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BIBLIOMETRIC ANALYSIS OF ENTREPRENEURSHIP EDUCATION IN SCOPUS-INDEXED JOURNALS

Sultono*, Univeritas Pendidikan Indonesia
sultono@upi.edu
M Syaom Barliana, Univeritas Pendidikan Indonesia
aombarli@upi.ac.id
Tutin Aryanti, Univeritas Pendidikan Indonesia
tutin@upi.ac.id
Dedy Suryadi, Univeritas Pendidikan Indonesia
dedysuryadi@upi.ac.id

**Corresponding author*

ABSTRACT

The aim of this study is to understand the roles, trends, and development of research in entrepreneurship education. The method used is bibliometric analysis with the help of tools such as OpenRefine, VOSViewer, MS Excel, and Bibliometrix. These tools were used to analyze document distribution per year across different countries, institutions, journals, authors, topic trends, and keyword co-occurrences. The search was conducted on August 10, 2024, the literature search was conducted by entering words based on the title, abstract and keywords "education" AND "entrepreneurship", with restrictions in the data search, namely for the type of document in the form of research journal articles from 2016 to 2024 with limited criteria, data was obtained as much as 2,592 documents.The results of this study show a growth in the publication of articles on entrepreneurship education over the past nine years, with an average annual increase of more than fifteen percent. However, a decline was observed in 2019-2020. China is the most productive country in publishing articles related to entrepreneurship education, while the most productive institution is Universitas Negeri Jakarta from Indonesia. The top journal in this field is Education and Training Journal. Author co-occurrence analysis reveals two major networks of authors, led by Wibowo A and Wang J, respectively. Based on the data collected, the most frequently appearing keywords are "entrepreneurship" and "entrepreneurship education." The latest topic trends related to entrepreneurship education include terms such as "innovation and entrepreneurship education," "innovation and entrepreneurship," and "evaluation models." Innovation and evaluation models become the current trend in this research area. This study can be useful for identifying research gaps regarding the development and implementation of entrepreneurship education, with the latest trends focusing on innovation and evaluation models. Based on the data search, further comprehensive studies on the integration of entrepreneurship

education, vocational education, and digital technology are needed. According to the analyzed Scopus metadata, research on the integration of these fields is still very limited.
Keywords: *Bibliometric analysis, entrepreneurship education, VOSviewer.*

INTRODUCTION

A nation's progress hinges upon advancements across multiple sectors. A hallmark of developed nations is a substantial population of entrepreneurs. For example, the United States, Switzerland, and Canada rank among the top three countries in The Global Entrepreneurship Index (Ács et al., 2019). To cultivate such an environment, a synergistic relationship between educational institutions, businesses, and industries is imperative. The proposed framework advocates for collaborative entrepreneurship learning to facilitate the execution of relevant entrepreneurial projects within knowledge-based enterprises (Secundo et al., 2017).

Developing nations can glean valuable insights from their developed counterparts and foster enduring collaborations for mutual benefit. In an era characterized by globalization and digitalization, international relations have intensified, particularly in the realm of entrepreneurship education within transnational education contexts. For instance, collaborative programs between Australia and Singapore have encountered managerial complexities such as the involvement of geographically dispersed students and challenges associated with cross-cultural biases in program management, human resources, and pedagogical processes (Pimpa, 2019). Research conducted in India on the impact of entrepreneurship on the career choices of young graduates reveals that Indian government policies, unskilled labor, entrepreneurship education, family background, and the caste system are significant determinants of the growth rate of young graduates pursuing entrepreneurial careers (Dinakaran et al., 2019).

Research on entrepreneurship education has been conducted extensively by numerous scholars, focusing on diverse themes such as educational systems, students, faculty, pedagogy, and the nexus between academia and industry. For instance, a study conducted at Politeknik Malaysia involving entrepreneurship educators employed qualitative data analysis using Nvivo software to develop methodologies for integrating entrepreneurship into the teaching and learning process (Zainal et al., 2020).

In the context of cultivating entrepreneurial skills among students, four primary strategies have been identified as essential for enhancing these abilities among vocational students in Ghana (Kissi et al., 2020). Research evaluating the quality of educational systems from the perspective of small and medium-sized enterprise owners and managers in the Czech Republic and Slovakia underscores the significance of a systematic approach to addressing challenges in entrepreneurship education, as well as the need to secure corporate support at all levels of education, including lifelong learning (Gavurova et al., 2021).

The most cited research trend is the Circular Economy (CE), which is a radical approach to improve resource efficiency by eliminating the concept of

waste and shifting from a linear model involving extraction, production, and waste disposal to a more sustainable model (Despeisse et al., 2017).

Digital entrepreneurship is an innovative step in fostering entrepreneurial spirit and entrepreneurial character in education. The process of entrepreneurship in vocational education with the integration of digital technology is an innovative step that must be taken considering the increasingly strong flow of digitalization so that the spirit and personality of entrepreneurship can be improved (Rizal et al., 2022). The difference between this study and previous studies is in the scope that will be found in several criteria such as trends in the development of publications in the fields of education and entrepreneurship seen from institutions, authors and trend topics that are currently being widely researched.

Innovation is a trend found in this study, meaning that entrepreneurship education needs to carry out continuous innovations to meet the development of the times. At this time, digital technology has emerged as an unavoidable need. The rapid and rapid development of digital technology greatly influences the development of the business and education worlds. The influence of digital technology makes the business and education worlds must be able to adapt. The speed of digital technology development can be a solution or a problem depending on the readiness of educational and business institutions. With the rapid digitalization of products and services across industries, entrepreneurial opportunities in this market (products and services) are also increasingly open with digital technology (Nambisan, 2017).

The integration of entrepreneurship education and vocational education is very important because in addition to vocational education graduates having competence, graduates are also required to have good entrepreneurial attitudes and competencies. Vocational education students who are mentally able to work in the field but are not accompanied by entrepreneurial experience will be a problem in the future. Vocational graduates who have entrepreneurial provisions must be able to compete in the job market and survive. Entrepreneurship education with a production-based learning approach provides opportunities for students to be able to apply the results of project work in the form of quality and highly marketable business plans. In addition, independence and entrepreneurial attitudes will also grow and emerge along with the integration of entrepreneurship learning in vocational education. The soul and spirit of entrepreneurship need to be transmitted and improved in students, this will have an impact on the vocational education environment to be better. Production-based learning is very appropriate as a basis for developing entrepreneurship pedagogy in vocational education, and policies and rules are needed to realize the competence of quality vocational education graduates (Ganefri et al., 2022).

Based on the development of research on entrepreneurship education and the challenges faced in the education and business sectors in the digital era, bibliometric analysis in this field has become essential. The aim is for us to be able to see the role, trends, and developments in research on entrepreneurship education seen from the perspective of institutions, countries, the most productive authors, and the trend of topics that are currently being researched. Additionally, this bibliometric analysis is useful for identifying research gaps

in entrepreneurship education trends and obtaining information from global research findings.

RESEARCH METHOD

The database used in this study is Scopus, which was selected to retrieve metadata related to entrepreneurship and education. The search was conducted on August 10, 2024, by inputting the keywords **"education" AND "entrepreneurship"** in the title, abstract, and keywords. The search was limited to research articles published between 2016 and 2024 in the English language. The data in this study spans from 2016 to 2024 with the aim of obtaining the latest data related to research related to education and entrepreneurship, such as; seeing the latest developments in the last 5-10 years, tracking the emergence of new keywords or concepts, identifying research areas that are losing attention and avoiding excessive or less relevant data.

