as a prominent pedagogical approach in contemporary education. Although prior studies highlight its potential to enhance critical thinking, research trends and thematic focus particularly involving preservice teachers remain insufficiently synthesized.

Aims: This study aims to identify research trends, bibliometric characteristics, and gaps related to the effectiveness of CBL in improving critical thinking skills, with a specific focus on preservice teachers. The scope includes Scopus-indexed publications from 2015 to 2025. The use of Scopus is considered by taking into account several factors, including quality assurance standards (peer-reviewed publications), reputation and credibility indicators (Scimago Journal Rank/SJR), and its broad multidisciplinary coverage. However, certain limitations remain, such as publication bias related to language and geographical representation, the presence of grey literature, and bias associated with publication types.

Methods: A Systematic Literature Review (SLR) combined with bibliometric analysis was conducted. Articles were selected based on predefined inclusion criteria and analyzed by country, subject area, journal quartile, SJR, and H-index. Keyword co-occurrence mapping was performed using VOSviewer.

Results: A total of 86 articles met the inclusion criteria, predominantly published in Q1 and Q2 journals within the Social Sciences domain. Bibliometric visualization shows that CBL and critical thinking are widely explored topics; however, studies focusing on preservice teachers and their relationship with decision making (CBL and critical thinking) remain limited.

Conclusion: The findings indicate strong scholarly interest in CBL while revealing a clear research gap concerning preservice teachers populations. Future research should prioritize the development of standardized instruments and expand empirical investigations to strengthen evidence-based practices in teacher education.

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INTRODUCTION

Education has undergone significant transformation driven by rapid advancements in information and communication technologies, which have reshaped the way knowledge is constructed, delivered, and applied in learning environments (Picauly, 2024; Rahmi et al., 2024). These developments have not only altered instructional practices but also redefined the competencies required of learners and educators in the modern era (Dadang & Karep, 2025). In particular, the increasing complexity of real-world problems demands that students are able to

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connect theoretical knowledge with practical contexts. However, many students still encounter difficulties in bridging this gap, especially when learning remains dominated by traditional one-way instructional approaches that limit active engagement and higher-order thinking processes (Agustin et al., 2023; Latif, 2020; Dharmayanthi, 2022). As a result, the need to promote more meaningful and interactive learning environments has become increasingly urgent.

In response to these challenges, critical thinking skills have emerged as a core competency that must be developed systematically, particularly among preservice teachers who will play a central role in shaping future learning environments. Critical thinking enables preservice teachers to analyze instructional problems objectively, evaluate information based on evidence, and make reflective pedagogical decisions (Özelçi & Çalışkan, 2019; Huda, 2025). These competencies are essential not only for improving the quality of classroom instruction (Altun & Yildirim, 2023; Hamatun, 2025), but also for preparing teachers who are capable of adapting to ongoing changes in curriculum, educational technology, and diverse student needs (Kannadass et al., 2023; Septiyani et al., 2020; Polat, 2015). Therefore, the development of critical thinking skills should be embedded within teacher education through instructional approaches that emphasize authentic problem solving, reflection, and contextual learning experiences (Fitriani et al., 2022; Suhirman & Prayogi, 2023).

One instructional approach that aligns with these demands is case-based learning (CBL), which emphasizes the use of real-world cases as a medium for fostering analytical and reflective thinking. In the context of preservice teacher education, CBL plays a strategic role in developing critical thinking skills that underpin professional competence (Mary & Nel, 2013; Şen Akbulut & Hill, 2020). Through this approach, preservice teachers are actively engaged in examining authentic educational scenarios, allowing them to connect pedagogical theory with practice and to formulate appropriate instructional decisions. Moreover, the relevance of CBL has become increasingly evident in the digital era, where the rapid expansion of information requires individuals to think critically, evaluate multiple perspectives, and respond adaptively to complex situations (Wulan et al., 2024; Andriani et al., 2024; Anwar & Rahmawati, 2024; Dharmayanthi, 2022). By integrating contextual case analysis with digital tools, CBL not only facilitates conceptual understanding but also supports the development of digital literacy, collaborative skills, and problem-solving abilities (Sari & Khairunnisa, 2025; Silitubun et al., 2024). Furthermore, the demands of the contemporary workforce increasingly emphasize competencies such as adaptability, collaboration, and decision making, which cannot be effectively developed through memorization-based learning approaches (Amalia & Khaerunnisa, 2024; Idris & Syarifuddin, 2025; Sugiansyah et al., 2025).

Despite its theoretical and practical relevance, the existing body of research on case-based learning and critical thinking reveals several important limitations. Numerous studies have examined the implementation of CBL across various educational contexts; however, a substantial proportion of this research is concentrated in fields such as medical and nursing education, rather than in teacher education contexts. In addition, many studies tend to integrate CBL with other instructional approaches, such as problem-based learning or technology-enhanced strategies, making it difficult to isolate the specific effects of CBL on critical thinking development. Furthermore, the availability of standardized and contextually appropriate instruments for measuring critical thinking within preservice teacher education remains limited. These conditions indicate that, although CBL has been widely studied, there is still a lack of focused and systematic synthesis of research that specifically examines its role in developing critical thinking skills among preservice teachers.

Based on these gaps, this study aims to provide a comprehensive analysis of research trends, bibliometric characteristics, and thematic developments related to case-based learning and critical thinking in preservice teacher education. By employing a systematic literature review combined with

bibliometric analysis, this study contributes to the literature in three main ways. First, it offers a structured mapping of research developments to identify dominant themes and underexplored areas. Second, it highlights methodological and conceptual gaps that require further investigation, particularly in relation to the measurement and implementation of CBL in teacher education. Third, it provides practical insights for educators and researchers in designing more effective and evidence-based instructional strategies to enhance preservice teachers' critical thinking skills.

METHOD

Research Design

This study employed a Systematic Literature Review (SLR) combined with bibliometric analysis to examine research trends on case-based learning (CBL) and critical thinking in preservice teacher education. The review followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework, which provides a structured and transparent procedure for identifying, screening, assessing eligibility, and selecting relevant studies. The application of PRISMA ensures methodological rigor and enhances the reproducibility of the review process by systematically documenting each stage of study selection (Yusri et al., 2024).

