



Knowledge Map Analysis of Innovation and Entrepreneurship Education Based on Citespace

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Abstract. This study examines the research trends in this field by comparing the number of papers published in the past 10 years in the Web of Science (WOS) and the China National Knowledge Infrastructure (CNKI) databases. The findings reveal a steady growth in research enthusiasm among domestic scholars. A total of 1000 documents were extracted from the WOS database, of which 950 were considered effective and analyzed using Citespace 6.2 R² for visual analysis. The analysis included examining keyword co-occurrence networks, clustering maps, keywords with the strongest citation bursts, and timeline graphs. Based on the knowledge graph analysis, the study discusses the connection between innovation and entrepreneurship education and the higher education system and the future directions in this field.

Keywords: Innovation · Entrepreneurship · Citespace · Visual Analysis

1 Introduction

Innovation and entrepreneurship are crucial drivers of economic growth and societal progress, with higher education institutions playing a significant role in fostering these aspects through education and resources. Several studies have examined the influence of entrepreneurship education on students' innovation and entrepreneurial intentions. Wei et al. (2019) investigated the impact of entrepreneurship education on students' innovation through a multiple mediation model, highlighting its positive effects on various mediators [1]. Similarly, Carpenter & Wilson (2022) conducted a systematic review, affirming the positive influence of entrepreneurship education on students' entrepreneurial intentions, attitudes, and skills [2]. Iwu et al. (2021) focused on the antecedents of students' entrepreneurial intentions, finding that entrepreneurship education, curriculum, and lecturer competency significantly influenced students' intention to become entrepreneurs [3]. Moreover, researchers have explored different approaches and challenges in entrepreneurship education. Linton & Klinton (2019) advocated for a design thinking approach in university entrepreneurship education to enhance students'

learning experience and readiness for real-world entrepreneurial challenges [4]. Ghafar (2020) emphasized the need to align entrepreneurship education with the evolving needs of the workforce, particularly in relation to 21st-century skills [5]. Ratten & Usmanij (2021) called for more relevant and practical research in entrepreneurship education to address emerging trends and challenges [6]. Additionally, the COVID-19 pandemic necessitated a transition to online formats in entrepreneurship education. Liguori & Winkler (2020) discussed the challenges and opportunities of this transition, stressing the importance of adapting pedagogical practices and leveraging digital tools [7]. Hameed & Irfan (2019) provided a comprehensive review, highlighting the characteristics, challenges, and opportunities associated with entrepreneurship education, emphasizing the need for tailored approaches and the development of entrepreneurial mindsets [8]. Azizi & Mahmoudi (2019) investigated the learning outcomes of entrepreneurship education, proposing a holistic approach encompassing knowledge, skills, attitudes, and collaborative abilities [9]. Lindner (2018) explored the integration of sustainability principles into entrepreneurship education for a sustainable future [10]. Overall, future research in entrepreneurship education should focus on practical implications, emerging trends, and addressing the evolving demands of the entrepreneurial ecosystem.

2 Data Materials and Research Methods

2.1 Data Materials

This research utilizes the WOS Core Collection as the search type, focusing on articles, and the CNKI journal database as the data source. The search keyword is “innovation and entrepreneurship education,” covering a 10-year period from January 1, 2014, to May 1, 2023. The WOS Core Collection retrieved 12,054 documents, CNKI retrieved 11,162 documents, and a random sample of 1,000 documents from the WOS Core Collection search results was downloaded as “download_WOS.txt” for visual analysis using Citespace 6.2. R2.

2.2 Research Methods

This study utilizes Citespace 6.2. R2 to process literature data and perform visual analysis. Citespace is a robust tool and framework specifically designed for visualizing and analyzing scientific literature and citation networks. It offers researchers and analysts a comprehensive platform to visually explore and comprehend the structure, dynamics, and evolution of knowledge domains. Citespace employs bibliometric data to generate insightful and interactive visualizations, enabling a sophisticated approach to knowledge mapping.

3 Result

3.1 Comparative Analysis of Published Volume

This study obtained publication data from the WOS and CNKI databases over a 10-year period (Table 1).

The 2023 data of the two databases is incomplete, and the retrieval time is May 1, 2023.

