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Bibliometric Analysis of Entrepreneurship Education: Trends and Research Gaps

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ABSTRACT

This study presents a bibliometric analysis of entrepreneurship education, examining research trends, publication patterns, and global collaborations from 2000 to 2024. Utilizing data from Scopus, the analysis identifies key thematic clusters within the field, such as foundational pedagogical approaches and the integration of technological advancements in educational practices. The research highlights significant shifts towards experiential and technology-enhanced learning, reflecting the evolving demands of the entrepreneurial landscape. Visualization tools like VOSviewer facilitated the exploration of global collaborative networks, revealing robust interconnections among researchers worldwide with a notable focus in regions such as North America, Europe, and Asia. The analysis also depicts a pronounced increase in research output post-2012, suggesting a burgeoning interest and recognition of entrepreneurship education's critical role in economic development. The findings underscore the importance of adaptability in educational policies and practices to foster effective entrepreneurial training. This study not only maps the intellectual structure of entrepreneurship education but also provides insights into the dynamic nature of research collaborations that shape the field.

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1. INTRODUCTION

Entrepreneurship education has emerged as a critical pathway to fostering an innovative mindset, promoting self-employment, and fueling economic growth across the globe. The increasing importance of entrepreneurial skills in the 21st century has led to a surge in academic and practical interest in this area, making it a focal point for policy makers, educators, and researchers alike. Over the years, entrepreneurship education has evolved from rudimentary business skills training to comprehensive curricula that encompass a variety of competencies including opportunity recognition, risk management, and innovation [1].

The globalization of markets and the rapid advancement of technology have further underscored the necessity for entrepreneurship education. As digital platforms and the gig economy redefine traditional employment, individuals

equipped with entrepreneurial skills are better positioned to navigate these changes successfully. This has prompted educational institutions worldwide to integrate entrepreneurship into their programs, ranging from primary schools to higher education [2]. The integration of entrepreneurship education is seen not just as a means to enhance business acumen but also as a tool to instill a proactive, resilient, and innovative approach towards the complex challenges of today's world.

However, the heterogeneity in how entrepreneurship education is implemented across different regions and educational systems presents a challenge. Varied pedagogical approaches, differing in content and delivery, lead to inconsistent outcomes among graduates [3]. This inconsistency raises questions about the most effective methodologies and outcomes associated with entrepreneurship education. Additionally, the interplay between entrepreneurship education and local economic conditions suggests that the impacts of such education are deeply contextual, affecting the scalability and adaptability of successful models.

Moreover, the field of entrepreneurship education itself is subject to rapid changes, influenced by economic shifts, technological advancements, and cultural variations. As such, staying abreast of the most current trends and identifying gaps in the existing body of research is crucial for academics, practitioners, and policymakers. This necessity underscores the importance of bibliometric analyses, which systematically quantify and visualize the extent and nature of published research, providing a macroscopic overview of the discipline's developmental trajectory and current foci [4].

Despite the recognized importance and expansive growth of entrepreneurship education, there remains a significant gap in comprehensive bibliometric studies that map the evolution of the field. Existing literature often focuses on isolated aspects of entrepreneurship education without providing a holistic view of the diverse research themes and methodologies employed over time. This lack of comprehensive analysis hampers the ability to draw informed conclusions about the effectiveness of different educational strategies and their impact on entrepreneurial success. Furthermore, there is an evident need to identify emergent trends and research gaps that could guide future studies and policy-making processes.

The objective of this study is to conduct a bibliometric analysis of the literature on entrepreneurship education to identify prevailing trends, major contributors, and significant research gaps. This analysis aims to synthesize the findings from various studies to offer a consolidated view of the field's evolution, highlight the most impactful research, and suggest areas for further investigation. By achieving this, the study intends to provide a valuable resource for educators, researchers, and policymakers aiming to optimize the design and implementation of entrepreneurship education programs worldwide.

