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Research Trends of Critical Thinking in Mathematics Problem Posing: A Bibliometric Study and Descriptive Content Analysis

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ABSTRACT

This study aims to systematically review the development of research on critical thinking in problem posing. This study is important due to the gap between the increasing demand for critical thinking skills as a key 21st-century competency and the relatively low level of students' critical thinking abilities, as well as the limited research examining the development of studies on critical thinking in problem posing. The data were collected using the PRISMA procedure. They were analyzed using the Bibliometrix package in RStudio through the Biblioshiny interface. A descriptive content analysis of Scopus-indexed publications from 2015 to 2025 was done. The results show that China, Indonesia and the United States are the influential countries in research on critical thinking in problem posing. This is based on the number of publications and citations. China ranks first in both. The productive affiliation is the National Taiwan University of Science and Technology. Hwang, G. Is the prolific author in terms of publications in this field. Publication trends have increased significantly since 2020. They reached their peak in 2024 with a total of 7 articles. Although critical thinking is strongly connected to problem posing, its relationship with creativity, problem solving and critical pedagogy remains relatively weak. The content analysis reveals that quantitative approaches, with-experimental designs are dominant. University students are commonly studied subjects. Purposive sampling is the sampling method. Tests are the research instrument. The frequently used data analysis methods include descriptive statistics, t-tests, ANOVA, N-gain. This study helps mathematics education by giving a picture of research on critical thinking in problem posing. It shows what topics are popular and what areas need study. The findings also show that we need to do research on critical pedagogy, creativity, learning technologies and understanding how our brains work when we think critically while solving problems.

Keywords**:** *Critical Thinking, Mathematical Problem Posing, Bibliometric*.

Tren Penelitian Berpikir Kritis Dalam Pengajuan Masalah Matematika: Studi Bibliometrik Dan Analisis Konten Deskriptif

ABSTRAK

Penelitian ini bertujuan meninjau secara sistematis perkembangan riset berpikir kritis dalam *problem posing*. Penelitian ini penting untuk dilakukan karena adanya kesenjangan antara tingginya tuntutan keterampilan berpikir kritis sebagai kompetensi abad ke-21 dan rendahnya kemampuan berpikir kritis siswa serta kurangnya penelitian terkait perkembangan kajian berpikir kritis dalam *problem posing*. Data penelitian dikumpulkan menggunakan prosedur PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), kemudian dilakukan analisis bibliometrik menggunakan aplikasi *Bibliometrix* pada program RStudio menggunakan *biblioshiny* dan analisis konten deskriptif terhadap publikasi Scopus tahun 2015–2025. Hasil menunjukkan bahwa Cina, Indonesia, dan Amerika Serikat merupakan negara paling berpengaruh dalam perkembangan penelitian berpikir kritis dalam pengajuan masalah (*problem posing*), ditinjau dari jumlah publikasi dan sitasi, dengan Cina menempati posisi teratas dalam publikasi dan sitasi. Afiliasi paling produktif adalah National Taiwan University of Science and Technology, dan Hwang, G. menjadi penulis dengan jumlah publikasi terbanyak pada penelitian berpikir kritis dalam pengajuan masalah (*problem posing*). Tren publikasi meningkat tajam setelah 2020 dan mencapai puncaknya pada 2024 sebanyak 7 artikel. Meskipun *critical thinking* kuat terhubung dengan *problem posing*, hubungan keduanya dengan kreativitas, *problem solving*, dan pedagogi kritis masih lemah. Analisis konten menunjukkan dominasi pendekatan kuantitatif dengan desain *quasi-experimental*, subjek penelitian terbanyak adalah mahasiswa, dengan metode *purposive sampling*, serta instrumen tes sebagai alat ukur utama. Metode analisis data yang sering digunakan adalah statistik deskriptif, uji t, ANOVA, dan n-Gain. Hasil penelitian ini memberikan kontribusi bagi pendidikan matematika dengan menyediakan peta perkembangan penelitian, tren topik, serta kesenjangan riset terkait berpikir kritis dalam problem posing yang dapat menjadi dasar dalam menentukan arah penelitian dan pengembangan pembelajaran di masa depan. Temuan ini menegaskan adanya peluang riset lebih lanjut pada integrasi pedagogi kritis, kreativitas, teknologi pembelajaran, serta eksplorasi proses kognitif berpikir kritis dalam *problem posing*.

Kata Kunci**:** *Berpikir Kritis, Pengajuan Masalah Matematika, Bibliometrik*.

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1. Introduction

Educational institutions need to prepare graduates with specific skills in accordance with the demands of the 21st century (Geisinger, 2016; Hujjatusnaini et al., 2022). When we look at these skills critical thinking is an important part of the skills we need for the 21st century. Critical thinking is important in all areas (Boyacı & Atalay, 2016; Kocak et al., 2021). Critical thinking is one of the things we need to know. It is part of the ten competencies in the Assessment and Teaching of 21st Century Skills framework. This framework is also known as ATC21S framework (Binkley et al., 2012). This is consistent with the statement of Frydenberg and Andone (2011) that to face learning in the 21st century, everyone must have critical thinking skills.

In the national context, the importance of critical thinking is also reflected in the Graduate Competency Standards (Standar Kompetensi Lulusan/SKL) based on Regulation of the Ministry of Primary and Secondary Education (Permendikdasmen) Number 10 2025, which emphasizes that students must be able to think critically, creatively, innovatively, productively, collaboratively, independently, and communicatively. However, research findings indicate that student' critical thinking process indicators have not yet been adequately achieved, particularly in interpreting questions, determining appropriate actions, and identifying inconsistencies in information (Susilawati et al., 2020; Ramidha et al., 2025; Setiyowati & Shodikin, 2022). This suggests that, in general, students' critical thinking processes remain at a relatively low level (Moseley et al., 2005). Therefore, it is important to investigate and strengthen students' critical thinking processes in order to prepare them to face increasingly complex global challenges.