Search Strategy

The literature search was conducted using the Scopus database, which was selected due to its extensive multidisciplinary coverage, high-quality peer-reviewed indexing, and availability of comprehensive bibliometric metadata such as citation counts, Scimago Journal Rank (SJR), and H-index indicators. The search was performed on November 3, 2025, using a combination of keywords and Boolean operators to ensure the retrieval of relevant studies. The search query was formulated as follows: ("case-based learning" OR "CBL") AND ("critical thinking") AND ("preservice teachers" OR "teacher candidates"). To ensure consistency and relevance, the search was limited to journal articles published between 2015 and 2025 and written in English. Although Scopus provides a robust dataset for bibliometric analysis, the use of a single database may introduce database bias, as relevant studies indexed in other databases such as Web of Science or ERIC may not be included.

Study Selection (PRISMA Process)

The study selection process followed the four stages of the PRISMA framework, namely identification, screening, eligibility, and inclusion. In the identification stage, a total of 139 articles were retrieved from the Scopus database based on the predefined search strategy. During the screening stage, articles were filtered according to specific criteria, resulting in the exclusion of 5 non-English articles, 29 articles that were not published in peer-reviewed journals, and 19 articles that did not provide DOI information. Subsequently, in the eligibility stage, the remaining articles were assessed through title and abstract screening, followed by full-text review when necessary to ensure alignment with the research focus. As a result of this process, a total of 86 articles met all inclusion criteria and were included in the final analysis. The overall selection process is illustrated in Figure 1.

Inclusion and Exclusion Criteria

The inclusion and exclusion criteria were defined to ensure the relevance and quality of the selected studies. Studies were included if they were empirical in nature, either quantitative or qualitative, focused on case-based learning and critical thinking, and involved preservice teacher populations. Conversely, studies were excluded if they were review or conceptual papers, conference proceedings, book chapters, reports, or if they did not align with the research focus. These criteria were applied consistently throughout the screening and eligibility stages to maintain the rigor of the selection process.

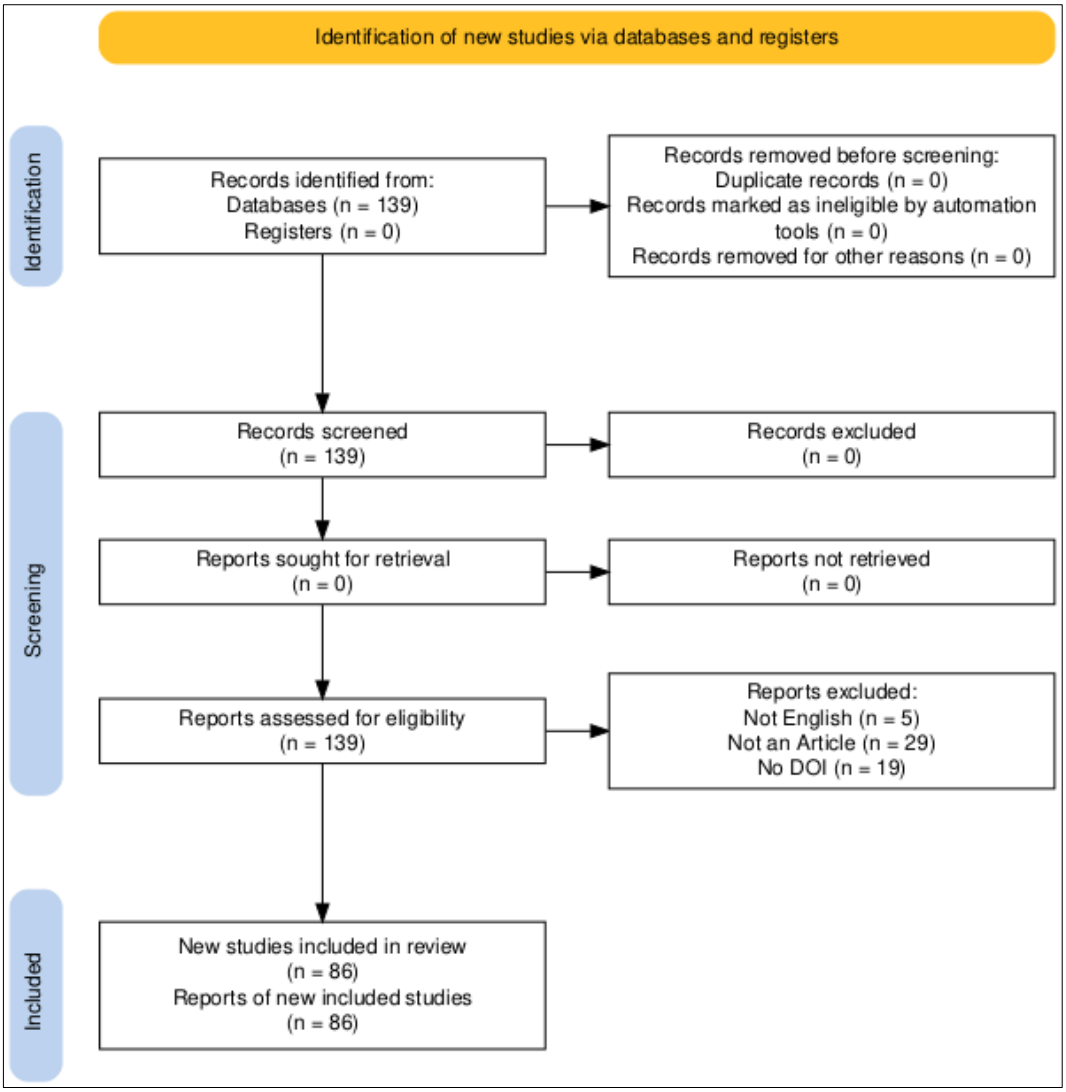

Figure 1. Prisma Models

Data Extraction

Data extraction was conducted systematically using a structured coding framework to ensure consistency and comprehensiveness. For each selected article, key information was extracted, including the publication year, country of study, research design, participant characteristics, educational domain, type of intervention (whether case-based learning was implemented as a standalone approach or integrated with other methods), outcome variables related to critical thinking, and the main findings. This process enabled a detailed mapping of research characteristics and supported subsequent descriptive and bibliometric analyses.

Quality Assessment

To ensure the reliability and relevance of the included studies, a quality assessment process was conducted based on several criteria, including the relevance of the study to the research topic, clarity of the research design, appropriateness of data analysis methods, and transparency in reporting findings. Studies that did not meet these criteria were excluded during the eligibility stage. Although a formal inter-rater reliability procedure was not implemented, the use of predefined criteria helped to minimize subjectivity and maintain consistency in the selection process.