2. LITERATURE REVIEW

2.1 The Evolution of Entrepreneurship Education

Entrepreneurship education has undergone significant transformation over the past few decades. Initially focused on developing basic business skills, the scope of this education has expanded to include a broader range of competencies essential for fostering innovation and handling the dynamic challenges of the modern economic landscape [5]. This evolution reflects the shift in global economic structures towards more knowledge-based economies, where entrepreneurial capabilities are increasingly seen as vital for personal and societal economic health [6]. Research by [7] highlights the integration of entrepreneurship education at various levels of schooling, from primary education through to tertiary and adult education. This widespread integration is part of a larger trend aimed at instilling entrepreneurial thinking from a young age. Moreover, the focus has shifted from teaching about entrepreneurship to teaching for entrepreneurship, emphasizing experiential

learning and the development of entrepreneurial attitudes [8].

2.2 Pedagogical Approaches to Entrepreneurship Education

The pedagogy of entrepreneurship education varies significantly across different educational institutions and countries. Traditional approaches often involve case studies and business plan development, while more progressive models employ experiential learning, simulations, and student-centered learning strategies [9]. These methodologies aim to develop not only business acumen but also soft skills like resilience, problem-solving, and opportunity recognition. [3] critique the efficacy of various pedagogical models, noting that experiential learning tends to be more effective in enhancing student engagement and retention of entrepreneurial concepts. However, they also point out the challenges associated with experiential learning, such as the need for more resources and the difficulty in assessing student performance in a non-traditional learning environment.

2.3 Global Perspectives and Cultural Impact on Entrepreneurship Education

Entrepreneurship education is not a one-size-fits-all proposition. Its effectiveness and implementation can vary greatly depending on cultural, economic, and institutional contexts. Research by [10] explores how entrepreneurship education impacts different cultures and economies, suggesting that programs must be tailored to fit the specific socioeconomic and cultural contexts of the regions in which they are implemented. For instance, in emerging economies, entrepreneurship education often focuses on creating job opportunities and fostering small business growth, while in developed nations, the focus may lean more towards innovation and global business expansion [11]. This diversity in focus underscores the importance of cultural adaptation in entrepreneurship education curricula.

2.4 Technological Advances and Entrepreneurship Education

The integration of technology in entrepreneurship education is another critical area of development. With the rise of digital platforms and tools, educators have more resources at their disposal to enhance learning outcomes. Technologies such as virtual reality, online collaborative platforms, and simulation software can provide immersive and interactive learning experiences that are conducive to developing entrepreneurial skills [12]v. Furthermore, the COVID-19 pandemic has accelerated the adoption of online learning platforms and digital tools in entrepreneurship education. Researchers like [13] have documented the rapid shift to online education and discussed its implications for entrepreneurial training, noting both the challenges and opportunities it presents for reaching a broader audience.

3. METHODS

This study employs a bibliometric analysis to systematically review and evaluate the corpus of literature on entrepreneurship education. The data for the analysis were collected from Scopus database, which include the most extensive peer-reviewed academic journal articles, conference proceedings, and books in the field. The search was conducted using a combination of key terms such as "entrepreneurship education," "entrepreneurial learning," and "innovation in education." The timeframe for the literature search was set from 2000 to 2024 to capture the most relevant and recent publications. For the analysis, VOSviewer software was utilized to create and visualize bibliometric networks. This software helps in identifying the most frequently cited research, pivotal authors, and institutions, as well as emerging trends and clusters within the dataset. The analysis also included examining citations, co-citations, and keywords to discern prevalent themes, research gaps, and future directions in entrepreneurship education research.

