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# Exploring the global trends of creative problem solving (CPS): A systematic literature review and bibliometric analysis

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**Abstract** This study aims to conduct a systematic literature review and bibliometric analysis on creative problem solving (CPS) to assess the evolution of research and identify key trends and contributions in the field. Using the systematic literature review (SLR) methodology and bibliometric analysis, the study focuses on articles discussing CPS in the Scopus database, which has yielded 9,543 publications from 1937 to 2025. Data were analyzed using VOSviewer to visualize trends and collaboration networks. Findings reveal that CPS research is predominantly led by the United States, with key affiliations at the University of Arizona, and the top publication source being Frontiers in Psychology. Research focus is distributed across various fields such as education, psychology, and engineering, with a noticeable increase in publications since 2016. These findings reflect a growing global interest in CPS, in line with the increasing recognition of the importance of creative thinking skills in the 21st century. The dominance of Western countries in publication and research highlights the need to expand research focus to regions such as Asia and Africa. This study contributes to the development of CPS theory by providing a broader overview of gaps in the literature and offering a new methodology for CPS research. Practically, these findings can assist curriculum developers and policymakers in designing interventions aimed at fostering creative skills across various educational and industrial sectors.

**Keywords:** research trends, curriculum, creative skills, educational sectors, industrial sector

## 1. Introduction

Creative problem solving (CPS) has emerged as a pivotal skill in addressing the complex, uncertain, and often ill-defined problems that characterize contemporary challenges across disciplines. Defined as a cognitive-emotional process involving the generation of novel, useful solutions within diverse contexts (Oppert et al., 2022), CPS integrates divergent and convergent thinking, reflective evaluation, and often collaborative engagement (Willemsen et al., 2024a). Its significance is particularly evident in education, where cultivating CPS competencies has been linked to improved learning outcomes, adaptability, and innovation-readiness (Hether, 2023; Kumnuansin et al., 2022).

Despite a growing corpus of empirical studies addressing CPS across domains such as public administration (Giedraitytė & Smaliukienė, 2024), primary and secondary education (Keleş, 2022b; Lee et al., 2023), engineering (Maker, 2020; Oppert et al., 2022), and digital pedagogy (Nasongkhla & Sujiva, 2022), significant theoretical and methodological gaps remain. First, conceptual inconsistencies persist regarding the operationalization of CPS attributes. Some studies emphasize cognitive components (e.g., divergent thinking), while others highlight affective, motivational, or contextual aspects (Bagassi & Macchi, 2020; He & Wong, 2021). Second, many existing studies adopt limited analytical scopes—often framed within specific geographic or curricular contexts—thus lacking generalizability and cross-domain insight. Furthermore, few studies have systematically mapped the landscape of CPS scholarship using integrative methodologies such as systematic literature review (SLR) and bibliometric analysis.

In response, this study employs a dual methodological framework—SLR and bibliometric analysis—to comprehensively examine the state of global research on CPS. While SLR allows for thematic synthesis and critical appraisal of peer-reviewed evidence (Creswell, 2014), bibliometric analysis provides quantitative insights into publication trends, author collaboration networks, and research frontiers (Donthu et al., 2021; Sucilestari et al., 2025a). Integrating these methods offers a robust approach to trace how CPS has evolved conceptually, methodologically, and geographically over time. For instance, recent Scopus-indexed studies reveal an uptick in CPS-related publications from 2019 to 2024, reflecting increased interdisciplinary interest and the expansion of open-access dissemination, particularly in psychology, education, and engineering (Chen & Chang, 2024; Liu et al., 2023; Van Hooijdonk et al., 2024).

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The contribution of this research is threefold. Theoretically, it bridges fragmented perspectives on CPS by identifying convergences and divergences in its conceptualization. Methodologically, it introduces a replicable framework that combines qualitative synthesis with bibliometric mapping, thereby facilitating evidence-based research navigation. Practically, it offers stakeholders such as educators, curriculum developers, and policy-makers an evidence-grounded compass for designing CPS-oriented interventions that align with 21st-century skill demands (Kumnuansin et al., 2022).

What distinguishes this study from prior reviews is its dual analytic scope, drawing simultaneously from narrative synthesis and bibliometric visualizations to provide a multidimensional portrayal of CPS scholarship. Unlike conventional reviews, which often rely on descriptive aggregation, this study identifies epistemic structures, thematic clusters, and emerging trends through co-citation, keyword co-occurrence, and publication network analyses. This integrative perspective not only highlights influential works and authors but also illuminates underexplored domains, such as affective-cognitive integration and context-sensitive implementation strategies.

In sum, this research contributes to advancing the scientific discourse on creative problem solving by offering an empirically enriched, methodologically innovative, and conceptually clarifying synthesis of global scholarship. The findings are expected to guide future inquiries and foster a more coherent, practice-relevant understanding of CPS as both a pedagogical goal and a foundational competency for the knowledge society.

This study focuses on exploring the current landscape of CPS research and evaluating the ongoing relevance of this topic as a focal point for future research. The study also reviews the evolution of the academic discourse on Creative Problem Solving and aims to identify how this field can contribute to leadership theory and organizational practice. The research questions addressed are: [RQ1]**:** Does the exploration of creative problem-solving remain a relevant and significant subject for scholarly inquiry in the future?; [RQ2]**:** What is the distribution and current publication trend of research on creative problem-solving within academic literature?; [RQ3]**:** What are the theoretical contributions and practical implications derived from existing studies on creative problem-solving, and how can these findings guide future research?

This study utilizes a systematic literature review (SLR) and bibliometric analysis to address three research questions. The SLR method is ideal for synthesizing existing research, identifying gaps, trends, and future directions, while providing evidence-based insights that can inform policy, practice, and future studies. Complementing this, bibliometric analysis quantifies the distribution and impact of CPS-related publications, using VOSviewer and the Scopus database to analyze publications across various journals up to July 27, 2025. This methodology offers a comprehensive mapping of the field's development, enhancing understanding of the growth and future trajectory of CPS research.

## 2. Materials and Methods

A systematic literature review using a bibliometric approach evaluates the literature quantitatively to identify trends, patterns, and key research entities within a specific field of study. By utilizing frameworks such as PRISMA, this approach ensures a comprehensive and replicable review process, providing a clear and transparent overview of the topic under investigation (Sucilestari et al 2025a). The inclusion criteria established for this review are as follows: (1) articles published up to July 27, 2025, (2) publications in English, and (3) a focus on the topic of creative problem solving. Bibliometric analysis was performed using VOSviewer software to visualize bibliographic data, such as citation networks, author collaboration, and co-occurrence of keywords, revealing the intellectual structure and dynamics of the research field.