Instruments and Tools

This study utilized several analytical tools to support the systematic review and bibliometric analysis. The PRISMA protocol was used as the primary guideline for the literature review process, while the Scopus database served as the main source for retrieving bibliometric data. In addition, VOSviewer software was employed to perform bibliometric analysis, including keyword co-occurrence mapping and visualization. The software generated density, network, and overlay visualizations to identify research trends and relationships among keywords. Prior to analysis, keyword cleaning was conducted using a thesaurus file to remove generic indexing terms, such as "human" and "article," in order to improve the accuracy and interpretability of the visualization results.

Data Analysis

Data analysis was conducted using both descriptive and bibliometric approaches to provide a comprehensive understanding of the research field. Descriptive analysis was used to examine publication characteristics, including publication trends, subject areas, journal quartile classifications (Q1–Q4), Scimago Journal Rank (SJR), and H-index values. Meanwhile, bibliometric analysis was performed using VOSviewer to analyze keyword co-occurrence patterns and visualize research trends through network, density, and overlay maps. This combined analytical approach enabled the identification of both quantitative distributions and conceptual structures within the literature on case-based learning and critical thinking in preservice teacher education.

RESULTS AND DISCUSSION

Results

Identification

At the identification stage, relevant scientific journal articles were retrieved from the Scopus database within the publication period of 2015–2025. The search was conducted on November 3, 2025, using predefined keywords related to case-based learning (CBL) and critical thinking skills in educational contexts. All records obtained from the initial search were documented to ensure comprehensive coverage of the relevant literature before proceeding to the screening and eligibility stages.

Screening

The initial search yielded 139 potential research articles. A screening process was then conducted to ensure the relevance and eligibility of the identified studies. During this stage, 5 articles were excluded because they were not written in English, 29 articles were excluded because they were not published in peer-reviewed journals, and 19 articles were excluded due to the absence of DOI information. After the screening and eligibility assessment were completed, a total of 86 scientific journal articles met the inclusion criteria and were selected for the final analysis.

Table 1. Research Search Keywords

Purpose	Main Keywords
The Effectiveness of Case-Based Learning on Critical Thinking Skills of Preservice Teachers	Case-based learning critical thinking Preservice teachers

Eligibility

The eligibility verification represented the final stage of the study selection process. At this stage, the articles that passed the screening phase were reviewed in greater depth by examining their titles and abstracts. When the relevance of an article was unclear, the full text was further examined. This procedure ensured the exclusion of review papers, duplicate records, and articles that were not aligned with the research theme.

Table 2. Inclusion and Exclusion Criteria for Articles

Criteria	Inclusion	Exclusion
Study type	Quantitative research Qualitative research	Review paper Conceptual paper
Language	English	Any other language
Document type	Final journal article	Proceeding paper Book series/chapter Report, Short survey
Study topics	Related to: The effectiveness of case- based learning on the critical thinking skills of prospective teachers	Other than: The effectiveness of case-based learning on the critical thinking skills of prospective teachers

Classification Method of Eligible Journal Articles

At the screening stage, a total of 86 research articles related to the research theme were identified. Subsequently, these articles were classified based on research subject areas.

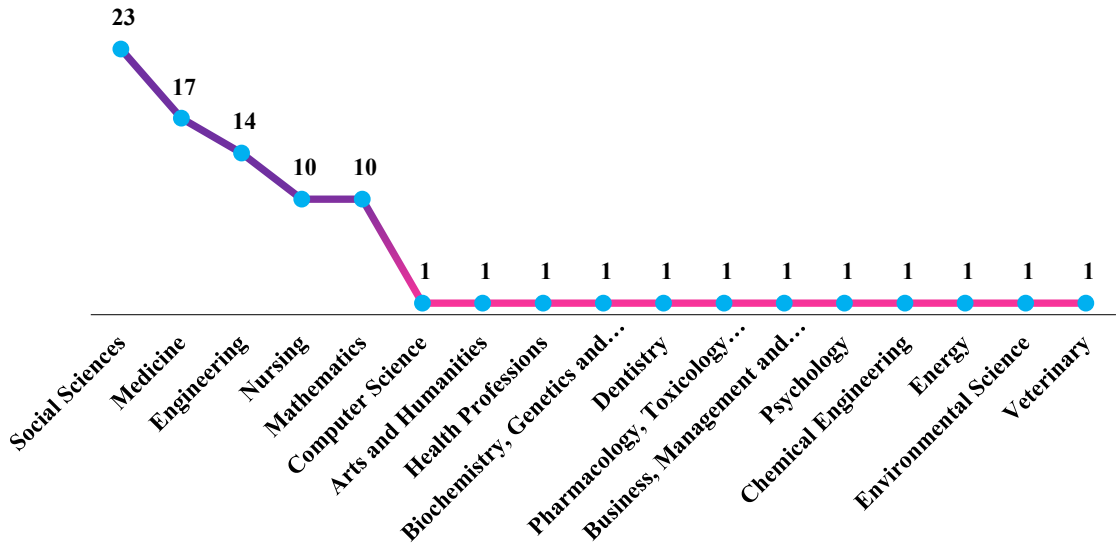

Figure 1. Distribution of Articles by Subject Area

Based on the subject area classification, studies related to the effectiveness of case-based learning in developing critical thinking skills were predominantly categorized within the Social Sciences, with 23 articles. This was followed by Medicine (17 articles) and Engineering (14 articles). Other subject areas included Nursing and Mathematics, each contributing 10 articles. The remaining subject areas contributed fewer than 10 articles each. These findings indicate that research on case-based learning and critical thinking is primarily concentrated within disciplines that emphasize analytical reasoning, professional training, and problem-solving skills.

Significant Journal Publication

In conducting the journal article review, a total of 86 articles were analyzed. In this study, conference proceedings and books were excluded from the literature review. The analysis was limited to journals indexed in the Scopus database, with journal rankings determined based on the 2024 Scimago Journal Rank (SJR) available on the Scimago Journal & Country Rank website (www.scimagojr.com), journal quartile categories (Q1–Q4), and H-index values. The H-index is a metric indicator used to assess the productivity and scientific impact of journal publications. The results of this analysis are presented in Table 3.