4. RESULTS AND DISCUSSION

4.1 Yearly Publication

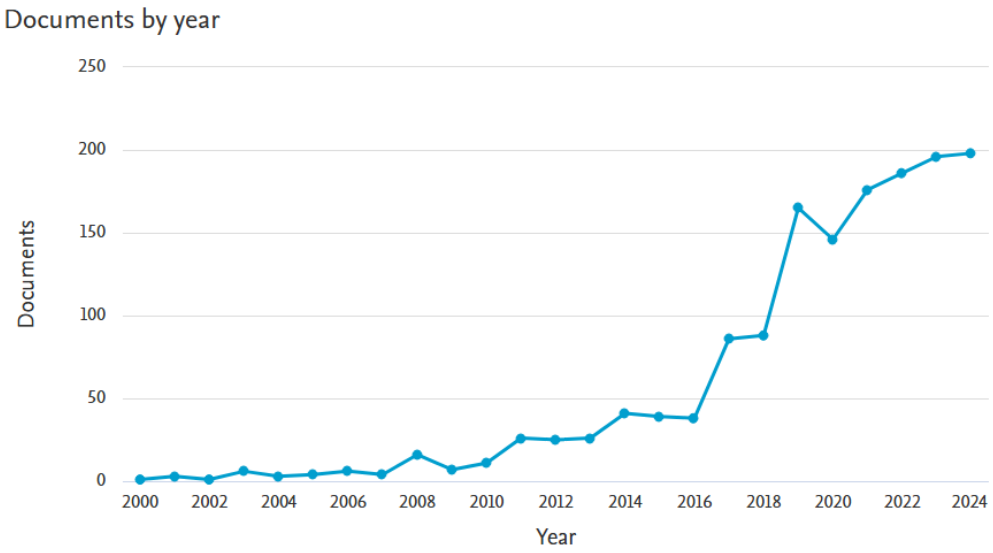

Figure 1. Yearly Publication
Source: Scopus Database, 2024

This line graph illustrates the annual number of documents published in a specific academic field from 2000 through 2024. The graph reveals a gradual increase in publications over the years, with a more pronounced rise starting around 2012. The relatively steady growth from 2000 to 2012 suggests a consistent but moderate interest in the field, which could indicate foundational research and development during this period. The sharp increase post-2012, especially notable from 2018 onwards, highlights a burgeoning interest and possibly the maturation of the field or a response to new technological advancements or societal needs that spurred more intensive research and publications. The slight dip in 2023 followed by stabilization in 2024 might indicate market saturation, changes in research funding, or shifts in academic focus, suggesting a potential plateau in interest or the beginning of a stabilization phase in the research cycle.

4.2 Keyword Co-Occurrence

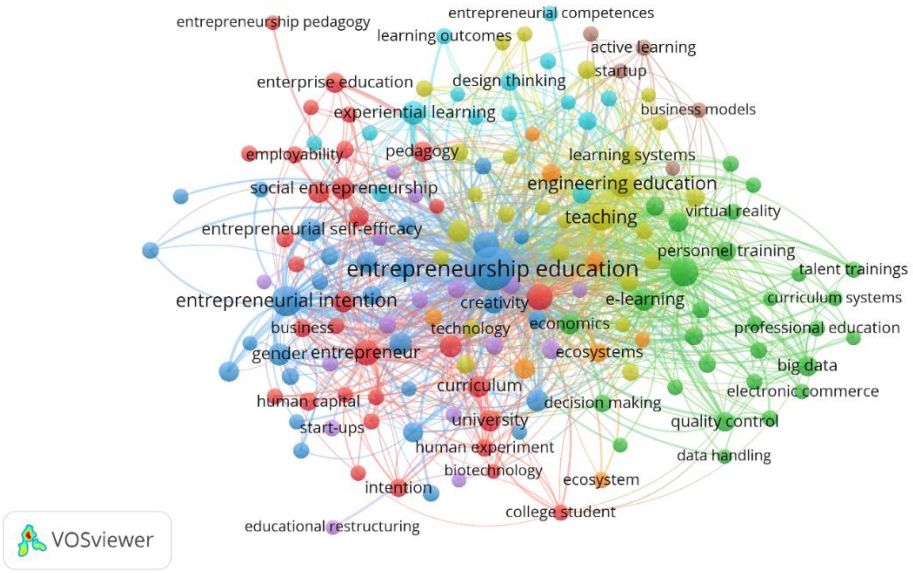

Figure 2. Network Visualization
Source: Data Analysis, 2024

The visualization offers a thorough summary of the state of entrepreneurship education research. It displays a network of related terms that were taken from the literature analysis, highlighting recurring themes and ideas in the area. Thematic groupings are indicated by the clustering of keywords into various hues, each of which represents a distinct area of attention. Each node's (keyword's) size indicates how frequently the term appears in the literature, emphasizing its importance in the conversations surrounding entrepreneurship education.

