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Research Trends of Creative Thinking in Education: Bibliometric Analysis 2016–2025

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ABSTRACT

Creative thinking is an essential skill of the 21st century, seen as essential for the development of individuals, society, and the global workforce. This study aims to map the research landscape of creative thinking in education during the period 2016–2025 through a data-based bibliometric analysis of Scopus data. By applying the keywords "creative thinking" and "students", 1,340 documents were analyzed using a combination of Scopus, VOSviewer, and Biblioshiny to identify publication trends, document type distribution, dominant keywords, and thematic evolution. The study's results show significant growth in publications since 2016, with a peak from 2020 to 2024. Journal articles dominated (883), followed by conference papers (550), with an international collaboration rate of 10.68%. The thematic analysis revealed two main clusters: the conceptual-pedagogical approach, which emphasizes learning theory and strategies, and the empirical-evaluative approach, which focuses on measuring creative thinking skills. Trends toward integrating digital technology, STEM/STEAM-based learning, and artificial intelligence (AI) to support creative thinking skills. The results of the study are expected to provide a basis for education policy, pedagogical innovation, and future research directions.

ARTICLE INFORMATION

Keywords:
bibliometric analysis; creative thinking; educational research

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INTRODUCTION

Creative thinking is widely recognized as a crucial skill in 21st-century education, enabling learners to generate original ideas, approach problems from multiple perspectives, and develop innovative solutions. International organizations such as UNESCO and the OECD emphasize creative and critical thinking as essential competencies for lifelong learning and future workforce demands (OECD, 2019; UNESCO, 2021). In educational contexts, creativity supports not only individual development but also societal progress, as creative capacity is closely linked to innovation and economic growth (Beghetto & Kaufman, 2014; Runco & Jaeger, 2012). Research on creativity in education has expanded rapidly, highlighting its role in enhancing students' problem-solving skills, adaptability, and engagement (Guilford, 2017; Sternberg, 2018). Creative thinking is commonly fostered through pedagogical approaches such as project-based learning, inquiry-based learning, and STEM/STEAM integration, which provide authentic contexts for the development of creativity (Erdogan et al., 2016; Mishra & Henriksen, 2017). In addition, digital technologies and online learning environments have been shown to stimulate creativity when designed to promote collaboration and exploration (Zhang et al., 2021).

Despite the growing volume of studies, the research landscape of creative thinking in education has not yet been systematically mapped. Bibliometric analysis provides a means of identifying research trends, influential works, and thematic clusters across large datasets (Aria & Cuccurullo, 2017). In comparison, bibliometric studies have examined creativity as a broad construct across disciplines (Childs et al., 2022). There remains a lack of bibliometric analyses that specifically focus

on creative thinking in educational contexts over the past decade, particularly regarding publication trends, thematic structures, and emerging research directions. This gap limits a comprehensive understanding of how research on creative thinking in education has evolved and where future investigations should be directed. Therefore, this study aims to address this gap by conducting a Scopus-based bibliometric analysis of creative thinking research in education published between 2016 and 2025. Specifically, this study examines publication trends, document types, thematic clusters, and emerging topics through keyword analysis to provide an explicit, up-to-date mapping of the field. The findings are expected to strengthen alignment among research, educational policy, and pedagogical innovation, while also offering clear directions for future research, particularly in underrepresented educational contexts.

METHOD

This study employed a bibliometric research design to systematically map the development of creative thinking research in education. Data were retrieved from Scopus, one of the world's leading abstract and citation databases for peer-reviewed literature, selected for its extensive coverage of educational research and suitability for bibliometric analysis (Mongeon & Paul-Hus, 2015). The research procedure consisted of four main stages: data identification, screening, eligibility assessment, and bibliometric analysis, as illustrated in Figure 1.

