Visual Analysis of the Current State of Research on Innovative Entrepreneurship Courses and Discussion of Cutting-Edge Topics

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Abstract: Since the implementation of dual-creation education, colleges and universities have launched over 40,000 online and offline dual-creation education courses [1] . Over the years, the publication of related research papers has consistently grown, leading to the development of a distinctive Chinese model for innovation and entrepreneurship courses. Identifying the problematic areas of Chinese innovation and entrepreneurship curriculum research through a systematic review aims to provide scholars with references and information for understanding the current state of China's innovation and entrepreneurship curricula and guide future research. This study used CiteSpace software to retrieve 1,192 relevant articles from the CNKI database from 2005 to 2023 and conducted visual analyses. The development of the domestic innovation and entrepreneurship curricula was objectively analyzed by mapping the knowledge map of literature publications, research authors, research institutions, and cutting-edge research topics in this field. The results highlight the following four key aspects. 1) Research authors in the same institution and region more frequently. 2) Universities with more publications are mostly concentrated in economically developed areas such as Beijing, East China and South China. 3) The focus of entrepreneurship education research is on entrepreneurship itself, including entrepreneurial awareness, intention, willingness, and ability. This research is organized vertically according to the chronological evolution of the research themes. 4) Curriculum development research focuses on curriculum construction, design, teaching mode, setting, and system. To enhance the value leadership of the innovation and entrepreneurship curriculum and promote its high-quality development, it is suggested to discuss hot issues such as curriculum ideology and intelligent curriculum system construction, strengthen the digital application of the curriculum system, and continue to carry out curriculum connotation construction.
CCS CONCEPTS • Human-centered computing • Visualization • Empirical studies in visualization

Keywords: Innovation and entrepreneurship curriculum, visual analytics, curriculum ideology, artificial intelligence

1 INTRODUCTION

China attaches great importance to nurturing young scientific and technological talents and training them to become the driving force of innovation. China's innovation and entrepreneurship education is related to the soft power of individuals and the country. Innovation and entrepreneurship courses are the foundation for colleges and universities to

promote innovation and entrepreneurship education. Since the implementation of dual-creation education, colleges and universities nationwide have launched over 30,000 dual-creation education courses, and more than 11,000 online open courses, and hired more than 30,000 full-time dual-creation teachers. Since the Chinese government strengthened dual-creation education in 2005, the number of papers published on innovation and entrepreneurship courses has increased steadily, with curriculum construction, research hotspots and cutting-edge themes becoming increasingly prominent.

Starting from the perspective of bibliometrics, this study used CiteSpace software to visualize and analyze 1,192 articles about innovation and entrepreneurship courses from China's CNKI database. The study mapped the knowledge structure and evolution path of the field, identified the core research topics, and combed through the research development vein and research hotspots of the field of dual-entrepreneurship courses in the past 18 years. The authors hope to provide references for future researchers and promote the high-quality development of innovation and entrepreneurship courses in colleges and universities.

2 METHODOLOGY AND DATA SOURCES

Knowledge mapping can identify relationships and trends between things in the objective knowledge database [3] . CiteSpace, a scientific knowledge mapping software developed by Prof [2] . Chaomei Chen in 2003, analyzes citation space to explore and mine the dynamic changes in scientific research.

In this study, CiteSpace (version 6.2.R4) was used to visualize and analyze the collected data. The data collection was carried out according to the following steps. Firstly, the search expressions were identified as "innovation course", "entrepreneurship course" and "innovation and entrepreneurship course" by reviewing a large number of high-quality periodicals related to the field of innovation and entrepreneurship education. Secondly, the data were screened according to the following rules: (1) the data source was selected from China's CNKI database; (2) the retrieved literature spanned 18 years, from 1 January 2005 to 1 September 2023; (3) the advanced search method of China's CNKI database was adopted in this study and (4) the search results were obtained from the Chinese database. After further screening and manual removal of irrelevant literature such as newspapers, conference papers, books and news, 1,192 valid literature data were finally retained [6] .
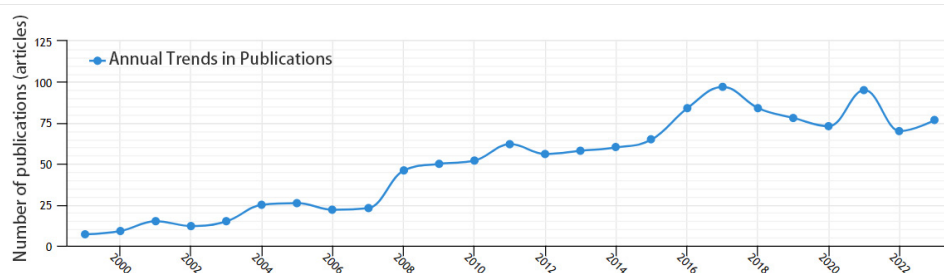

Figure 1: Article number - A particular year.