Based on these criteria, 2,592 documents were obtained. Prior to applying this limitation, the total number of documents found was 12,567. The database used in this study is Scopus, which was selected to retrieve metadata related to entrepreneurship and education. The search was conducted on August 10, 2024, by inputting the keywords **"education" AND "entrepreneurship"** in the title, abstract, and keywords. The search was limited to research articles published between 2016 and 2024 in the English language. Based on these criteria, 2,592 documents were obtained. Prior to applying this limitation, the total number of documents found was 12,567. Several searches with different keywords yielded the following number of documents:

“vocational education” AND “entrepreneurship” (without limitations) resulted in 194 documents,

“education” AND “entrepreneurship” AND “digital technology” (without limitations) resulted in 67 documents.

The search using the keywords **"entrepreneurship"** in conjunction with "**vocational education**" and "**digital technology**" yielded insufficient data for bibliometric analysis. Based on this search chronology, the analysis of data on entrepreneurship education related to vocational education or digital technology is inadequate for current bibliometric analysis. Therefore, further research on the relationship between entrepreneurship education, vocational education, and digital technology is still needed in the future.

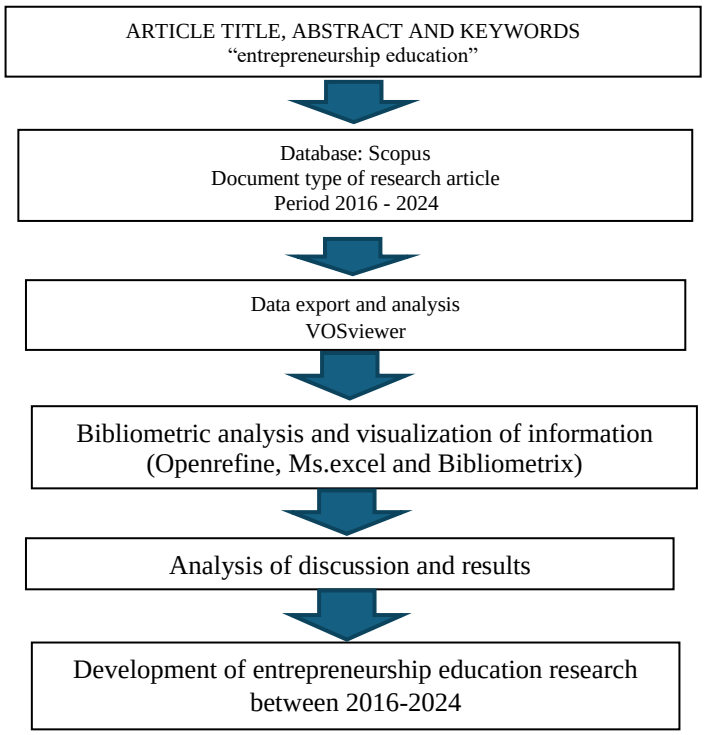

Figure 1. Bibliometric Research Workflow

Analysis Procedure and Tool

The process of screening in bibliometric research requires specific criteria. For instance, selecting specific document types or only articles within a certain year range will automatically exclude other documents (Linnenluecke et al., 2020). This study only used article data, not conference papers, from Scopus. This study uses journal article data, not proceedings papers, books and short reviews. Journal articles are selected because they have high quality standards and have gone through a rigorous review process. Databases such as Scopus prioritize journal articles in their indexes to ensure the validity and reputation of the source. The language used in journal articles is English because it has a wider audience coverage. Therefore, documents that do not meet the initial criteria need to be removed as they are not relevant to the topic being discussed. Inclusion and exclusion criteria were applied to determine the final sample of the study before downloading the dataset.

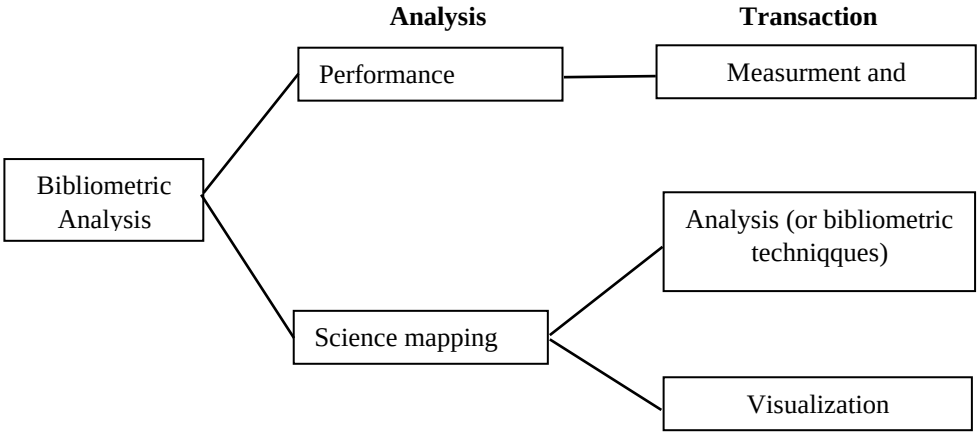

Figure 2. Analysis procedure in bibliometric research Saurce Drawn by utilizing from (Block & Fisch, 2020), and (Donthu et al., 2021).

The software used for analysis includes OpenRefine, VOSviewer, Ms. Excel, and Bibliometrix. The data obtained from Scopus was processed using OpenRefine to standardize keywords so that different terms with similar meanings were unified. This was done to avoid bias in subsequent analysis processes. VOSviewer, Excel, and Bibliometrix were used to visualize the data and find answers to the research questions posed in the introduction.

OpenRefine is used to clean and select keywords that appear repeatedly. For broader data cleaning and transformation, OpenRefine provides a multitude of expressions that can be used, such as: "facet", "edit cells", "edit column" (Delpeuch, 2021). Microsoft Excel is used to display visualizations of research trends in entrepreneurship education in the form of graphs and histograms. According to Tufte (Kemp, 2016), visual explanations encompass representations of mechanisms and movement, processes and dynamics, cause and effect, explanations, and narratives. To create graphs and histograms, Excel divides data using preset values in available columns (Grech, 2018).

VOSviewer is used to analyze and visualize bibliometric networks (van Eck & Waltman, 2010). VOSviewer was developed by van Eck and Waltman (van Eck & Waltman, 2010). Some visualizations produced using VOSviewer in this study include co-authorship and co-occurrence. VOSviewer visualizes data in the form of nodes connected by lines. The larger the size of the node and the font of the keyword, the more frequently the keyword appears in the research (Cai et al., 2019). Conversely, the smaller the distance between nodes, the stronger the correlation between the keywords (Cai et al., 2019). Co-occurrence analysis conducted by VOSviewer evaluates the frequency of keyword occurrence and the relationships between words (Zhu & Zhang, 2020). This analysis can identify research hotspots and limitations. Reasons to use VOSviewer in bibliometric research, because of its interactive and easy-to-understand visualization, VOSviewer is specifically designed to analyze bibliometric data, VOSviewer can handle large datasets exported from scientific databases such as Scopus, VOSviewer supports various input file formats from Scopus or Web of Science (CSV, RIS), depicts relevant

relationships between elements (e.g., keyword groups or authors), and there are no licensing fees, making it a cost-effective solution for researchers.

