



BIBLIOMETRIC INSIGHTS INTO RESEARCH TRENDS AND COLLABORATIVE EFFORTS IN CREATIVITY AND CRITICAL THINKING IN HIGHER EDUCATION

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ABSTRACT

This study examines the role of creativity and critical thinking in higher education through bibliometric analysis, aiming to identify trends and gaps in the literature. Analyzing 588 documents from 2020 to 2023, key themes such as student engagement, instructional design, and sustainable development were identified. The findings underscore sustained research interest in higher education, creativity, and critical thinking, with a growing focus on creativity-related topics in recent years. Collaboration among authors and international partnerships was notable, highlighting the importance of cross-border knowledge exchange in addressing global challenges. The study emphasizes the need for innovative teaching methods and curriculum design to foster creativity and critical thinking effectively, informing strategies to enhance educational quality and prepare students for the demands of the 21st century.

ABSTRAK

Penelitian ini mengkaji peran kreativitas dan pemikiran kritis dalam pendidikan tinggi melalui analisis bibliometrik, dengan tujuan untuk mengidentifikasi tren dan kesenjangan dalam literatur. Dengan menganalisis 588 dokumen dari tahun 2020 hingga 2023, tematik utama seperti keterlibatan siswa, desain pembelajaran, dan pembangunan berkelanjutan diidentifikasi. Temuan menunjukkan minat penelitian yang berkelanjutan dalam pendidikan tinggi, kreativitas, dan pemikiran kritis, dengan peningkatan fokus pada topik terkait kreativitas dalam beberapa tahun terakhir. Kolaborasi antara penulis dan kemitraan internasional sangat mencolok, yang menunjukkan pentingnya pertukaran pengetahuan lintas-batas dalam mengatasi tantangan global. Studi ini menekankan perlunya metode pengajaran dan desain kurikulum yang inovatif untuk mengembangkan kreativitas dan pemikiran kritis secara efektif, yang akan membantu dalam meningkatkan kualitas pendidikan dan mempersiapkan siswa menghadapi tantangan abad ke-21.

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INTRODUCTION

Creativity is characterized by the ability to deal with ideas of expression and produce unique and useful results (Chrysochoou et al., 2022; Da Silva Bertossi et al., 2023; Trinidad, 2023). It is often qualified by its outcome but can be associated with a specific process that is likely to produce creative artifacts in design (Hu et al., 2023; Koçak & Soylu, 2023; Laamanen et al., 2023). A creative design process is a special type of design that generates innovative ideas (Alt et al., 2023; Liudmyla et al., 2022; Naqvi et al., 2023). Guilford pointed out that creativity is closely related to the ability to reconstruct problems and reinterpret thinking, which leads to freedom from fixation when developing logical solutions (Fischer & Barabach, 2023; Linh et



al., 2023; Ubah & Ogbonnaya, 2021). New ideas emerge from a new combination of existing knowledge and ideas found in experiments. Designers can find solutions based on processes such as problem interpretation, memory exploration, and adoption of relevant knowledge (Hu et al., 2023; Samdani et al., 2023; Tortorella et al., 2023). Cross argued for a design way of knowing that was distinct from scientific and academic ways of knowing (Dehtjare & Uzule, 2023; Malik et al., 2023; Uddin et al., 2023).

Creative design thinking can be a powerful way to motivate various design ideas by allowing an interactive understanding of ill-defined design issues (Bachnik et al., 2022; Brady & Katre, 2021). Accordingly, many researchers and educators have attempted to find effective ways to stimulate students' creative thinking, and they emphasize the importance of design education (Laamanen et al., 2023; Malik et al., 2023; Mareque & de Prada, 2023). Transitions between divergence and convergence thinking often occur throughout creative design idea generation. Dorst studied the core of design thinking to generate ideas, defined reasoning patterns derived from design, and emphasized abduction as a basic reasoning pattern for creative thinking (Liu et al., 2023; Silva et al., 2023; Tam, 2023). Enhancing creativity is crucial in design fields and helps students discover their visions, acquire core expertise and knowledge, and understand the professional philosophy and foundation of the design process.

Students can intensively demonstrate their creative skills while learning during the design process and engaging in communication, discussion, and knowledge acquisition methods. Creative thinking has become a way to lead students' creativity and innovation, teach creative problem-solving, and improve or rediscover creative confidence. In the university education environment, each field has its basic characteristics. The higher education system is an active area where research, teaching, and learning processes are based on interaction, sharing, and production at the forefront rather than on theoretical processes (Maiti et al., 2023; Sáez-López et al., 2023).