Figure 1 shows the increasing annual trend of related publications on innovation and entrepreneurship course research. The chart in Figure 1 was obtained from the document "Implementation Opinions on Deepening the Reform of Innovation and Entrepreneurship Education in Colleges and Universities" issued by the General Office of the State Council. It can be seen from Figure 1 that the number of publications has a significant upward trend since 2015.

Since the General Office of the State Council re-issued the "Guidance Opinions on Further Support", the number of articles reached the latest peak in 2021.

3 ANALYSIS OF FINDINGS

3.1 Analysis of authors

Figure 2 shows the cooperative map of domestic published authors. The size and depth of nodes in the knowledge graph indicate the amount of an author's posting and the frequency of their appearances. The more connections a node has, the more collaboration there is between the authors. The thickness of the connection indicates the strength of the collaboration. The map in Figure 2 has 297 nodes and 83 connections, in which the most appearances of the issuing authors are Zhuo Zelin (10 times), followed by Huang Zhaoxin (9 times), Xu Xiaozhou (7 times), and there are 11 authors with more than 4 appearances. The network density of the total number of cited documents is 0.0019, as shown in Table 1. Zhuo Zelin, Huang Fuchuan, and Zeng Wentjie, all from the South China Teachers' University, and Xu Xiaozhou, Zheng Gang, Mei Weihui and Ni Hao, all from Zhejiang University, demonstrate that innovation and entrepreneurship course researchers tend to cluster in the same institutions and regions, indicating a preference for collaborative research within institutions and regions. Moreover, authors who issue articles alone account for most of the articles, and there is less cooperation among authors from different institutions and regions, and the overall academic research is decentralized.

Figure 2: Cooperative map of domestic published authors.

3.2 Analysis of Research Institutions

The visual analysis of research institutions was carried out through CiteSpace software. The co-occurrence mapping of author institutions is shown in Figure 3 consisting of 294 nodes, 44 connections, and a network density of 0.001. It can be seen from the figure that the College of Educational Sciences of South China Normal University, the College of Education of Beijing Normal University, the College of Education of Zhejiang University, and the Research Institute of Curriculum and Instruction of East China Normal University are the most prominent, indicating that these universities have carried out in-depth curriculum research. The number of connecting lines suggests that research institutions tend to work independently, with little close collaboration across institutions. Instead, collaboration tends to occur within the same region.

Figure 3: Cooccurrence map of authors institutions.

Table 1 lists the high-frequency published authors and high-frequency research organizations. From the geographical point of view, the universities with more publications are mostly concentrated in Beijing, East China South China and other regions with higher economic levels. The rich economic resources and economic conditions also promote the cultivation of innovative and entrepreneurial talents in universities. From the research level of the universities, the institutions with more publications are mostly the institutions with higher academic levels in China, indicating that the research and construction of innovative and entrepreneurial courses are the foundation for high-level universities to cultivate complex and innovative talents [4] .

Table 1: High-frequency published authors and high-frequency research organizations.

Serial number	Author	Literature	Serial number	Research Institution	Literature
1	Zhuo Zelin	10	1	Zhejiang University	35
2	Huang Zhaoxin	9	2	South China Normal University	28
3	Xu Xiaozhou	7	3	East China Normal University	25
4	Huang Puquan	4	4	Beijing Normal University	22

5	Sang Xinmin	4	5	Tsinghua University	18
6	Zheng Gang	4	6	Nanjing Normal University	17
7	Pan Yong	4	7	Nanjing University	17
8	Zeng Wenjie	4	8	SouthEast University	15
9	Mei Weihui	4	9	Beihang University	14
10	Li Hongxiu	4	10	Wuhan University	13

3.3   Thematic discussion on research frontiers

The keywords contained in the literature from 2005 to 2023 were visualized to track down the hot research topics focused on in that time region. Figure 4 shows the research keyword knowledge map, which provides insights into the trends in this research area.