Table 3. Journal List Based on Scimago Journal Rank (SJR), Quartile Categories, and H-Index

No	Journal Publications	SJR 2024	Q Category	H-Index
1	Acta Paedagogica Vilnensia	0,164	Q4	5
2	Advances in Medical Education and Practice	0,548	Q2	47
3	Advances in Physiology Education	0,784	Q2	156
4	African Journal of Reproductive Health	0,350	Q3	51
5	Archives of Design Research	0,165	Q1	9
6	Asia Pacific Scholar	0,208	Q2	7
7	Asian Education and Development Studies	0,573	Q2	22
8	Belitung Nursing Journal	0,446	Q2	11
9	Biochemistry and Molecular Biology Education	0,369	Q3	50
10	BMC Medical Education	8,523	Q1	963
11	BMC Nursing	1,272	Q1	62
12	BMC Oral Health	0,843	Q1	80
13	Bulletin of Educational Psychology	0,193	Q4	8
14	Collegian	0,685	Q2	47
15	Currents in Pharmacy Teaching and Learning	0,854	Q2	70
16	Disciplinary and Interdisciplinary Science Education Research	0,825	Q1	19
17	Education Sciences	1,460	Q1	136
18	European Journal of Dental Education	1,342	Q1	116
19	European Public and Social Innovation Review	0,171	Q3	6
20	Forum for Linguistic Studies	0,468	Q2	14
21	Frontiers in Education	1,950	Q2	165
22	Frontiers in Medicine	3,848	Q1	408
23	Georgian Medical News	0,172	Q3	24
24	IDA: International Design and Art Journal	0,136	Q2	1
25	IEEE Transactions on Education	0,760	Q1	80
26	Innovations in Education and Teaching International	0,812	Q1	69
27	Interactive Learning Environments	3,952	Q1	160
28	International Journal of Engineering Education	0,596	Q3	128
29	International Journal of Management Education	1,741	Q1	65
30	International Journal of Medical Education	0,437	Q3	42
31	International Journal of Online and Biomedical Engineering	0,336	Q2	27
32	International Journal of Science Education	0,672	Q2	132
33	International Journal of Surgery	2,076	Q1	99
34	International Journal on Interactive Design and Manufacturing	0,493	Q2	44
35	International Review of Aerospace Engineering	0,297	Q3	19
36	Issues in Educational Research	0,544	Q2	36
37	JK Science	0,127	Q4	19
38	Journal of Applied Research in Higher Education	0,615	Q2	30
39	Journal of Educational Evaluation for Health Professions	2,068	Q1	25
40	Journal of Engineering Education Transformations	1,268	Q2	60
41	Journal of International Education in Business	0,492	Q2	21
42	Journal of Medical Internet Research	3,984	Q1	428
43	Journal of Postgraduate Medicine	0,292	Q3	64
44	Journal of Research in Education Sciences	0,420	Q4	22
45	Journal of Veterinary Medical Education	0,473	Q2	47
46	Jurnal Ners	0,187	Q4	9
47	Medicine (United States)	0,469	Q3	180
48	National Journal of Clinical Anatomy	0,164	Q4	6
49	Neutrosophic Sets and Systems	0,399	Q3	38
50	Nurse Education in Practice	2,258	Q1	136
51	Nurse Education Today	1,483	Q1	109
52	Ochsner Journal	0,380	Q3	52
53	Revista Iberoamericana de Tecnologias del Aprendizaje	0,366	Q2	25
54	SAGE Open Nursing	0,752	Q1	24
55	Saudi Journal of Anaesthesia	0,399	Q2	39

No	Journal Publications	SJR 2024	Q Category	H-Index
56	School Science and Mathematics	0,438	Q1	59
57	STEM Education	0,343	Q3	7
58	Sustainability (Switzerland)	0,688	Q1	207
59	Teachers College Record	0,810	Q1	111
60	Thinking Skills and Creativity	1,410	Q1	75
61	Universal Access in the Information Society	0,633	Q2	57

Source: www.scimagojr.com

Journal Quartile (Q1-Q4) Classification

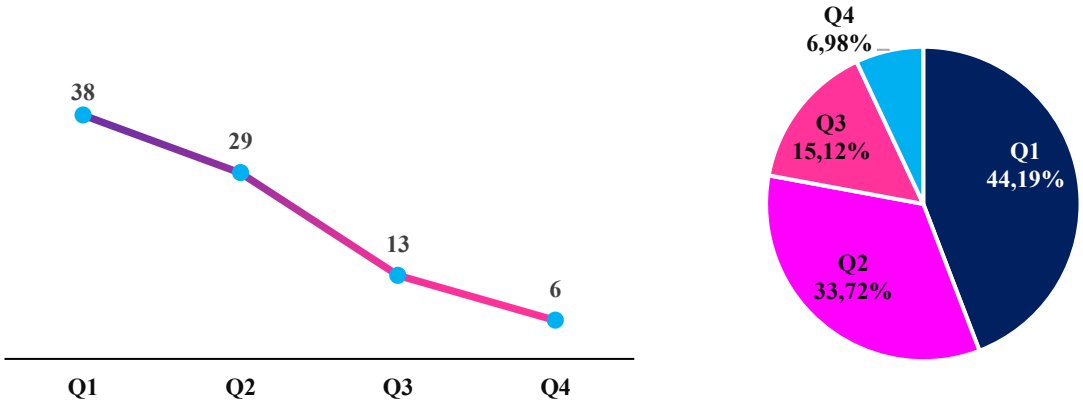

Figure 2. Distribution of Articles by Scopus Journal Quartile Categories (Q1–Q4)

Figure 2 shows that 38 literature articles, accounting for 44.19% of the SLR sources, were published in Scopus Q1-indexed journals. A total of 29 articles (33.72%) were published in Scopus Q2 journals, 13 articles (15.12%) in Scopus Q3 journals, and 6 articles (6.98%) in Scopus Q4 journals. In addition, the journal review analysis was also conducted by examining the Scimago Journal Rank (SJR) values of the selected research articles. The SJR value reflects the number of citations and the influence of citation sources, providing a balanced indicator of journal impact. Journals with an SJR value greater than 1.0 indicate above-average citation potential, whereas journals with an SJR value below 1.0 indicate below-average citation potential. Based on the SJR values, the results are presented in Figure 3.

