Evolution of Thinking Skills Research in Educational Psychology: A Bibliometric Analysis

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ABSTRACT

Thinking skills have become a central focus in educational psychology as rapid technological progress demands learners who can think critically, creatively, and adaptively in complex environments. Despite growing interest, the evolution of thinking skills research remains fragmented, with limited understanding of its intellectual structure, thematic development, and global research patterns. Addressing this gap, this study conducts a comprehensive bibliometric analysis to map the scientific landscape and identify emerging trajectories in the field. Data were collected using Scopus advanced searching with keywords related to thinking skills, educational psychology, and their intersection, resulting in a final dataset of 690 documents. The dataset was cleaned and analyzed to generate descriptive statistics on publication trends, authorship patterns, country productivity, and document impact. VOSviewer software was then employed to visualize co-authorship networks, keyword co-occurrence, citation structures, and thematic clustering. The results reveal a steady increase in publications over the past decade, with strong contributions from the United States, the United Kingdom, China, and Australia. Keyword co-occurrence analysis identifies prominent themes such as critical thinking, computational thinking, higher-order cognitive skills, instructional design models, digital learning, and bibliometric analysis, forming several distinct clusters that reflect the field's multidimensional nature. Co-authorship mapping shows growing international collaboration, particularly among Western and Asian academic networks. Overall, this study provides an integrated overview of the intellectual progress in thinking skills research within educational psychology, highlighting the shift toward digital learning environments and interdisciplinary approaches. The findings contribute to a clearer understanding of research directions, methodological evolution, and knowledge gaps, offering valuable insights for scholars seeking to advance research on thinking skills in contemporary educational contexts.

Keywords: Thinking skills, educational psychology, critical thinking, metacognition, digital learning, bibliometric analysis

INTRODUCTION

The evolution of thinking skills research in educational psychology has been a dynamic and multifaceted journey, reflecting broader shifts in educational paradigms and cognitive science. Thinking skills, encompassing critical, creative, reflective, analytical, and meta-cognitive thinking, are increasingly recognized as essential for problem-solving and effective learning across various educational contexts (Kapanadze, 2019) (Bower, 2018). This recognition has spurred a growing body of research aimed at understanding, developing, and assessing these skills within educational frameworks. The integration of thinking skills into curricula, the role of educators in fostering these skills, and the impact of technological advancements on thinking skills development are key areas of focus in contemporary educational psychology (Manalo et al., 2026) c (Klinbumrung et al., 2025).

LITERATURE REVIEW

The evolution of thinking skills research in educational psychology has been a dynamic and multifaceted journey, reflecting broader shifts in educational paradigms and cognitive science (Bower, 2018). Thinking skills, encompassing critical, creative, reflective, analytical, and meta-cognitive

thinking, are increasingly recognized as essential for problem-solving and effective learning across various educational contexts (Kapanadze, 2019) (Zang et al., 2026).

The theoretical underpinnings of thinking skills in education have evolved significantly over the decades. Early frameworks, such as Bloom's taxonomy, provided a foundational structure by categorizing thinking skills into lower-order and higher-order skills, which helped educators design and assess learning outcomes.

A major emphasis has been placed on Higher-Order Thinking Skills (HOTS), including analysis, synthesis, and evaluation, as they are crucial for deep learning and intellectual development. Research confirms that these skills are not innate but can be cultivated through targeted instructional strategies and curricular interventions. Recent studies have highlighted the hierarchical nature of HOTS, suggesting that specific, fundamental skills, such as evidence-based reasoning and model construction, serve as building blocks for more complex skills like critical thinking and problem-solving (Zang et al., 2026). This hierarchical perspective underscores the importance of stepwise instructional approaches that progressively develop students' cognitive abilities.

Crucially, modern frameworks integrate the concept of meta-thinking skills, which involve reflecting on and regulating one's own thinking processes. This metacognitive ability has been identified as a critical component of effective learning and is fundamental to academic and professional success. Highly cited foundational works underscore the role of metacognition as a bridge between cognitive psychology and educational practice (Kuhn & Dean, 2004). Its importance extends to professional domains, where promoting cognitive and metacognitive reflective reasoning skills is vital for fields like nursing (Kuiper & Pesut, 2004).

The role of educators in promoting thinking skills is pivotal. Research indicates that teachers' beliefs, practices, and the alignment of their instructional strategies with learning objectives significantly influence the development of students' thinking skills. To foster these skills, innovative approaches, such as simulation-based learning (Klinbumrung et al., 2025) and experiential learning (Yadav et al., 2024), have shown promise in enhancing analytical and critical thinking skills by providing students with hands-on, real-world applications of their knowledge. However, challenges persist, including the difficulty of fitting thinking skills promotion into existing curricula and the need for professional development to equip teachers with effective pedagogical techniques.