Problem posing is one instructional approach that has been proven effective in enhancing critical thinking. Stoyanova and Ellerton (1996) define mathematical problem posing as a process in which students, based on their mathematical experiences, construct personal interpretations of concrete situations and formulate them into meaningful problems. Silver (1994) further explains that problem posing involves both the generation of new problems and the reformulation of existing ones. Problem posing consists of three cognitive activities: pre-solution posing, within-solution posing, and post-solution posing (Silver & Cai, 1996). Through these activities, students are encouraged to engage more actively in critical and creative thinking and to develop a deeper conceptual understanding, as they are not only required to solve given problems but also to construct relevant mathematical problems on their own.

Previous studies have predominantly focused on empirical analyses of students' critical thinking skills based on cognitive styles (Aryani et al., 2024), learning styles (Setiana & Purwoko, 2020), and problem-solving abilities (Imayanti et al., 2021). Research on problem posing in mathematics education has also shown significant growth, as evidenced by the increasing number of scientific publications that highlight problem posing as a research focus in both theoretical and practical instructional contexts (Cai & Hwang, 2023; Cai & Leikin, 2020). Accordingly, research attention has expanded toward analyzing the quality of posed problems in terms of solvability, sufficiency of information, contextual appropriateness, and mathematical structure (Cankoy & Özder, 2017; Grundmeier, 2015; Leavy & Hourigan, 2024; Rosyidi et al., 2025). While these advances in research have played an important role in shaping the practices of mathematics education, there is still a requirement to conduct systematic mapping in order to study the trend changes in relation to research about critical thinking in problem posing. Unfortunately, most of the existing research has been quite fragmented and has failed to provide an overall bibliometric and content analysis of the area.

This indicates a clear research gap in understanding the overall structure and evolution of research on critical thinking in problem posing.

Further, bibliometric study is a necessity for understanding the trends in research, collaborations between authors, and directions of knowledge creation in this subject area (Machmud et al., 2023; Nor & Sihes, 2021). Therefore, a review of literature is indispensable for discovering trends in publication, prevailing research areas, and future directions of research. Based on this rationale, the objectives of this study are to (1) describe the most influential countries, affiliations, and authors, (2) examine publication trends over the past ten years, and (3) identify future research opportunities.

2. Research Method

This study aims to identify research gaps and future research directions related to critical thinking in problem posing. To achieve these objectives, bibliometric analysis and descriptive content analysis were employed. A bibliometric analysis approach was chosen because this tool can show the evolution of research through time in various ways (Donthu et al., 2021). Bibliometric means the use of statistical methods in examining information as well as the quantification of bibliographical features in science publications (Mayr et al., 2014). Accordingly, bibliometric analysis can be utilized to examine the dynamics of existing research in a broader and more comprehensive manner (Zupic & Čater, 2014).

Meanwhile, descriptive content analysis was used to explore research trends on critical thinking in problem posing in greater depth and comprehensiveness. According to Dinçer (2018), descriptive analysis aims to reveal thematic patterns based on frequencies or percentages in order to describe phenomena as a whole without conducting detailed inferential analysis. In this study, descriptive content analysis was applied to descriptively identify research topics related to critical thinking in problem posing that have been developed. In addition, this method also reveals research trends in critical thinking in problem posing from a methodological perspective. The scientific credibility of the research methodology has been ensured using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol, which helped maintain a high degree of transparency at each stage of the study. The implementation of the PRISMA protocol has been accomplished in four major steps, that is, identification, screening, eligibility, and inclusion. In the step of identification, articles were collected using appropriate keywords and parameters in the Scopus database. In the step of screening, the articles failing to meet the criteria were excluded from consideration. Finally, inclusion involved the assessment of the entire article to verify its eligibility. In addition, the sources of data for this research were collected from the Scopus database.

2.1 Data Collection

In the Data Collection, keywords such as “critical thinking” AND “problem posing” were used in order to find the studies concerned about critical thinking in problem posing, and the search was limited to papers published between 2015 and 2020. The search was done on November 24, 2025, using the Scopus database. Based on this search process, a total of 36 documents were identified as relevant for analysis in the bibliometric context.

Meanwhile, data collection for the descriptive content analysis was carried out by following the PRISMA stages, which consist of four main steps: identification, screening, eligibility, and inclusion. Based on this process, 20 documents were considered relevant and

selected for analysis in the descriptive content analysis. The stages of this selection process are illustrated in Figure 1.

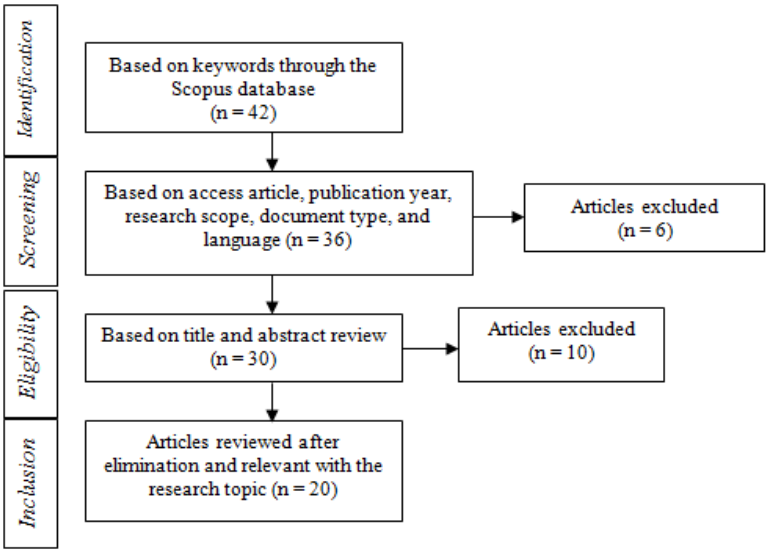

Figure 1. PRISMA stages

At the identification stage, the search was conducted based on the occurrence of the keywords "critical thinking" and "problem posing" in the article titles, abstracts, and keywords without applying any additional filters. Using the search settings within = (article title, abstract, keywords), search documents = ("critical thinking" AND "problem posing"), published from = (2015) to (present), and added to Scopus = (anytime), a total of 42 initial documents were retrieved.