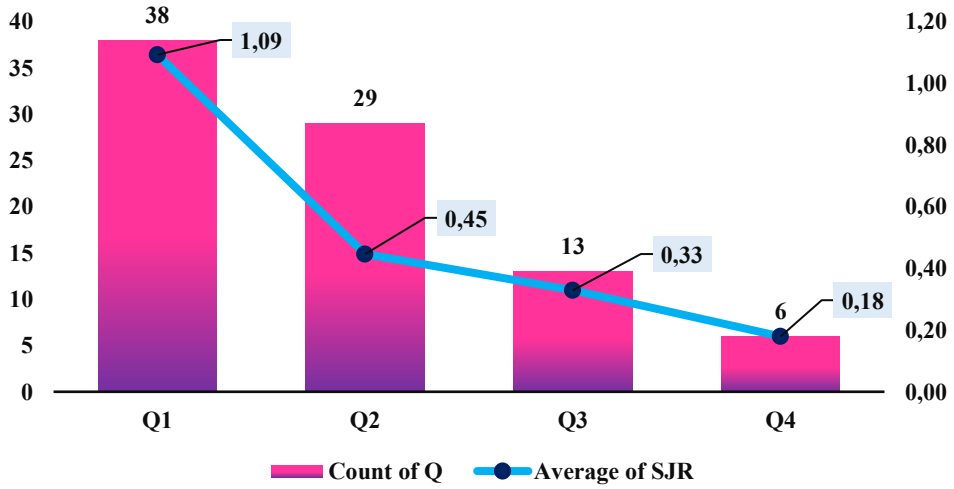

Figure 3. Mean Scimago Journal Rank (SJR) Values by Journal Quartile

Based on Figure 3, the 38 literature review articles published in Scopus Q1 journals show an average SJR value of 1.092. Meanwhile, the 29 articles from Scopus Q2 journals have an average SJR value of 0.446, the 13 articles from Scopus Q3 journals have an average SJR value of 0.329, and the 6

articles from Scopus Q4 journals have an average SJR value of 0.179. These findings indicate that 44.19% of the journal articles forming the basis of this literature review were published in Scopus Q1 journals with an average SJR value of 1.092, suggesting that these journals have above-average citation potential.

Subsequent analysis was conducted by examining the average intensity of H-index values from 139 research journal articles included in the SLR. The H-index represents a measure of both the quality and quantity of publications, serving as an indicator of researcher reputation and academic competitiveness. In assessing publication quality and quantity, the H-index corrects for cases in which researchers have a large number of publications with low citation impact, or conversely, a single highly cited paper with limited impact from other works. In terms of reputation, the H-index reflects the extent to which a researcher is recognized and influential within the scientific community. Regarding academic competitiveness, the H-index is widely used in evaluation processes, grant funding decisions, and academic promotions, as it reflects significant scholarly contributions. Overall, the H-index can be interpreted as a single metric that summarizes research impact, indicating the number of publications that have meaningfully influenced and been acknowledged by other researchers.

Based on the H-index values, the journals included in the dataset demonstrate a wide range of scholarly impact, with H-index scores varying from 1 to 963. Several journals exhibit particularly high H-index values, including the *BMC Medical Education* (H-index = 963), the *Journal of Medical Internet Research* (H-index = 428), and *Frontiers in Medicine* (H-index = 408). A high H-index typically reflects a well-established publication history, a substantial volume of highly cited articles, and a strong influence on the advancement of knowledge within the respective field. This indicates that these journals serve as prominent platforms for disseminating impactful research. In contrast, journals with lower H-index values are often relatively new, focus on highly specialized research domains, or have not yet accumulated a large number of publications or citations. Therefore, variations in H-index values may reflect differences in journal maturity, disciplinary scope, and citation impact within the scholarly community. The 38 research articles published in Scopus Q1 journals show an average H-index value of 90.53. Meanwhile, the 29 research articles published in Scopus Q2 journals have an average H-index value of 36.48. The 13 research articles published in Scopus Q3 journals have an average H-index value of 50.85. Furthermore, the 6 research articles published in Scopus Q4 journals have an average H-index value of 9.86. The results of this analysis are presented in Figure 4.

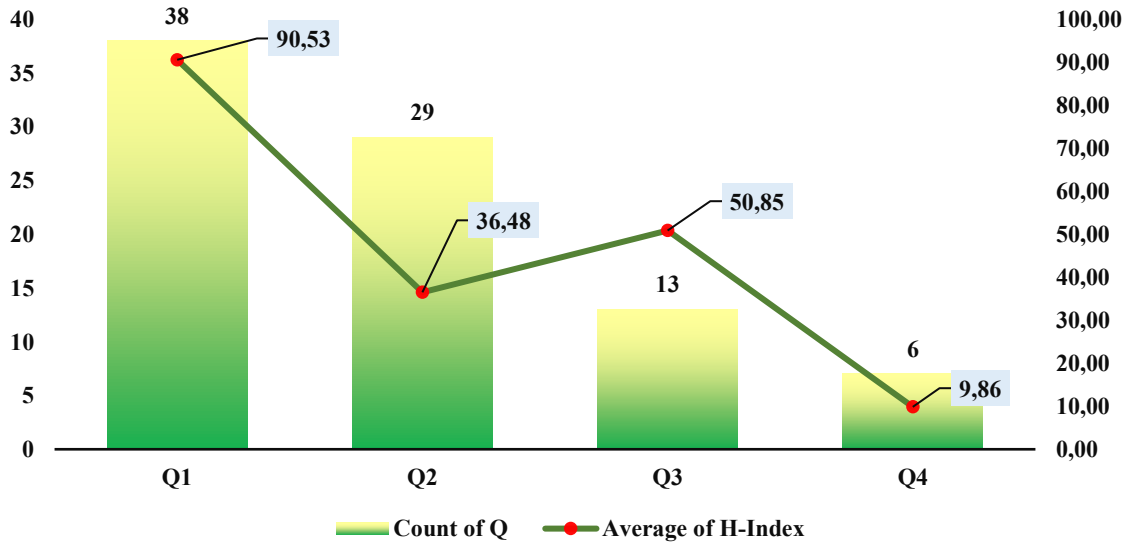

Figure 4. Mean H-Index Values Based on Journal Quartile

Density, Network,* and *Overlay Visualization

Based on the results of the density visualization analysis generated using the VOSviewer application, several keywords appear with relatively high co-occurrence intensity in the literature. These include critical thinking, education, teaching, problem-based learning, engineering education, curriculum, and students. The prominence of these keywords indicates that they frequently co-occur within the analyzed publications. The results of the density visualization are presented in Figure 5.