Figure 5 is obtained from a comprehensive collation and analysis of frequency, centrality, year, and keyword. The higher the frequency, the greater the centrality, which indicates that the keyword has been the focus of attention in the research field in recent years. According to the order of frequency, the keyword with the largest node is "entrepreneurship education", and the top-ranked keywords include curriculum ideology, innovation ability, entrepreneurship curriculum, teaching mode, and curriculum construction. The increasing focus on curriculum ontology construction suggests that universities value and are committed to optimizing curriculum systems and constructing meaningful curricula.
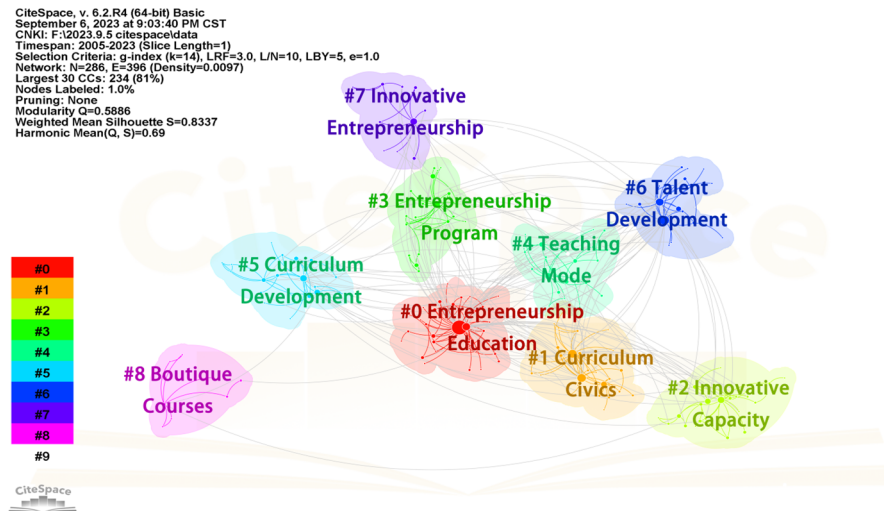

Figure 4: Keyword Cluster Analysis of Innovative Entrepreneurship Curriculum Research.

The knowledge map of the time sequence of the evolution of the research subject can reflect the time of the appearance of the keywords, which intuitively demonstrates the evolution process of the hotspots in the research field. Figure 6 shows the evolution time sequence of keywords in the field of curriculum research from 2005 to 2023. It can be seen from the figure that research on entrepreneurship education, entrepreneurial awareness, intention, willingness, and ability has mainly focused on entrepreneurship itself and has also developed along a line focused on curriculum development, including curriculum construction, design, teaching mode, setting, and

system, highlighting the Curriculum Civics and Politics, Intelligent Curriculum System Construction and other key thematic directions with high discussion heat.

Figure 5: Keywords map of innovation and entrepreneurship research in Higher Vocational Education.

Figure 6: Research Topic Timeline View (2005-2023).

3.3.1 Practical Path of Civics in Innovation and Entrepreneurship Courses

The concept of "curriculum ideology and politics" comes from the educational exploration of Shanghai universities. Its essential purpose is to solve the phenomenon of "two skins" that exists between the ideological and political theory courses and other courses of college students. The solution of ideology and politics of innovation and entrepreneurship is to develop and explore the ideological and political education resources of the courses, and to conduct ideological and

political education for college students with the help of dual-creation courses and dual-creation practical activities [7] .

In recent years, the reform of innovation and entrepreneurship education in Chinese colleges and universities has made certain achievements. However, there still exist certain problems to be solved, such as a lack of focus on cultivating students' innovation and entrepreneurship spirit, a lack of value leadership in students' entrepreneurship process, and a lack of emphasis on cultivating innovation consciousness in scientific research exploration. To solve the above-mentioned problems, the path for the construction of ideological and political construction of innovation and entrepreneurship courses in colleges and universities mainly has the following aspects:

Continuously build the innovation and entrepreneurship education system with school characteristics and enhance the value leadership of the curriculum. Taking engineering colleges and universities as an example, they should critically evaluate their innovation and entrepreneurship education programs and develop programs that align with their institutional missions and values, and that apply what students are learning in the classroom to real-world problems. They should also strengthen the role of innovation and entrepreneurship courses in cultivating engineering students' ideological and political awareness, and enhance the value leadership of dual-creation courses. It highlights the cultivation of students' entrepreneurial spirit, entrepreneurial spirit and sense of social responsibility.

Civic and political elements are deeply integrated with the teaching content of innovation and entrepreneurship programs. Led by the concept of "curriculum ideology and politics", ideological and political education is conducted through the whole process of the construction of dual-creation courses. Organic integration of ideological and political education with the teaching content of innovation and entrepreneurship courses: Continuous updating and adjustment of the course content based on students' ideological education, career planning and social demand. Focus on identifying and developing the ideological and political elements of dual-creation courses. Use practical teaching such as the "Internet + Competition Camp" as the path of integration, with an emphasis on cultivating students' entrepreneurship and entrepreneurial awareness. Ensure that the teaching practice is integrated with students' employment and social demands. Cultivation of entrepreneurship and entrepreneurial awareness is emphasized in the course, and the teaching practice is combined with students' employment and social needs to make students constantly feel the pulse of the times and the needs of the country.