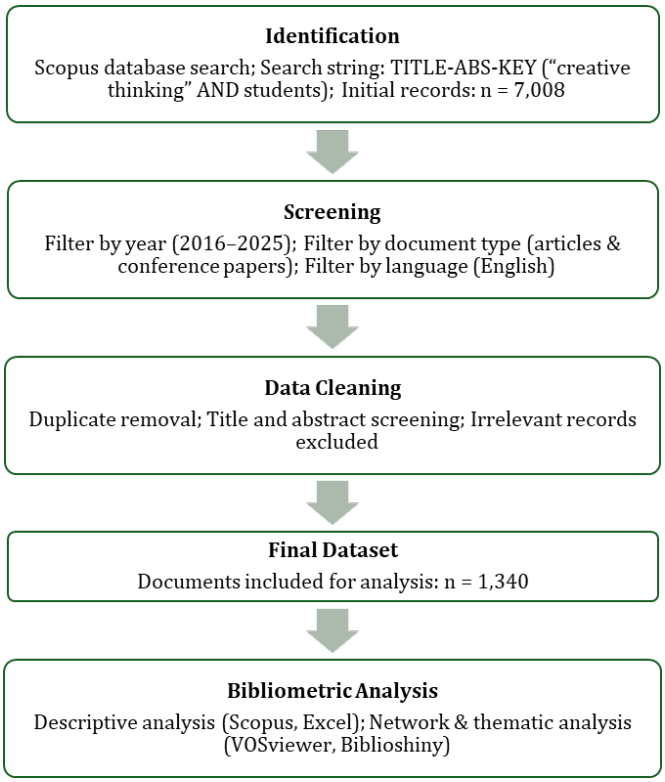


Figure 1. Research Procedure of the Bibliometric Analysis

The data search was conducted using the following search string applied to the Scopus database: TITLE-ABS-KEY ("creative thinking" AND students). To ensure relevance and consistency, the inclusion criteria were limited to journal articles and conference papers published in English between 2016 and 2025. This restriction was applied to maintain data quality while ensuring global accessibility of the literature (van Leeuwen, 2006). The initial search yielded 7,008 records. Data cleaning was conducted in several stages to improve reproducibility and accuracy. First, duplicate

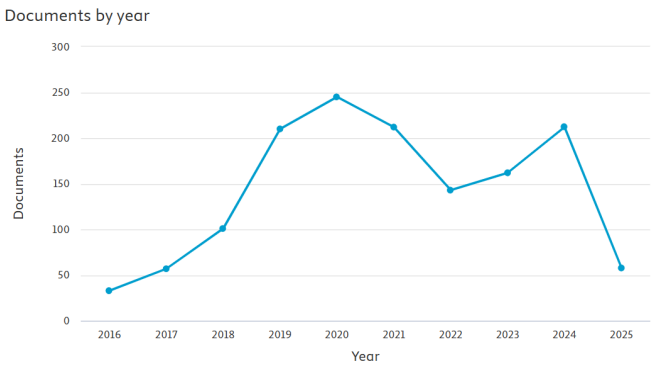
records were removed automatically using Scopus filtering features. Second, documents outside the specified publication years, document types, and language were excluded. Third, titles and abstracts were screened to exclude publications not directly related to creative thinking in educational contexts. After completing these procedures, a total of 1,340 documents were retained for bibliometric analysis. The final dataset included metadata such as authorship, affiliations, keywords, citation counts, and publication sources.

Bibliometric analysis was performed using a combination of analytical tools. Scopus analytical features were used to generate initial descriptive statistics, including annual publication trends and document-type distributions. VOSviewer was employed to visualize co-authorship networks and keyword co-occurrence patterns (van Eck & Waltman, 2009), while Biblioshiny, an R-based interface within the Bibliometrix package, was used for advanced bibliometric mapping, thematic analysis, and thematic evolution (Aria & Cuccurullo, 2017). Microsoft Excel supported data organization and descriptive analysis. The analysis focused on (a) annual publication trends, (b) document type distribution, (c) keyword-based thematic clustering, and (d) thematic evolution over time. This integrated quantitative mapping and qualitative interpretation approach enabled a comprehensive understanding of research trends and developments in creative thinking education (Donthu et al., 2021).

RESULTS AND DISCUSSION

The trend in the number of publications or documents from 2016 to 2025 (Figure 2) shows that the number of documents has increased significantly since 2016 (33 documents), reaching its peak in 2020 with 245 documents. A sharp increase occurred during the 2017–2019 period, with publications jumping more than threefold. However, after 2020, the number of documents fluctuated: in 2021, it decreased slightly to 212, then dropped further in 2022 to 143. However, in 2023–2024, the number will increase again, reaching 212 documents in 2024. Meanwhile, in 2025, there will be a drastic decrease of up to 58 documents. This decrease occurs because the 2025 data is still ongoing and therefore does not cover the entire year.