Creativity and critical thinking are representative cognitive abilities that are considered important in higher education. The classrooms are a unique educational area in which students require creative abilities and communication skills. Higher education courses are the most fundamental part of academic education where students acquire practical and theoretical knowledge and creatively transform that knowledge into solutions. Higher education has a complex and interdisciplinary structure based on comprehensive and abstract concepts. Nevertheless, it can be a powerful way to allow an interactive understanding of complex issues and motivate additional innovative ideas (Alt et al., 2023; Setyosari et al., 2023).

The approach to teaching and learning consists of repetitive reflections and representations throughout the educational process (Jugembayeva & Murzagaliyeva, 2023; Meng, 2022). In terms of the education aspect, how new teaching techniques change the role of creative thinking in higher education needs to be identified rather than just experimenting with techniques. However, despite the recognized importance of creative thinking in higher education, there remains a gap in understanding how to effectively cultivate and assess creative thinking skills among students. Therefore, employing bibliometric analysis can provide valuable insights into current research trends and methodologies used in promoting creative thinking in higher education settings. This study aims to bridge this gap by analyzing the existing literature on creative thinking in higher education using bibliometric methods, shedding light on effective strategies and areas for further research and development.

RESEARCH METHODS

This study employs a quantitative methodology, following the structured approach outlined by Firdaus et al. (2019). Initially, it involves designing the research, which encompasses formulating relevant research questions, identifying key keywords associated with creative thinking, and selecting appropriate databases for data retrieval. Subsequently, data collection proceeds using a shortlisting technique to gather pertinent information. The collected data undergoes bibliometric analysis, facilitated by Biblioshiny, aiding in data interpretation as recommended by Jones and Gatrel (2014).

Following the analysis, the study advances to interpret the results obtained and makes predictions regarding potential avenues for future research endeavors. Moreover, it identifies research gaps, pinpointing areas requiring further investigation, and offers recommendations for synthesizing existing studies. These sequential stages are visually represented in Figure 1, enhancing comprehension of the study's methodology and progression.

Furthermore, this research methodology allows for a comprehensive understanding of the landscape of creativity and critical thinking research in higher education. By systematically following the outlined stages, the study ensures rigor and reliability in data collection and analysis. The integration of bibliometric analysis offers insights into publication trends, influential authors, and emerging themes in the field. Through this approach, the study aims to contribute to the advancement of research in creativity and critical thinking in higher education by identifying areas for further exploration and providing guidance for future studies in the domain.