Table 1. Number of papers published by WOS and CNKI in 10 years

Year	WOS (paper)	CNKI (paper)
2014	170	156
2015	365	379
2016	412	975
2017	570	1524
2018	846	1936
2019	1353	2017
2020	1829	1631
2021	2387	1293
2022	3096	1006
2023	1026	245

Data Sources: WOS and CNKI

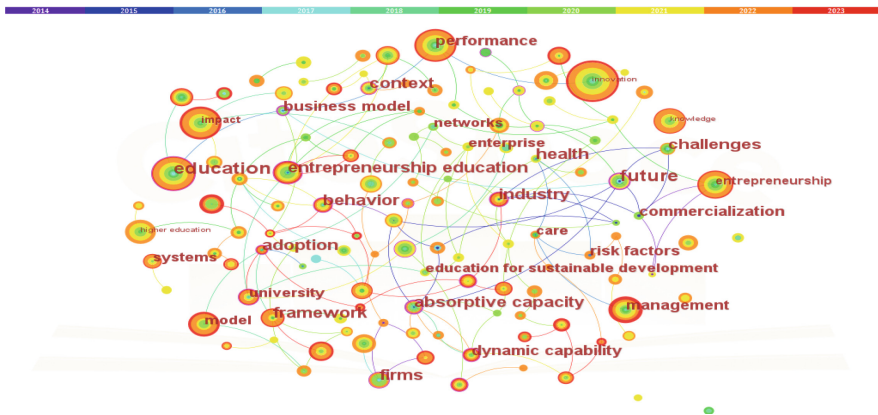


Fig. 1. Keyword network co-occurrence source: Citespace 6.2. R2

3.2 Keyword Co-Occurrence Network Analysis

Keyword co-occurrence networks visualize associations and interactions between keywords. Node size indicates keyword frequency, node color represents appearance time, and line thickness signifies co-occurrence strength. Figure 1 displays a keyword network with 383 nodes and 991 connections.

3.3 Keywords with the Strongest Citation Bursts

Keywords with the strongest citation bursts is used to identify prominent occurrences or significant increases in keywords over a period of time. In Fig. 2, red is the high heat state, and blue is the low heat state.

Top 20 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2014 - 2023
culture	2014	1.72	2014	2019	
future	2015	2.95	2015	2017	
research and development	2015	2.09	2015	2017	
engineering education	2017	1.39	2017	2019	
social entrepreneurship	2018	2.83	2018	2020	
self efficacy	2018	2.32	2018	2019	
adsorption	2018	2.09	2018	2019	
perspective	2018	1.95	2018	2019	
intentions	2018	1.41	2018	2020	
networks	2018	1.4	2018	2020	
market orientation	2019	2.14	2019	2020	
personality	2019	1.71	2019	2020	
challenges	2015	1.41	2019	2020	
green	2020	1.86	2020	2021	
climate change	2020	1.86	2020	2021	
bibliometric analysis	2020	1.86	2020	2021	
enterprise	2020	1.55	2020	2021	
empirical evidence	2020	1.24	2020	2021	
success	2021	1.75	2021	2023	
policy	2017	1.46	2021	2023	

Fig. 2. Keywords with the strongest citation bursts source: Citespace 6.2. R2

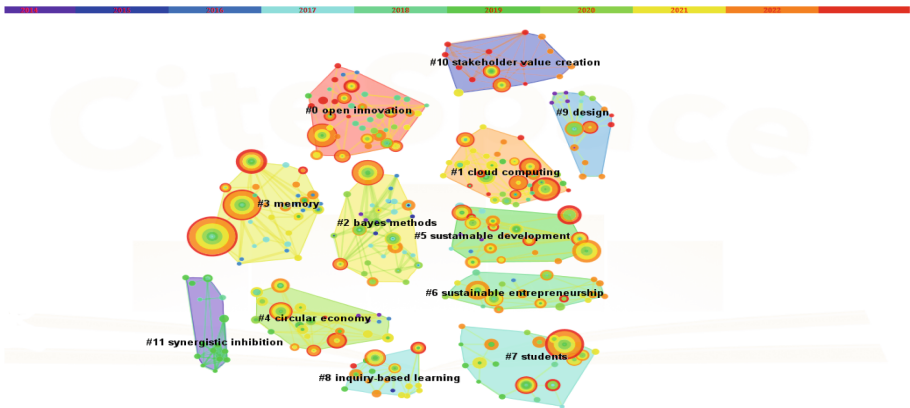


Fig. 3. Keyword cluster analysis source: Citespace 6.2. R2

3.4 Keyword Cluster Analysis

Keyword clustering analysis can identify and organize keywords with similar co-occurrence patterns, thereby revealing themes and research structures within the research field. As shown in Fig. 3, there are 12 clustering results, #0 open innovation, #1 cloud computing, #2 bayes methods #3 memory, #4 circular economy, #6 sustainable entrepreneurship, #7 students, #8 inquiry-based learning, #9 design, #10 stakeholder value creation, #11 synergistic inhibition.