The combination of a systematic review and bibliometric analysis assists researchers in synthesizing empirical findings and mapping the landscape of research activity, including identifying key contributors and emerging trends. The integration of both approaches provides a comprehensive understanding of the development, historical flow, and future directions of the research field, offering valuable insights for interdisciplinary studies. Bibliometric analysis is also employed for strategic purposes in scientific publishing. The initial phase of this study involves keyword selection, which can be conducted using a macro (top-down) methodology, beginning with broad search pathways and narrowing down to specific studies and topics. After evaluating the limitations in previous research and the scarcity of studies addressing creative problem solving, this study focuses on the keyword "creative problem solving" in the title, abstract, and keywords of articles. Additionally, the Scopus database was used by the researchers for various investigative purposes, including conducting the literature review, identifying field experts, and monitoring research trends.

Figure 1 illustrates the process flow for article selection in the systematic literature review and bibliometric analysis related to Creative Problem Solving (CPS). Based on the literature search conducted on July 27, 2025, through the Scopus database, a total of 9,543 documents were retrieved using the keywords "creative AND problem AND solving" in the article title, abstract, and keywords. In the initial screening phase, 8,610 articles were excluded as they did not contain the specific keyword "creative problem-solving," leaving 933 articles for further consideration. Subsequently, articles were excluded based on document type, which included conference proceedings (467), book chapters (61), review articles (19), books (4), retracted publications (1), and editorials (1), resulting in a total of 380 eligible articles.

The next screening phase excluded articles based on language, specifically those published in Japanese (4), Spanish (2), Portuguese (1), Persian (1), Korean (1), and German (1), narrowing the selection to 371 articles. Further refinement was conducted by excluding articles based on access type: Gold (64), Green (61), Hybrid Gold (21), and Bronze (12). This process

resulted in a final set of 121 articles deemed eligible for inclusion. At the final inclusion stage, articles were filtered based on subject area, retaining only those categorized under Social Sciences (66 articles), Psychology (37 articles), and Environmental Science (3 articles). Ultimately, 87 articles were included in the systematic literature review.

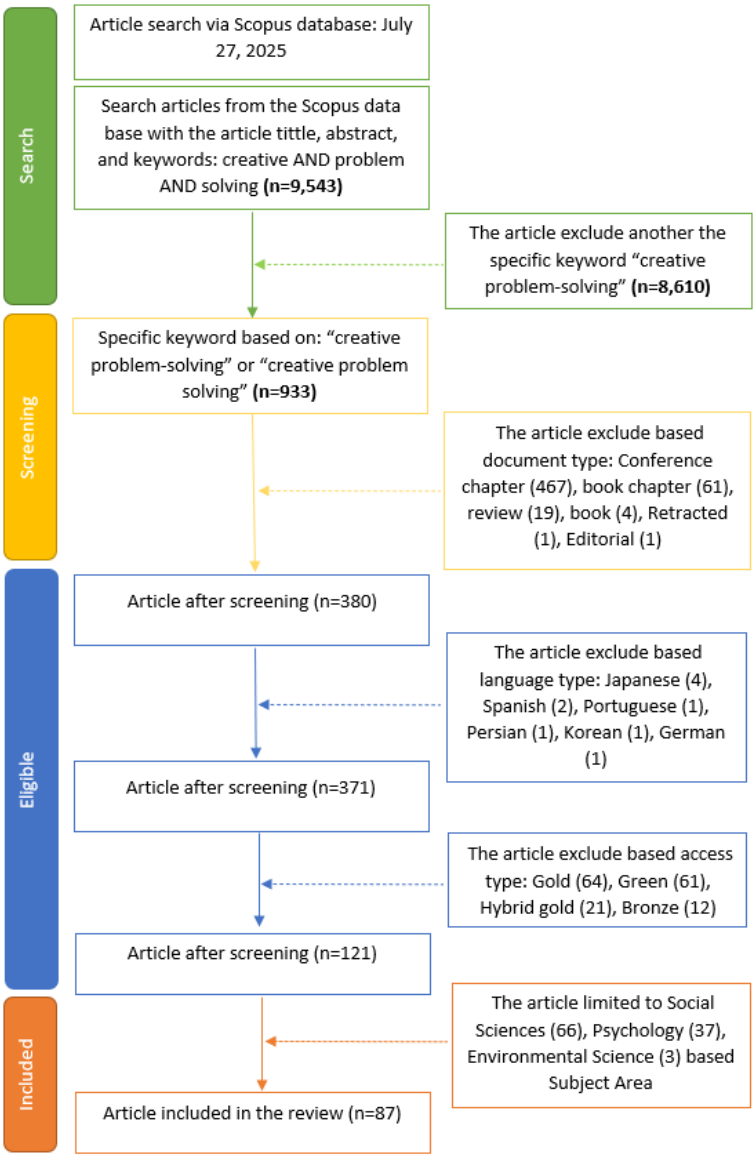


**Figure 1** Systematic literature review information flow using PRISMA.

## 3. Results

The findings of this study focus on the results from 87 articles in the Scopus database regarding creative problem solving. This data was obtained by identifying the number of articles published, publication trends over the years, and the journals in which these articles were published. The study also highlights the most influential elements in creative problem solving, including the authors, institutional affiliations, and the countries contributing to this field.

### *3.1. RQ 1: Does the exploration of creative problem-solving remain a relevant and significant subject for scholarly inquiry in the future?*

Figure 2 illustrates that, based on data obtained from the Scopus database, scholarly work on creative problem solving has been limited over the past two decades, with only 87 articles published. Exploration of creative problem solving has progressively developed in the last decade, particularly since 2016. The initial study was conducted by Kandemir and Gür (2009) titled "The use of creative problem solving scenarios in mathematics education: views of some prospective teachers," which marked the emergence of the term now widely known as creative problem solving.

Currently, the development of research on creative problem solving is gaining significant attention from a large number of academics, with a focus on learning models (Fathonah et al., 2024), student higher thinking (Trisnayanti et al, 2023), 21-st

century learning (Kumnuansin et al., 2022), elementary science education (Van Hooijdonk et al., 2023; Willemsen et al., 2024a), multidisciplinary education (Kim & Lee, 2022). In addition, creative problem solving has also made significant contributions to the formation of public management competencies (Giedraitytė & Smaliukienė, 2024), education management (Chen & Chang, 2024), and action learning (Nasongkhla & Sujiva, 2022).