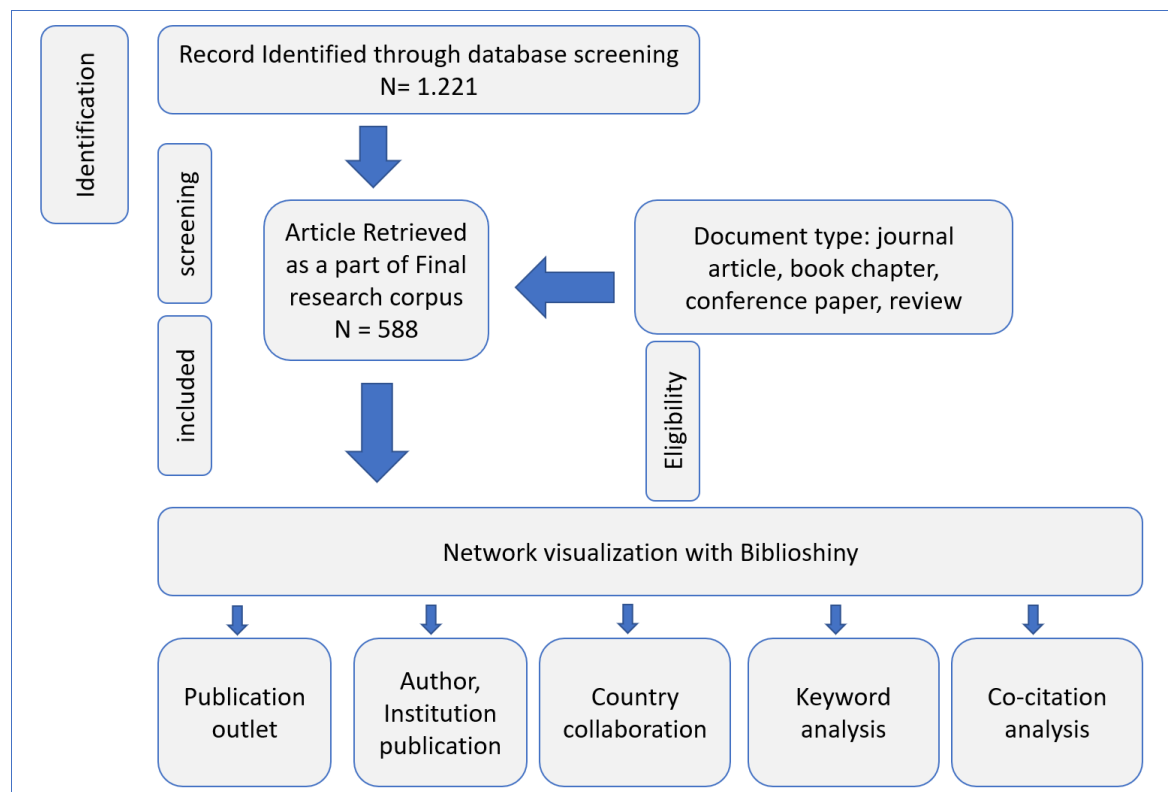


Fig. 1. Process of data screening and visualization

Database, keywords, and inclusion criteria

Data were extracted from the Scopus database, in April 2024 to reach the relevant information in this study. Scopus is best suited for bibliometric analysis and includes publications from top journals (Korom 2019). The data analyzed in the period 2020-2023 regarding creative thinking and higher education. To facilitate a suitable search, the search term ("creativity" OR "creative thinking") AND "higher education" is used to search for keywords, abstracts, and titles so that initial results are obtained from as many as 1.408 documents. This research is limited to research only. Related to creative thinking and higher education which produced 588 (articles), then articles focusing on creative thinking and higher education were selected for the final analysis.

Bibliometrics Analysis

The analysis in this study initiates with bibliometric statistics, encompassing two primary analyses. Firstly, a performance analysis evaluates various parameters such as authors, affiliations, and countries, utilizing a bibliographic index constructed from data citations and author affiliations. This assessment provides insights into the productivity and impact of authors and institutions in the field of creativity and critical thinking in higher education. Additionally, it helps identify key contributors and their affiliations, offering a comprehensive overview of research activity in the domain.

Secondly, a science mapping analysis is conducted to extract data map social structures, and research cognitive networks. This approach allows for a visualization of the connections between different research areas, highlighting emerging trends and areas of collaboration. Figure 2 illustrates the workflow employed for this purpose, providing a visual representation of the analytical process. Through science mapping, the study aims to uncover hidden patterns and relationships within the literature, aiding in the identification of key themes and research directions.

Data analysis unfolds in two stages, employing inductive analysis (Seuring and Müller, 2008). Initially, bibliometric analysis is performed to identify publication trends, influential authors, and collaboration networks. This quantitative assessment provides a foundation for understanding the research landscape. Subsequently, network mapping is conducted to delve deeper into the relationships among research topics and contributors, offering valuable insights into the structure of the field. The statistical software R is utilized for data analysis, seamlessly integrating bibliometric analysis and graphical representation via an integrated data visualization tool facilitated by Biblioshiny.

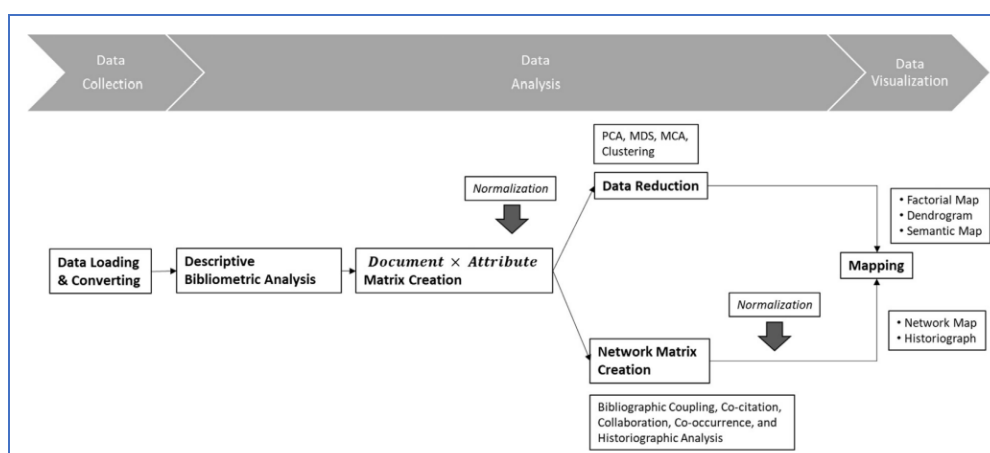


Fig. 2. Main methodology's phases-adapted from Aria and Cuccurullo (2017) and Firdaus et al. (2019).