Table 1. Cluster Composition

Cluster	Item Composition	Description
Blue and Red (Left Side Cluster)	"entrepreneurship education", "creativity", "entrepreneurial intention", "curriculum", "human experiment", "biotechnology", "human capital", "gender entrepreneur", "employability", "pedagogy", "enterprise education", "self efficacy", "social entrepreneurship", "entrepreneurship pedagogy"	This cluster encapsulates the foundational elements of entrepreneurship education, focusing on the development of entrepreneurial skills and intentions. It includes traditional educational topics and emphasizes diverse aspects such as creativity, gender perspectives, and social entrepreneurship, indicating a broad and inclusive approach to entrepreneurship education.
Yellow	"e-learning", "economics", "decision making", "quality control", "data-handling", "electronic commerce", "big data", "professional education", "curriculum system", "talent training", "personnel training", "virtual reality"	This cluster highlights the integration of modern technology and digital tools in entrepreneurship education. It focuses on how e-learning and emerging technologies like big data and virtual reality can be utilized to enhance educational outcomes, suggesting a trend towards more technologically advanced, data-driven, and professionally oriented educational models.
Yellow	"learning systems", engineering education", "teaching", "technology"	This subset of the yellow cluster further emphasizes the technological and systemic aspects of education, specifically in the context of engineering and technology-focused teaching. It points to the utilization of systematic learning approaches and advanced technologies to improve teaching effectiveness and curriculum delivery.
Light Blue	"entrepreneurial competences", "learning outcomes", "design thinking", "experiential learning"	This cluster is centered on innovative and experiential learning methodologies that foster critical entrepreneurial competencies. It underlines the importance of design thinking and practical experiences in developing tangible skills and learning outcomes, reflecting a shift towards more dynamic, hands-on educational practices.
Brown	"active learning", "start-up", "business model"	This cluster focuses on the practical aspects of entrepreneurship, such as starting and managing new ventures. It

		emphasizes active learning through real-world business model development and application, catering specifically to aspiring entrepreneurs who seek to apply theoretical knowledge in practical, startup scenarios.