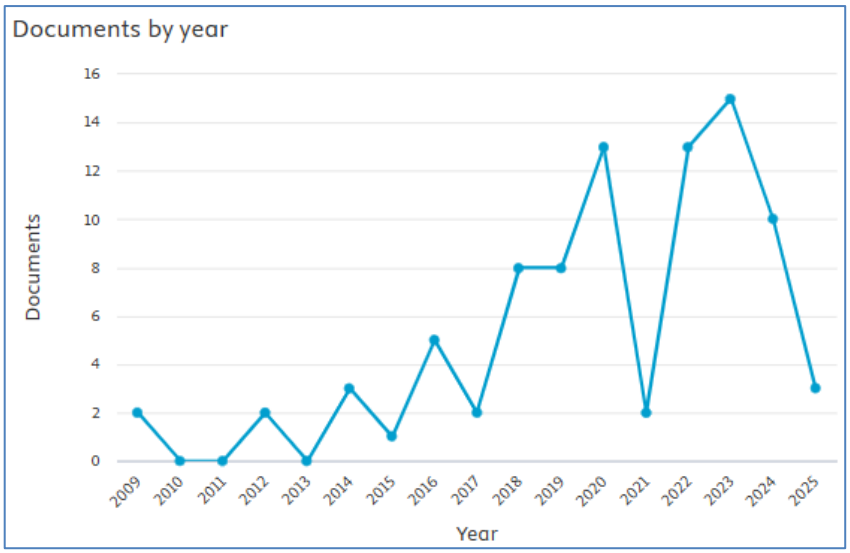


**Figure 2** Distribution articles by year. *Source:* Scopus data base.

Since 2009, literature on creative problem solving has remained limited due to the lack of research published in reputable journals. This creates an opportunity for future researchers to fill this gap. This study plays a crucial role in enriching the understanding of creative problem solving, which positively impacts the development of this competency in preparing individuals to face the increasingly uncertain challenges of life. With the foundation of creative problem solving instilled in each individual, particularly students, they will be better equipped to innovate and solve problems they encounter wisely and intelligently. This approach can encourage a deeper understanding of the implementation of creative problem solving across various dimensions of life.

*3.2. RQ2: What is the distribution and current publication trend of research on creative problem-solving within academic literature?*

Figure 3 presents the distribution of research on creative problem solving across various countries and regions. An analysis of 83 articles was conducted, categorizing them based on classifications such as country, region, affiliation, source, and authors, with a limitation to the top 10 articles in each category. This in-depth analysis of the allocation of studies on CPS offers valuable insights for both academics and practitioners, particularly in guiding the development of future research agendas and the advancement of sustainable 21st-century skills paradigms. The United States led the distribution with 21 articles, followed by China with 7 articles, the Netherlands and the United Kingdom with 6 articles each, Canada with 5 articles, Thailand with 5 articles, Australia with 4 articles, Germany with 4 articles, Indonesia with 4 articles, and Japan with 4 articles.

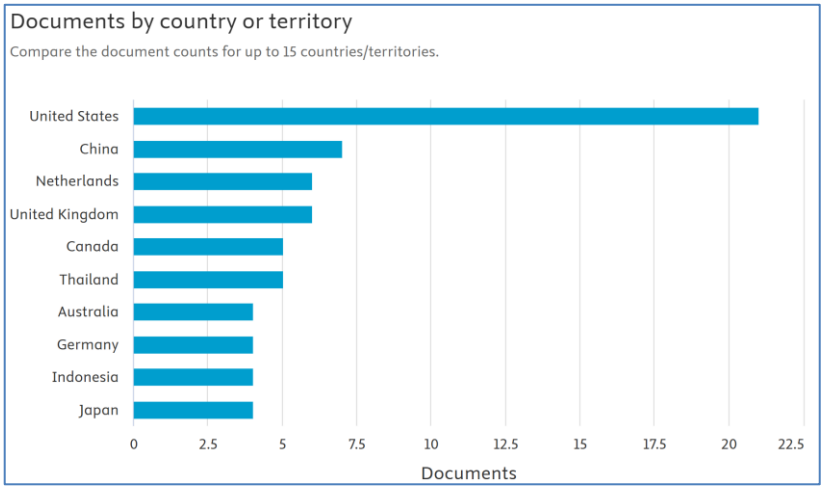


**Figure 3** Distribution articles by country. *Source:* Scopus data base.

Figure 4 illustrates the relationships between countries involved in creative problem solving research, as analyzed using VOSviewer software. The distribution of scientific studies related to CPS by country or region reveals the dominant presence of the United States with 21 manuscripts, followed by China with 7 manuscripts. Several other countries have also made notable contributions to this field, including the Netherlands and the United Kingdom, each with 6 articles, Canada and Thailand, each with 5 manuscripts, and Australia, Germany, Indonesia, and Japan, each with 4 manuscripts. These findings underscore the global relevance of creative problem solving, demonstrating that the topic has garnered significant attention not only in European and American countries but also in Asian and Australian nations. This trend reflects the rapid progress made by these countries in the development of innovative solutions and products. The analysis of these country relationships is a critical step in formulating a comprehensive and forward-looking research agenda.