RESULTS AND DISCUSSIONS

This study employs comprehensive bibliometric statistical descriptions encompassing authorship, citation indicators, institutional affiliations, and countries of origin. Each category undergoes thorough analysis utilizing a range of techniques, including but not limited to (1) Annual Publication Trends, (2) Authorship and Institutional Patterns, (3) Identification of Leading Journals, (4) Topic Dendrograms, (5) Collaboration Maps among countries, and others. Subsequent subsections delve deeper into additional analyses conducted within each category, providing a comprehensive overview of the findings.

Trend Analysis On Creative Thinking And Higher Education

The data obtained from Biblioshiny provides insights into the bibliometric analysis conducted for the period from 2020 to 2023. The analysis covers a total of 362 sources, including journals and books, resulting in 588 documents. The annual growth rate stands at 6.55%, indicating a steady increase in the number of documents over the years. On average, the age of the documents is 2.4 years, suggesting that the dataset comprises relatively recent publications. Each document receives an average of 7.219 citations, indicating the impact and relevance of the research within the scholarly community. Interestingly, there are no references listed, indicating that the analysis might focus more on document content rather than citing external sources.

In terms of document contents, there are 768 Keywords Plus and 1890 Author's Keywords identified, providing a comprehensive overview of the topics covered in the documents. The analysis also highlights the involvement of authors, with a total of 1734 authors contributing to the documents. Among them, 107 authors are credited with single-authored documents. Collaboration among authors is evident, with an average of 3.1 co-authors per document, and approximately 18.88% of collaborations are international. Document types mainly include articles, with 583 articles identified, along with a small number of article-related documents seen in Table 1.

Table 1. Main Information from Biblioshiny

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2020:2023
Sources (Journals, Books, etc)	362
Documents	588
Annual Growth Rate %	6.55
Document Average Age	2.4
Average citations per doc	7.219
References	0
DOCUMENT CONTENTS	
Keywords Plus (ID)	768
Author's Keywords (DE)	1890



Description	Results
MAIN INFORMATION ABOUT DATA	
AUTHORS	
Authors	1734
Authors of single-authored docs	107
AUTHORS COLLABORATION	
Single-authored docs	111
Co-Authors per Doc	3.1
International co-authorships %	18.88
DOCUMENT TYPES	
article	583
article article	5

Publication outlets

The data on Most Relevant Sources provides insights into the key journals or sources where significant research related to the analyzed topic has been published. Among the top sources, "Sustainability" from Switzerland stands out with 24 articles, indicating its significant contribution to sustainability-related research. Following closely is "Education Sciences" with 19 articles, emphasizing the importance of educational research in the field. "Thinking Skills and Creativity" is another notable source, reflecting the focus on fostering critical and creative thinking skills in education.

Other prominent sources include "Frontiers in Psychology" with 14 articles, highlighting the psychological aspects of education and creativity. "Journal of Higher Education Theory and Practice" and "Frontiers in Education" also make significant contributions, emphasizing research on higher education practices and innovations. Additionally, journals like "International Journal of Environmental Research and Public Health," "International Journal of Learning, Teaching and Educational Research," and "Education and Training" further contribute to the discourse on education, learning, and environmental research. Overall, these sources represent a diverse range of disciplines contributing to the understanding and advancement of topics related to education, sustainability, and creativity seen in Figure 3.