3.5 Keyword Timeline Analysis

Keyword timeline analysis, you can understand the first time when key words appear in keyword clustering, as well as the hot and cold states of research in different time

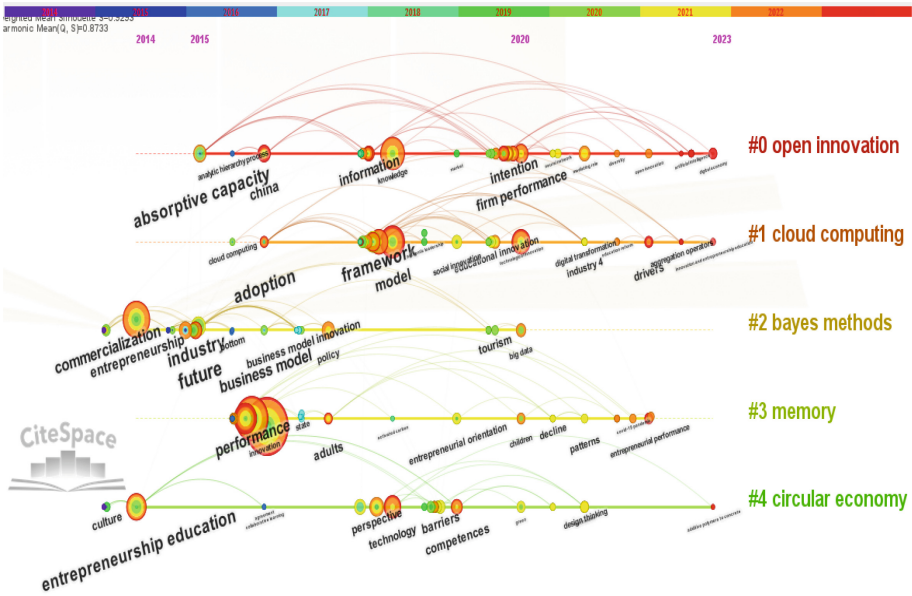


Fig. 4. Keyword Timeline Analysis source: Citespace 6.2. R2

periods. Reflect the time evolution and development process of the research field. As shown in #0 open innovation in Fig. 4, the keywords in this cluster first appeared in 2015 and the research trend is still in a hot state so far. The #4 circular economy cluster has shown a cooling state since its appearance in 2014, and the research enthusiasm is low.

4 Discussion

4.1 Innovation and Entrepreneurship Education and Higher Education System

Innovation and entrepreneurship education play a crucial role in the higher education system. By incorporating innovation and entrepreneurship into higher education curricula, institutions aim to prepare students to identify opportunities, develop creative solutions, and take calculated risks. Entrepreneurship education encourages students to think critically, embrace ambiguity, and cultivate an entrepreneurial mindset. It fosters an environment that promotes innovation, problem-solving, and the ability to adapt to changing circumstances. By integrating entrepreneurship into various disciplines, higher education institutions can equip students with the skills needed to drive economic growth, create jobs, and address societal challenges.

4.2 The Future Development of Innovation and Entrepreneurship Education

The future development of innovation and entrepreneurship education holds great potential. Here are some key areas of focus for the future development of entrepreneurship education. Encouraging collaboration between different disciplines and departments within

universities can promote innovative thinking and problem-solving. Interdisciplinary programs and initiatives foster creativity and allow students to leverage diverse perspectives. Embracing technological advancements and leveraging digital tools can enhance entrepreneurship education. Online platforms, virtual learning environments, and digital resources can facilitate flexible and accessible education, reaching a wider audience and promoting global collaboration. Integrating social and sustainable entrepreneurship into entrepreneurship education addresses the growing demand for businesses that have a positive impact on society and the environment. This includes teaching ethical practices, social responsibility, and the development of sustainable business models.

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