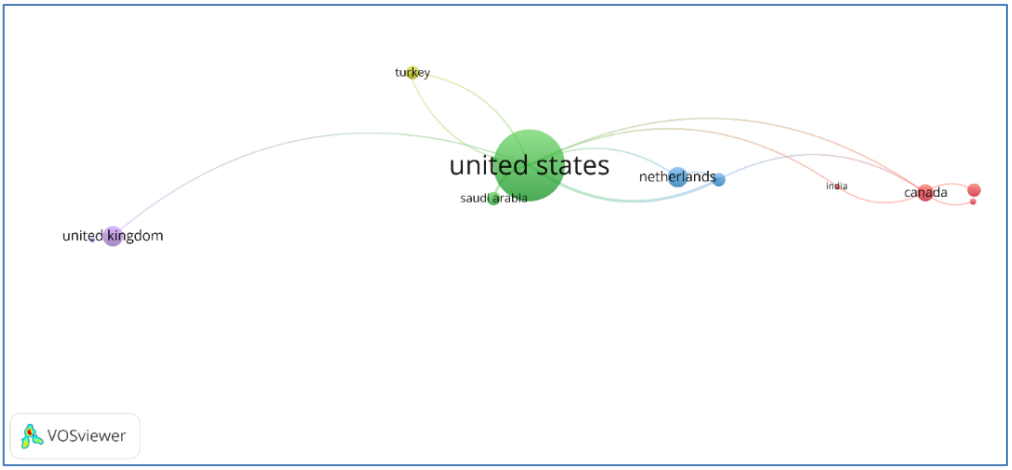


**Figure 4** Network country visualization.

Figure 5 highlights the allocation of scientific studies related to creative problem solving based on institutional affiliation. These findings further reinforce the idea that creative problem solving is not only a topic of interest in Western-majority countries but is also gaining traction in various other regions. The concept of CPS is highly relevant and applicable in nearly every country striving to integrate it into multiple dimensions of life. In terms of institutional affiliation, The University of Arizona (United States) leads with 8 articles, followed by Radboud University (Netherlands) with 5 articles, and Utrecht University (Netherlands) with 4 articles. Other significant contributors include Pennsylvania State University (United States), The University of British Columbia (Canada), Leiden University (Netherlands), Chulalongkorn University (Thailand), and the University of Georgia (United States), each with 3 articles. Additionally, The Chinese University of Hong Kong (China) and The University of Waikato (New Zealand) each contributed 2 articles.

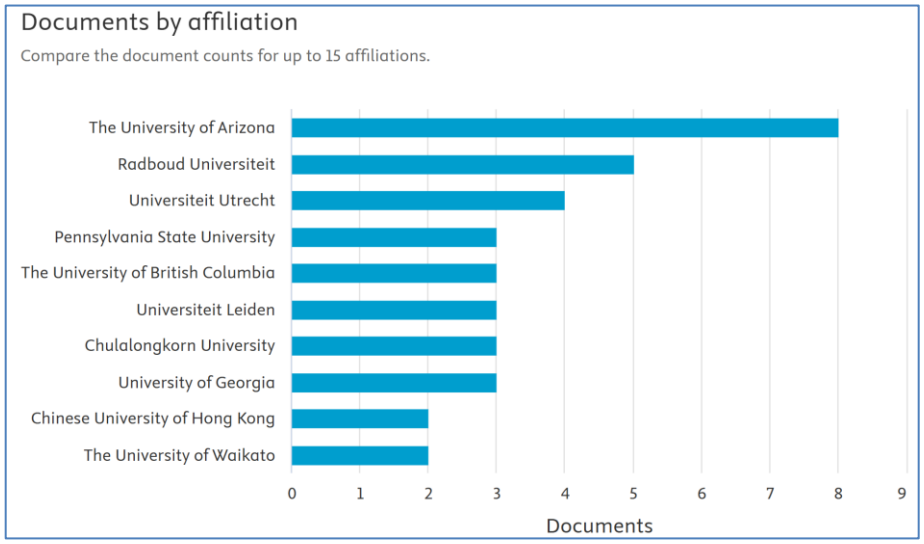


**Figure 5** Distribution articles by affiliation. *Source:* Scopus data base.

Figure 6 illustrates the distribution of studies on creative problem solving based on publication sources. The findings demonstrate that scientific interest in CPS is not confined to academic institutions in Western countries (such as the United States and Europe), but also attracts considerable attention from educational institutions in Asia and Australia. In terms of

publication sources, Frontiers in Psychology leads with 9 articles, followed by Journal of Creative Behavior with 6 articles. Other notable journals include Journal of Advanced Academics and Thinking Skills and Creativity, each with 4 articles, and International Journal of Emerging Technologies in Learning with 3 articles. Additionally, Education Sciences, Eurasia Journal of Mathematics Science and Technology Education, European Journal of Engineering Education, Frontiers in Education, and International Journal of Information and Education Technology each contributed 2 articles.

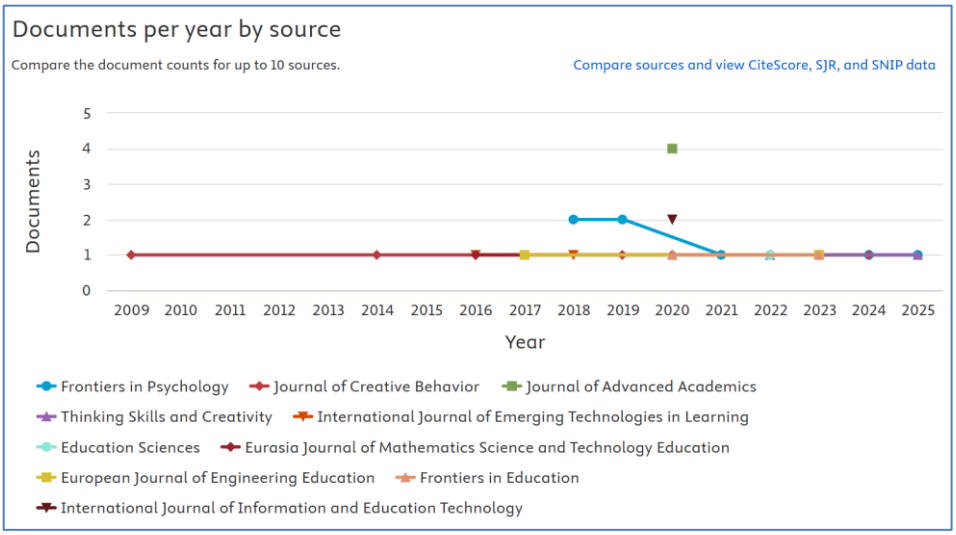


**Figure 6** Number of Article by Sources (top 10 sources). *Source:* Scopus data base.

Figure 7 illustrates the distribution of articles by author, based on data from the Scopus database. The chart shows the number of documents authored by the top 10 contributors in the field of creative problem solving. Maker, C.J. (6 documents) is the leading author with the highest number of publications, followed by Kroesbergen, E.H. (5 documents) and Mainhard, T., (4 documents) each with a significant number of articles. Other authors, including Pease, R., Van Hooijdonk, M., and Van Tartwijk, J., also contributed 3 documents to the field. The data reflects the prominent authors in the CPS research area, highlighting their contributions to advancing knowledge and understanding of creative problem-solving methodologies.