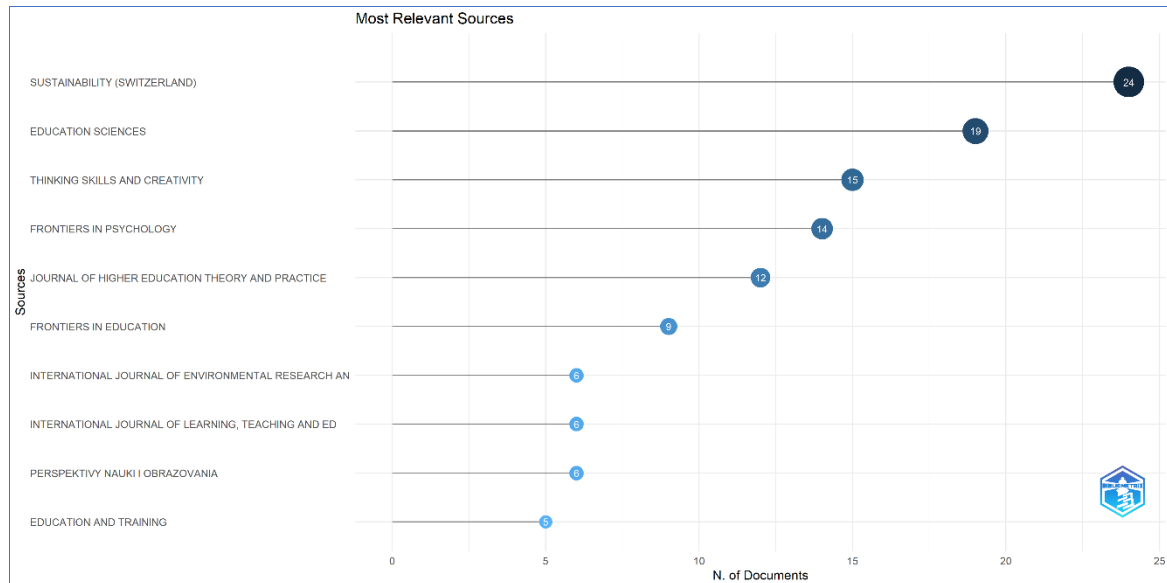


Fig 3. Publication Outlet

Authors and their affiliated institutions

The data on Most Relevant Authors highlights the researchers who have made significant contributions to the analyzed topic, along with the number of articles they have authored and their fractionalized contribution. Ioannou A, Loizides F, Mavri A, Morais E, and Oleksiyenko AV each have authored four articles, indicating their substantial involvement in the field. Among them, Oleksiyenko AV stands out with a fractionalized value of 3.50, suggesting a higher degree of contribution per article. Other authors like Abad-Segura E and González-Zamar MD have authored three articles each, demonstrating their notable involvement in research related to the topic. Each author's fractionalized value provides insight into their relative contribution compared to the total number of articles.

Additionally, the Most Relevant Affiliations data identifies the institutions where significant research related to the analyzed topic has originated. The University of Granada leads with 10 articles, indicating its substantial contribution to the field. Following closely are Appalachian State University and the University of Trás-os-Montes e Alto Douro, each with eight articles, emphasizing their active involvement in research related to the topic. Other notable affiliations include the School of Engineering and Sciences, Imam Abdulrahman Bin Faisal University, and Kerman University of Medical Sciences, among others. These affiliations represent diverse academic institutions contributing to research in the field.

The prominence of specific authors and affiliations underscores their significant role in advancing knowledge within the analyzed domain. Collaborations between authors from different institutions may lead to interdisciplinary research outcomes, enriching the overall understanding of the subject matter. Furthermore, the concentration of research output in certain institutions highlights potential hubs of expertise and collaboration opportunities for further advancement in the field can be seen in figure 4 and figure 5.