The second step was that of screening. In this process, filtering papers was done according to certain criteria. These criteria for inclusion are papers must be freely accessible, their period of publishing should be from the year 2015 to 2025, types of documents can only be journal articles and proceeding, sources should only be journals and proceedings, and language should be English. The total number of documents filtered out using this screening procedure was 36.

Eligibility step entailed conducting a thorough analysis of titles and abstracts to identify those meeting the research purpose, which involves identification of countries, affiliations, and authors who have contributed significantly towards the research, trend analysis over the past ten years, and future research directions. The total number of articles identified after this screening procedure was 30.

The final stage was inclusion, in which all remaining articles were read in full to confirm the relevance of their content to the research objectives, particularly studies that explicitly discuss critical thinking within the context of problem posing in mathematics education. The final outcome of this stage was 20 documents, which were subsequently used as the primary data sources for the descriptive analysis.

2.2 Data Analysis

The bibliometric analysis in this study was conducted using the Bibliometrix package in RStudio. To facilitate the analysis process, Biblioshiny, a web-based interface of Bibliometrix that can be operated without programming, was employed, making data processing more practical. Initially, Bibliometrix was developed as a method for the quantitative evaluation of publications and citations; however, it has since evolved into an analytical tool used across

various disciplines to assess the growth and maturity of research fields, identify influential researchers, and map research concepts and developmental trends (Aria & Cuccurullo, 2017).

Meanwhile, the data for the descriptive content analysis were analyzed by grouping information with similar characteristics into specific conceptual or thematic frameworks and subsequently interpreting them. At this stage, the selected articles were classified based on the publication categories developed by Birgin & Öztürk (2021), including author names, year of publication, research methods, research subjects, sample size, research instruments, and data analysis techniques employed. All article content data were compiled using Microsoft Excel to ensure accurate data recording. After the data compilation process was completed, the articles were grouped according to the predefined criteria. Prior to further interpretation, percentage calculations were also performed to determine the frequency of each data category, thereby providing a clearer overview of research tendencies and patterns identified in the study.

3. Results and Discussion

3.1 Bibliometric Analysis

A total of 36 articles were retrieved from the Scopus database using the keywords "critical thinking" and "problem posing" within the field of mathematics. Subsequently, an analysis was conducted on these 36 identified articles. The results of the bibliometric analysis, which was carried out using the Biblioshiny software, are presented below.

3.1.1 Country Scientific Production Distribution

The distribution of scientific publications by country is presented in Figure 2, where the blue-shaded areas indicate countries that have contributed to research on critical thinking in problem posing. As far as the color blue is concerned, the darker its shade in any particular nation, the higher the number of publications from that nation. This can be made clearer through more data presented in Table 1. Based on Table 1, the country with the highest number of publications in the field of critical thinking in problem posing is China, with 19 articles, followed by Indonesia, with 13 articles.

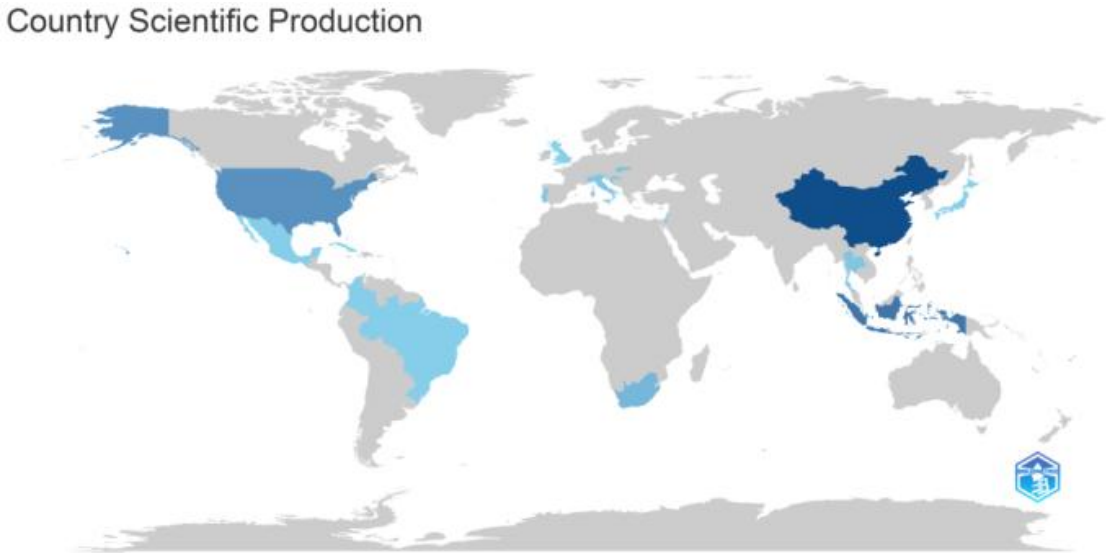

Figure 2. Country scientific production distribution

Table 1. Country scientific production distribution

Country	f	%	Country	F	%
China	19	29,23	Portugal	2	3,08
Indonesia	13	20,00	Thailand	2	3,08
USA	9	13,85	Brazil	1	1,54
South Africa	4	6,15	Colombia	1	1,54
Slovakia	3	4,62	Cuba	1	1,54
Croatia	2	3,08	Japan	1	1,54
Israel	2	3,08	Mexico	1	1,54
Italy	2	3,08	Singapore	1	1,54
			UK	1	1,54
Average			4 (5,88 %)		

3.1.2 Most Cited Country Distribution

The analysis conducted using Biblioshiny indicates that China is the country receiving the highest number of citations in research on critical thinking in problem posing. According to Figure 3, 100 citations have been identified for the period between 2015 and 2025. The figure indicates that there are many more citations than what was obtained by the USA (53) and Indonesia (32).