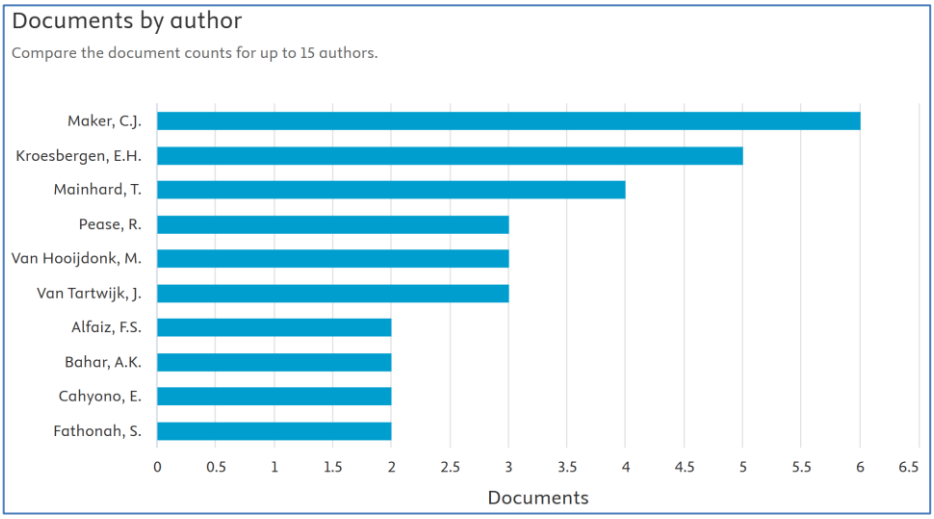


**Figure 7** Number of Article by author (top 10 sources). *Source:* Scopus data base.

*3.3. RQ3: What are the theoretical contributions and practical implications derived from existing studies on creative problem-solving, and how can these findings guide future research?*

The examination was conducted on 87 manuscripts collected from the Scopus repository. VOSviewer software was used to indicate that the results may have both theoretical and pragmatic implications for future research on Creative Problem Solving (CPS). The metadata analysis using VOSviewer will assist researchers and practitioners in understanding the assumptions and findings related to Islamic leadership more effectively. The bibliometric analysis using VOSviewer can highlight which variables have been extensively researched by previous scholars and which ones have been less explored, thus providing a foundation for future studies. From a practitioner's perspective, the literature analysis using VOSviewer will aid in the

sustainable application of Creative Problem Solving in the future and promote its integration into educational institutions worldwide.

Based on Figure 8 and Table 1, the emergence of topics related to Creative Problem Solving according to keyword analysis shows a strong connection between these concepts. Based on their frequency in the table, it can be seen that Creative Problem Solving appeared 48 times, followed by creative problem-solving (43 times), and creativity (22 times). This reflects that creativity and creative problem-solving are the main focus in the accumulated literature. Moreover, topics such as problem solving (10 times), students (6 times), and divergent thinking (6 times) also appear significantly, indicating that creative problem-solving is closely linked to the development of divergent thinking skills in students and the application of related concepts in education. Topics like humans, physiology, and controlled study appeared less frequently, but still underscore the importance of human factors and controlled research approaches in understanding the dynamics of creative problem-solving. Overall, this data provides insight into the significance of creative problem-solving in various aspects of life, particularly in the context of education, creativity, and the development of critical thinking skills involved in solving complex problems.

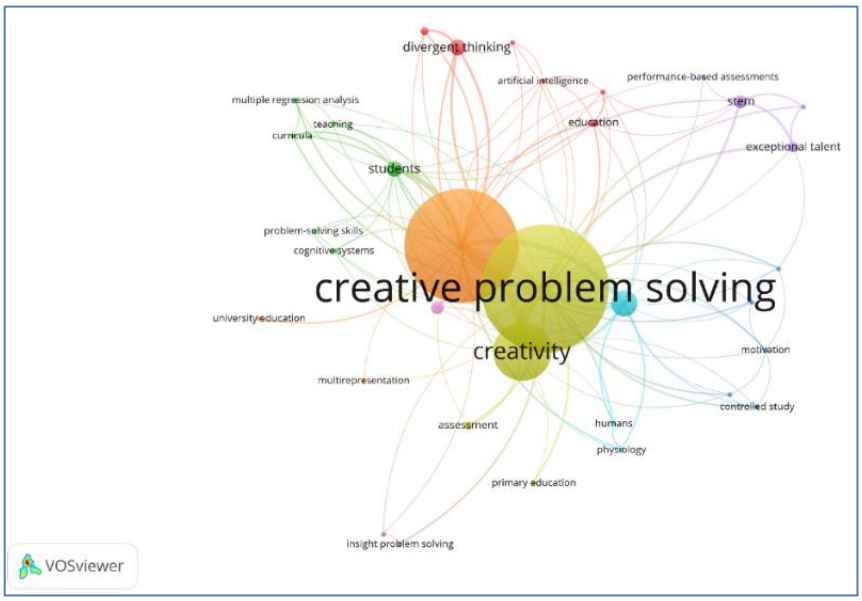


**Figure 8** Keywords by authors.

**Table 1** Keywords by authors.

| Rank | Keyword | Occurences | Total link strength |
|---|---|---|---|
| 1 | Creative problem solving | 48 | 81 |
| 2 | Creative problem-solving | 43 | 81 |
| 3 | Creativity | 22 | 52 |
| 4 | Problem solving | 10 | 51 |
| 5 | Students | 6 | 26 |
| 6 | Humans | 2 | 17 |
| 7 | Physiology | 2 | 17 |
| 8 | Controlled study | 2 | 14 |
| 9 | Divergent thinking | 6 | 13 |
| 10 | Education | 3 | 13 |

## 4. Discussion

Creative problem solving (CPS) is an approach used to solve problems in innovative and distinct ways, emphasizing both divergent and convergent thinking abilities. Divergent thinking refers to the ability to generate a wide range of creative ideas, while convergent thinking involves evaluating and selecting the best solution. CPS plays a crucial role in enhancing an individual's ability to solve complex and poorly defined problems, skills that are highly sought after in the 21-st century. CPS can be viewed as a process that involves problem identification, the generation of new ideas, the selection of the best solution, and the implementation of that solution (Isaksen et al., 2016; Van Hooijdonk et al., 2023).

Table 2 summarizes the key elements of CPS, which involves a systematic, iterative process of understanding challenges, generating ideas, evaluating solutions, and planning actions. It combines divergent and convergent thinking, influenced by individual differences, communication, critical thinking, and creativity. CPS is enhanced by collaboration and open learning

environments, encouraging diverse perspectives. The process requires reflective thinking, the ability to adapt knowledge across situations, and involves iterative refinement of ideas. These factors collectively foster effective, innovative problem-solving across various fields.