Year	Number of Publications
2016	33
2017	57
2018	101
2019	210
2020	245
2021	212
2022	143
2023	162
2024	212
2025	58

Figure 2. Annual Publication Trends in Research (2016-2025)

This publication trend describes the influence of external factors, such as policy changes, research trends, or global situations (e.g., the 2020–2022 pandemic), on publication productivity. This growth aligns with a global emphasis on 21st-century competencies and the integration of creativity into educational frameworks (Beghetto, 2019; OECD, 2019). An analysis of the annual publication output shows that research on creative thinking in education grew consistently over the period.

In this study (Figure 2), publications increase steadily, peaking in 2024. This trend confirms that this steady growth suggests creative thinking has become a key focus in education research, reflecting global policy priorities such as the OECD and UNESCO's call to reimagine the future of education (UNESCO, 2021). This trend is consistent with previous findings that creativity research has grown rapidly since the early 2000s (Cuetos-Revuelta et al., 2022). Although the number of publications has increased, some academics argue that theoretical developments are not yet aligned, resulting in fragmented perspectives and a lack of a unifying framework (Plucker et al., 2004). This suggests that, although productive, this field still needs a more integrative consolidation of theories and models. Compared with earlier bibliometric studies on creativity that reported steady but moderate growth before 2015 (Childs et al., 2022; Cuetos-Revuelta et al., 2022). The sharp increase observed between 2020 and 2024 in this study indicates an accelerated shift in research focus toward creative thinking in education. This surge coincides with major global disruptions, such as the COVID-19 pandemic, which intensified the need for innovative, flexible, and technology-supported learning approaches. The 2016–2025 timeframe, therefore, captures a critical transition period in which creative thinking shifted from a complementary educational goal to a central competence within educational research and policy agendas.

Table 1. Article review information

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2016:2025
Sources (Journals, Books, etc.)	393
Documents	1433
Annual Growth Rate %	6.47
Document Average Age	4.02
Average citations per doc	8.538
References	11496
DOCUMENT CONTENTS	
Keywords Plus (ID)	3135
Author's Keywords (DE)	5218
AUTHORS	
Authors	6950
Authors of single-authored docs	2
AUTHORS COLLABORATION	
Single-authored docs	2
Co-Authors per Doc	9.92
International co-authorships %	10.68
DOCUMENT TYPES	
article	883
conference paper	550

A bibliometric study conducted from 2016 to 2025 (Table 1) analyzed 1.433 documents from 393 sources and demonstrated the importance of creativity in education. The analysis showed that journal articles dominated (883), with conference papers contributing 550. This distribution shows that although journal articles remain the dominant source, conferences continue to play an important role in disseminating new findings. This pattern is consistent with the broader field of educational research, where conferences often serve as platforms for early-stage studies (Donthu et al., 2021). With an incredible annual growth rate of 6.47%, the study shows rapid progress in this area of research. Per the document, an average of 8,538 citations describes the relevance and impact of creative thinking in the educational literature, and the average document age is 4.02 years, showing how quickly new ideas are being implemented. Compared with earlier bibliometric studies that reported lower levels of international collaboration in creativity research, the findings from the 2016–2025 period indicate a growing trend toward cross-national research networks. This suggests that creative thinking in education has increasingly been addressed as a global educational concern rather than a context-specific issue.

The study resulted in contributions from 6950 authors, including 2 single authors, and involved 10.68% international collaborations. In this study, the collaborative nature, with an average of 9.92 authors per document, is critical for innovation and the exchange of ideas in creative thinking in education worldwide. In addition, the study identified 5218 "Author Keywords" and 3135 "Plus Keywords", indicating that it covered a diverse range of creative thinking topics and approaches. The article's focus reflects researchers' preference for this format, reinforcing the standards and reliability of shared scientific knowledge. All documents are published in English, underscoring its role as a global language of academic communication (van Leeuwen, 2006). Amano et al. (2016) found that language remains a significant obstacle in global science, leading to a lack of representation of valuable local research.