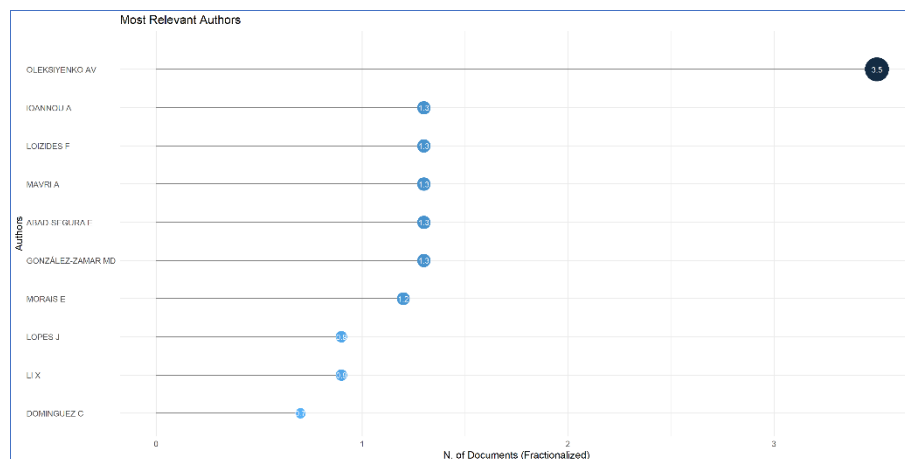


Fig. 4 Most Relevant Authors

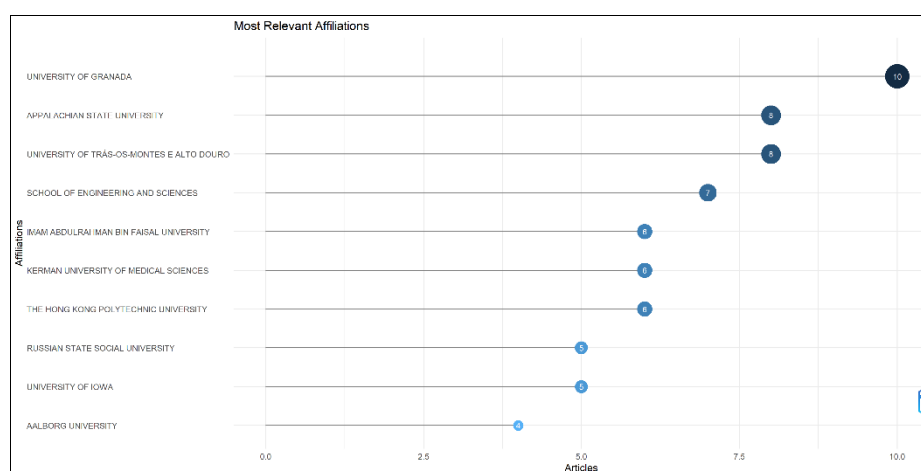


Fig. 5 Most Relevant Affiliations

Citation analysis

The table presents the Most Global Cited Documents based on their total citations and citation metrics. These documents have been highly cited within the scholarly community, indicating their significant impact and relevance in the field. However, it's noteworthy that the DOI (Digital Object Identifier) information is not available for these papers. Among the top cited documents, "Kumar P, 2020" from "Invest Oper" stands out with the highest total citations of 42. This paper has received an average of 8.40 citations per year, indicating sustained interest and influence over time. The normalized TC (Total Citations) value of 3.46 suggests a relatively high impact compared to other documents in the dataset.

Similarly, "Rizwan A, 2021" and "Martínez Garcés J, 2021" have also received notable citations, each with 14 total citations. These papers have an average TC per year of 3.50, indicating consistent recognition within the scholarly community. Their normalized TC values of 1.42 further emphasize their impact relative to the dataset can be seen in figure 6.

Other documents in the list, such as "Rakib M, 2020" and "Kim Y, 2021," have received fewer citations but still demonstrate relevance in the field. These papers contribute to the overall body of knowledge, with citation metrics ranging from 1.00 to 0.41. Despite lower citation counts, they still hold importance within their respective research contexts.



Overall, the Most Global Cited Documents table provides valuable insights into the documents that have made a significant impact in the field, based on their citation metrics. These papers contribute to the advancement of knowledge and serve as important references for further research and academic discourse.

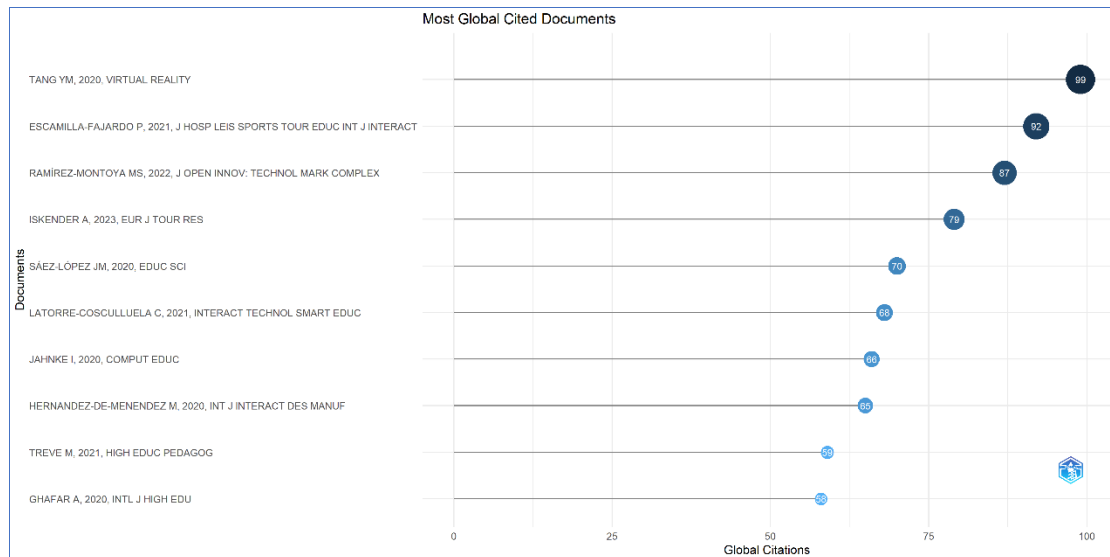


Fig. 6. Most Global Cited Documents

Keyword analysis

Thematic map

The Thematic Map table provides insights into the occurrences and thematic clusters of words within the analyzed dataset. Each row represents a specific word or theme, along with its occurrences, thematic cluster, cluster label, and centrality metrics. For instance, "instructional design" appears 5 times in the dataset and is clustered under "instructional design" with a betweenness centrality of 159.788, closeness centrality of 0.002, and PageRank centrality of 0.004. This indicates that instructional design is a prominent theme within the dataset, connecting various other themes or concepts.