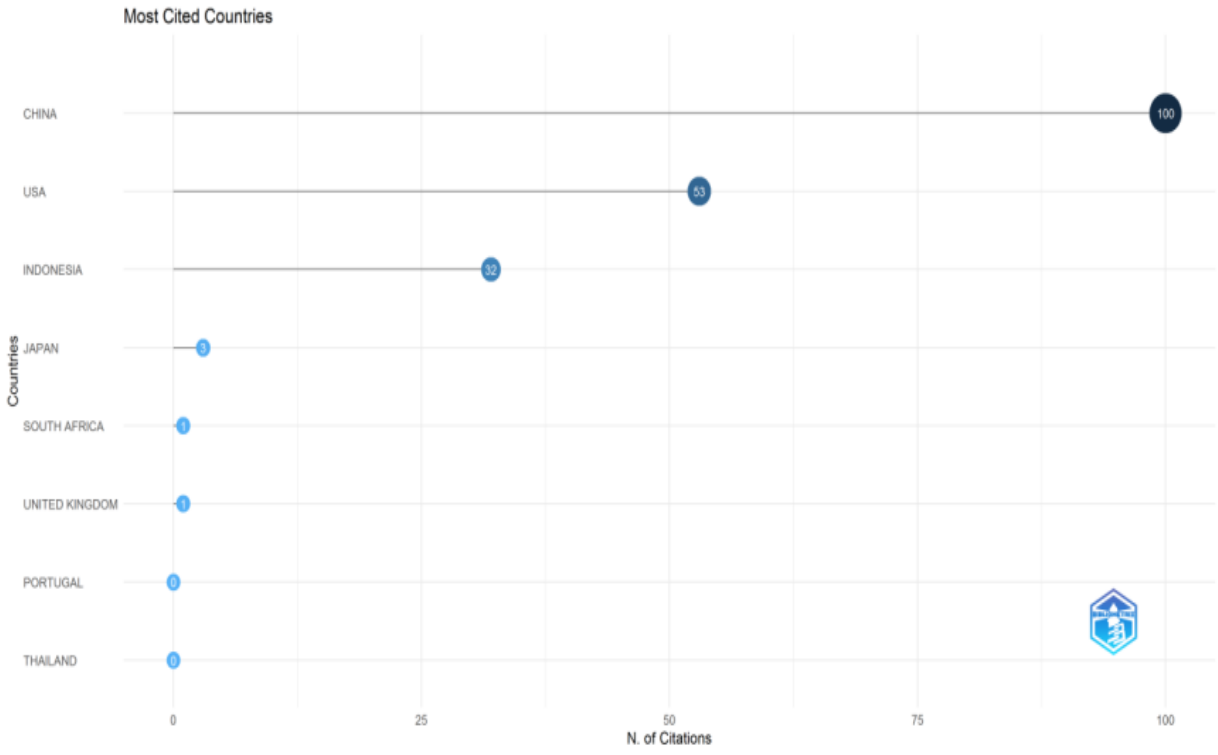

Figure 3. Most cited countries distribution

3.1.3 Most Relevant Affiliations

The analysis conducted using Biblioshiny indicates that the National Taiwan University of Science and Technology is the affiliation with the highest article production in research on critical thinking in problem posing. Figure 4 shows that 7 papers have been written in this time frame from 2015 to 2025. Next to the Indonesian University of Education, Universitas Pendidikan Indonesia is also productive.