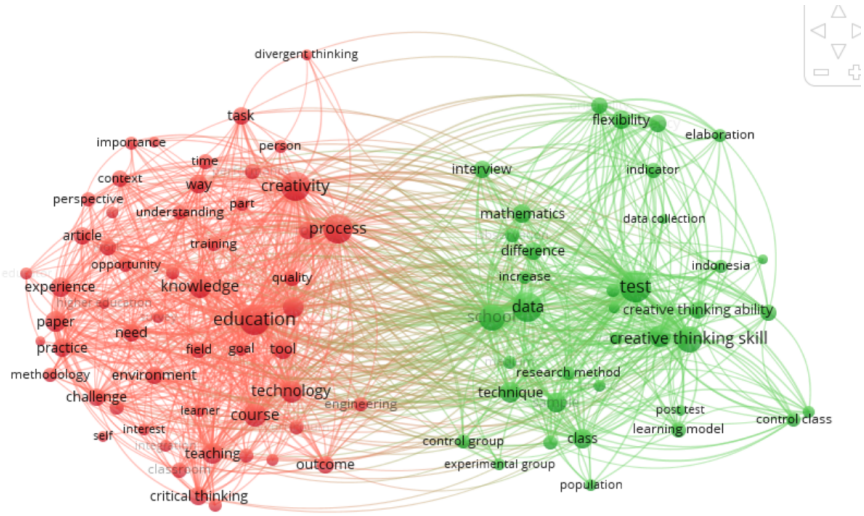


Figure 3. VosViewer Results

Analysis of the VoV (Figure 3) keyword network map shows that research on creative thinking in education is structured into two main clusters that complement each other. The red cluster emphasizes a conceptual-pedagogical approach, focusing on understanding creativity as an integrated process across education, technology, and learning practices, thereby further developing theoretical frameworks and pedagogical strategies. Meanwhile, the green cluster highlights an empirical-evaluative approach that assesses creative thinking skills using test instruments, experimental design, and data analysis in real-world contexts, such as mathematics and secondary school subjects in

Indonesia. The interconnectedness of the two shows a dialectic between theory and practice: the red cluster provides a conceptual foundation, while the green cluster empirically tests it to assess its effectiveness and application. This analysis reveals that the development of the study of creative thinking in education requires not only a solid conceptual framework but also robust empirical testing to produce relevant and measurable educational innovations.

The conceptual map in Figure 3 shows the structure of the research theme, based on the relevance of the keywords that frequently appear. The red field depicts the research space defined by the dominant keyword, while the keyword's position indicates its relevance and its relevance to other studies. First, it is evident that the keywords "innovation", "design thinking", "problem-based learning", and "creative thinking skills" occupy positions at the top and middle of the map, indicating that these topics are the main clusters most researched and the center of academic attention. This aligns with global trends that emphasize the importance of creativity, innovation, and problem-solving-based learning approaches in 21st-century education. Second, keywords such as "*education*", "*learning*", "*higher education*", and "*student*" are distributed across a broader range, indicating cross-field connections among educational levels, learning subjects, and high-level thinking skills. Thus, research is not limited to high school but also extends to higher education and general education.

Third, the bottom of the map displays keywords such as "*adult*", "*female*", and "*human*", which are relatively separate from the main cluster. This position indicates that studies on demographics, gender, or age are still rarely addressed in learning innovation research, suggesting a new research opportunity that has not been widely explored. Moreover, fourth, the map also shows important intersections between STEM-related keywords such as *"engineering education", "physics", "problem solving",* and *"artificial intelligence".* The presence of this keyword indicates the growing integration of technology and STEM approaches to encourage students' creativity and critical thinking. This conceptual map confirms that the current research direction focuses a lot on the development of creativity-based learning innovations and problem-based learning. However, there are also research gaps to explore, especially regarding demographic factors, the role of advanced technology, and applications at the basic education level. This dual-cluster structure extends earlier bibliometric findings that primarily emphasized psychological or conceptual perspectives on creativity, indicating that research during 2016–2025 has increasingly integrated pedagogical design with empirical classroom-based validation.