Similarly, "active learning" is another significant theme with 12 occurrences, clustered under "active learning." This theme demonstrates a higher betweenness centrality of 177.997, indicating its importance in connecting different concepts within the dataset. Additionally, "sustainable development," "blended learning," "communication skills," "problem-based learning," and "soft skills" are also grouped under the "active learning" cluster, suggesting their association with this broader theme.

Furthermore, the table highlights themes related to "higher education" such as "higher education," "creativity," and "innovation." These themes have relatively high occurrences and centrality metrics, indicating their significance within the analyzed dataset. The centrality metrics provide insights into the importance of each theme in connecting various concepts, with higher centrality values indicating stronger connections and influence within the dataset. Overall, the Thematic Map table offers a structured overview of the main themes and their relationships within the analyzed dataset, facilitating a better understanding of the underlying content and concepts can be seen in Figure 7.

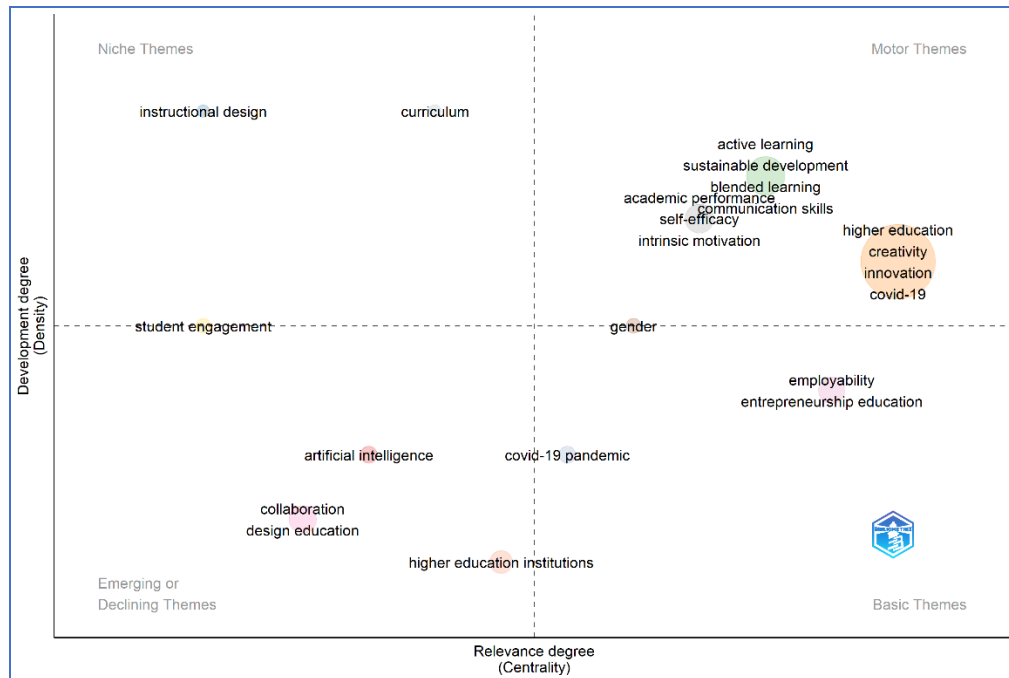


Figure 7. Thematic Maps-based Authors

Keyword

The Word Cloud table presents the most frequently occurring terms in the analyzed dataset, offering insights into the central themes and topics discussed. Notably, "creativity" emerges as the most prevalent term, indicating a significant focus on fostering creative thinking and innovation within the context under study. Following closely are terms like "students," "higher education," "learning," and "education," suggesting a strong emphasis on student-centered learning approaches and the broader landscape of higher education. These terms reflect the key areas of interest within the dataset, highlighting discussions around teaching practices, student engagement, and the evolving role of higher education institutions in facilitating learning and creativity among students.

Moreover, the presence of terms such as "teaching," "student," and "article" underscores the scholarly context of the dataset, indicating a focus on pedagogical methods, student experiences, and academic discourse. Additionally, terms like "human" and "humans" suggest discussions on the human aspects of education, possibly focusing on the role of individuals in the learning process or human-centric approaches to education. Overall, the Word Cloud provides a concise overview of the dominant themes and concepts present in the dataset, guiding further exploration into the topics of creativity, student learning, and the dynamics of higher education can be seen in figure 8.