Technological advancements have played a transformative role in thinking skills research. The integration of e-learning technologies (Lebese & Mhlongo, 2024) and mobile applications (Isrokatun et al., 2023) has opened new avenues for engaging students and fostering critical thinking. Digital tools have been demonstrated to enhance students' cognitive abilities by providing interactive and adaptive learning environments. For example, the use of e-modules based on problem-based learning combined with Socratic dialogue has been shown to improve various aspects of critical thinking, including interpretation, analysis, and self-regulation (Pitorini, 2025). The increasing validation of tools like the Computational Thinking Test further influences this field in the digital era (Román-González et al., 2017).

In conclusion, the evolution of thinking skills research in educational psychology reflects a growing recognition of the importance of these skills for academic and professional success. The development of thinking skills is influenced by a complex interplay of theoretical frameworks, instructional strategies, educator practices, and technological innovations. As research continues to advance, it is essential to explore and address the challenges associated with promoting thinking skills, ensuring that educational practices are aligned with the cognitive and developmental needs of students in the 21st century.

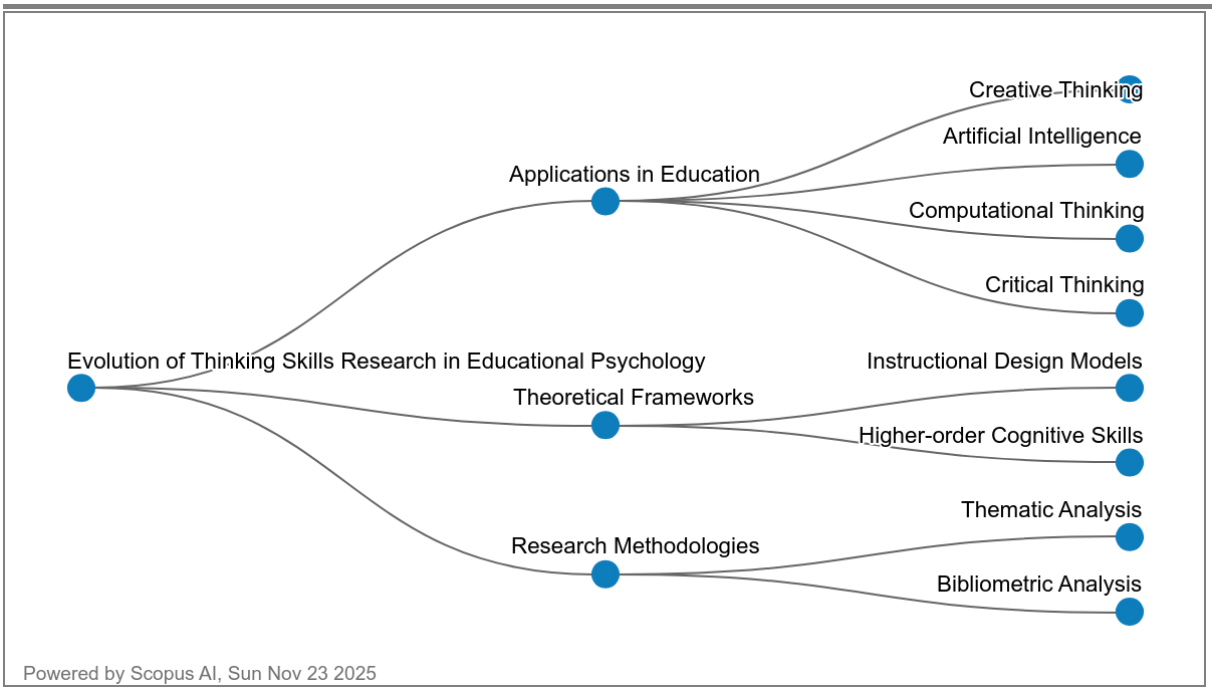

Figure 1: Thematic Structure of Thinking Skills Research in Educational Psychology

Figure 1 illustrates the conceptual structure of Human Behaviour in the Digital Era by showing how three major thematic streams shape current research: consumer behaviour, online social networks, and digital transformation. The concept map highlights that consumer behaviour is strongly influenced by digital reading habits, mobile-reading practices, and changing purchase intentions driven by online exposure. Online social networks form the second major theme, emphasising how sharing platforms and electronic word-of-mouth shape social interaction and communication patterns within digital environments. The third theme, digital transformation, reflects broader societal changes, including digital amnesia and the increasing reliance on digitalization across daily activities. Together, these interconnected themes show that digital-era behaviour is shaped by shifts in consumption patterns, social communication, and technological adaptation. The map provides a clear overview of how behavioural responses evolve as digital tools continue to reshape learning, decision-making, and information processing. This conceptual landscape serves as a foundation for understanding the expanding research focus on human behaviour within rapidly developing digital ecosystems.

Research Question

RQ1: What are the research trends in this field based on the yearly distribution of publications?

RQ2: What are the most top 10 cited articles?

RQ3: Where is the top 10 country based on number of publications?

RQ4: What are the popular keywords related to the study?

RQ5: What is co-authorship by countries' collaboration?