Several well-known countries appear to be scientifically productive in research on creative thinking education. The darkest blue countries show higher levels of scientific production (Indonesia), while the light blue countries show a lower contribution. The United States, China, and Spain stand out for their darker blue intensity, indicating that they are also leading scientific production on this topic. Established academic infrastructure, continuous investment in educational research, and the availability of resources that enable extensive and in-depth research are testaments to the great contributions of these countries. Other countries also show significant research activity, but at different intensities, reflecting differences in research capacity and education priorities across countries. Malaysia, the UK, and Russia have also invested in research and education, resulting in a significant increase in scientific output. In addition, Taiwan, Turkey, and Thailand made significant contributions, demonstrating their roles in educational research worldwide. Their strong presence on the map shows that the national curriculum's strategic focus on developing creative thinking in educational innovation is the reason for it. Lighter blue indicates greater innovation and research in other States, and darker blue indicates structural challenges or research priorities that affect the visibility and influence of creative thinking across the board.

Hobri is the most prolific writer in this field with 21 articles, and Dafik with 15 publications; they almost completely contribute to all their articles, showing that they are very independent in their

research, which shows a specific expertise or a centralized and innovative approach that can influence their field of study. However, other parts of the research article are written collaboratively, which also indicates that the contribution is significant, as it plays an important role in creative thinking research in education, and demonstrates that they can lead their research groups. Other authors, such as Waluya, Susanto, Ashadi, Masykuri, and Rochmad, show variations in the number of publications, indicating different levels of collaboration and individual contributions. Other authors with 6 articles, such as Herman and Liu, also have full and recognized contributions, with different fractional scores. This suggests that they played an important or unique role in the study and can be considered the main thinkers.

Table 2. The Most Cited Documents Globally

Paper	Tittle	DOI	Total Citations	TC/ Year	Normalized TC
Ritter & Mostert. (2017). Journal of Cognitive Enhancement, 1(3), 243-253.	Enhancement of creative thinking skills using a cognitive-based creativity training.	10.1007/s41465-016-0002-3	197	21.89	9.05
Romero et al., (2017). International Journal of Educational Technology in Higher Education, 14(1), 42.	Computational thinking development through creative programming in higher education.	10.1186/s41239-017-0080-z	177	19.67	8.13
López-Pernas et al., (2019). IEEE Access, 7, 31723-31737.	Examining the use of an educational escape room for teaching programming in a higher education setting.	10.1109/ACCESS.2019.2902976	150	21.43	12.48
Ülger (2018). Interdisciplinary journal of problem-based learning, 12(1).	The effect of problem-based learning on the creative thinking and critical thinking disposition of students in visual arts education.	10.7771/1541-5015.1649	143	17.88	12.24
Essel et al. (2024). Computers and Education: Artificial Intelligence, 6, 100198.	ChatGPT effects on cognitive skills of undergraduate students: Receiving instant responses from AI-based conversational large language models (LLMs).	10.1016/j.caeai.2023.100198	131	65.50	40.13

Paper	Tittle	DOI	Total Citations	TC/ Year	Normalized TC
Muñoz-Repiso & Caballero-González, (2019). Comunicar: Revista Científica de Comunicación y Educación, (59), 63-72.	Robotics to develop computational thinking in early Childhood Education	10.3916/C59-2019-06	114	16.29	9.48
Wannapiroon & Pimdee, (2022). Education and Information Technologies, 27(4), 5689-5716.	Thai undergraduate science, technology, engineering, arts, and math (STEAM) creative thinking and innovation skill development: a conceptual model using a digital virtual classroom learning environment.	10.1007/s10639-021-10849-w	84	21.00	9.41
Ritter et al., (2020). PloS one, 15(3), e0229773.	Fostering students' creative thinking skills by means of a one-year creativity training program.	10.1371/journal.pone.0229773	82	13.67	9.21
Siburian et al., (2019). Eurasian Journal of Educational Research, 19(81), 99-114.	The correlation between critical and creative thinking skills on cognitive learning results.	10.14689/ejer.2019.81.6	81	11.57	6.74
Corebima et al., (2017). International Journal of Instruction, 10(2), 245-262.	Creative Thinking of Low Academic Student Undergoing Search Solve Create and Share Learning Integrated with Metacognitive Strategy.	10.12973/iji.2017.10216a	81	9.00	3.72