Finally, Bibliometrix, an R package, was used for the analysis. In this study, Bibliometrix was employed to visualize highly cited authors. This tool enables the visualization of bibliometric analysis data with substantial and effective statistical algorithms (Aria & Cuccurullo, 2017). Furthermore, Bibliometrix provides high-quality numerical access and integrated data visualization tools, making it an accurate and comprehensive tool for scientific calculations (Aria & Cuccurullo, 2017). Some of the advantages of using the Bibliometrix program such as; citation analysis measures the influence of articles, authors, or journals, co-word analysis analyzes the relationship between keywords to map research trends, co-citation analysis: analyzes the relationship between articles that are cited together, bibliographic coupling: identifies documents that have the same references, scientific mapping: creates a comprehensive science map.

RESULTS AND DISCUSSION

Publications Trends

The trend of publications in the fields of education and entrepreneurship has shown a significant increase (Figure 2). Bibliometric analysis is very useful for tracking the development of theories and research streams (Mariani & Borghi, 2019). Initially, the number of articles found without any limitations on year and article type was 12,237. After applying limitations to the metadata search—with the category of journal articles within the last nine years, and in English—the number of articles obtained was 2,592.

This data shows an increasing trend in the number of published articles on the topic of entrepreneurship education each year, except in 2020, 2023, and 2024, which experienced a decline compared to the previous year. The decline in 2024 is due to data collection being conducted in August 2024, so data from September, October, November, and December is not included in this analysis.

Here is the percentage increase and decrease in the number of documents each year:

Table 1. Percentage of documents

Years	Percentage
2016–2017	+10.32%
2017-2018	+36.51%
2018-2019	+70.63%
2019-2020	-19.05%
2020-2021	+65.08%
2021-2022	+38.89%
2022-2023	-12.70%
2023-2024	Not yet analyzed as 2024 is still ongoing.

The highest percentage increase occurred during the period from 2018 to 2019, while the highest decrease occurred from 2019 to 2020. Future entrepreneurship research is at the crossroads of sustainable entrepreneurship, social entrepreneurship, and conventional entrepreneurship (Anand et al., 2021). This is in line with public perception that digital businesses are considered easier to build compared to traditional businesses (Biclesanu et al., 2021).

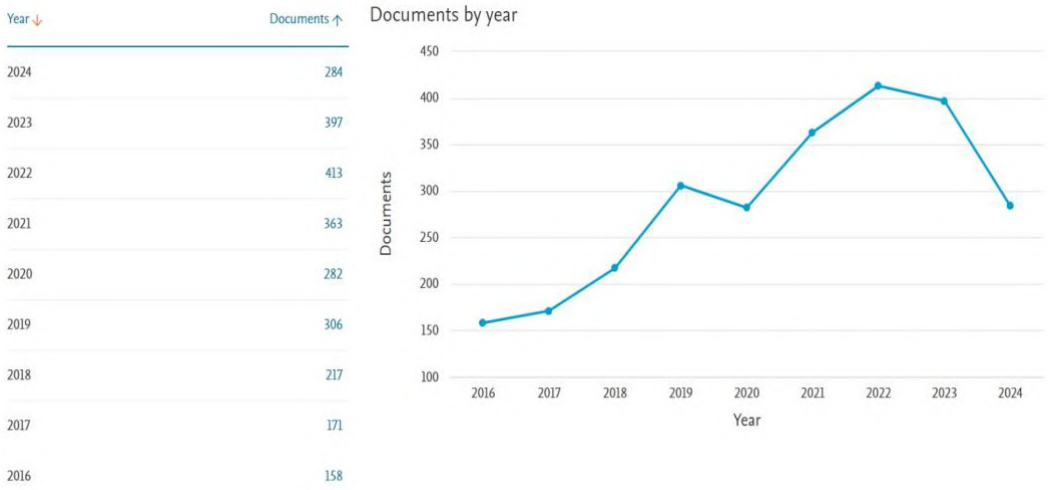

Figure 3. Quantitative distribution of publications on Entrepreneurship Education, 2016-2024

The decline in the number of research in 2019 and 2020 in certain fields, including entrepreneurship education, may be due to factors that occurred during that period, namely the emergence of the pandemic. The global COVID-19 pandemic has had a major impact on various aspects of life, including research activities. Some of the influencing factors include; Many researchers shifted their attention to pandemic-related topics, such as public health, emergency economics, or online education, leading to a decline in publications in other fields. Lockdowns and travel restrictions hampered access to research facilities, resources, and data, which slowed down the research and publication process. Educational and funding institutions allocated resources to handling the pandemic, so non-priority topics may experience limited support.

Co-authorship analysis

From a total of 4443 authors who published articles on topics related to education and entrepreneurship, a number of authors met the criteria of having at least 7 documents and 29 citations. The author with the highest number of documents was Wibowo, with 13 articles (15.29%), followed by Narmaditya with 11 articles (12.94%), Wang J, and Bell R each with 10 articles (11.76%). The next three authors, Huang Y, Zhang Y, and Wang Y, each had 9 articles (10.59%). Lastly, authors with 7 articles (8.24%) were grouped together as they had the same number of documents.

However, the ranking changed when we looked at the number of citations. The first position was occupied by Bell R with 120 citations (20.27%), followed by Wang Y with 95 citations (16.05%). Wibowo A had 84

citations (14.19%), Narmaditya B.S with 76 citations (12.84), Zhang Y with 59 citations (9.97%), Huang Y with 50 citations (8.45%), Wang J with 43 citations (7.26%), Chen Y with 36 citations (6.08%), and Zhang J with 29 citations (4.90%). When the criteria were changed to a minimum of 10 documents and 10 citations, four main authors were obtained, namely Narmaditya B.S, Wibowo A, Bell R, and Wang J. (Figure 3).

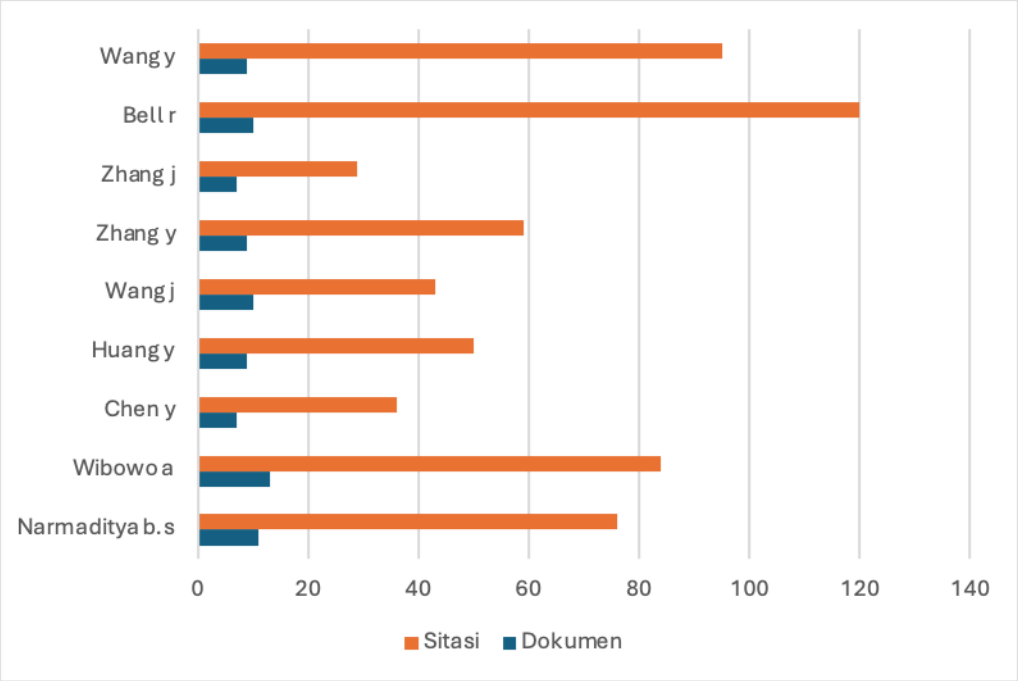

Figure 4. Top nine authors with a minimum of 7 documents and 29 citations

Figure 5. Top four researchers

Wibowo A. (Agus Wibowo) is a lecturer in the Department of Economics Education at Universitas Negeri Jakarta, Indonesia. His research focuses on character building, entrepreneurship education, educational management, and Islamic entrepreneurship. Next, Narmaditya B.S. (Bagus Sandy Narmaditya) is a lecturer in the Faculty of Economics at Universitas Negeri Malang, Indonesia, focusing on education, economics, finance, economic development, and economics education. Robin Bell from the University of Worcester, United States, is a senior lecturer at the Worcester