METHODOLOGY

Bibliometrics encompasses the systematic retrieval, organization, and evaluation of bibliographic information derived from scholarly publications (Alves et al., 2021; Assyakur & Rosa, 2022; Verbeek et al., 2002). Beyond descriptive metrics, such as identifying core journals, temporal publication patterns, and influential authors (Wu & Wu, 2017), bibliometric techniques incorporate advanced analytical procedures, including document co-citation and keyword co-occurrence analysis, which enable scholars to map intellectual structures, trace the evolution of research themes, and ultimately ensure the reliability of research outcomes (Fahimnia et al., 2015).

Guided by these principles, the present study prioritised high-impact publications, recognising that frequently cited works offer deeper insights into the theoretical foundations and conceptual trajectories of thinking skills research in educational psychology.

Data Source and Search Strategy

To ensure data validity and consistency, SCOPUS was selected as the principal data source due to its extensive indexing of international, peer-reviewed scholarship(Al-Khoury et al., 2022; di Stefano et al., 2010; Khiste & Paithankar, 2017). Relevant publications from 1990 through November 2025 were systematically retrieved and analysed to support the bibliometric assessment undertaken in this study

In conducting the search for strategic data, the Scopus advanced search function was employed, as detailed in **Table 1**.The precise search string used was: TITLE ("thinking skills" AND educational AND pyschology) AND (LIMIT-TO (LANGUAGE , "English")). The access date for this retrieval was November 2025.

Screening and Inclusion-Exclusion Criteria

To maintain the academic integrity and sharp focus of the dataset, several systematic screening criteria were applied, as detailed in **Table 2**. The language was restricted to English to ensure accessibility and consistency in interpretation, while non-English publications were excluded. The timeline was confined to the period between 1990 and 2025, thereby focusing on the most recent decade of scholarship, while publications prior to 1990 were excluded to avoid outdated theoretical perspectives. Furthermore, only journal articles were considered, with conference papers, book chapters, and other forms of literature intentionally excluded (Gu et al., 2019), as journal articles generally represent peer-reviewed, high-quality sources. Only publications in the "Final" stage were retained, excluding those still marked as "In Press" to ensure reliability and completeness of information. Finally, the subject areas were limited to Environmental Science, Energy, and Social Sciences to maintain a sharp focus on the fields most relevant to the intersection of thinking skills, education, and psychology. Through this rigorous selection process, the final dataset comprised 690 articles, representing a robust and refined body of literature.

Data Analysis and Visualization

Datasets containing publication year, titles, author names, journal sources, citation counts, and keywords were extracted from the Scopus database in PlainText format, covering the period from 2004 to December 2024. These datasets were subsequently analyzed using VOSviewer version 1.6.19, a widely recognized and user-friendly bibliometric software(van Eck & Waltman, 2010, 2017).

VOSviewer was employed for its powerful visualization capabilities, which enabled the generation of bibliometric maps through its clustering and network visualization capabilities. The software supports the examination of co-authorship, co-citation, and keyword co-occurrence structures, allowing scholars to gain comprehensive insights into the intellectual, conceptual, and social foundations of a research field.

Unlike traditional Multidimensional Scaling (MDS), VOSviewer positions items within a low-dimensional space such that the distances between nodes accurately represent their relatedness, thereby enhancing interpretability(van Eck & Waltman, 2010),(Appio et al., 2014). Instead of relying on conventional metrics such as cosine or Jaccard indices, VOSviewer employs the Association Strength (ASij) measure for normalizing co-occurrence frequencies(Van Eck & Waltman, 2007):

$$\frac{C_{ij}}{w_i w_j}$$

This measure is proportional to the ratio between the observed number of co-occurrences of i and j and the expected number of co-occurrences under the assumption of statistical independence. This normalization technique ensures that the resulting visualizations more accurately reflect the underlying structure and connectivity of the dataset, thereby strengthening the reliability and analytical precision of the bibliometric maps produced.

Table 1 The search string.

Scopus	TITLE ("thinking skills" AND educational AND pyschology) AND (LIMIT-TO (LANGUAGE , "English")) November 2025

Table 2 The selection criterion is searching

Criterion	Inclusion	Exclusion
Language	English	Non-English
Time line	1990 – 2025	< 2025
Literature type	Journal (Article) All	None
Publication Stage	Final In Press	None

FINDINGS AND DISCUSSION

RQ1: What are the research trends in this field based on the yearly distribution of publications?