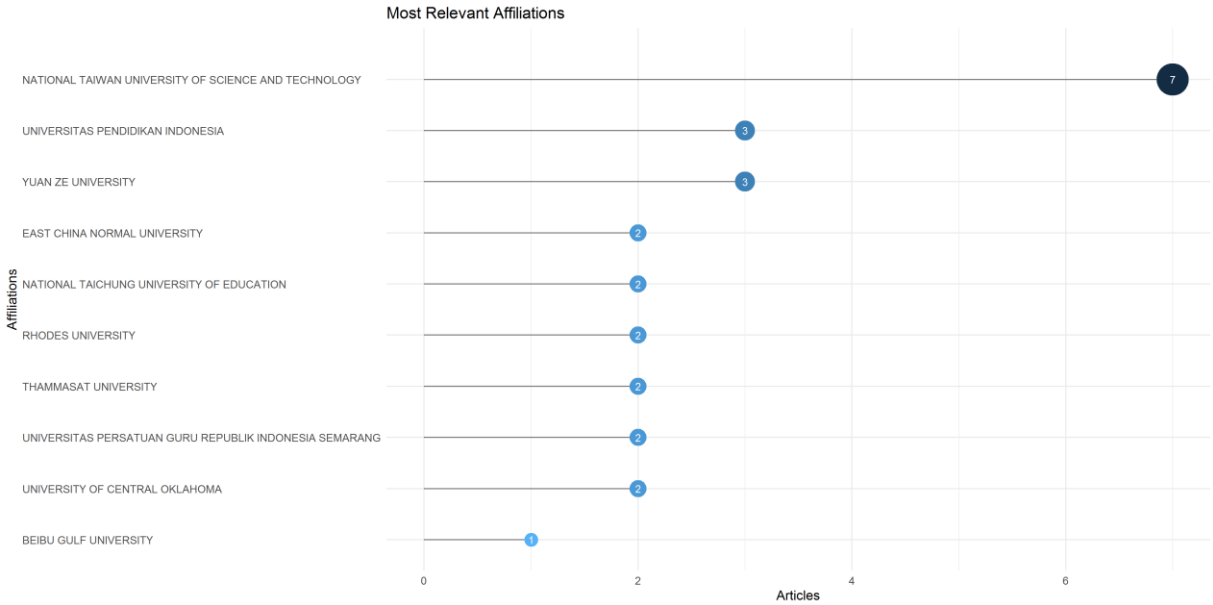

Figure 4. Most Relevant Affiliations

3.1.4 Most Relevant Author

The analysis conducted using Biblioshiny indicates that Hwang, G. is the author with the highest article production in research on critical thinking in problem posing. As shown in Figure 5, a total of 5 articles were published during the 2015–2025 period.

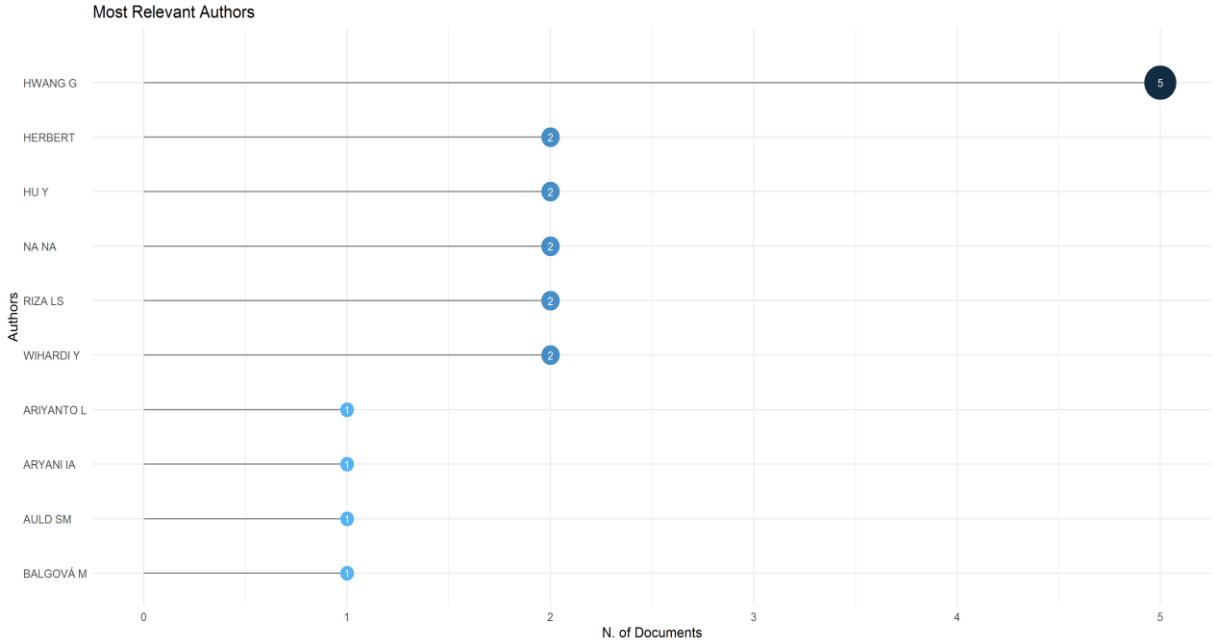

Figure 5. *Most Relevant Author*

3.1.5 Annual scientific production distribution

The analysis conducted using Biblioshiny indicates that the number of studies on problem posing in mathematics has increased significantly since 2020. Although there was a decline of four articles in 2022 compared to the previous year, the publication trend rose again quite rapidly in the subsequent years. As shown in Figure 6, publications on problem posing reached their highest number in 2024, with a total of 7 articles. This trend suggests that researchers' interest in critical thinking within

problem posing in mathematics education continues to grow and has gained increasing attention within the academic community.