Business School, United States, with a focus on marketing, entrepreneurship specialization, business development, and the development of innovative teaching curricula in the field of entrepreneurship. The fourth researcher is Wang J from China, who works at the School of Business, Macau University of Science and Technology, with research themes related to entrepreneurship, health, and psychology.

Figure 6. *Co-Writing Network Between Researchers*

Figure 6 shows the two largest networks of authors, namely the Wibowo A network in collaboration with Narmaditya BS and Kusumojanto, including productive authors and the second network is the Wang J network which is included in the top four authors with the largest number while Bell, although in the top four, none of them are in collaboration with the researchers in Figure 6. In addition, in Figure 6, the authors who stand alone mean that their cluster is studied without any connection or agreement between the others (Hamidah et al., 2021). From these data, researchers tend to collaborate with researchers in that country. There are several factors that influence productive researchers not to collaborate with researchers from other countries, such as; productive researchers often focus on issues that are very specific to their local context, such as the education system, entrepreneurship policies, or entrepreneurial culture in their country. Highly contextual research results may be difficult to apply in other countries, so interest in international collaboration is lower. International collaborative research requires additional resources, such as funding for travel, cross-country communication, or access to shared research tools. In some cases, productive researchers prefer to lead their own projects rather than work in cross-country teams. Not all researchers have access to grants designed for cross-country collaborative research.

The top four researchers from Indonesia, the United States, and China show diverse approaches to education and entrepreneurship, reflecting the diversity of research focus in a global context. This reflects the trend in these countries, Indonesia places more emphasis on character building, education management, and its relationship to economic development. The United States focuses on innovative curriculum and methods in teaching entrepreneurship, which are in line with the needs of the global market. China builds

multidisciplinary relationships between entrepreneurship, health, and psychology, showing a growing trend in the modern era. Collaboration between researchers from various countries has the potential to produce new insights into the development of entrepreneurship education globally.

Countries and institutions research

Challenges in entrepreneurship education are key indicators for providing solutions to problems faced by both developed and developing nations. Research in this field has garnered global attention. Analyzing articles from various countries is crucial as it provides researchers with insights into trends and productivity in future entrepreneurship education research. Researchers can observe the collaboration between countries and the productivity of each nation in this domain.

The involvement and collaboration among countries in publishing articles on entrepreneurship education can be seen in Figure 5. Data from VOSviewer shows a total of 128 countries that have documents on entrepreneurship education research. Table 2 shows the documents published by the country of co-authors from 2017 to 2022. The data reveals that the three countries with the highest number of publications are the United Kingdom (16.45%), China (14.81%), and the United States (12.82%). Meanwhile, the countries with the highest citations are the United Kingdom (24.50%), the United States (12.03%), and Spain (11.68%). The order in this table reflects the extent of collaboration between researchers across different countries. A different result is observed for the period between 2016 and 2024 (Figure 6), where the three countries with the highest number of publications are China (446 documents), the United States (317 documents), and the United Kingdom (215 documents).

Table 2. The Most Productive Countries in Entrepreneurship Education Research, 2017 – 20222

Country	Documents	Citations	Total link strength
United Kingdom	231	2609	120
United States	180	1281	81
Spain	141	1244	54
China	208	874	44
Germany	61	558	39
Italy	52	473	35
Australia	46	453	32
Netherlands	51	781	32
Sweden	40	241	32
Finland	58	331	29
Poland	45	399	26
Malaysia	83	426	24
Portugal	35	269	15
Russian Federation	35	222	13
South Africa	55	236	12

Country	Documents	Citations	Total link strength
Indonesia	83	253	6

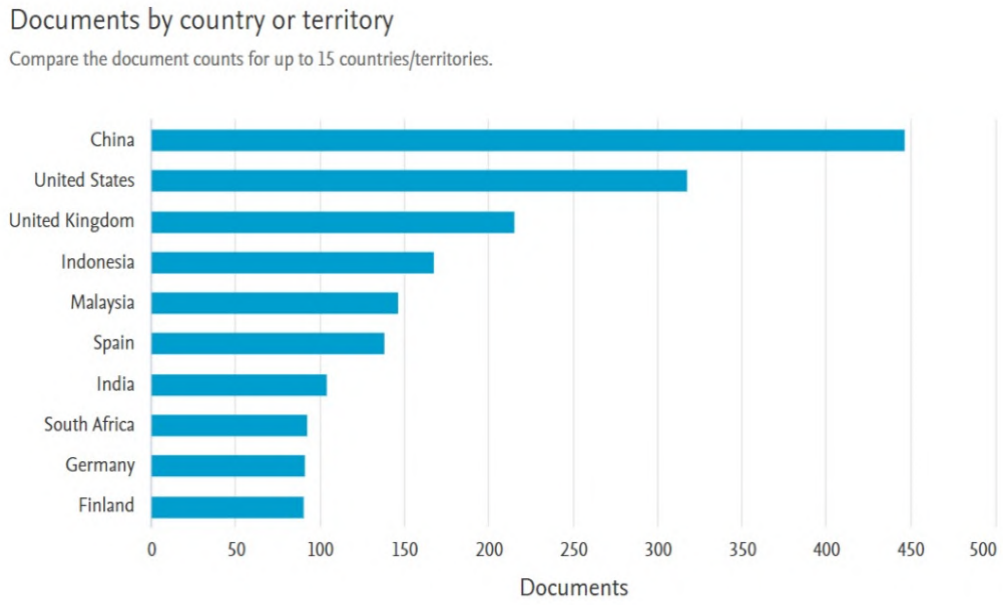

Figure 7. The Most Productive Countries in Entrepreneurship Education Research, 2016 – 2024

Figure 7 and 8 shows several countries highlighted in yellow, indicating that research on entrepreneurship education is currently trending in those nations, such as Vietnam, Saudi Arabia, Ukraine, and China. Data from 2016 to 2024 positions China at the top with the highest number of publications on entrepreneurship education. Countries with fewer collaborative networks include Ethiopia, Colombia, Kazakhstan, and Iran. Notably, researchers in Iran have minimal networks with other countries. Meanwhile, although America and England are dominant, the trend that is occurring is starting to decline, as evidenced by the 2024 data, dominance is dominated by China.