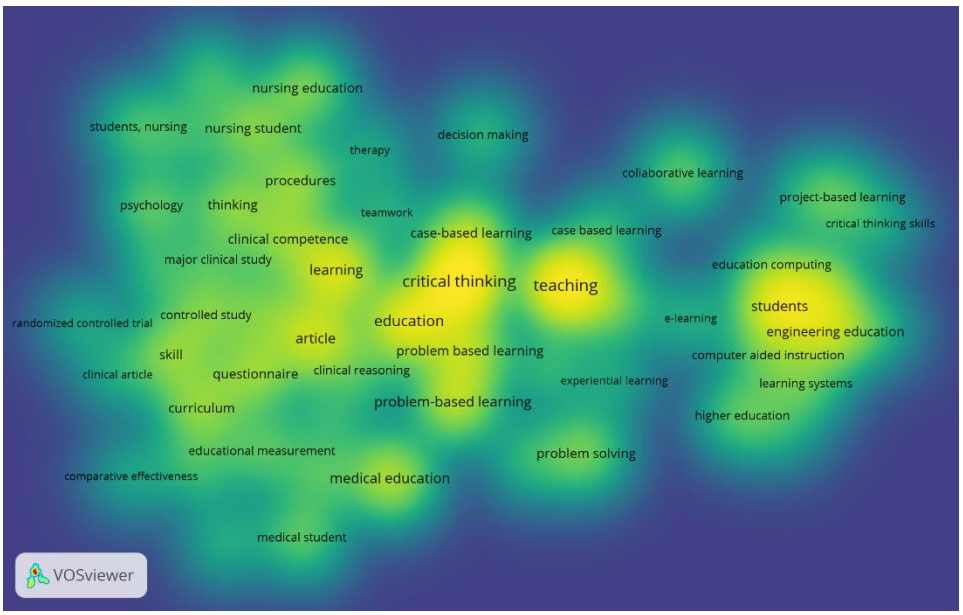

Figure 5. Keyword Density Map of Research Topics

The authors also examined the relationships among keywords in the research articles included in the literature review through Network Visualization. Based on Figure 6, The Network Visualization Map of Keywords generated using VOSviewer, the figure illustrates the co-occurrence relationships among keywords in the literature. The visualization map shows that the keywords are grouped into three major clusters, each represented by different colors (blue cluster, green cluster, and red cluster). 1) Blue Cluster (Nursing and Clinical Education Context). This cluster is dominated by keywords such as critical thinking, nursing student, nursing education, decision making, thinking, psychology, and major clinical study. This indicates that a substantial portion of research on critical thinking has been conducted within the context of nursing education and the health sciences. Studies in this cluster generally focus on the development of clinical decision-making abilities, professional competence, and analytical thinking skills among nursing students. 2) Green Cluster (Medical Education and problem-based learning). This cluster includes keywords such as problem-based learning, education, learning, clinical competence, medical education, clinical reasoning, questionnaire, and curriculum. The presence of these terms indicates that many studies also focus on medical education and the implementation of problem-based learning (PBL). Within the literature, PBL is frequently applied as a pedagogical strategy to enhance critical thinking skills, clinical reasoning, and professional competence among students in health-related disciplines. 3) Red Cluster (Teaching, Engineering Education, and Technology-Based Learning). This cluster consists of keywords such as teaching, students, collaborative learning, project-based learning, problem solving, engineering education, e-learning, and computer-aided instruction. The cluster reflects research focusing on general education and engineering education, particularly in relation to active and technology-enhanced learning strategies. Approaches such as project-based learning, collaborative learning, and e-learning are frequently examined as methods to improve critical thinking skills and problem-solving abilities among students.

Based on Figure 6, the visualization also highlights central keywords within the network. Several keywords appear with larger node sizes, indicating higher frequency of occurrence in the literature. The most central keywords include critical thinking, teaching, students, education, and problem-based learning. The central position of these keywords within the network suggests that the development of critical thinking through instructional strategies represents a primary focus in the analyzed body of research. Figure 6 also illustrates the relationships between clusters. The connecting lines between nodes represent co-occurrence links among keywords. The visualization shows that critical thinking functions as a key bridging node between the health education cluster and the general education cluster. Meanwhile, problem-based learning connects research in medical education with broader pedagogical studies. Learning approaches such as collaborative learning and project-based learning are linked to problem solving and engineering education, indicating the integration of active learning pedagogies with the development of higher-order thinking skills.

Overall, the Network Map of Research Keywords reveals several important trends in the literature. First, research on critical thinking is still dominated by studies in health education, particularly in nursing and medical education. Second, problem-based learning appears to be the most frequently used approach for developing critical thinking skills. Finally, in the context of engineering education and higher education, instructional approaches such as project-based learning, collaborative learning, and technology-enhanced learning are increasingly being implemented to support the development of problem-solving abilities and critical thinking skills

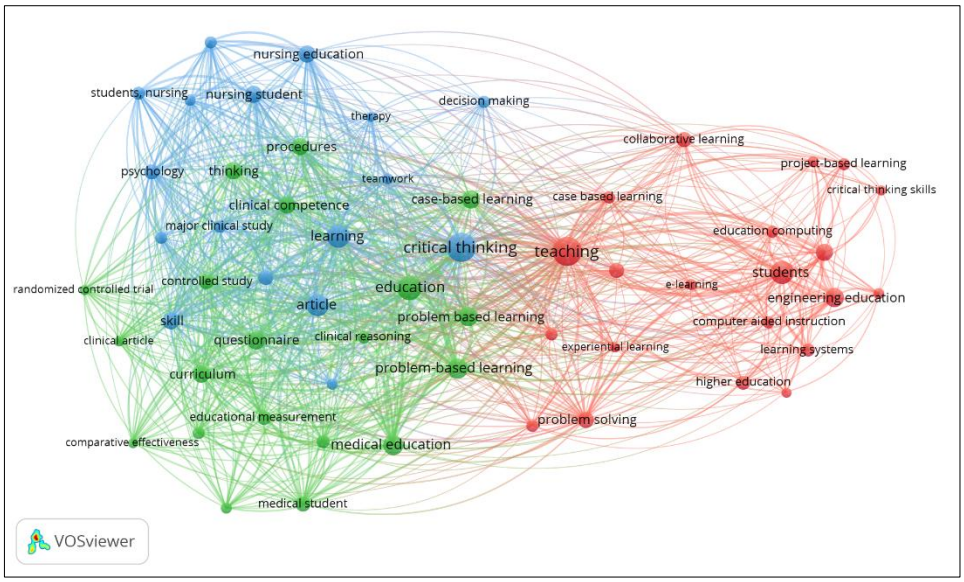

Figure 6. Network Map of Research Keywords

Based on the Network Visualization results shown in Figure 6, three distinct keyword clusters were identified, represented by three different colors: red, green, and blue. The blue cluster is predominantly composed of the keywords critical thinking, learning, and article. The red cluster mainly consists of the keywords teaching, students, problem solving, and engineering education. Meanwhile, the green cluster is largely represented by the keywords education, problem based learning, problem-based learning, thinking, and case-based learning.