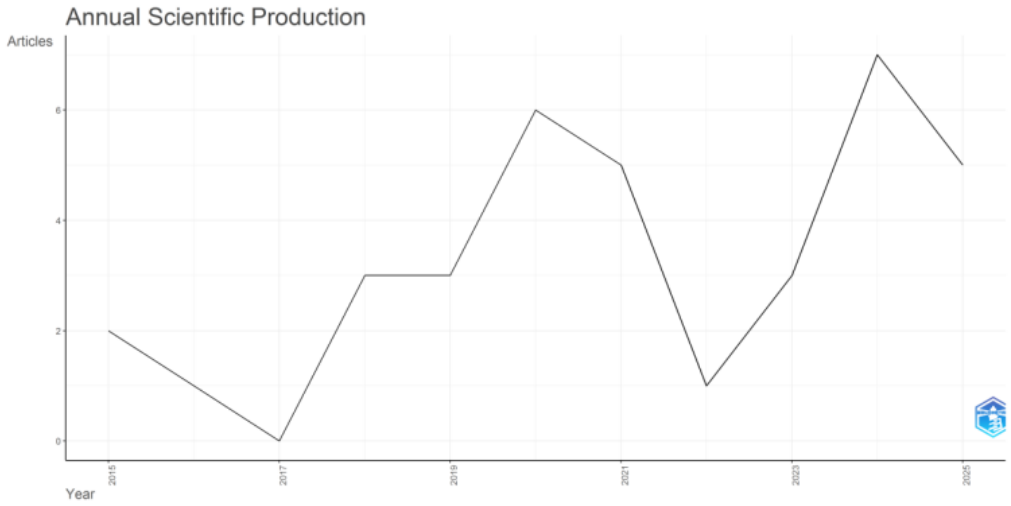

Figure 6. Annual scientific production distribution

3.1.6 Co-Occurrence Network

The co-occurrence network for research related to critical thinking in problem posing is presented in Figure 7. This network was constructed based on the keywords used by authors in the analyzed articles. The figure illustrates the relationships among keywords, forming several main clusters. The analysis indicates that "critical thinking" is the most dominant keyword and is strongly associated with the term problem posing. Nevertheless, the problem posing problem solving creativity cluster, the students critical pedagogy cluster, and the teaching learning systems concept mapping cluster have been identified as weaker clusters that are yet to be interconnected effectively. The entire map shows that although some progress has been made, much work needs to be done to connect all these aspects in future research studies.

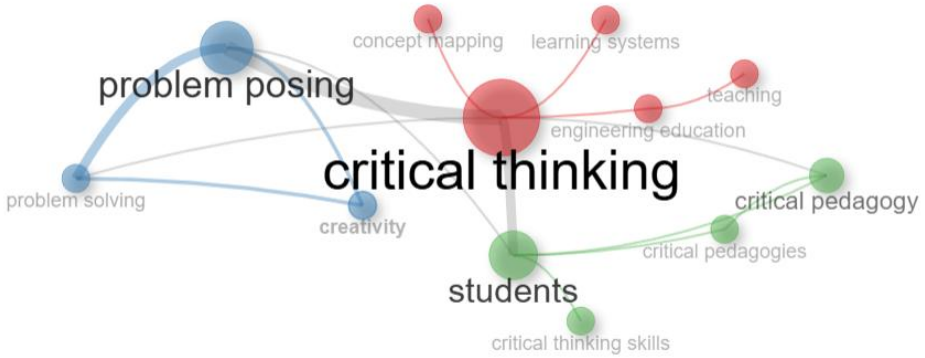

Figure 7. Co-Occurrence Network

3.1.7 Thematic Map

Each color denotes the group of topics with close relevance, whereas the lines represent the strength of links between different themes depending on the keywords' frequency. As can be seen from the diagram (Figure 8), critical thinking is located at the center of the network (cluster red), with the most extensive connections to all other themes, for example, concept mapping, learning systems, and student learning.

The cluster green reveals the themes related to the students and critical pedagogy, which have strong ties with critical thinking. This indicates that research on the development of critical thinking is frequently associated with critical pedagogy as well as students' characteristics and roles in the learning process.

Meanwhile, the blue cluster contains topics such as problem posing, problem solving, and creativity, which form a separate group and are only weakly connected to the critical thinking cluster. This suggests that although problem posing is relevant to creativity and problem solving, its integration with critical thinking research remains limited.