The development of entrepreneurship education in China has undergone significant transformation in recent decades, driven by supportive government policies and a culture that encourages innovation. The Chinese government has implemented various policies to support Micro, Small and Medium Enterprises (MSMEs), which are the backbone of the country's economy. Entrepreneurship education has been integrated into the higher education curriculum in China, with a focus on developing practical and innovative skills. This approach aims to equip students with the knowledge and skills necessary to start and manage their own businesses (Oriza et al., 2024). The development of digital information technology has become an important factor in entrepreneurship education in China. Digital platforms are used to provide educational resources, online training, and access to global markets, enabling young entrepreneurs to seize business opportunities more effectively. China is actively pursuing international cooperation to improve the quality of vocational education, including entrepreneurship education. This cooperation aims to share best practices, improve curricula, and provide opportunities for students to gain international experience.

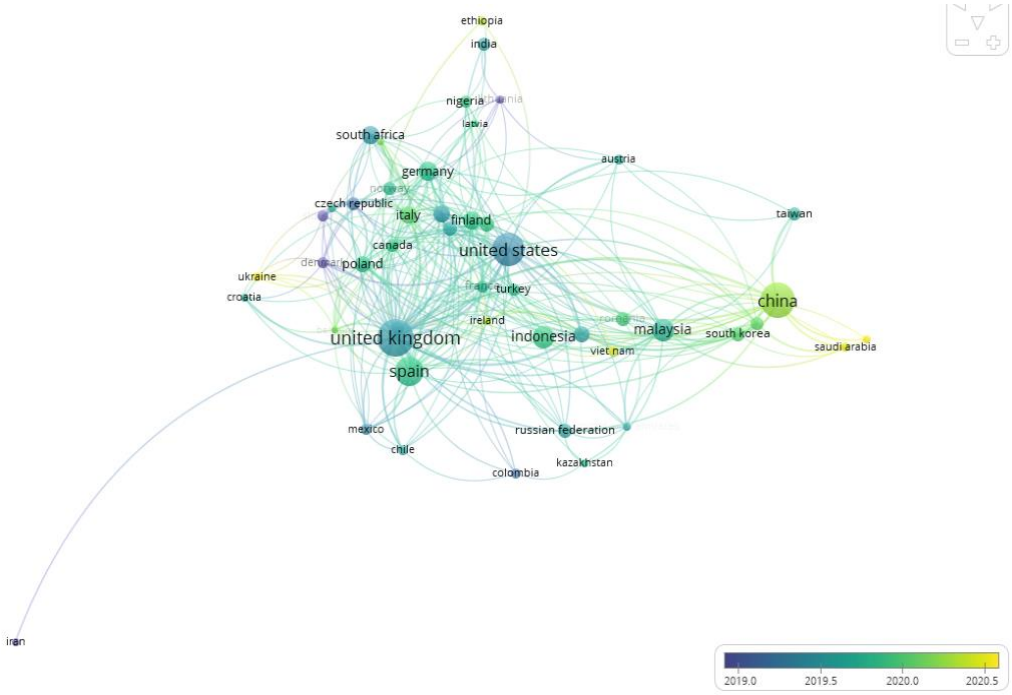

Figure 8. Research Collaboration Networks Among Countries

There are 3,519 institutions conducting research on entrepreneurship education. Figure 8 highlights the ten most productive institutions in this field. Universitas Negeri Jakarta ranks first with 40 documents (16.26%), followed by Universitas Negeri Malang with 37 documents (15.04%), and Universiti Kebangsaan Malaysia with 25 documents (10.16%). Norges Teknisk Naturvitenskapelige University ranks fourth with 23 documents (9.35%), while both Wenzhou Medical University and Aarhus Universitet share the same number of documents, 22 (8.94%). Universidade da Beira Interior is seventh with 21 documents (8.54%), followed by Universiti Malaysia Kelantan with 20 documents (8.13%). Lastly, University of Worcester and LUT University are ranked ninth and tenth, with 18 documents (7.32%) each.

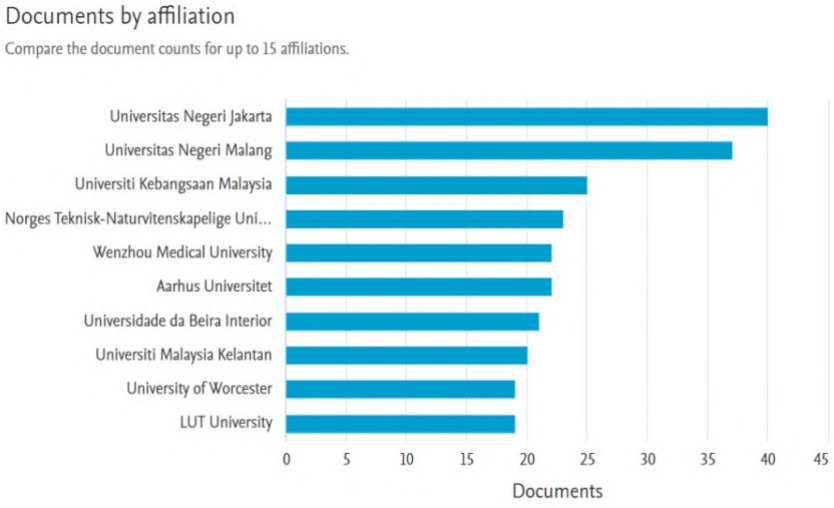

Figure 9. The Most Productive Institutions in Entrepreneurship Education Research, 2016 – 2024

The most productive institutions in entrepreneurship education research are Jakarta State University (UNJ) and Malang State University (UM) from Indonesia. Both universities have a mandate to develop educators, including teachers who teach entrepreneurship. Therefore, entrepreneurship education research is one of their priorities. Entrepreneurship education is often integrated into study programs such as Economic Education, Business Education, and Vocational Education. UM and UNJ have Research and Community Service Centers that support lecturers to actively conduct research. Internal research grants are often given for strategic themes such as entrepreneurship education. Research at both institutions is often supported by the Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia, which prioritizes entrepreneurship in education as one of its strategic programs. The MBKM which was launched in 2020 places entrepreneurship as one of its priority programs, this encourages UM and UNJ to be more productive in researching and implementing entrepreneurship education, both in the curriculum and community service programs. Researchers such as Bagus Sandy Narmaditya (UM) and Agus Wibowo (UNJ) have a strong track record of publications, both in national and international journals, which enhances the reputation of the institution.

The position of Lut University located in Finland, is ranked 10th or last in the data obtained. Finland's main focus in research is more often directed at high-tech innovation, digitalization, and education based on science and technology. Entrepreneurship research is less developed due to lack of funding and broader attention to traditional entrepreneurship or community-based entrepreneurship. Lut University is better known for its focus on technology, innovation, and sustainability, with a combination of engineering, business, and natural science studies.

Main journal publishing

Research on entrepreneurship education has been widely published in various international journals, demonstrating that this topic is a global issue of ongoing relevance. Figure 10 highlights the ten most productive journals publishing articles related to this topic for the 2016–2024 period. The top journal is Education and Training, with a total of 132 articles, followed by Frontiers in Psychology with 115 articles. The third place is occupied by the Journal of Entrepreneurship Education with 113 articles, while the International Journal of Management Education ranks fourth with 111 articles. Other journals contributing to research on entrepreneurship education include Entrepreneurship Education and Pedagogy (91 articles), Sustainability (76 articles), Industry and Higher Education (71 articles), Applied Mathematics and Nonlinear Sciences (50 articles), International Journal of Entrepreneurial Behaviour (48 articles), and lastly Education Sciences with 34 articles. From this data, it is clear that the journals with the most articles, from first to fourth place, each have over 100 articles.