Table 2 presents the 10 most-cited documents worldwide on the development of creative thinking in education. The ranking of the most cited documents globally provides an overview of the most important contributions to educational creative thinking, based on total citations. Article Ritter and Mostert (2017) in *the Journal of Cognitive Enhancement* topped the ranking, with 197 citations and an average annual citation of 22.89, the most influential of which raised the theme of cognitive-based creativity training. The high citation rate and wide dissemination are driven by the interest in interdisciplinary research and international collaboration in this analysis. Development of *computational thinking* through creative programming (Romero et al., 2017), to innovative

approaches such as *escape rooms* for learning programming (López-Pernas et al., 2019). Other high-citation articles also highlight *problem-based learning* (Ülger, 2018), Integration of Robotics in Early Childhood Education (Muñoz-Repiso & Caballero-González, 2019), and STEAM learning in a digital environment (Wannapiroon & Pimdee, 2022).

Interestingly, the latest publication by Essel et al. (2024), ChatGPT's impact on students' cognitive skills, stands out as the work with the highest normalized citations (40,13), reflecting a rapidly evolving trend in artificial intelligence-based educational research. In terms of patterns, the majority of research focuses on two major directions: (1) the development and testing of innovation-based learning models (*problem-based*, STEAM, *escape room*, digital *classroom*) to increase creativity, and (2) the study of the relationship between creative thinking skills, cognitive factors, and metacognitive strategies. This shows that the most influential literature not only examines the concept of creative thinking theoretically but also emphasizes its application in real contexts, using technology, innovative learning strategies, and assessment instruments. Thus, research in this field is moving from a conceptual approach to integrative practices relevant to modern educational challenges, including the use of AI to support higher-level thinking skills. The prominence of AI and technology, and the focus of publications among the most cited documents, highlight the unique contribution of the 2016–2025 timeframe, as these themes were largely absent in earlier creativity bibliometric studies.

Creative thinking is a key focus in educational research for students, with various interrelated nodes representing subthemes and methodologies related to the concept. Key nodes such as "problem-based learning", "project-based learning", and "STEM" are related to "creative thinking", which emphasizes applying creativity in real-world contexts through problem-solving and STEM-integrated projects. The nodes of "creative", "outcome design", and "college" emphasize the growing role of universities in creative thinking education, indicating a new, divergent direction for research to improve creative thinking skills.

The mapping of research themes in the field of creative thinking education is based on bibliometric analysis; the position of the keywords in the diagram indicates the degree of relevance (centrality) and development (density) for each theme. The results of the analysis show that *students*, *creative thinking*, *education*, and *computing* are in the central position (*core themes*). This shows that these four themes are at the core of the literature, closely related to one another, and serve as the main framework for research on creative thinking education. These findings confirm that the development of students' creative thinking skills remains closely linked to the learning process grounded in computing and educational technology (Chevalier et al., 2020; Romero et al., 2017). In addition, groups of keywords such as creativity, teaching, and critical thinking occupy the basic themes quadrant. These themes are highly relevant, serving as an important foundation in the field of study, but their level of development is relatively low. Thus, although there has been extensive research, there remains ample scope to deepen research on the application of creativity, teaching strategies, and critical thinking skills in the context of 21st-century education (Ritter & Mostert, 2017; Ülger, 2018).