Improve the reform of teaching mode and play the effect of "value-led". Upgrading the innovation and entrepreneurship teaching mode by SPOC+PBL, forming a distinct blend of 'Civic Engagement, Professionalism, and Innovation and Entrepreneurship'. This approach fosters a deeper integration of ideological and political education, innovation and entrepreneurship education, and professional education. Linking the school with high-quality curriculum resources, fostering collaboration between classrooms through the flipped classroom model and constructing a community of civic and political education, a comprehensive educational environment can be created. This is achieved through the seamless integration of on-campus and off-campus resources, flipping mode connecting inside and outside the classroom, building a community of ideological and political education, forming an integrated curriculum group with "ideological and political infiltration, consistent content, learning and

training as a whole" through the "ideological and political education-curriculum-projects-practical training-contests-transformation" necklace-type educating chain, and building a dual-creation brand tournament.

3.3.2 Construction of Intelligent Innovation and Entrepreneurship Curriculum System in Colleges and Universities

Intelligent innovation and entrepreneurship curriculum systems are emerging in the new educational landscape. These systems are built on traditional education curriculum concepts, within the context of the development of "Internet+Education", and according to the innovation and entrepreneurship curriculum cultivation program [8] . Their core focus is on cultivating students' innovation spirit, entrepreneurial awareness and innovation and entrepreneurial ability. The innovation and entrepreneurship curriculum system is constructed according to the cultivation program of innovation and entrepreneurship courses. Different from the innovation and entrepreneurship courses under the traditional teaching mode, the construction of an intelligent innovation and entrepreneurship course system is more in line with the needs of teaching development.

The design scheme of intelligent innovation and entrepreneurship course systems in the context of "mass entrepreneurship and innovation" differs from the traditional "learn first and ask questions later" approach. By leveraging the Internet + intelligent teaching platform, these systems can enable "ask first and learn later" teaching, stimulate students' interest in innovation and entrepreneurship, and improve the teaching quality of innovation and entrepreneurship courses.

The digital application of intelligent innovation and entrepreneurship curriculum system construction should be enhanced. At the level of curriculum construction, intelligent innovation and entrepreneurship courses have been established and the inclusion of the innovation and entrepreneurship curriculum system of school-enterprise cooperation in the application program has been encouraged. Focusing on the deep integration of innovation and entrepreneurship education and professional education under "Internet+Education", the practical path is the intermingling of the professional talent training curriculum system and the innovation and entrepreneurship curriculum system. At the level of talent cultivation, the consensus of the domestic education sector is to strengthen the cultivation of digital application talents, which is also the fundamental trend of the development of higher education. Digital application talents must have a high degree of sense of responsibility, and possess a certain degree of innovation ability, practical ability, and learning ability under the "Internet +".

Continuously optimize and constantly develop the intelligent innovation and entrepreneurship curriculum system. At present, there is still a long way to improve and optimize the intelligent innovation and entrepreneurship curriculum system in colleges and universities. In particular, there is room for improvement in the following areas: the importance attached by leaders of colleges and universities, the top-level design of schools, the connotation construction of courses, and the in-depth integration of classes and races. Currently, most of the universities in China focus on one or several elective courses, and they have not developed intelligent innovation and entrepreneurship courses with their advantages, not to mention the formation of a perfect curriculum system.

4 CONCLUSIONS

This paper uses CiteSpace visual analysis software to statistically analyze the innovation and entrepreneurship course papers published in the CNKI journal library from 2005 to 2023 [5] . By visualizing the massive literature information of CiteSpace, the paper presents the analysis of the research authors, the analysis of the research institutions in this research field, the knowledge spectrum map of research keywords and the research theme evolution. The paper discusses the research frontier themes to provide a deeper understanding of the construction and development of innovation and entrepreneurship courses in Chinese universities, to explore the hot issues at the research frontier of this field, and to provide references for further in-depth research.

Innovation and entrepreneurship course is an applied course that helps students understand the content and essence of innovation and entrepreneurship, provides students with knowledge of innovation and entrepreneurship and cultivates innovation and entrepreneurship ability. This paper aims to solve the problems highlighted in the construction and development of innovation and entrepreneurship courses in the context of mass entrepreneurship and innovation. It responds to the government's call to promote innovation and entrepreneurship education in colleges, vocational colleges and universities. The paper uses knowledge maps to visually display the panorama of information in the field of innovation and entrepreneurship courses. Moreover, it also takes the education of course ideology as a guiding ideology to promote innovation and entrepreneurship courses and improve their quality. Colleges and universities should embed ideological and political education into innovation and entrepreneurship courses, enrich the connotation of these courses, and upgrade their teaching methods. They should also significantly enrich the digital resources of innovation and entrepreneurship courses, reinforce students' practice in these areas, and promote the diversification of innovation and entrepreneurship education. This will help to improve the quality of innovation and entrepreneurship talents training in colleges and universities the quality of innovation and entrepreneurship talents training in colleges and universities.

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