**Table 2** Defining elements of creative problem-solving.

| No. | Define factors of creative problem solving | References |
|---|---|---|
| 1 | A systematic process involving understanding the challenge, generating multiple and original ideas, evaluating them, and planning for action to solve complex problems. Uses tools such as brainstorming and evaluation techniques, with a focus on improving fluency, flexibility, and originality in generating and solving problems. | Kumnuansin et al. (2022) |
| 2 | It requires reflective and unbiased thinking, transferring knowledge to varying situations. | Kim (2022) |
| 3 | The process involves generating various solutions and evaluating them to address complex problems. | Giedraitytė and Smaliukienė (2024) |
| 4 | Creative problem solving is influenced by individual differences such as perception and learning styles. | Keleş (2022a) |
| 5 | It is associated with skills like communication, critical thinking, and creativity. | Oppert et al. (2022) |
| 6 | Divergent and convergent thinking are core modes in problem-solving, with divergent thinking generating ideas and convergent thinking evaluating them. | Willemsen et al. (2024b) |
| 7 | The process is iterative and applied across various phases such as research question construction and evidence evaluation. | Nonthamand and Songkhla (2018) |
| 8 | Open learning environments and collaboration help enhance creative problem-solving by encouraging diverse perspectives. | Oppert et al. (2022) |
| 9 | A series of iterative activities that include understanding the challenge, generating various ideas, and preparing and planning the implementation of solutions effectively. Involves a combination of divergent thinking to generate many ideas and convergent thinking to evaluate and select the best solution. | Isaksen et al. (2016) |
| 10 | A systematic, collaborative process that involves understanding complex problems, generating diverse and original ideas, gathering relevant information, and selecting the most effective solutions. It combines creativity and domain knowledge, encouraging the sharing of ideas and feedback to refine and implement practical solutions. | Van Hooijdonk et al. (2023) |
| 11 | Emphasizes the importance of a deep understanding of the challenges faced to generate more effective and innovative ideas. | Isaksen et al. (2016) |
| 12 | Involves answering unfamiliar problems correctly, using divergent and convergent thinking processes. It requires the ability to hypothesize and reflect on potential solutions. | He and Wong (2021) |
| 13 | Defined as questioning, reframing, and reflecting to find innovative solutions. Includes a longer creative process, consisting of various stages like understanding the challenge, generating ideas, preparing for action, and planning your approach. | Nasongkhla and Sujiva (2022) |
| 14 | Enhances creativity through iterative processes of generating, testing, and refining ideas for innovative problem-solving. | Bagassi and Macchi (2020) |
| 15 | Involves a cyclical process of divergent thinking (generating ideas) and convergent thinking (refining and selecting the best solutions) to develop creative solutions for open-ended problems. | Willemsen et al. (2024a) |
| 16 | Focuses on using a combination of different knowledge domains, engaging in collaborative learning, and applying problem-solving techniques that foster creativity and innovation. | Nonthamand and Songkhla (2018) |
| 17 | Involves critical thinking and the ability to adapt to new situations while creatively solving problems, leveraging both individual knowledge and group collaboration. | Giedraitytė and Smaliukienė (2024) |

Key indicators of CPS include the ability to think openly, critical thinking, flexibility in dealing with poorly defined challenges, and the capacity for collaboration. In CPS, group discussions and diverse perspectives often lead to the best ideas, making collaboration a crucial factor in the process (Nonthamand & Songkhla, 2018). In addition, the ability to reflect on the solutions found and adapt to changing situations is also an important indicator of CPS (Kim, 2022; Ling et al., 2023; Takase et al., 2020; Urban & Urban, 2023). CPS is not only useful in problem-solving but also in enhancing the creative and innovative skills required in various contexts, both in education and the workplace (Giedraitytė & Smaliukienė, 2024; Maker, 2020; McCrum, 2017; Van Hooijdonk et al., 2022). In the field of education, CPS can help students develop the skills to solve complex problems and encourage deeper critical thinking. For example, in science education, CPS enables students not only to understand theoretical concepts but also to apply that knowledge in real-world situations (Willemsen et al., 2024a; Arizona et al., 2025). In the workplace, CPS is crucial for innovation, product development, and improving efficiency in solving complex

operational problems. Research shows that individuals trained in CPS are better able to adapt to changes and find creative solutions in uncertain situations (Oppert et al., 2022).

Various approaches have been implemented to enhance CPS in different educational contexts. One such approach is the use of cloud-based adaptive learning systems. Kumnuansin et al. (2022) developed this system to be tailored to individual students' abilities. Their research demonstrated that this system significantly improved post-learning test scores, highlighting its effectiveness in enhancing creative problem-solving skills. The system utilizes Platform as a Service (PaaS) and Software as a Service (SaaS) models, enabling collaboration and knowledge sharing among students, which further supports the creative learning process.

In addition, multidisciplinary educational programs have also proven to be effective in enhancing CPS. Kim and Lee (2022) studied the impact of the SMICE (Science, Mathematics, and Informatics Convergence Education) program on secondary school students in Korea. They found that this program was more effective in enhancing problem analysis skills and algorithm execution compared to general software education. However, the challenge of integrating core concepts in STEAM education highlights the need for further efforts to ensure the effectiveness of multidisciplinary programs (Kim, 2022). On the other hand, the aesthetic appreciation of the environment also plays a role in developing CPS. Research by Quaye et al. (2023) indicates that aesthetic elements in the surrounding environment can enhance students' creative thinking abilities, especially in the context of visual arts. These findings emphasize the importance of art teachers' involvement in integrating aesthetics into the learning process to support students' creativity development.

CPS has also been applied in public management. Giedraitytė & Smaliukienė (2024) examined the implementation of CPS at the Lithuanian Military Academy and found that integrating CPS into the curriculum helped students develop skills such as creativity, critical thinking, and teamwork. Despite challenges in its implementation, such as the need for additional time in the curriculum, CPS has proven to foster innovative solutions in the public sector.

Furthermore, research by Nonthamand et al. (2018) revealed that collaboration in learning can enhance CPS. Open learning environments that encourage group discussions and the sharing of diverse perspectives can strengthen creative problem-solving skills. This finding highlights that collaboration is a key factor in CPS development. CPS has also been applied in basic science education. That instructional support can improve students' convergent thinking abilities, though there was no significant improvement in divergent thinking. This suggests that the techniques used may not yet fully stimulate divergent thinking in elementary students (Willemsen et al., 2024b).