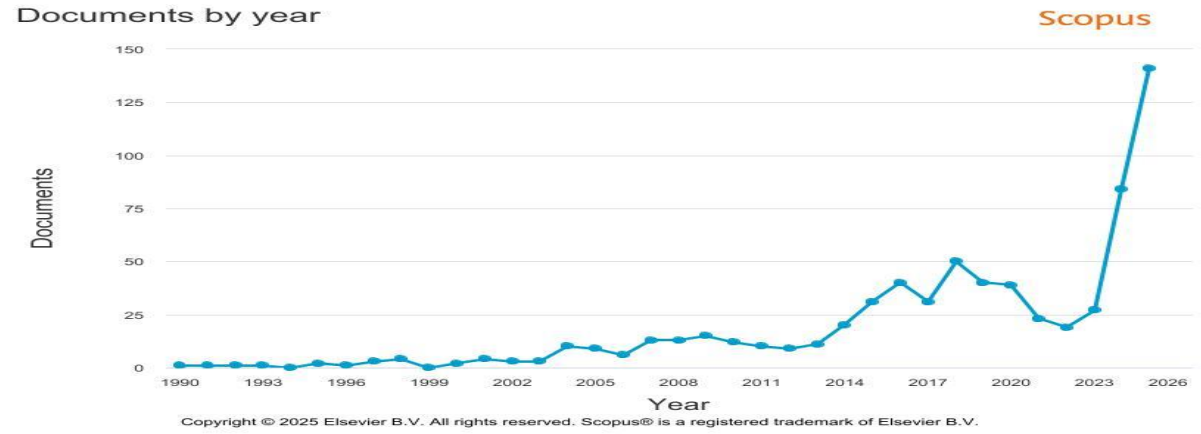

Figure 3: Publication Trend on the Evolution of Thinking Skills Research in Educational Psychology from 2015 to 2025 based on Scopus data

Figure 3 illustrates the publication trend on the Evolution of Thinking Skills Research in Educational Psychology from 1990 to 2025 based on Scopus data, showing a clear long-term progression from a niche field to an increasingly prominent research domain. Between 1990 and the early 2000s, the output remained very low, with most years recording fewer than five publications, indicating that thinking skills research—such as critical thinking, creative thinking, and higher-order cognitive processes—was still emerging and had not yet gained broad scholarly traction in educational psychology. A gradual upward shift began around 2005 to 2014, where annual publications consistently ranged between 10 and 20 documents. This steady increase reflects growing interest in cognitive development, problem-solving skills, and 21st-century competencies as part of global education reforms. The period from 2015 to 2020 represents a more noticeable acceleration, with publications rising sharply and reaching peaks around 40–50 documents per year. This surge corresponds with the global emphasis on creativity, metacognition, analytical reasoning, and the integration of thinking-skills-based pedagogies into school and higher education settings. Although there is a minor fluctuation around 2021–2022—likely due to disruptions caused by the COVID-19 pandemic—the field rebounds strongly in 2023, and the growth becomes exponential in 2024 and 2025, where publications rise dramatically to over 80 and then exceed 140 documents. This sharp escalation signals a significant shift in educational research priorities, driven by digital transformation, AI-enhanced learning environments, and the urgent need to equip learners with adaptable

cognitive skills for complex and uncertain futures. The continuous rise in 2024–2025 also suggests expanding interdisciplinary collaborations that link thinking skills with educational technology, instructional design, computational thinking, and psychological assessment. Overall, the trend demonstrates that thinking skills have evolved into a central component of educational psychology research, with recent years highlighting their crucial role in enhancing student learning outcomes, promoting higher-order cognition, and preparing individuals for the demands of the digital and knowledge-based era.

RQ2: What are the most top 10 cited articles?

Table 3: Most Cited Articles on the Evolution of Thinking Skills Research in Educational Psychology

Authors	Title	Year	Source title	Cited by
(Glaser, 1984)	Education and thinking: The role of knowledge	1984	American Psychologist	841
(Román-González et al., 2017)	Which cognitive abilities underlie computational thinking? Criterion validity of the Computational Thinking Test	2017	Computers in Human Behavior	623
(Jonassen, 2010)	Learning to solve problems: A handbook for designing problem-solving learning environments	2010		463
(Tim Dornan et al., 2006)	How can experience in clinical and community settings contribute to early medical education? A BEME systematic review	2006	Medical Teacher	343
(Goldie, 2012)	The formation of professional identity in medical students: Considerations for educators	2012	Medical Teacher	328
(Brown, 1997)	Transforming Schools into Communities of Thinking and Learning about Serious Matters	1997	American Psychologist	315
(Kuhn & Crowell, 2011)	Dialogic argumentation as a vehicle for developing young adolescents' thinking	2011	Psychological Science	294
(Greenfield, 2009)	Technology and informal education: What is taught, what is learned	2009	Science	278
(Kuhn & Dean, 2004)	Metacognition: A bridge between cognitive psychology and educational practice	2004	Theory into Practice	266
(Kuiper & Pesut, 2004)	Promoting cognitive and metacognitive reflective reasoning skills in nursing practice: Self-regulated learning theory	2004	Journal of Advanced Nursing	261