Source: Own Interpretation, 2024

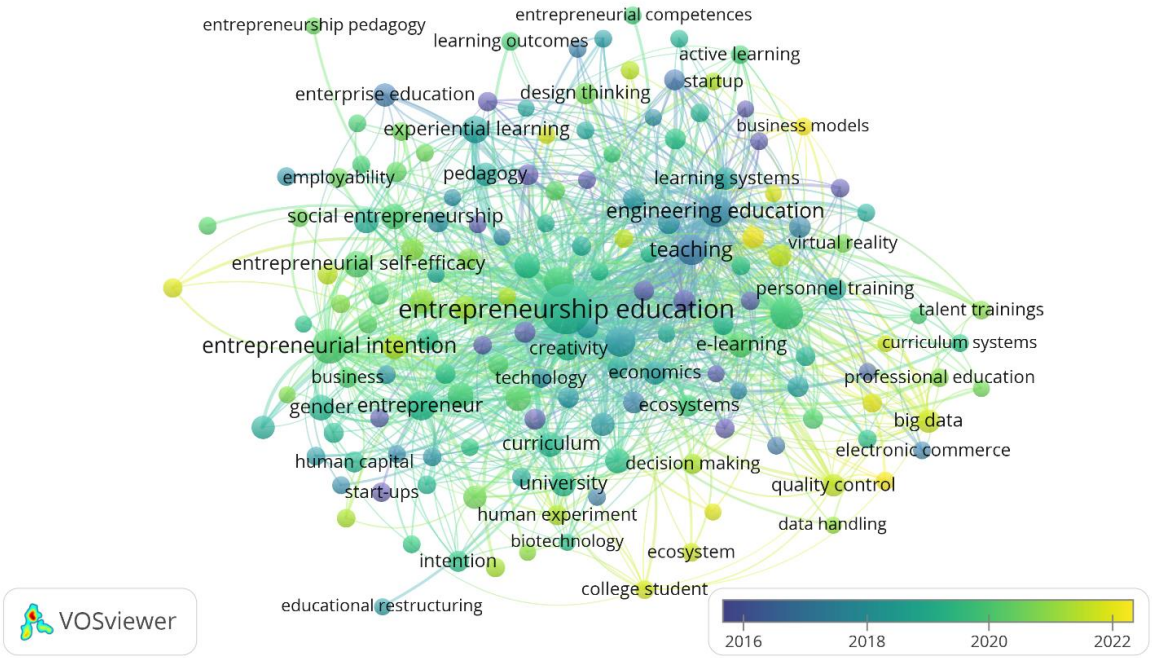

Figure 3. Network Visualization
Source: Data Analysis, 2024

The overlay visualization employs a color gradient (from blue to yellow) to indicate the temporal evolution of research themes within the field of entrepreneurship education. In this visualization, cooler colors (blues and greens) represent older studies, while warmer colors (yellows) denote more recent contributions. This color coding is particularly useful for observing shifts in research focus over time. For example, terms like "virtual reality" and "big data," which appear in warmer hues, suggest these topics have gained prominence in recent years. Conversely, foundational topics such as "entrepreneurial intention" and "business models" are depicted in cooler tones, indicating their established nature in earlier studies.

The appearance of recent technologies in the network, highlighted by their warmer colors, underscores a significant shift towards integrating digital tools in entrepreneurship education. The visualization reflects an increasing focus on how modern technologies such as e-learning platforms, virtual reality, and big data analytics can enhance entrepreneurial training. These tools are not only reshaping how entrepreneurship is taught but also how students engage with the subject matter, allowing for more interactive and immersive learning experiences. This trend highlights the field's adaptation to digital advancements and its impact on pedagogical strategies.