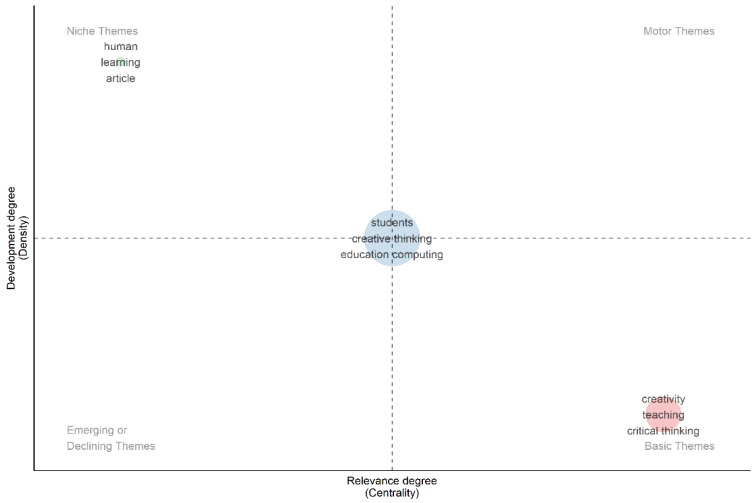


Figure 4. Thematic Map

On the other hand, keywords such as *human*, *learning*, and *article* fall into the niche themes quadrant. This position indicates that the theme is developing quite intensively, but it is more specific and less connected to the core theme. This means that research focused on humans as individual learners or on article-based analysis tends to fill certain gaps, but its contribution to shaping the main discourse in this field is limited (Meyer & Norman, 2020). Meanwhile, *the motor themes* quadrant (dominant themes that are highly developed and relevant) and *emerging or declining themes* (new or declining themes) have not displayed significant keywords. This shows that, despite a strong core and basic theme, research in this area is still in the early stages of development towards a more established motor theme. So this thematic map hints that research on *creative thinking*, *education*, and *computing* still has great potential to develop into *motor themes* in the future, especially if it is associated with new issues such as the integration of artificial intelligence (Alafnan et al., 2023; Essel et al., 2024), digital-based learning, and other learning approaches in 21st-century education.

Figure 4 shows the dynamics of research theme development from 2017 to 2025, based on the frequency of term occurrence in scientific publications. It can be seen that since 2017, topics such as *computational thinking*, *education computing*, *flipped classroom*, *laboratories*, and *medical education* have emerged as initial focuses, indicating attention to technology integration and innovative approaches to learning. Entering the 2019–2020 period, terms such as *creative thinking*, *students*, and *problem-solving became dominant,* with high frequency (characterized by large circle size), indicating an increase in interest in high-level thinking skills as a 21st-century competence. Meanwhile, the latest trends that emerged from 2021 to 2025 show a shift towards more strategic and contextual themes, such as *artificial intelligence*, *problem-solving*, *STEM*, *design thinking*, *creative thinking skills*, and *higher education* and *young adults*.

This indicates that recent research increasingly links creative thinking and problem-solving skills with the use of cutting-edge technology and application at the higher education level. Interestingly, the theme of *human* and *curricula* is only beginning to receive attention in the final phase, indicating a shift in focus towards the human dimension and curriculum policies that are more adaptive to technological developments. Thus, this trend map shows the transition from a focus on innovative learning methods and media to the integration of intelligent technology (AI) and the strengthening of soft skills such as creativity and problem-solving, which have the potential to become the dominant direction of research in the future.