According to **Table 3**, the top ten most cited articles reveal a strong intellectual foundation anchored in classical cognitive psychology, problem solving research, computational thinking, and metacognition, demonstrating the diverse roots of thinking skills research in educational psychology. Glaser's (1984) landmark article, cited 841 times, remains the most influential because it established foundational concepts linking knowledge, cognition, and thinking processes, ideas that continue to shape contemporary theories of critical and analytical thinking. Román González et al. (2017), with 623 citations, significantly influenced the digital era by validating computational thinking assessments, making it highly relevant in a world increasingly shaped by coding, STEM

education, and digital literacy. Jonassen's (2010) work on problem solving environments also achieved high citation impact because it offers practical frameworks widely used in instructional design and technology enhanced learning. Articles by Dornan et al. (2006) and Goldie (2012), both centered on clinical and professional learning, highlight the application of thinking skills in real world, high stakes contexts such as medicine, where reflective thinking, experiential learning, and identity formation are essential. These highly cited works collectively demonstrate that thinking skills research is not confined to traditional classroom settings but spans multiple disciplines, illustrating its relevance to both theoretical and applied dimensions of education.

The remaining influential articles further emphasize the role of metacognition, argumentation, and technology in shaping modern thinking skills development. Brown's (1997) article on transforming schools into learning communities is widely cited because it introduced a socially grounded perspective on thinking, where collaboration and discourse play central roles. Kuhn and Crowell's (2011) work on dialogic argumentation continues to gain traction as argumentation becomes a core element of critical thinking in educational assessment frameworks. Greenfield's (2009) publication in Science stands out due to its broad interdisciplinary relevance, exploring how technology shapes informal learning and cognitive development, an issue that has grown even more critical in the digital age. Meanwhile, articles by Kuhn and Dean (2004) and Kuiper and Pesut (2004) underscore the importance of metacognition and reflective reasoning in both academic and professional settings, explaining their continued citation over time. Overall, the citation patterns suggest that highly cited articles are those offering foundational theories, scalable assessment tools, practical instructional models, or interdisciplinary insights. These works continue to be referenced because they address universal challenges in education such as how students think, learn, solve problems, and transfer knowledge into complex real-world situations, making them enduringly influential in the evolution of thinking skills research.

RQ3: Where is the top 10 country based on number of publications?

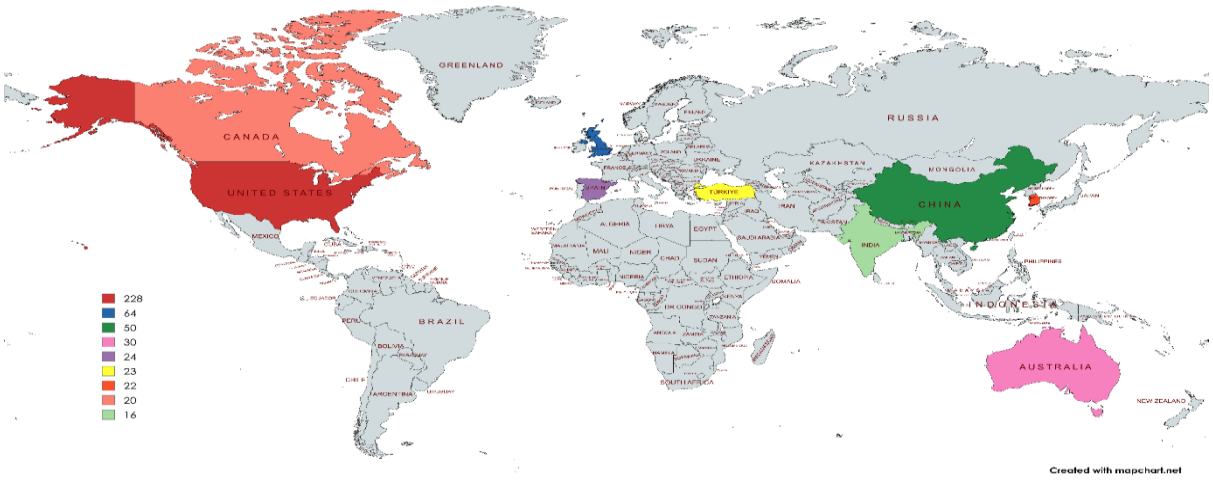

Figure 3: Top 10 Countries by Number of Publications on the Evolution of Thinking Skills Research in Educational Psychology

The publication distribution by country reveals a dominant contribution from the United States, which leads with 228 documents, far surpassing the United Kingdom (64) and China (50). This strong US presence reflects the country's long-standing leadership in educational psychology, cognitive science, and research on thinking skills. The United States possesses a well-established research ecosystem characterized by extensive funding, high-impact journals, leading universities, and strong interdisciplinary collaborations that integrate psychology, education, computer science, and neuroscience. The United Kingdom, ranking second with 64 publications, also has a rich academic tradition in critical thinking, pedagogy, and metacognition research, supported by influential universities such as Oxford, Cambridge, and UCL. China's position in third place, with 50 publications, reflects its rapid educational modernization and substantial investments in STEM education, computational thinking, and cognitive development research over the past decade. Countries such as Australia (30) and Spain (24) follow closely, supported by strong teacher education programs, active research groups in educational reform, and collaborations focusing on inquiry-based learning and thinking skills development. Turkey (23) and South Korea

(22) show notable contributions as well, reflecting their growing academic emphasis on critical thinking, digital competencies, and 21st-century skill frameworks within national education reforms.