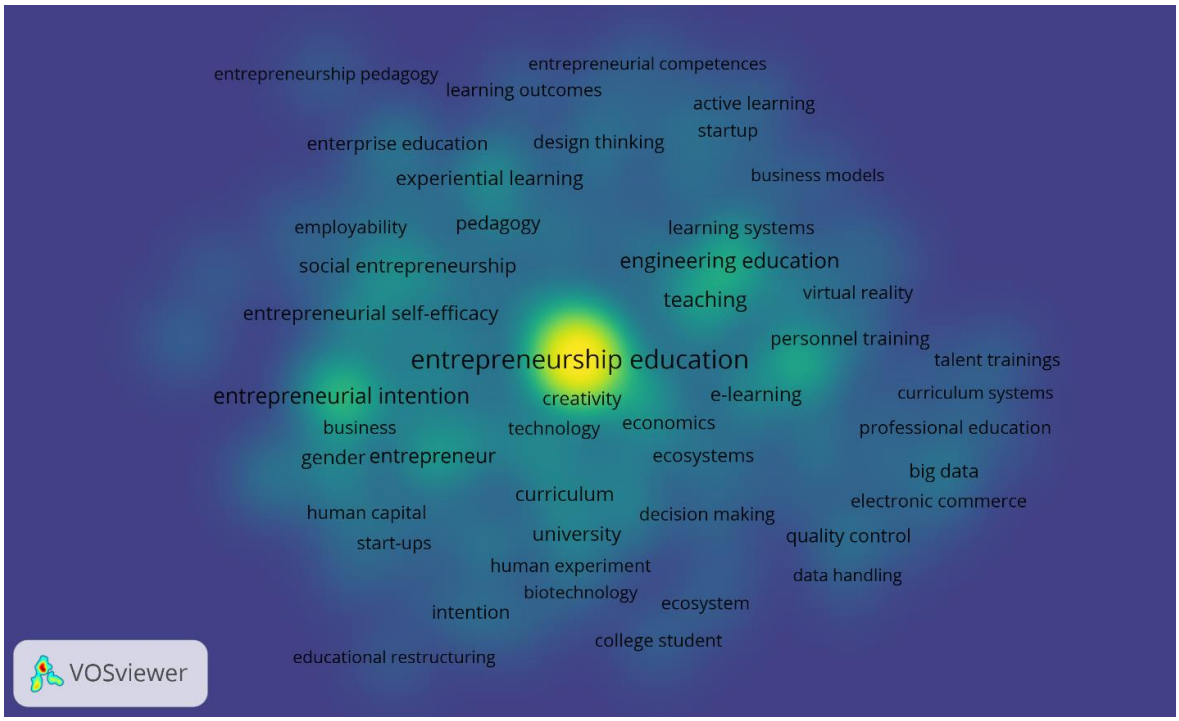

Figure 4. Density Visualization
Source: Data Analysis, 2024

The heatmap visualization provided by VOSviewer offers a dynamic representation of the most discussed and currently trending topics within the field of entrepreneurship education. The intense concentration of heat, indicated by the brighter yellows around terms like "entrepreneurial self-efficacy," "entrepreneurship education," and "entrepreneurial intention," suggests these areas are receiving significant scholarly attention. This pattern reflects an ongoing focus on the core competencies and psychological aspects of entrepreneurship, indicating a robust interest in understanding the traits and educational impacts that contribute to successful entrepreneurial outcomes. The central placement and brightness of these terms also suggest that they serve as pivotal points connecting various sub-themes within the broader research landscape, highlighting their fundamental role in the field. The heatmap also reveals emergent trends through the warming colors around terms like "e-learning," "big data," and "virtual reality." The proximity of these technological terms to traditional entrepreneurship education topics points to an increasing integration of digital tools and data analytics into pedagogical strategies. This trend towards digitalization in education indicates a shift in teaching methodologies, with a growing emphasis on enhancing learning environments and outcomes through innovative technologies.

4.3 Top Literature

Table 2. Top Cited Literature

Citation	Authors	Title
606	[14]	Factors affecting entrepreneurial intention levels: A role for education
423	[15]	The impact of an entrepreneurship education program on entrepreneurial competencies and intention
399	[16]	Universities and regional economic development: The entrepreneurial University of Waterloo
381	[17]	The impact of entrepreneurship education, entrepreneurial self-efficacy and gender on entrepreneurial intentions of university students in the Visegrad countries

318	[18]	University training for entrepreneurial competencies: Its impact on intention of venture creation
315	[19]	A contemporary approach to entrepreneurship education
298	[20]	Entrepreneurial selection and success: Does education matter?
218	[21]	Exploring alternative approaches in high-level entrepreneurship education: Creating micromechanisms for endogenous regional growth
199	[22]	Universities and enterprise education: Responding to the challenges of the new era
181	[23]	Impact of personality traits and entrepreneurship education on entrepreneurial intentions of business and engineering students