Finally, gender differences in CPS have also been explored. He et al. (2021) found that men showed greater variability in creativity scores compared to women, particularly in figural creativity, although there were no significant differences in average divergent thinking or creative problem-solving scores between men and women. These findings highlight the importance of analyzing variability in creativity to better understand gender differences in CPS. Overall, CPS is not only beneficial for enhancing problem-solving skills but also for developing creative and innovative thinking abilities, which are crucial for personal and professional development. Therefore, CPS should be an integral part of educational curricula at various levels and applied across industries to support improved quality and productivity (Kim & Lee, 2022; He et al., 2021).

CPS involves a systematic and iterative process that helps individuals address complex challenges by generating and evaluating various potential solutions. It starts with understanding the problem, followed by generating a wide range of original and diverse ideas. These ideas are then refined through a process of convergent thinking, where the most practical and effective solutions are selected for implementation. CPS is deeply rooted in both divergent thinking, which fosters creativity by encouraging the generation of multiple ideas, and convergent thinking, which focuses on narrowing down ideas to choose the best solution. The cyclical nature of this process ensures that ideas are continually tested, evaluated, and improved (Kumnuansin, 2022; Willemsen, 2024a).

An important aspect of CPS is reflective thinking, where individuals engage in unbiased reflection and transfer knowledge from one context to another, helping to adapt solutions to different situations (Kim, 2022). Additionally, collaboration plays a key role in CPS. The process encourages the sharing of ideas among team members, where feedback is used to refine and enhance the solutions, making it a collaborative effort to ensure more comprehensive and creative outcomes (Oppert, 2022; Van Hooijdonk, 2023; Asyari et al., 2024). Furthermore, CPS is not just about generating ideas; it is about applying domain-specific knowledge to refine those ideas into practical solutions. This integration of creativity with subject-specific expertise enables individuals to approach problems innovatively while maintaining practical feasibility (Isaksen et al., 2016; He & Wong, 2021).

Creative problem solving involves several key indicators that encompass important aspects of the creative thinking and problem-solving process. Figure 9 illustrates the CPS model, which includes five main elements: Fluency, Flexibility, Originality, Critical Evaluation, and Solution Implementation. These five elements are interconnected and form a continuous cycle within the CPS process. Each element plays a crucial role in generating innovative and effective solutions, with a dynamic approach and critical evaluation at each stage. The sources used in this model include various recent studies in the field.

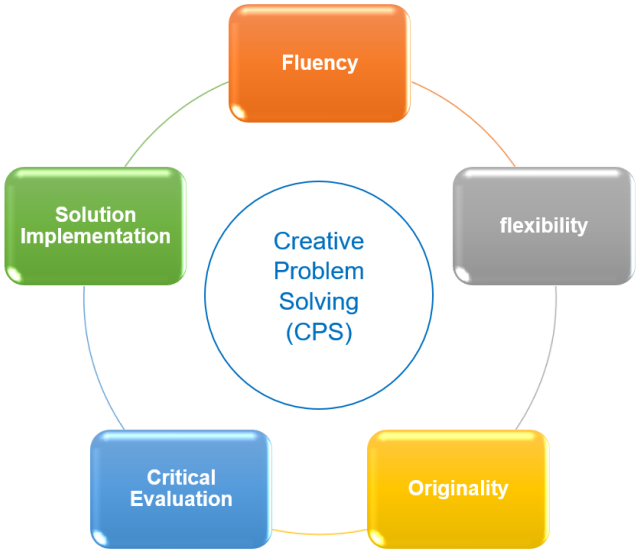


**Figure 9** Creative problem solving indicators.
*Sources:* (Andresen & Dahl, 2023; Bagassi & Macchi, 2020; Bin & Zhu, 2020; Chen & Chang, 2024; Fathonah et al., 2023, 2024; Giedraitytė & Smaliukienė, 2024; He & Wong, 2021; Hether, 2023; Keleş, 2022b; Keleş, 2022a; Kim, 2022; Kim & Lee, 2022; Kumnuansin et al., 2022; Loesche et al., 2018; Maker et al., 2023; Nasongkhla & Sujiva, 2022; Nonthamand & Songkhla, 2018; Oppert et al., 2022; Quaye et al., 2023; Trisnayanti et al., 2023; Van Hooijdonk et al., 2020; Van Hooijdonk et al., 2022; Van Hooijdonk et al., 2023 ; Van Hooijdonk et al., 2024; Willemsen et al., 2024a; Yasunaga et al., 2020; Yokozuka et al., 2021)

Fluency is the ability to generate a large number of ideas or solutions in a short amount of time, reflecting how many different approaches can be found for a given problem. This demonstrates an individual's capacity to think quickly and broadly in producing solutions (Kumnuansin, et al., 2022; Willemsen, et al., 2024b). Next, Flexibility refers to the ability to switch between various approaches or perspectives, as well as to adjust ideas in response to changes in situations or problems encountered. This flexibility is crucial for adapting solutions based on an ever-changing context (He & Wong, 2021; Sucilestari et al., 2025b). Originality focuses on the ability to generate unique, novel, and unconventional solutions, thereby distinguishing the solutions from those previously existing. This aspect of originality is vital in generating new and unexpected creative ideas (Oppert, et al., 2022). Critical Evaluation assesses how well an individual can evaluate ideas or solutions based on criteria such as feasibility, effectiveness, and impact, to select the best solution most suited to the existing challenge. Critical evaluation is a key skill in assessing various available solutions and choosing the most effective one (Van Hooijdonk, et al., 2023; Willemsen, et al., 2024b). Finally, Solution Implementation measures an individual's ability to plan and execute the chosen solution, as well as to assess its success based on certain criteria, such as efficiency, desired outcomes, or impact achieved. This also includes the ability to adapt the solution in response to changing needs or challenges that arise during the implementation process (Kumnuansin, et al., 2022). Indikator-indikator ini memberikan kerangka yang komprehensif untuk menilai kemampuan berpikir kreatif dalam menyelesaikan masalah, dengan fokus pada pencapaian hasil yang efektif dan terukur These indicators provide a comprehensive framework to assess creative thinking abilities in problem-solving, with a focus on achieving effective and measurable results.