Canada (20) and India (16) also emerge as important contributors to thinking skills research, though at a smaller scale compared to Western nations and East Asia. Canada's steady output aligns with its strong educational psychology community and emphasis on reflective thinking, student-centred learning, and problem-based pedagogies. India's rising contribution reflects its expanding higher education sector and national policy shifts promoting critical and creative thinking, particularly within engineering and computer science education. Overall, the geographic distribution suggests that countries with established research infrastructures, strong educational psychology traditions, and active reform agendas tend to produce more publications. The prominence of Western countries and technologically advanced Asian nations indicates that thinking skills research is deeply tied to national priorities in innovation, digital literacy, and global competitiveness. Furthermore, the variation across countries may also reflect differences in research funding, language accessibility, and access to high-impact publication outlets. In sum, the global publication landscape demonstrates that thinking skills research is strongly driven by nations that prioritize cognitive development and educational transformation, underscoring its growing relevance in preparing learners for rapidly evolving, knowledge-intensive societies.

RQ4: What are the popular keywords related to the study?

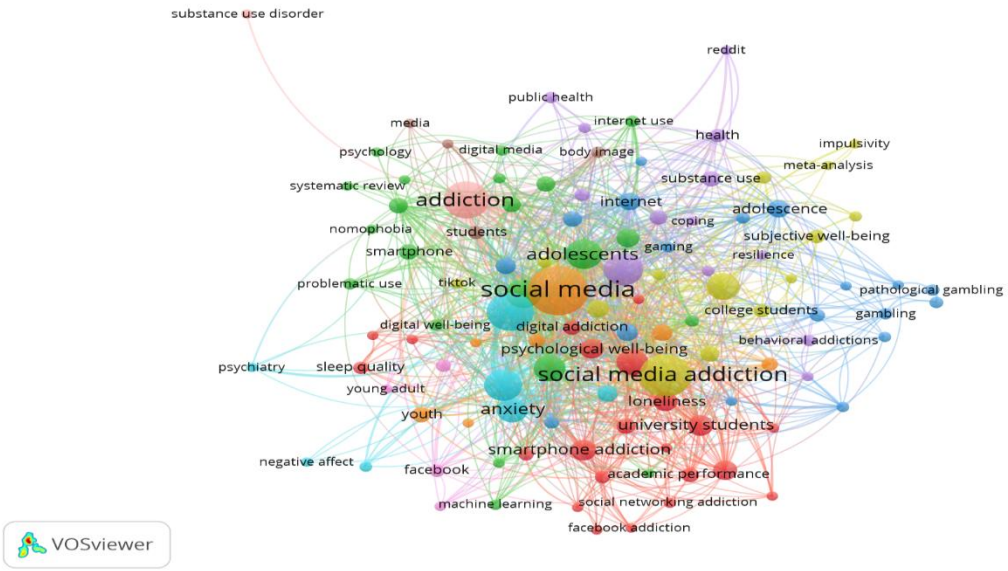

Figure 4: Keyword Co-Occurrence Map for Thinking Skills Studies in Educational Psychology

The co-occurrence analysis of author keywords in VOSviewer identifies how frequently specific keywords appear together across the same publications, allowing researchers to uncover the conceptual structure and dominant themes within the study of thinking skills in educational psychology. This approach maps intellectual linkages by grouping keywords that share strong co-occurrence strength, revealing how ideas cluster around shared theoretical or methodological foundations. Using the full counting method, each keyword occurrence was counted equally, ensuring that every document contributed to the overall network structure. A minimum threshold of five occurrences was applied, resulting in 112 selected keywords from a total of 1767 were included in the network as show in **Figure 4**. To ensure meaningful representation, a minimum cluster size of five was applied, producing ten clusters that visualise the major thematic concentrations in this field. These clusters form colour coded groups that show how constructs such as metacognition, critical thinking, problem solving, digital literacy, cognitive development, and academic performance connect and interact within the broader landscape of thinking skills research.

The network visualization contributes to the body of knowledge by revealing how thinking skills research has evolved and expanded in response to emerging educational needs and technological changes. Prominent keywords such as social media, adolescents, addiction, anxiety, and academic performance highlight the growing integration of digital era challenges into educational psychology, suggesting that thinking skills are now studied within more complex and technology driven contexts. Keywords related to digital well-being, internet use, machine learning, and behavioural patterns indicate the shift toward multidisciplinary perspectives that integrate psychology, education, digital media studies, and computational approaches. The presence of clusters focusing on university students, resilience, coping, problematic use, and social networking shows that contemporary thinking skills research increasingly examines real world cognitive demands faced by learners in digital environments. Overall, the ten clusters reflect a rich, interconnected research structure that captures both traditional foundations of cognitive skill development and modern extensions shaped by digital transformation. These findings help clarify research gaps, highlight emerging priorities, and support future scholars in advancing theoretical and empirical work on thinking skills within educational psychology.