It is important to assess the quality of journals based on their index level. Below is the Scopus index ranking for the 10 most productive journals focusing on entrepreneurship education:

Table 3. Most Producctive Journals

Number	Name of Journal
1	*Education and Training:* Scopus Q1, focuses on business, management, and accounting, published in the United Kingdom.
2	*Frontiers in Psychology:* Scopus Q2, covers interdisciplinary fields including pedagogy, linguistics, business, economics, management, artificial intelligence, and environmental impacts linked to psychological foundations, published in Switzerland.
3	*Journal of Entrepreneurship Education*: Scopus Q3, focuses on business, management, and accounting, published in the United States.
4	*International Journal of Management Education:* Scopus Q1, focuses on business, management, and accounting, published in the Netherlands.
5	*Entrepreneurship Education and Pedagogy:* Scopus Q2, focuses on business, management, and accounting, published in the United States.
6	*Sustainability:* Scopus Q1, focuses on entrepreneurship education and includes socio-economic, scientific, and integrated approaches to sustainable development, published in Switzerland.
7	*Industry and Higher Education:* Scopus Q2, focuses on business, management, and accounting, published in the United States.
8	*Applied Mathematics and Nonlinear Sciences:* Scopus Q3, covers mathematics, computing, and entrepreneurship-related topics such as business and economics, published in Poland.
9	*International Journal of Entrepreneurial Behavior Education:* Scopus Q1, focuses on business, management, and accounting, published in the United States. and
10	*Education Science*: Scopus Q2, focuses on educational administration and management, published in Switzerland.

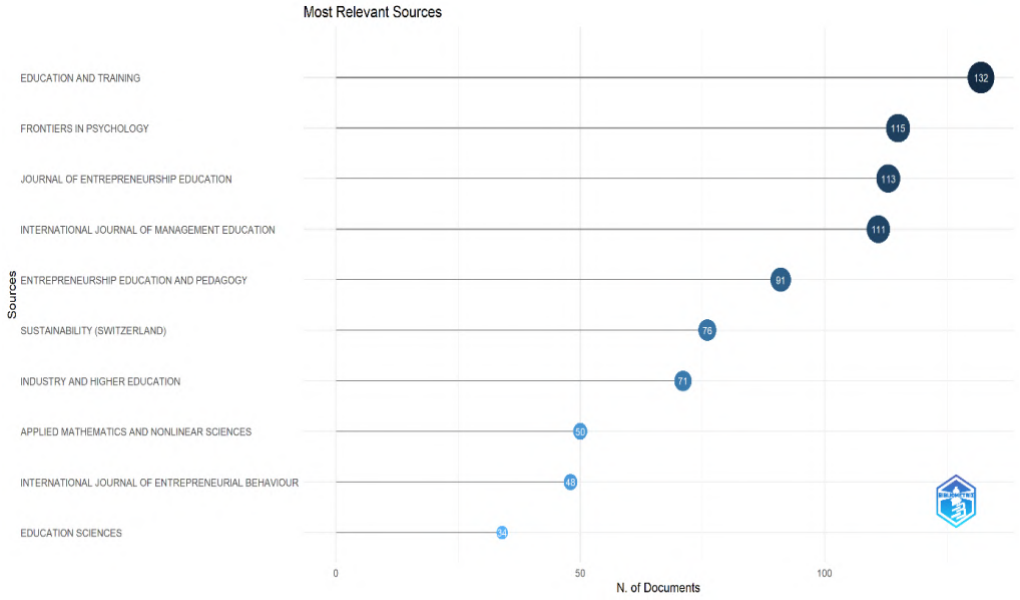

Figure 10. Ranking of the Ten Journals with the Most Articles in 2016-2024

The trend in topics related to entrepreneurship education research from 2016 to 2024 is shown in Figure 10. In 2024, emerging topics include innovation and entrepreneurship education and evaluation models. In 2023, prominent topics were e-learning, quality control, and big data. The year 2022 highlighted topics like entrepreneurship education, students, and education computing. The year 2022 highlighted topics like entrepreneurship education, students, and education computing. In 2021, the focus was on education, entrepreneurship, and students, while in 2020, emphasis was on adolescent analysis, training, and empirical analysis. In 2019, the research focused on engineering entrepreneurship, professional aspects, and engineering, and in 2018, topics included personnel training, ecology, and entrepreneurship programs. Finally, in 2017, the focus was on societies and institutions, social participation, and institutional frameworks. The findings suggest that mentoring plays a crucial role in knowledge sharing and innovation, which subsequently contributes to digital entrepreneurship (Zhao, 2021a). Entrepreneurship education must continue to innovate in the digital era, with digital technology bringing numerous benefits such as centralization, access to new markets, and transparency, enabling remote business operations (Bai, 2021). Research on entrepreneurial culture is also important, with sustainable entrepreneurial competence being a significant factor explaining entrepreneurial intent. Perceived behavioral control moderates the relationship between sustainable entrepreneurial competence and entrepreneurial intent, and the effect of sustainable entrepreneurial competence diminishes if perceived behavioral control increases (Joensuu-Salo et al., 2022).

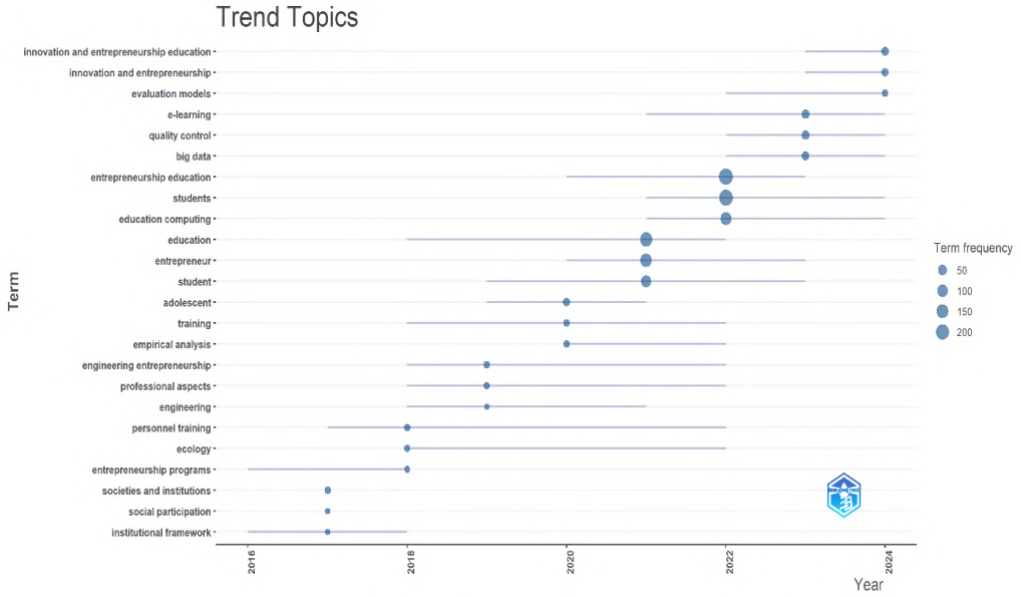

Figure 11. Trend Topics Related to Entrepreneurship Education Research, 2016 – 2024

Keyword analysis

The analysis of keywords in bibliometric analysis serves to highlight keywords that are trending in current research topics. Keyword analysis can also assist researchers in identifying research gaps that have not been widely explored, offering greater opportunities for novelty. Moreover, keyword analysis can delineate the boundaries and areas of research within our discipline based on classes or groups. Figure 10 illustrates keywords related to entrepreneurship education. Among the keywords that emerged, several appeared repeatedly. The repetition of keywords with the same meaning, such as "entrepreneurial competences" and "entrepreneurial competencies," as well as "start-up," "startups," and "star-ups," was observed. In this study, we combined 13 keywords with similar meanings. This opens new pathways in the field of education for integrating knowledge concealment and transformational entrepreneurship (Zhao, 2021b).