The results of this study indicate that CPS remains a relevant and significant topic in scientific research, although the number of existing publications to date is relatively limited. Based on an analysis of 87 articles indexed in the Scopus database, it was identified that although CPS was first introduced in 2009 by Kandemir and Gür (2009), interest in this topic has only developed progressively since 2016 (Arizaga et al., 2016; Isaksen et al., 2016; Karyotaki & Drigas, 2016). This development, particularly in the context of education and the development of 21st-century skills, highlights a gap in the literature, presenting a significant opportunity for future researchers to delve deeper into aspects of CPS that have not been explored in depth, especially concerning education and the development of creative competencies to tackle increasingly complex challenges (Chen & Chang, 2024; Keleş, 2022b; Maker et al., 2023; Martinsen & Furnham, 2019; McCrum, 2017; Nakagawa, 2020; Van Hooijdonk et al., 2023; Yokozuka et al., 2021). This research plays a crucial role in enriching the understanding of CPS, while also providing a solid theoretical foundation for integrating CPS into various dimensions of life, both in the context of formal education and its application in the public and professional sectors (Gauselmann & Tempel, 2025; Maker & Bahar, 2025; Thakur et al., 2024; Xia et al., 2025).

The distribution of publications identified in this study also highlights significant engagement from various countries, with the United States dominating the landscape by contributing 21 articles, followed by China, the Netherlands, and the United Kingdom. These findings illustrate that CPS is not only a concern in countries with advanced educational systems in the West but is also gaining traction in Asian and Australian nations, which are increasingly recognizing the importance of creativity in education and innovation development. The participation of these countries further affirms that CPS is a global and applicable

topic across nearly all cultural contexts and education systems (Azevedo et al., 2019; Giedraitytė & Smaliukienė, 2024; Gilhooly et al., 2015; Isaksen et al., 2016; Kim & Lee, 2022; Kumnuansin et al., 2022; Martinsen & Furnham, 2019; Milovanović & Kopas-Vukašinović, 2014; Nonthamand & Songkhla, 2018; Takase et al., 2020; Van Hooijdonk et al., 2020). Further analysis using bibliometric software such as VOSviewer reinforces the understanding of the growing network of international collaboration. Through these collaborative efforts, countries share findings and experiences in integrating CPS into their education systems, which in turn contributes to the advancement of CPS research and its global applications. This also demonstrates that CPS has become a transcendent issue, connecting nations from different parts of the world in a collective effort to develop innovative solutions to educational challenges and societal development (Abbood, 2023; Giedraitytė & Smaliukienė, 2024; Ling et al., 2023; Sio et al., 2024; Thakur et al., 2024; Urban & Urban, 2023; Van Hooijdonk et al., 2024; Yoorubsuk & Maneewan, 2022).

In terms of theoretical contribution, the findings of this study confirm that CPS has a significant impact on the development of critical and creative thinking skills, particularly within educational contexts. Tfhe emphasis on keywords such as creativity, problem solving, and divergent thinking in the analyzed literature indicates that the development of divergent thinking and creative problem-solving abilities lies at the core of CPS research. Thus, CPS is not merely concerned with finding solutions, but also with sharpening the capacity for creative and critical thinking—skills that are essential for addressing complex and unpredictable challenges (Fathonah et al., 2023; Kim & Lee, 2022; Kumnuansin et al., 2022; Lee et al., 2023; Quaye et al., 2023). Therefore, the implementation of CPS in education holds great potential to support both students and professionals not only in developing technical competencies, but also in equipping them with the cognitive flexibility to consider multiple possible solutions. In an era marked by rapid and dynamic global changes, adaptability and innovation are crucial, positioning CPS as a foundational approach in preparing individuals to face global challenges (Chen & Chang, 2024; Giedraitytė & Smaliukienė, 2024; Nonthamand & Songkhla, 2018).

Furthermore, these findings introduce a CPS model that comprises five key elements: fluency, flexibility, originality, critical evaluation, and solution implementation. These five elements form a continuous and highly interdependent cycle within the creative problem-solving process, where each component reinforces and enriches the others (He & Wong, 2021; Trisnayanti, et al., 2023). For instance, fluency enables individuals to generate a large number of ideas within a relatively short period, while flexibility allows them to adapt and shift approaches in response to changing contexts. Originality challenges individuals to produce unique and unconventional ideas, whereas critical evaluation underscores the importance of selecting ideas based on criteria such as effectiveness and feasibility. Finally, solution implementation focuses on applying the chosen solutions and evaluating their success based on the achievement of desired outcomes. This model not only offers a robust theoretical framework for understanding CPS but also provides practical guidance applicable across various educational and training contexts to systematically develop creative thinking and problem-solving skills.

Overall, this study makes a significant contribution to enriching the CPS literature and opens up opportunities for further research aimed at deepening the understanding of how CPS can be implemented more effectively across various sectors of life. It also offers valuable insights for education practitioners and policymakers to more fully integrate CPS into curricula and educational policies, in order to better prepare future generations to be innovative, creative, and capable of addressing the challenges of an ever-changing world. By mapping trends and the distribution of CPS research, as well as identifying underexplored areas, this study provides a solid foundation for future research that can bridge existing knowledge gaps and promote the broader and more global development of CPS.

## 5. Final Considerations

This study reveals that creative problem solving (CPS) continues to evolve as an important topic in global research, with a growing focus across various disciplines such as education, psychology, engineering, and public management. The analysis results show that although CPS research has increased since 2016, the available publications remain limited, with the majority of articles coming from developed countries such as the United States and Europe. The study also finds that CPS contributes significantly to the enhancement of critical thinking, creativity, and adaptability, which are essential in the 21st century, both in education and industry. Geographically, CPS research is dominated by countries such as the United States and China, with a focus on learning models, basic science education, and multidisciplinary education. However, there is a need to expand the focus of this research to regions like Asia and Africa to enhance the inclusiveness and global relevance of this topic. Additionally, bibliometric analysis shows that while CPS topics are already published in various reputable journals, areas such as the integration of affective-cognitive aspects and context-based implementation strategies are still rarely explored.

Based on these findings, it is recommended to expand CPS research in African and Asian countries and strengthen interdisciplinary research to fill the gaps in the current literature. Future studies should also consider developing more inclusive methodologies by integrating context-based approaches to improve CPS application across sectors. Furthermore, future research could delve deeper into the role of CPS in leadership development and its contribution to organizational development across various fields.

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**Ethical Considerations**

Not applicable.

**Conflict of Interest**

The authors declare that they have no conflicts of interest.

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