RQ5: What is co-authorship by countries' collaboration?

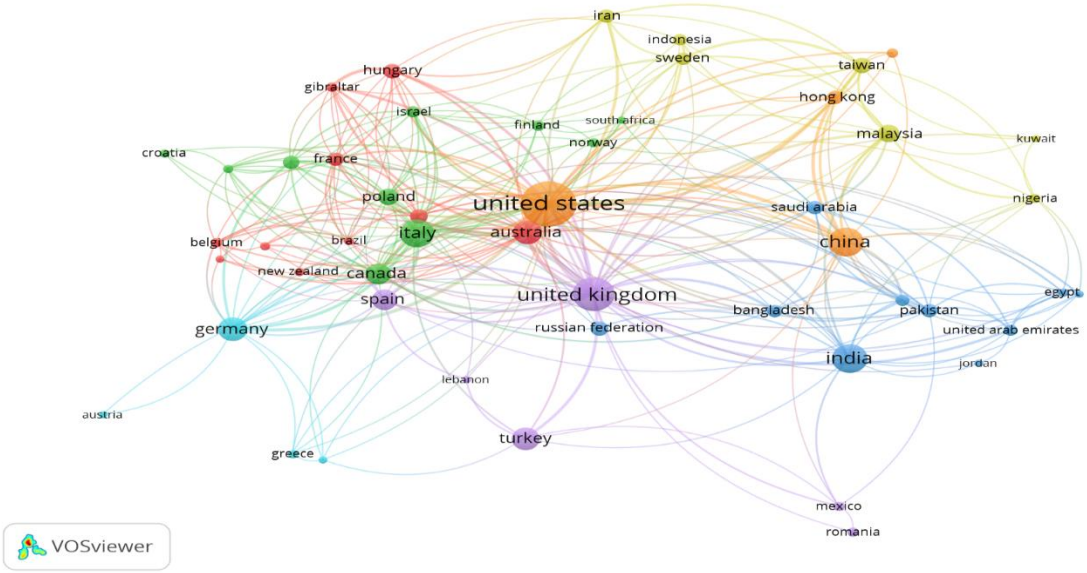

Figure 5: Network Visualization of Co-Authorship Collaboration by Countries Using VOSviewer

The co-occurrence analysis of countries using VOSviewer visualizes the relationships between countries based on the number of collaborative documents they have in common, illustrating how frequently countries work together in published research illustrated in **Figure 5.** This approach identifies countries that frequently appear together as co-authors and measures the strength of their collaborative relationships. Using the full counting method, each joint publication contributes equally to the link strength between countries. For this visualization, a minimum threshold of five documents was applied, and from a total of ninety countries, fifty-three met the requirement. A minimum cluster size of five was also set, which resulted in seven clusters that represent natural groupings of countries based on their collaborative tendencies, shared research themes, or similarities in academic infrastructure. These clusters reflect the structure of international partnerships and show how countries align according to regional proximity, disciplinary focus, or established research networks.

The generated map strengthens understanding of the global research landscape by revealing the roles and influence of countries within the collaborative network. Countries such as the United States, the United Kingdom, China, and India appear as central hubs because of their high publication volume and extensive international partnerships. Their strong link strengths indicate leadership in shaping research agendas and facilitating multinational collaboration. At the same time, the presence of countries from Europe, Asia, the Middle East, and other regions shows that the field is inclusive and internationally interconnected. These patterns highlight how research capacity, funding support, institutional priorities, and language accessibility influence participation in global scholarship. The visualization contributes to the body of knowledge by showing how

ideas, methods, and innovations are co-developed across borders, reinforcing the importance of international cooperation in advancing scientific and educational progress.

DISCUSSION AND INTERPRETATION OF FINDINGS

Analysis of Global Productivity and Temporal Trends

The analysis of publication trends (Figure 3) reveals a clear pattern of sustained growth in research output on thinking skills within educational psychology over the past three decades. While the growth has been steady, the number of publications shows a significant acceleration in recent years, culminating in a projected exponential increase in 2024 and 2025, where output is expected to exceed 140 documents. This dramatic surge in scholarly activity is not simply a reflection of an expanding academic community; rather, it is a direct consequence of global pressures and fundamental educational shifts. This exponential trend specifically correlates with the heightened societal focus on digital transformation in education, the integration of AI-enhanced learning environments, and the subsequent necessity for adaptable cognitive skills to successfully navigate modern economic and social landscapes (Zang et al., 2026).

Simultaneously, the analysis of country productivity (Figure 4) clearly establishes the dominance of the United States (228 documents) in terms of sheer output, followed by significant contributions from the United Kingdom, China, and Australia. This substantial geographical concentration of research suggests that methodological and conceptual agendas are closely tied to national priorities concerning innovation, digital literacy, and global competitiveness. The prominence of these nations indicates substantial institutional investment in cognitive research and educational reform.