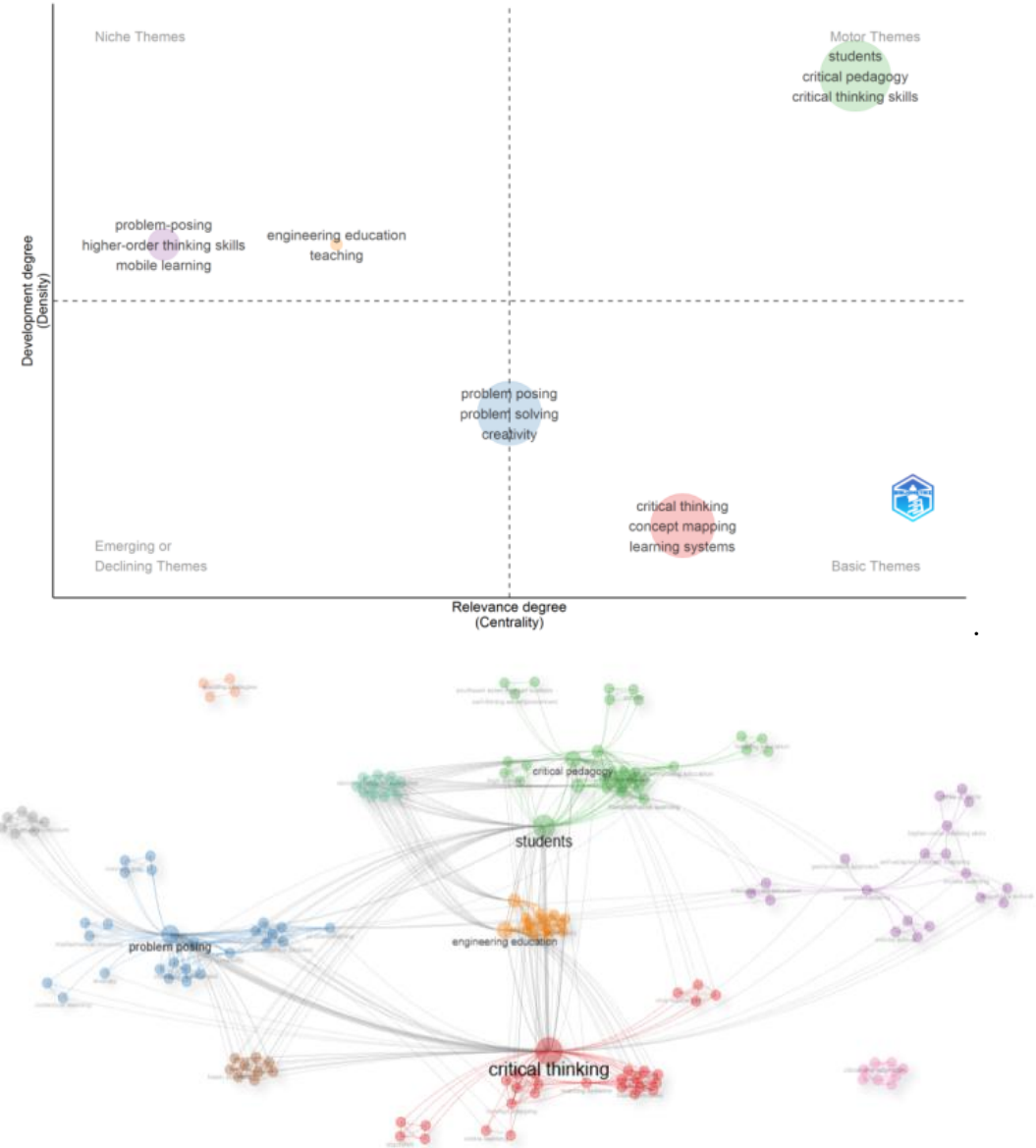

Figure 8. Thematic Maps

3.1.8 Trend Topics

Based on the research fields, the findings indicate that there are 16 fields of study that have become the focus of research on critical thinking in problem posing. These fields include problem solving, learning systems, critical pedagogy, and transformative learning, among others. The distribution of these research focuses is presented more clearly in Figure 9.

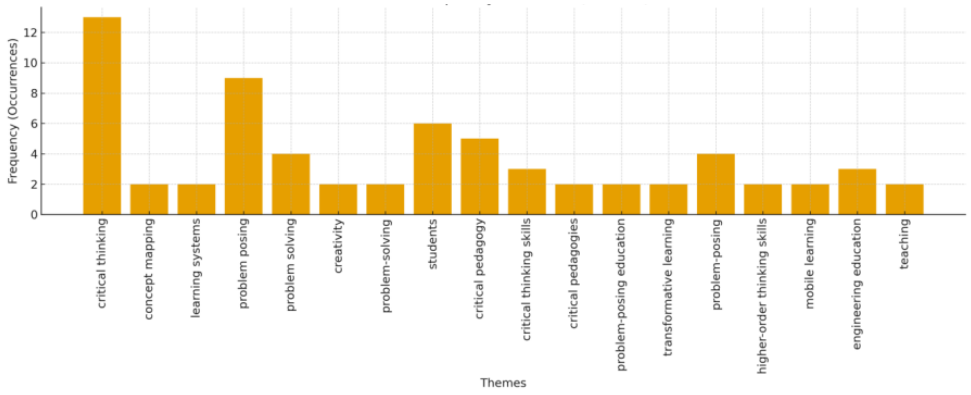

Figure 9. Trend Topics

3.2 Descriptive Content Analysis

This section presents a descriptive analysis of 20 selected documents identified through the PRISMA stages that are related to the theme of critical thinking in problem posing. These documents were published during the 2015–2025 period. The descriptive analysis covers research subjects; research approaches and designs; sampling methods, sample populations, and sample sizes; research instruments; and data analysis methods.

3.2.1 Research Approaches and Designs

Researchers employed a variety of research approaches and designs in studies on critical thinking in problem posing. Three main approaches were identified: qualitative, quantitative, and mixed methods. Among these approaches, the quantitative approach was the most frequently used. Of the 20 analyzed documents, 12 studies employed a quantitative approach, 7 studies used a qualitative approach, and the remaining study adopted a mixed-methods approach. The distribution of research approaches and designs used in the published studies is presented in detail in Table 2.

Table 2. Research Approaches and Designs

Research Approach	Design	Frequency	%
Quantitative	Quasi Experiment	9	75,00
	Path Analysis	1	8,33
	Experimental Research	2	16,67
	Total	**12**	100,00
Qualitative	Systematic Literature Review (SLR)	2	28,57
	Case Study	3	42,86
	Design Research	1	14,29
	Practice Led-Research	1	14,29
	Total	**7**	100,00
Mixed Method	Exploratory research	1	33,33
	Quasi Experimental	1	33,33
	Case Study	1	33,33
	Total	**3**	100,00

Research designs in studies on critical thinking in problem posing also vary considerably. Within the quantitative approach, several research designs were employed, including quasi-experimental, path analysis, and experimental research designs. For the qualitative approach, the designs included literature reviews, case studies, and design research. Meanwhile, within the mixed-methods approach, the designs applied were exploratory designs, quasi-experiments, and case studies.

3.2.2 Sampling Methods, Sample Population, and Sample Size

The next stage of identification focused on the research subjects. This section encompasses three main aspects: sampling methods, sample population, and sample size. The results of the analysis indicate that university students were the most frequently studied population. The sampling methods employed included purposive sampling (45%), cluster sampling (15%), as well as census and convenience sampling, each accounting for 5%. Meanwhile, the sample sizes most commonly used by researchers ranged from 11 to 100 participants. The results of the participant-related analysis are presented in Table 3.

Table 3. Sampling Methods, Sample Population, and Sample Size

Category	Research Subject	Fr	%
Sample Population	Article	3	15
	Preservice teacher	1	5
	Higher education	7	35
	Student with special needs	1	5
	Lower secondary student	3	15
	Primary student	1	5
	Student (Not indicated)	4	20
	Total	**20**	**100**
Sample Method	Random sampling	0	0
	Purposive sampling	9	45
	Cluster sampling	3	15
	Census sampling	1	5
	Convenience sampling	1	5
	Not indicated	6	30
	Total	**20**	**100**
Sample Size	10 and below	0	0
	Between 11–100	9	45
	Between 101–300	4	20
	301 and above	1	5
	Not indicated	6	30
	Total	**20**	**100**

3.2.3 Research Instrument

Another methodological aspect that needs to be identified is the research instruments, namely the tools used to collect data. The results of the analysis indicate that five types ofresearch instruments were employed to collect data related to critical thinking in problem posing, namely tests**,** interviews**,** observations**,** scales, and validation sheets. Among these five instruments, tests were the most frequently used by researchers; 47.62% of the studies employed test instruments for data collection. Table 4 presents the distribution of the instruments used across the analyzed studies.