Source: Scopus Database, 2024

4.4 CO-Authorship

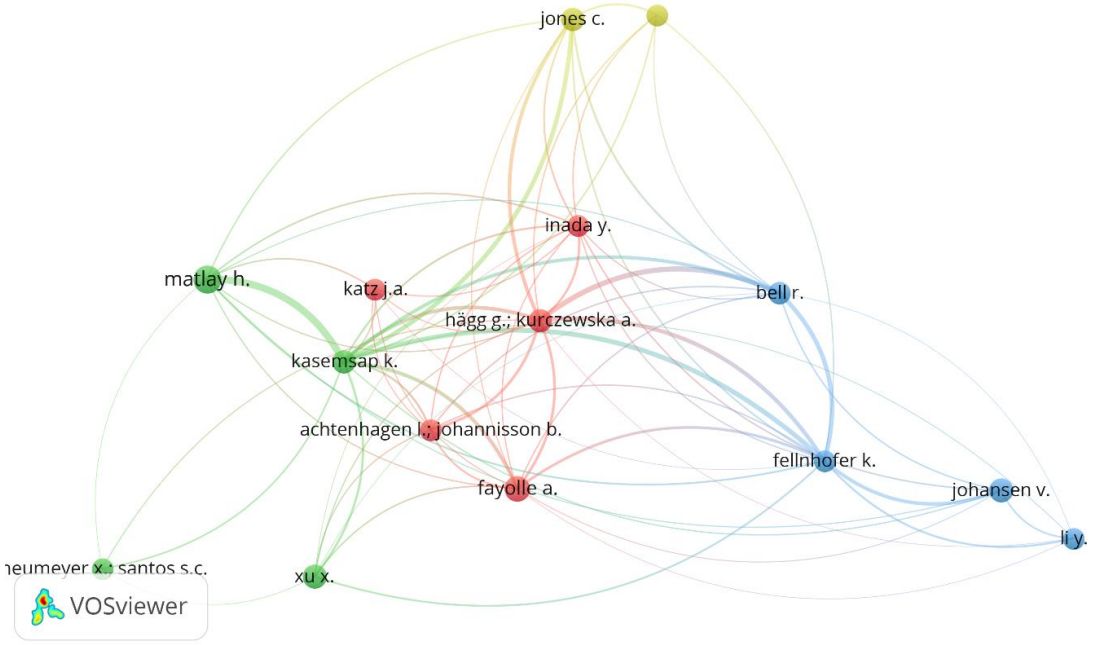

Figure 5. Author Visualization

Source: Data Analysis, 2024

This VOSviewer visualization details the intricate network of co-authorship among scholars within the field of entrepreneurship education. The visualization clusters researchers into distinct groups based on their collaborative relationships, shown through lines connecting the nodes (representing individual researchers). Notably, researchers like "Jones C." in yellow and "Matlay H." in green stand out due to their larger node sizes, suggesting they have extensive publication records or central roles within their respective networks. Each color group represents a distinct cluster of researchers likely focused on similar sub-themes or methodologies within entrepreneurship education. For example, the green cluster, with scholars like "Matlay H." and "Fayolle A.," might focus on pedagogical innovations in entrepreneurship education, while the blue cluster, including "Bell R." and "Johansen V.," could be exploring the impact of technology in entrepreneurial curricula.

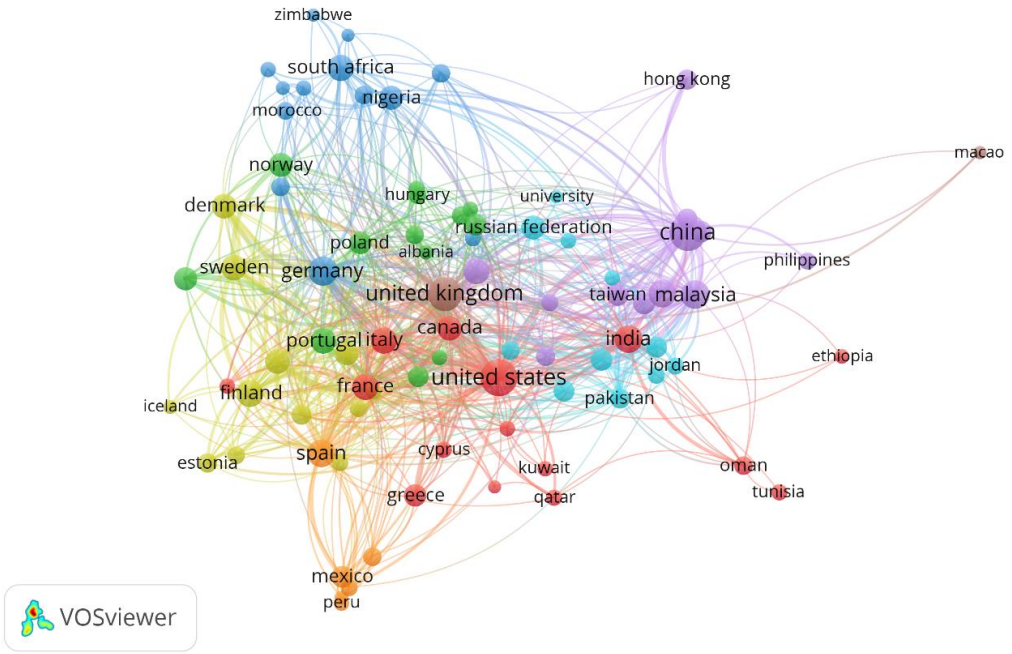

Figure 6. Country Visualization
Source: Data Analysis, 2024

This VOSviewer visualization maps the global research collaboration network related to a specific academic field, presumably entrepreneurship education, by showcasing the connections between different countries. The various colors represent distinct clusters of countries that frequently collaborate with each other. For instance, the purple cluster featuring China, Hong Kong, and Macao indicates a regional collaboration network in East Asia. Similarly, the densely connected cluster of European countries, like Germany, France, and the United Kingdom, depicted in green and yellow, illustrates a strong intra-European collaboration. The size of each node (country) likely represents the volume of research output or the intensity of collaborations originating from that country. The lines connecting the nodes symbolize the existence and strength of collaborative ties between these countries, with thicker lines possibly indicating more robust or frequent collaborations.