Furthermore, the co-authorship network (Figure 5) confirms that both the United States and China function as central, powerful hubs in international research collaboration. Their high volume of both domestic and international partnerships signals their key leadership role in shaping methodological standards and defining thematic directions for the field globally. The clustering of collaboration clearly highlights strong transatlantic and Asian-Pacific partnerships, suggesting a shared, though regionally nuanced, academic dialogue on the development and instruction of thinking skills worldwide.

Conceptual Structure and Thematic Evolution: The Rise of Digital-Era Challenges

The keyword co-occurrence map (Figure 4) provides the most insightful finding regarding the field's conceptual shift and thematic evolution. The analysis reveals a clear trend: research is moving beyond studies focused purely on traditional pedagogical methods to embrace multidisciplinary perspectives that integrate digital media and contemporary societal challenges (Lebese & Mhlongo, 2024).

Specifically, the bibliometric analysis identified a prominent conceptual cluster featuring the terms “social media,” “adolescents,” “addiction,” and “anxiety”. This clustering signals a profound theoretical evolution and the growing incorporation of digital era challenges into the core concerns of educational psychology. This development signifies a critical shift in focus within the field, broadening its scope from merely investigating how to teach critical thinking to addressing the complex challenge of how to apply and protect thinking skills within ubiquitous digital environments (Isrokatun et al., 2023).

This conceptual shift carries significant real-world implications for educational practice. The prominence of this cluster suggests that future instructional strategies cannot afford to ignore the pervasive influence of social technologies on students’ cognitive development and mental well-being. Educational interventions must now be designed not only to teach analytical skills but also to address the complex cognitive demands and potential risks, such as the processing of misinformation or the maintenance of digital well-being, associated with constant digital engagement. Thus, the bibliometric pattern directly links the development of thinking skills to urgent contemporary issues of student mental health and digital citizenship, demanding a more comprehensive and ecologically valid approach to curriculum design.

Furthermore, the co-occurrence data strongly supports the central necessity of the Metacognitive focus discussed in the theoretical framing. Keywords related to "reflective thinking" and "self-regulation" are central to the overall network structure, suggesting that the most effective and durable interventions are those that teach students to actively manage and monitor their thinking processes (Kuhn & Dean, 2004). This is especially critical when students face complex, high-stakes stimuli, such as navigating overwhelming social media data, solving ill-structured real-world problems, or managing high-stakes academic scenarios. The bibliometric evidence thus reinforces the idea that true proficiency in thinking skills is inherently linked to the ability to reflect on and regulate one's own cognition.

Future Research

Based on the temporal trends and conceptual shifts identified through this comprehensive bibliometric mapping, future research should concentrate its efforts in three key strategic areas to advance the study and practice of thinking skills. Firstly, there is a necessity to shift focus toward rigorous intervention studies. Future research should prioritize the systematic, empirical evaluation of the specific impact of emerging themes, such as digital well-being and AI-mediated learning, on the successful development of higher-order cognitive skills. This requires researchers to move beyond descriptive or correlational analyses and implement controlled experimental designs that test the efficacy and scalability of novel instructional strategies within these new digital contexts (Pitorini, 2025).

Secondly, given the high connectivity of global research hubs evident in the co-authorship maps, there is a clear imperative to promote explicit interdisciplinary collaboration. Educational psychology must integrate insights from fields like computer science and neuroscience to better understand the underlying cognitive mechanisms and effectively cultivate thinking skills in the digital era (Román-González et al., 2017). This collaboration will be crucial for developing computationally informed models of cognition.

Finally, future efforts must address the critical translational challenge to bridge the research-practice gap. Educational institutions and researchers must work collaboratively to translate the rich theoretical and empirical insights gained from studies on metacognition and digital literacy into practical, scalable, and readily implementable instructional strategies for classroom teachers. Successfully executing this step will ensure that the identified academic trends and innovations effectively benefit real-world educational practice and ultimately improve student outcomes globally (Yadav et al., 2024).

CONCLUSION

The bibliometric analysis undertaken in this study reveals that thinking skills research is currently at a critical juncture, fundamentally driven by technological necessity and evolving societal demands. The findings, particularly the exponential growth in publications and the central role of keywords related to the digital age, confirm that educational psychology is actively responding to the urgent, contemporary need for cognitive resilience in a rapidly changing world. The dominant research output originating from developed nations clearly implies that resources and policy focus are accelerating the research-to-practice pipelines in these regions. However, this geographical concentration of productivity also suggests a limitation: for the field to achieve true global relevance and impact, there is a necessity for greater diversity in authorship and an expansion of studies focusing on thinking skills across varied cultural and socio-economic contexts. Overall, the analysis successfully mapped the field's intellectual structure, identifying a pronounced conceptual shift toward the importance of metacognition and the challenges inherent in ubiquitous digital learning environments.

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