Figure. 8. Word cloud of Islamic Character Education

Trend topics

The Trend Topic table provides an overview of the frequency of specific terms within the analyzed dataset over different years, indicating the evolving trends in research focus. Terms like "adult," "psychology," and "curricula" show relatively lower frequencies, indicating their presence in the dataset but not as prominently as other terms. "Higher education" and "education" are consistent themes across the years, with higher frequencies, suggesting sustained research interest in these areas. Notably, "creativity" and "students" emerge as significant topics, with the highest frequencies among all terms, indicating growing attention towards fostering creativity and understanding student learning experiences. The frequency distribution across years also reveals evolving trends; for example, "creativity" shows an increasing trend from 2021 to 2023, indicating a rising interest in exploring creativity-related topics in recent years can be seen in figure 9.

Furthermore, terms like "university sector" and "human" demonstrate fluctuating frequencies across the years, indicating varying levels of research focus or emerging interests in specific topics. "University sector" shows an increase in frequency from 2020 to 2021 before stabilizing, suggesting a possible shift in research attention towards university-related aspects during this period. Similarly, "human" demonstrates a peak frequency in 2021 and 2022, indicating a sustained focus on human-centric topics within the dataset. Overall, the Trend Topic table offers insights into the changing landscape of research interests over time, highlighting key topics of focus and the dynamic nature of research trends in the analyzed domain.

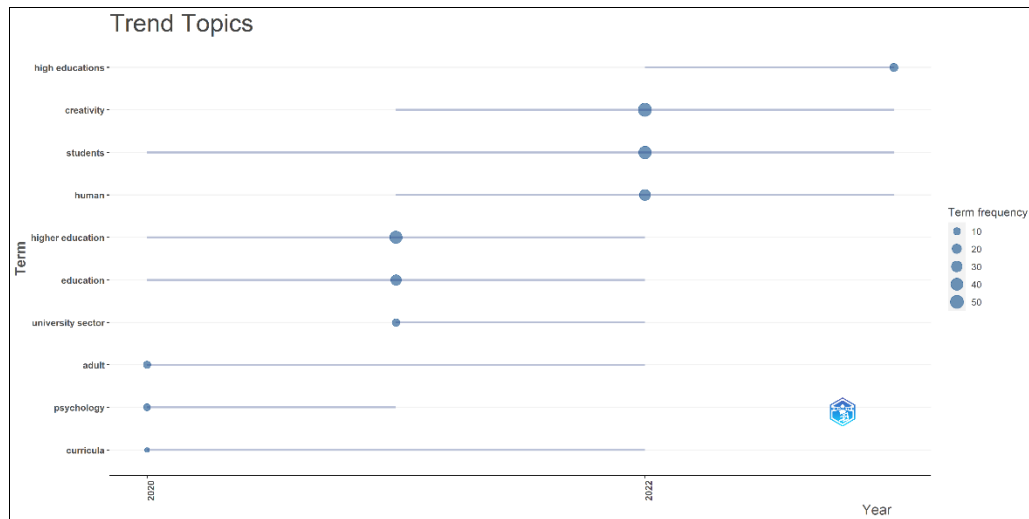


Figure 9. Trend Topics of Islamic Character Education

CONCLUSIONS

The analysis highlights the importance of fostering creativity and student engagement in higher education. Findings indicate that higher education consistently remains a primary research focus, alongside creativity and student learning experiences. Trends shifting from year to year depict the dynamic changes in research interests, with an increasing focus on creativity-related topics in recent years. The emphasis on cultivating critical thinking skills also reflects significant challenges in developing these skills within higher education institutions. Additionally, author collaboration and the emergence of international cooperation in research underscore the importance of cross-border collaboration in addressing global challenges in education. In conclusion, this research provides valuable insights into research trends and focuses, guiding future efforts to enhance higher education, facilitate creativity, and improve student learning experiences.

Moreover, bibliometric analysis identifies key topics dominating the literature, such as higher education, creativity, and critical thinking skills, which are integral parts of current educational curricula. These findings reinforce the importance of paying attention to the development of students' creative and critical skills at the higher education level. Furthermore, the increasing interest in creativity-related topics indicates a response to the need for innovation in the learning and teaching processes. Collaboration among authors and international partnerships also highlights the significance of cross-border knowledge exchange in advancing educational research. With a better understanding of relevant research trends and focuses, higher education institutions can develop more effective strategies to enhance educational quality and prepare students for global challenges in the 21st century.



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