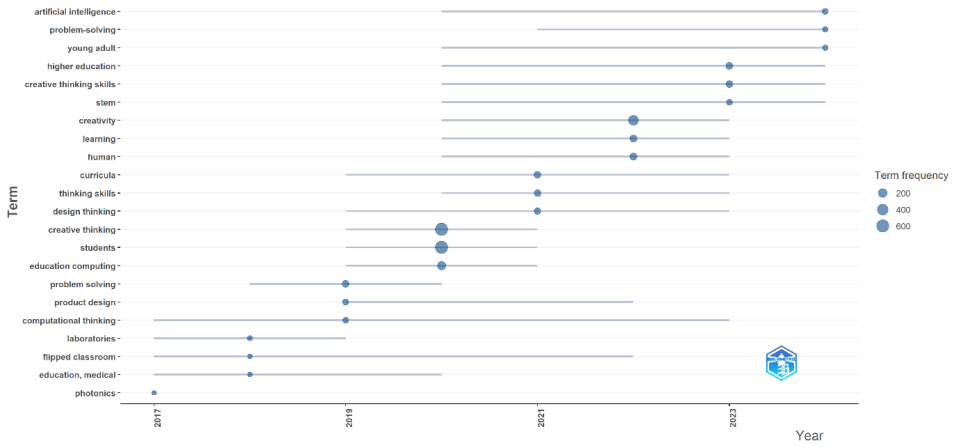


Figure 5. Trending Topics

The keyword analysis identified four main clusters. In STEM education and innovation, a large body of research links creativity with STEM/STEAM education, emphasizing inquiry-based, problem-based, and project-based approaches (Capraro, Capraro, & Morgan, 2013). This reflects a global emphasis on equipping learners with the skills for innovation and workforce readiness. These studies often examine the interaction between creativity and critical thinking, supporting the finding that these skills reinforce each other (Sternberg, 2018). However, some argue that treating the two as separate constructs can simplify the complex relationship between the two (Runco & Jaeger, 2012). Digital learning and technology, a thematic evolution that has increased the focus on creativity in online and blended learning, especially during the COVID-19 pandemic. Research supports the idea that the digital environment can foster collaboration and creativity (Zhang et al., 2024), but others warn that excessive emphasis on technology can obscure the social and cultural dimensions of creativity (Glăveanu, 2020). Moreover, in Teacher education and curriculum development, there is still much research exploring strategies to foster creativity in schools, emphasizing the role of teacher preparation and curriculum innovation (Beghetto & Kaufman, 2014). However, there are still gaps in the class-based empirical studies evaluating the effectiveness of these interventions. This thematic shift demonstrates that the 2016–2025 period captures a transition toward technology-driven, context-sensitive research on creative thinking that was not evident in earlier periods.

The research on creative thinking education highlights the keywords' students' and 'creative thinking' with more frequency in trending topics (Figure 5), confirming the main focus on developing students' creative thinking. The supporting themes, which are also quite dominant, include creativity, education, computing, teaching, and critical thinking, indicating a close link among creativity, the teaching process, technology use, and critical thinking. In addition, other keywords such as *learning systems*, *e-learning*, *design thinking*, *problem-solving, and learning underscore a research direction that integrates digital technology with a problem-solving, innovation-based approach to learning*. The keywords with lower frequency, such as curricula, physics, higher education, surveys, innovation, and thinking skills, enrich the context but are not the main focus. Overall, this treemap shows that the study of creative thinking is student-centered and creativity-centric, with teaching, educational technology, and critical thinking skills as important pillars.

Future research in creative thinking education should focus on integrating AI and big data to analyze students' learning patterns, thereby enabling more personalized and adaptive strategies for developing creativity. In addition, the application of technology-based differentiated learning is important to facilitate each individual's creativity according to their needs and learning styles. On the other hand, interdisciplinary approaches such as STEM–STEAM are also worth exploring, as they can

combine science, technology, the arts, and humanities to spark innovation and creative thinking. Future research should also link creativity to 21st-century skills, namely critical, creative, collaborative, and communicative thinking, which are urgently needed in the face of global challenges. To support this, adaptive digital assessments are needed to assess creativity not only qualitatively but also quantitatively. In addition, inclusive and sustainable education can be the main focus, with creativity seen as a means to solve social and environmental problems. Finally, aspects of culture, curriculum, and education policy need further research to understand how local and global contexts can shape the direction of creativity development in education.

Therefore, future research should be able to review articles by broadening their scope by integrating multilingual and multicultural datasets to ensure inclusivity, focusing on early education to counter the trend of declining creativity in young learners, designing comparative cross-cultural studies to understand contextual differences, and evaluating practical interventions at the classroom level to bridge the gap between theory implementation and practice.

CONCLUSION

Based on the results of the bibliometric analysis of 2016–2025 publications, it can be concluded that research on creative thinking in education has shown rapid development, with consistent publication growth culminating in a peak in 2020–2024. However, it has fluctuated due to external factors such as the pandemic. The increase in publications, the dominance of journal articles, and the high level of international collaboration indicate that this field is becoming an increasingly strategic global concern in addressing the challenges of 21st-century education. The analysis of keywords and conceptual maps revealed two main clusters: conceptual-pedagogical and empirical-evaluative approaches, which complement each other in developing a theoretical framework and in testing the application of creative thinking skills in the classroom. The trend of research topics also shows a shift from the initial focus on *computational thinking* and *flipped classroom* to more complex issues, such as the integration of artificial intelligence, STEM/STEAM, design thinking, and high-level thinking skills (problem-solving, critical thinking, creativity). Recent publications even show a shift toward the use of AI and LLMs (such as ChatGPT) in supporting students' creative thinking skills, marking a new phase in the integration of smart technologies into education. Thus, although this field has developed rapidly, there remains a research gap in theoretical consolidation, empirical testing in real-world contexts of primary-secondary education, and the connection between the curriculum and social, cultural, and policy factors. The future of research needs to be directed toward integrating AI, adaptive digital assessment, interdisciplinary approaches (STEM–STEAM–humanities), and cross-cultural studies to build a more inclusive, relevant, and applicable understanding that fosters creativity in education.

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