Table 4. Research Instrument

Research Instrument	Fr	%
Test	10	47,62
Interviews	4	19,05
Observation	3	14,29
Scale	1	4,76
Validation Sheets	1	4,76
Not Identified	2	9,52

3.2.4 Data Analysis Method

Table 5 shows that, quantitative studies, data were analyzed using descriptive statistics, t-tests, n-Gain, ANOVA, bibliometric analysis, path analysis, and the Mann–Whitney analysis. In qualitative studies, the analysis methods employed included descriptive, interpretative, and retrospective analyses.

Table 5. Data Analysis Method

Category	Data Analysis Method	Fr	%
Quantitative	Descriptive Statistic	3	13,04
	T-Test	2	8,70
	N-Gain	1	4,35
	Bibliometic	2	8,70
	ANOVA	3	13,04
	Path Analysis	1	4,35
	Mann-Whitney	1	4,35
Qualitative	Qualitative Descriptive	3	13,04
	Interpretative	3	13,04
	Retrospective Analysis	1	4,35
Mix Method	Descriptive Statistic	2	8,70
	Unidentified	1	4,35

3.2 Discussion

Based on the bibliometric results, research on critical thinking in problem posing indicates that China, Indonesia, and the United States are the three most influential countries, with China occupying the leading position in terms of both the number of publications and citations. This result is also in line with the existing trend towards the study of educational and pedagogical technology in the East Asian region (Cai & Hwang, 2023). Concerning affiliation, National Taiwan University of Science and Technology is ranked number one regarding productivity, whereas Hwang, G. stands out as the most productive author with respect to problem posing.

The trend in publishing works on the subject over the past decade also shows a marked increase, especially after 2020, although there has been a temporary fall in publications in 2022. This trend peaked in 2024 when there were seven publications. This trend suggests a growing awareness regarding the connection between problem posing and critical thinking skills. However, the connection between the various themes remains disjointed, similar to problem-posing research done previously (Bonotto & Passarella, 2019; Silver, 2013).

The descriptive content analysis of 20 research documents further reinforces these bibliometric findings. Empirical studies are predominantly dominated by quantitative approaches, particularly quasi-experimental designs, a pattern frequently observed in research aimed at enhancing critical thinking through problem-based learning and problem posing (Darhim et al., 2020). Research subjects were mostly university students, with purposive sampling being the most commonly used method and sample sizes generally ranging from 11 to 100 participants.

The most frequently used research instrument was tests, indicating that existing studies tend to focus more on learning outcomes assessment rather than on thinking processes, in line with the findings of Fajrianthi et al. (2016) regarding patterns of critical thinking measurement in higher education. Meanwhile, data analysis methods in quantitative studies largely involved descriptive statistics, t-tests, ANOVA, and n-Gain, whereas qualitative studies employed descriptive and interpretative analyses, consistent with the problem-posing

research tradition that emphasizes the analysis of question quality and cognitive processes (Silver, 1994).

Based on these findings, several future research opportunities remain open. It is worth noting that there is much potential for further research in the field of integrating critical thinking, problem posing, critical pedagogy, and AI technology, considering that connections between the mentioned topics are relatively poor in terms of bibliometric mapping and empirical research. Furthermore, the links between problem posing, creativity, and problem-solving skills, which can be viewed as essential elements of higher-order thinking skills (Rosli et al., 2015; Silver, 2013), merit additional study. Among other possible directions, there may be further research into new populations, such as elementary-level children or children with disabilities, as well as into the development of more realistic tests for assessing critical thinking skills. Methodologically, design-based research methods, mixed-methodology frameworks, and learning analytics may be explored to deepen knowledge about the sustainable improvement of critical thinking skills through problem posing.

4. Conclusion

According to the results of bibliographic and content analysis, countries like China, Indonesia, and the USA are considered to be the most influential in the field of critical thinking in problem posing, where China takes the lead concerning publications and citation counts. The National Taiwan University of Science and Technology is noted as the top affiliation, and Hwang, G. is the top author contributing to this topic. There have been increasing publication trends over the last decade following the year 2020, where there were a peak number of publications in 2024, with seven articles published on the topic. Despite that, the links among themes such as problem posing, creativity, problem-solving, and critical pedagogy still appear to be fragmented.

The descriptive content analysis of 20 documents reveals that existing research is predominantly dominated by quantitative approaches, particularly quasi-experimental designs, with university students as the primary research subjects, purposive sampling as the most commonly used sampling method, and tests as the main data collection instruments. Data analysis methods frequently include descriptive statistics, t-tests, ANOVA, and n-Gain.

This indicates that there is an inclination towards emphasizing the consequences of learning rather than investigating the cognitive process involved in problem posing in the existing research literature, which offers possibilities for integrative research in the future. Some possible lines of inquiry may encompass establishing connections between problem posing and creativity, problem-solving, critical pedagogy, and artificial intelligence technology; broadening the scope of research participants beyond the university level; constructing more valid and reliable critical thinking assessments; and employing design-based research, mixed methods, and learning analytics to enhance the investigation into fostering critical thinking through problem posing. The current study makes its contribution to the field of mathematics education through offering a detailed map of research trends in relation to problem posing as a critical thinking skill that could be used as the base for identifying possible areas for future research and curriculum development. Nevertheless, this study suffers from being confined to one database (Scopus).

5. References

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