Based on the keywords emerging from entrepreneurship education data, four main thematic clusters were formed, as shown in Figure 11. These clusters are distinguished by colors: Cluster 1 (red), Cluster 2 (green), Cluster 3 (yellow), and Cluster 4 (blue). In general, Cluster 1 (red) is dominated by the general keyword "entrepreneurship," followed by terms like "innovation," "human capital," "startup," and "entrepreneurship education," which includes related terms such as "curriculum," "vocational education," and "active learning." Next, Cluster 2 (green) includes terms such as "sustainability," "social entrepreneurship," and "technology transfer." In Cluster 3 (yellow), terms like "entrepreneurial attitude," "entrepreneurial self-efficacy," and "theory of planned behavior" appear. Finally, Cluster 4 (blue) encompasses terms such as "digital entrepreneurship," "entrepreneurial skill," "female entrepreneurship," and "motivation." These terms are supported by several studies, including policy recommendations to address the gender gap in entrepreneurship through specialized training, particularly in strategic sectors

such as the digital economy (Molina-lhaipez et al., 2021). Additionally, efficacy suggests that outdoor learning environments are closely linked to entrepreneurship education and entrepreneurial self-efficacy (Saptono et al., 2021). Data comparison shows that students' entrepreneurial traits are significantly positively correlated with entrepreneurial attitudes, and students' entrepreneurial self-efficacy is also significantly positively correlated with entrepreneurial attitudes (Cao, 2021).

From the discussion on the clusters, we can draw connections between the emerging terms, which are trending in entrepreneurship education research. Vocational education and entrepreneurship education are two inseparable concepts. Graduates are not only reliant on the availability of job opportunities but are also capable of creating new jobs (Ganefri et al., 2022). r instance, if we explore entrepreneurship related to vocational education and digital technology, Figure 11 highlights the term "vocational education" in Cluster 1 and "digital entrepreneurship" in Cluster 4. These terms provide a basis for further investigation if one is interested in these research areas.

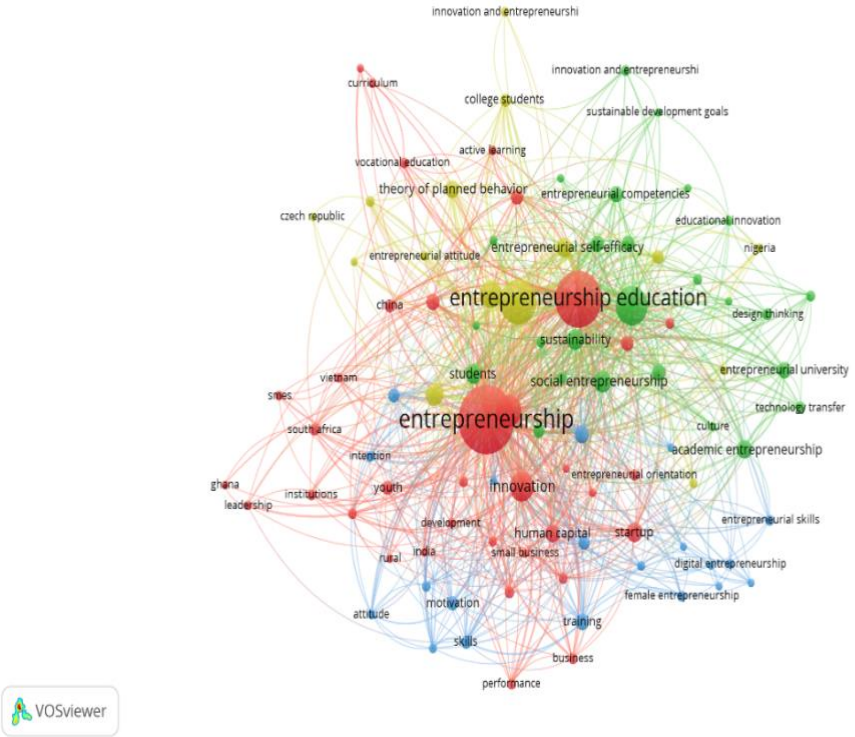

Figure 12. Network with the Keyword "Entrepreneurship Education"

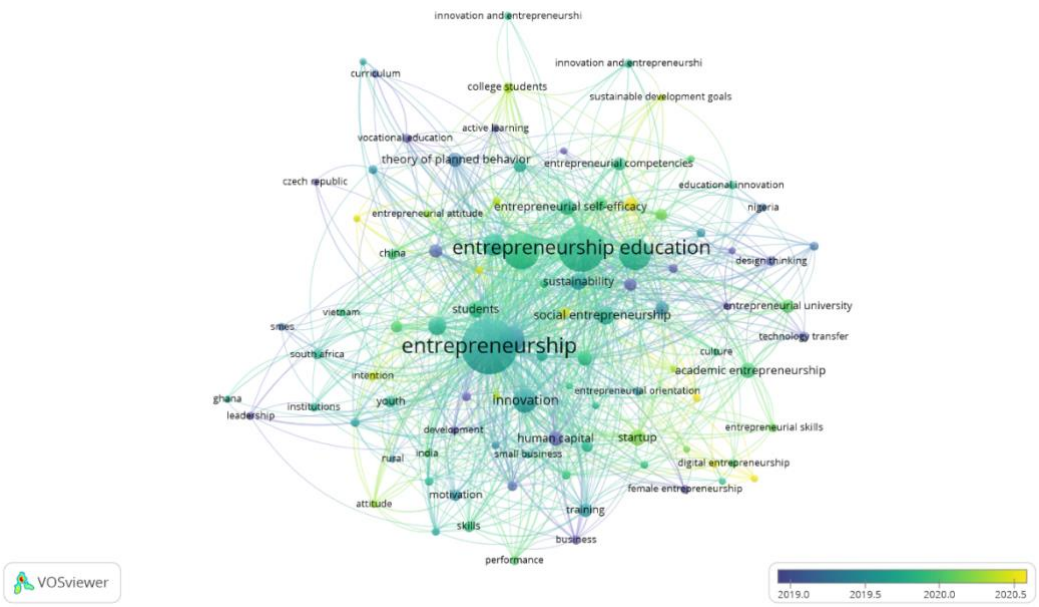

Figure 13. Trend Network by Year with the Keyword "Education AND Entrepreneurship"