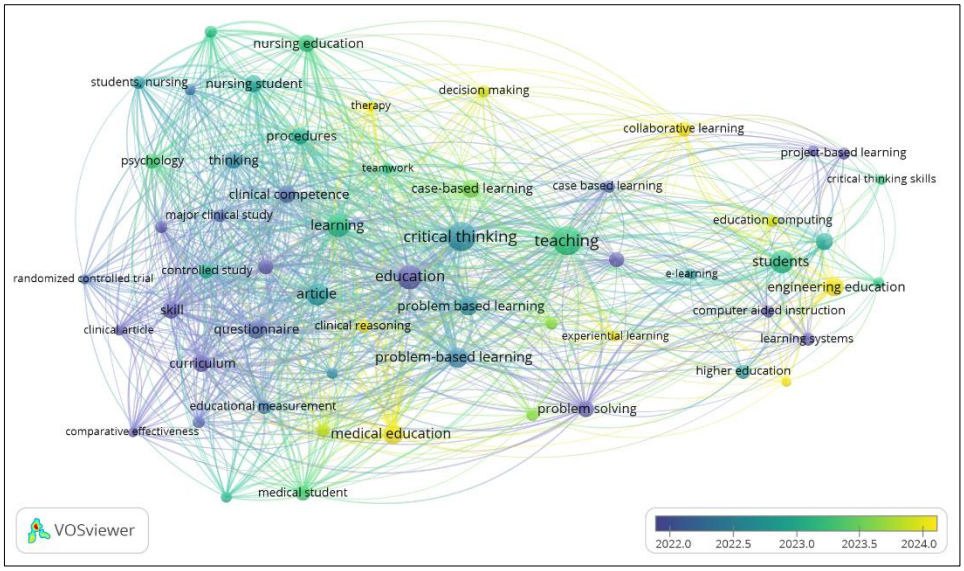

Figure 7. Keyword Overlay Map Based on Publication Year

To examine the publication years of the research journal articles included in the literature review, the authors conducted an Overlay Visualization analysis using the VOSviewer application. The results indicate that research keywords such as decision making, therapy, collaborative learning, engineering education, education computing, experimental learning, medical education, and higher education were frequently used in journals published in 2024.

Discussion

Based on the analysis of 86 articles included in this systematic literature review, case-based learning (CBL) emerges as a highly relevant instructional approach for developing critical thinking skills across various educational contexts. The dominance of publications in high-ranked journals (Scopus Q1 and Q2), as well as journals with relatively high SJR and H-index values, indicates that this topic has attracted considerable attention from the international academic community (Bornmann et al., 2022). These findings suggest that research on CBL and critical thinking has gained increasing recognition as an important area of investigation within contemporary education.

Conceptually, CBL utilizes real-world cases to promote discussion, reasoning, reflection, and decision making grounded in authentic real-world contexts (Yan & Ottenbreit-Leftwich, 2023; Zhu, 2021). This approach is aligned with the demands of 21st-century education, which emphasize the development of higher-order thinking skills, particularly critical thinking and problem solving abilities. Helleve et al., (2023) emphasize that the analysis of authentic cases enables preservice teachers to develop professional reflection and to think like educational practitioners, rather than merely acting as passive recipients of knowledge.

Empirical findings from various studies support the effectiveness of CBL in enhancing active engagement, learning motivation, and the overall quality of the learning process. Studies by Irwan et al., 2023; Simbolon, 2022; Magwilang, 2022; Das, 2021; Vedi, 2021; Masko, 2020; Lyons, 2020 demonstrate that CBL promotes active student participation and extends attention span throughout the learning process. Beyond its impact on students, the implementation of CBL has also been shown to enhance lecturers' or teachers' instructional skills, particularly in creating interactive and student centered learning environments (Silitubun et al., 2025; Tambak & Sukenti, 2024). Nevertheless, the results of the Network Visualization analysis reveal a conceptual distance between the keywords *critical thinking* and case-based learning as well as *decision making*, indicating that studies directly examining the relationships among these concepts remain limited. Most existing studies integrate CBL with other approaches, such as Problem Based Learning (PBL) or reflective strategies, making it difficult to isolate the pure effect of CBL. This is evident in the study by Jiang et al., (2025), which

demonstrates that the integration of CBL and PBL can create more meaningful learning environments and support deep learning as well as cognitive load reduction. However, because the approach employed is integrative and focuses on clinical thinking skills, the findings do not specifically explain the impact of CBL on preservice teachers' critical thinking skills outside the context of medical education.

Similar limitations are also evident in the study by Jung et al., (2025) through the case-based Room-of-Error (RFE) program. Although this approach is effective in enhancing clinical analysis and decision-making skills, the research focus remains on healthcare professionals rather than preservice teachers, and it does not explicitly measure critical thinking skills using standardized pedagogical instruments. Consequently, empirical evidence regarding the effectiveness of CBL in fostering preservice teachers' critical thinking skills remains inconclusive.

The study by Amin et al., (2025) indicates that integrating CBL into faculty development programs through reflective critique writing can enhance critical reflection and higher-order thinking. However, in this study, CBL was implemented as part of professional development training for lecturers rather than as a primary pedagogical approach for preservice teachers. Moreover, the evaluation focused on the quality of reflective practice rather than on measuring critical thinking skills as a distinct cognitive competency. On the other hand, the emergence of technology-based innovative pedagogical approaches, such as virtual reality–based CBL (Sung et al., 2024; Zhao et al., 2024) and digital escape rooms Sidekerskienė & Damasevicius, (2023) demonstrates substantial potential for enhancing engagement, collaboration, and immersive learning experiences. However, these approaches have rarely been directly compared with CBL in the context of preservice teacher education. Similarly, the Socio-Scientific Issues (SSI) approach examined by Kinskey & Newton, (2024) demonstrates a positive influence on preservice teachers' perspectives toward science instruction; however, it does not quantitatively examine its effectiveness on critical thinking skills nor compare it directly with CBL.