DISCUSSION

Thematic Concentrations and Pedagogical Innovations

The identification of primary research clusters, including foundational educational practices and the integration of technological advancements, underscores a dynamic shift in the academic approach towards entrepreneurship education. The focus on entrepreneurial self-efficacy, intention, and creativity within the core clusters reflects an enduring emphasis on individual entrepreneurial capabilities. This focus aligns with the broader educational objectives of nurturing skills such as problem-solving, innovation, and resilience, which are crucial in today's fast-paced, unpredictable business environment. Moreover, the growing emphasis on digital tools such as e-learning, big data, and virtual reality indicates a proactive adaptation of entrepreneurship education frameworks to incorporate technology-driven pedagogies. These advancements not only enhance the learning experience but also prepare students for the digital nuances of modern entrepreneurial ventures. The trend towards experiential learning, highlighted by design thinking and active learning methodologies, further showcases a shift from theoretical to more practical, hands-on educational experiences that are likely to improve student engagement and learning outcomes.

Global Collaboration Networks

The analysis of the co-authorship network visualization reveals a robust pattern of international collaborations among researchers in the field of entrepreneurship education. Notably, scholars from countries like China, the United States, and the United Kingdom appear as central nodes in these networks, suggesting their pivotal roles in the global research community. These collaborations are not only instrumental in cross-pollinating ideas and practices across different educational and cultural contexts but also in fostering a more integrated and comprehensive understanding of what constitutes effective entrepreneurship education. Furthermore, the country collaboration network highlights how geopolitical and economic factors may influence research partnerships and thematic focuses. The dense networks within regions such as Europe and Asia suggest regional synergies and shared academic interests, likely driven by similar economic or educational policies. Conversely, the interactions between more distant countries, such as collaborations between the U.S. and various Asian countries, underscore the global reach and applicability of entrepreneurship education research, addressing diverse entrepreneurial ecosystems.

Publication Trends and Future Directions

The significant growth in the volume of publications from 2012 onwards points to a rising academic and practical interest in entrepreneurship education. This could be attributed to various factors including the global economic shifts post-2008 financial crisis, which emphasized the need for innovative economic solutions and job creation through entrepreneurship. The slight decline observed in 2023 might suggest a momentary saturation or shift in research priorities, which could be a natural adjustment as the field matures or as new emerging topics gain prominence.

Implications for Policy and Practice

The insights garnered from the bibliometric analyses have several implications for both policy and practice. For educational policymakers and curriculum designers, the emphasis on technology and experiential learning may inform the development of more contemporary, relevant educational programs that align with the needs of today's entrepreneurial landscape. For practitioners, understanding the trends in research and collaboration can aid in better aligning their teaching methods with proven practices and innovations in the field.

Limitations and Areas for Further Research

While the analyses provide valuable insights, they also present limitations typical of bibliometric studies, such as the reliance on available published data, which may not fully capture all ongoing research activities or the most recent trends due to publication delays. Future research could delve deeper into qualitative assessments of pedagogical effectiveness, the impact of educational innovations on entrepreneurial success, and the sustainability of newly formed businesses post-education.

5. CONCLUSION

A lively and developing area with strong thematic diversity and dynamic international collaborations is highlighted by the thorough bibliometric analysis of entrepreneurship education. In line with broader educational trends toward experiential and hands-on learning, the field shows a consistent transition away from traditional pedagogical approaches and toward the integration of state-of-the-art technological tools. Important topics like innovation, entrepreneurial self-efficacy, and the use of digital tools like virtual reality and e-learning demonstrate a continuous adjustment to the needs of contemporary entrepreneurship. A networked academic community with important roles played by North America, Europe, and Asia is revealed by the visualization of worldwide research collaborations. This network promotes breakthroughs across a variety of educational and cultural landscapes and allows for a rich interchange of ideas. In addition to improving our knowledge of successful entrepreneurial education strategies, this expanding corpus of

research helps shape curriculum and policy decisions that support the development of the next generation of entrepreneurs and corporate executives. In order to make sure that the development of entrepreneurship education keeps pace with the constantly shifting needs of the global economy, the area could profit from further research on the direct effects of educational innovations on entrepreneurial success.

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