An important factor in choosing a research topic is the trend and novelty of that topic. Figure 13 shows the trends of topics based on frequently appearing keywords and the year they trended. The color of the keywords indicates the trend and novelty of the theme, with yellow representing the most recent trends that are being researched in the latest years. For instance, keywords like “innovation,” “digital entrepreneurship,” and “sustainable development goal” are marked in yellow, indicating they are currently trending topics being studied by researchers. The driving force behind starting digital businesses is recognized, and the digital environment is considered crucial for future business growth (Biclesanu et al., 2021). Conversely, keywords that move away from yellow indicate trends that occurred in previous years. In line with the earlier discussion on topic trends, 2024 highlights topics like “innovation and entrepreneurship education,” “innovation and entrepreneurship,” and “evaluation models.” Innovation in education and entrepreneurship, supported by digital technology, is becoming a culture that should be adopted by regions or countries seeking sustainable progress. For example, the Chinese government has made various efforts to promote technological innovation, even elevating it to a national strategic level, achieving international excellence in several fields (Zhang & Huang, 2023). Research on the topic of "entrepreneurial culture" shows that developing entrepreneurial skills in adolescents requires generational articulation processes between various factors such as family members, educational institutions, the general public, government entities, and the productive sector (Campo-Ternera et al., 2022). Moreover, concerning the latest trend on “evaluation models” in the context of entrepreneurship education, to develop a good entrepreneurship education program and improve individual Opportunity Identification performance, different perspectives on opportunity emergence and learning

must be combined and integrated into a consistent and aligned entrepreneurship education program (Farrokhnia et al., 2022). Research on social entrepreneurship opportunities indicates that ICT-based services and Industry 4.0 will play a significant role in the future during and after the COVID-19 scenario (Kamran et al., 2022). When viewed from the type of entrepreneurship education, (Li, 2014) categorizes it into 4 types, namely: 1.) The first category is "Entrepreneurial Awareness Education" which aims to increase knowledge about entrepreneurship and to influence attitudes/intentions; 2.) The second category of entrepreneurship education is "Education for Start-Up". Entrepreneurship education is aimed at helping people realize entrepreneurial ideas so they can start and run their businesses; 3.) The 3rd category focuses on efforts to encourage (promote) entrepreneurs after the start-up phase; 4.) The last category focuses on entrepreneurial experience.

Based on several definitions of entrepreneurship education above, it can be stated that entrepreneurship education is a conscious and programmed process both formally and informally to shape attitudes, provide knowledge and train skills both curricularly and non-curricularly for students to become entrepreneurs as a career choice (job). Despite challenges such as the digital divide and unequal access, entrepreneurship education continues to adapt to take advantage of the opportunities offered by innovation and digitalization. It is important to ensure that all individuals have equal access to quality entrepreneurship education (Syafitri, 2024). Overall, this trend shows that entrepreneurship education is increasingly focusing on the development of innovative and digital skills, with the aim of supporting the achievement of sustainable development and preparing entrepreneurs for future global challenges.

Bibliometric methods are very useful tools for evaluating and reviewing literature in a particular research field. However, like any other method, bibliometrics has limitations. Here are some of the main limitations, along with suggestions for overcoming them: Potential Indexing Bias, the solution is to use additional indexing methods, such as other databases such as Google Scholar or other local databases, to expand the coverage of publications, using a mixed-method approach with a combination of bibliometric and qualitative to evaluate findings. Limitations of Outdated or Incomplete Data, the solution is to update the dataset regularly and incorporate the latest data dynamically in the study, using tools and methods that can access a wider and more recent dataset. To overcome these limitations of bibliometric methods, it is important to integrate with other approaches that can enrich the research results. By combining various methods, both quantitative and qualitative, and using a variety of databases and publication sources, the results of bibliometric analysis will be more comprehensive and representative.

CONCLUSION

Research related to entrepreneurship education is expected to continue to increase in order to improve the quality of education in this digital technology era. Entrepreneurship education and entrepreneurship policies share the same goal, namely to stimulate entrepreneurial activities and their impact on

individuals, organizations, regions, and countries (Aly et al., 2021). The objective of this study was to identify the role, trends, and developments in current entrepreneurship education. The research method used in this study was bibliometric analysis. After being analyzed using this method, it became apparent that the trend of entrepreneurship education publications has shown an overall increase, despite some declines, particularly in 2019 to 2020. However, the general trend remains upward, indicating that research related to entrepreneurship education continues to be a relevant global concern. Entrepreneurship education forms a synergistic entity, with various branches of education and entrepreneurship continuing to evolve in line with changing times. For instance, the connection between entrepreneurship education and digital technology, based on keyword analysis, shows current trends being researched, while the relationship between entrepreneurship and vocational education shows that this topic has long been a research focus.

From this research review, it is evident that terms related to entrepreneurship education are very diverse. The latest emerging topic trends include themes such as "innovation and entrepreneurship education," "innovation and entrepreneurship," and "evaluation models." Innovation in education and entrepreneurship, supported by digital technology, has become a culture that must be adopted by regions or countries aiming for sustainable progress. For example, the Chinese government has made various efforts to promote technological innovation, even making it a national strategy. This technological innovation has reached international excellence in several fields (Zhang & Huang, 2023).

Apart from the latest trends regarding "innovation and evaluation models" in 2024, there were also trends that emerged in previous years, such as "e-learning," "quality control," "big data," "entrepreneurship education," "students," "education computing," "adolescent," "training," "empirical analysis," "engineering entrepreneurship," "professional aspects," "personnel training," "ecology," "entrepreneurship programs," "societies and institutions," "social participation," and "institutional framework."

Some other important findings regarding country, institution, author, and journal productivity from 2016 to 2024 are as follows: The country with the highest publication productivity and citation count is China. The institution ranked first is Universitas Negeri Jakarta, Indonesia. In line with this, the author with the most articles related to entrepreneurship education is Wibowo A (Agus Wibowo), a lecturer in the Department of Economic Education at Universitas Negeri Jakarta, Indonesia, whose research focuses on character development, entrepreneurship education, and education management.

Furthermore, the top-ranked journal is the Education and Training Journal, with 132 documents indexed in Scopus Q1, focusing on business, management, and accounting from the United Kingdom. In terms of author collaboration, the two largest author networks are Wibowo A's network, collaborating with Narmaditya BS, and Wang J's network. Wang J ranks in the top four authors with the most publications, while Bell, despite having the most citations, does not show strong links with other authors. This research can be beneficial for identifying research gaps regarding the development or implementation of entrepreneurship education in the future.

Implications

The results of the bibliometric study on entrepreneurship education indicate that this topic is highly intriguing and warrants further exploration. From the data analysis, the latest trends in topics related to entrepreneurship education include terms such as "innovation and entrepreneurship education," "innovation and entrepreneurship," and "evaluation models." Therefore, comprehensive follow-up research is needed that focuses on the innovation of evaluation models. In addition, it is also important to study the integration of entrepreneurship education, vocational education, and digital technology. Based on metadata searches in Scopus, it was found that the integration of these fields has been relatively underexplored.

Research in the field of entrepreneurship education also has an impact on social innovation and entrepreneurial culture, which are critical aspects in shaping the character of individuals, regions, or nations. Innovation in education and entrepreneurship, supported by digital technology, should be part of the culture adopted by regions or countries seeking sustainable progress.

Findings from bibliometric analysis and research in entrepreneurship education, especially in the digital and vocational context, can provide valuable insights to improve entrepreneurship education. Here are some practical implications and suggestions for educators or policy makers to apply the findings: integration of digital innovation in the curriculum is suggested to design a curriculum that includes digital technology training such as e-commerce, data analysis, and innovative platforms that can help students develop digital-based businesses. Strengthening practical entrepreneurship skills is suggested to provide entrepreneurship laboratories or collaborative workspaces in educational institutions to develop and test business ideas in a safe environment. Focusing on increasing innovation and creativity is suggested to provide additional training or incubator programs to help students develop their innovative ideas with the guidance of mentors or industry experts. By integrating digital technology, improving practical skills, and paying attention to industry inclusion and collaboration, entrepreneurship education can develop more holistically and relevant to future needs.

The integrated model of entrepreneurship education, vocational education, and digital technology provides a holistic approach to developing practical and entrepreneurial skills that are relevant to current industry needs. Through the use of digital technology, students can develop innovative solutions that integrate technical, entrepreneurial, and digital aspects for various sectors, such as IT, energy, agriculture, and creative arts.

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