Based on these findings, this study highlights three major gaps in the existing literature. First, empirical research that specifically examines the effectiveness of CBL in enhancing preservice teachers' critical thinking skills remains limited. Second, there is a lack of standardized and contextually appropriate instruments for measuring critical thinking in evaluating the effectiveness of CBL within teacher education. Third, comparative studies that contrast CBL with other innovative pedagogical approaches, such as PBL, SSI, and technology-based learning, are still scarce.

The findings of this study provide both theoretical and practical implications for the development of learning in the field of education. Theoretically, these findings strengthen the position of case-based learning (CBL) as a relevant instructional approach for fostering critical thinking skills, particularly within the context of preservice teacher education. Practically, the results of this review can serve as a reference for lecturers and curriculum designers in systematically integrating CBL into teacher education programs. Moreover, the mapping of research trends and keywords can assist researchers in identifying more focused and need-based research directions within the field of education.

This study offers both theoretical and practical implications for teacher education. Theoretically, the findings strengthen the position of case-based learning (CBL) as a relevant instructional approach for fostering critical thinking skills among preservice teachers. Practically, the results provide guidance for lecturers and curriculum designers in systematically integrating CBL into teacher education programs, while the mapping of research trends and keywords supports the identification of focused and need-based research directions.

Despite its contributions, this study has several limitations. The review was limited to Scopus-indexed journal articles, potentially excluding relevant studies from other databases, and relied on secondary data without direct empirical investigation. In addition, empirical studies that

specifically focus on preservice teachers and employ standardized instruments to measure critical thinking within the CBL context remain limited.

Future research should therefore employ experimental or quasi-experimental designs to isolate the effects of CBL on preservice teachers' critical thinking skills and pedagogical decision making. Further efforts are also needed to develop and validate standardized, context specific critical thinking measurement instruments and to expand data sources across multiple international databases to provide a more comprehensive understanding of CBL in teacher education.

Implications

The findings of this study provide several implications for future research in teacher education. First, there is a need to develop standardized instruments specifically designed to measure preservice teachers' critical thinking skills within the context of case-based learning. Second, future studies should employ experimental or quasi-experimental research designs to isolate the specific effects of case-based learning on the development of critical thinking skills. Third, comparative studies examining case-based learning alongside other instructional approaches, such as problem-based learning (PBL), socio-scientific issues (SSI), and technology-enhanced learning environments, may provide deeper insights into the relative effectiveness of these pedagogical strategies. Fourth, future research should focus on integrating decision-making competence within case-based learning frameworks for preservice teachers, as the bibliometric mapping results indicate that the connections between case-based learning, critical thinking, and decision making remain relatively weak in the existing literature. Finally, the bibliometric mapping conducted in this study highlights several emerging research themes that can guide future investigations and support the development of more focused and evidence-based research agendas in teacher education.

Limitations

This study has several methodological limitations that should be acknowledged. First, the dataset was limited to journal articles indexed in the Scopus database and published between 2015 and 2025. Although Scopus provides broad multidisciplinary coverage and reliable bibliometric metadata, relying on a single database may introduce database bias and potentially exclude relevant studies indexed in other databases such as Web of Science or ERIC. Second, the search strategy relied on predefined keywords related to case-based learning and critical thinking. This approach may introduce query bias, as relevant studies using different terminologies or alternative keywords might not have been captured in the search results. Third, the screening and eligibility process was conducted by the authors based on predefined inclusion and exclusion criteria. However, the screening process did not involve a formal double-coding procedure or independent reviewers, which may introduce screening bias and affect the reliability of study selection. Fourth, this review excluded grey literature such as conference proceedings, reports, and unpublished studies, which may lead to publication bias. In addition, the analysis relied on secondary data from published articles and did not involve direct empirical investigation. Finally, although the study identifies research trends and gaps related to case-based learning and critical thinking, empirical studies that specifically focus on preservice teachers and employ standardized instruments to measure critical thinking within the context of case-based learning remain relatively limited in the existing literature.

Suggestions

Future research should therefore employ experimental or quasi-experimental designs to isolate the effects of CBL on preservice teachers' critical thinking skills and pedagogical decision making. Further efforts are also needed to develop and validate standardized, context-specific critical thinking measurement instruments and to expand data sources across multiple international databases to provide a more comprehensive understanding of CBL in teacher education.

CONCLUSION

This systematic literature review analyzed research on the effectiveness of case-based learning (CBL) in enhancing the critical thinking skills of preservice teachers published between 2015 and 2025. From an initial dataset of 139 Scopus-indexed articles, 86 studies met the predefined inclusion criteria and were included in the final analysis. The results indicate that research on this topic is primarily concentrated in professional education fields such as social sciences, medicine, engineering, and nursing, with a substantial proportion of publications appearing in high-impact journals (Q1 and Q2). Bibliometric mapping further reveals that critical thinking, teaching, students, and problem-based learning constitute central themes in the literature. However, studies that explicitly investigate the relationship between case-based learning and critical thinking within preservice teacher education remain relatively limited. In particular, the analysis highlights a lack of standardized measurement instruments and empirical studies that isolate the specific effects of case-based learning on preservice teachers' critical thinking development. These findings suggest that future research should focus on developing validated assessment instruments for critical thinking in teacher education and implementing experimental or quasi-experimental designs to examine the direct impact of case-based learning in preservice teacher training contexts.

AUTHOR CONTRIBUTIONS STATEMENT

EK : Played a primary role in formulating the research idea and focus, designing the Systematic Literature Review, conducting the literature search and article selection, performing bibliometric data analysis using VOSviewer, and writing and preparing the manuscript in its entirety.

HP : Contributed to the development of the research conceptual framework, reviewed the research methodology, validated the analysis results, and critically revised and refined the academic content of the manuscript.

CA : Contributed to the interpretation of bibliometric analysis results, strengthened the discussion and research implications, and provided substantive input during the revision and final refinement of the manuscript.

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