

Research Progress and Future Prospect of Vocational Undergraduate in China—Bibliometric Visualization Analysis Based on Citespace

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In order to explore the research progress and future development trend of vocational undergraduate education in China, 699 references in the field of vocational undergraduate research from 2010 to 2022 are comprehensively analyzed with the project of “vocational undergraduate” in CNKI in China by using the functions of scientific and technological text mining and visualization of Cite Space software. According to the results, the annual number of papers issued by vocational undergraduates presents a blowout-like development trend, and has gradually become an important carrier for the exchange of vocational education practice and theoretical research. The research projects focus on the basic theory of vocational undergraduate education, the training mode of vocational undergraduate talents, specialty setting and orientation, and the future research hotspots involve teaching reform, vocational education transformation, ideological and political programs, technical skills, etc.

Keywords: vocational undergraduate, research hotspots, future trend

Introduction

With the rapid development of scientific and technological progress and industrial change, China’s demand for skilled vocational undergraduates is increasing day by day so as to improve the overall quality of the development of higher vocational education, reverse the mismatch between what students learn and the needs of the society, and realize the transformation and development of higher vocational education into an applied technology university. In October 2021, the General Offices of the Communist Party of China Central Committee and the State Council issued the *Opinions on Promoting the High-quality Development of Modern Vocational*

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Education, which clearly stated that by 2035, “the enrollment scale of vocational undergraduate education shall not be less than 10% of the enrollment scale of higher vocational education”, and the development of a number of higher education institutions with applied technology and skills shall be encouraged. As an important way for the popularization and high-quality development of higher education, vocational undergraduate is an important measure for the development of modern vocational education system. It is an important research method to summarize by traditional reference reading method, but the bibliometrics research method based on mathematics and statistics can dig out the complex relationship between knowledge network structure and evolution trend through graph, explore the research hotspots and trends in the research field, understand the world by means of scientific knowledge graph, and integrate three ways of thinking: vision, mathematics, and philosophy, so as to reflect and approach the development law of the research field more deeply (Chen et al., 2015).

This paper, using graph quantitative research, shows the evolution process of vocational undergraduate field, summarizes the overall framework and research frontier of vocational undergraduate combined with the theoretical basis of disciplines, and emphatically comments on the current research problems and hot trends of vocational undergraduate through quantitative analysis of references, so as to deepen the understanding of the development law of vocational undergraduate field and grasp the future development trend of vocational undergraduate.

Research Foundation

Data Source

In CNKI, the key word “vocational undergraduate” is used to search words, the reference type is selected as journals, and the search time is set from 2010 to 2022, ending on December 31, 2022, a total of 797 documents are retrieved. In order to ensure the accuracy and effectiveness of the retrieved data, 699 Chinese references are retrieved by reading the references and manually removing the references on irrelevant topics such as conferences and news reports, and the references are analyzed in refword format.

Research Tools

With the help of citespace 6.2. R2 software and CNKI, this paper retrieves and collects effective data, sets reasonable parameters and debugs repeatedly, and finally draws an intuitive and easy-to-read graph. Based on the visual graph drawn from the data, the keywords and emergent words of vocational undergraduates are systematically interpreted and analyzed to predict the research hotspots and future development trends.

Research Results and Analysis

Analysis of the Change Trend of Reference Output

There is a positive correlation between the number of references and the research activity. According to Figure 1, the domestic research dynamics are becoming more and more active between 2019 and 2022, with an overall rapid upward trend and a sharp increase in the rate of development. CNKI counts the published reference in the field of vocational undergraduate research from January 1, 2010 to December 31, 2022, as shown in Figure 1.

As shown in Figure 1, according to the distribution of the number of research documents, the research stage of “vocational undergraduate” can be roughly divided into three parts.

In the first stage, i.e., the embryonic stage (before 2012), the total number of articles published was less than 10. A few scholars have attempted to combine the “undergraduate level” with “vocational education”, which has

not had a corresponding academic impact.

In the second stage, i.e., the gradual development period (2013-2018), the number of articles published increased slowly. The national policy clearly puts forward to explore the development of vocational undergraduates, and transform and upgrade into vocational undergraduates from three ways: higher vocational education, merger of higher vocational colleges and independent schools, and independent schools. The introduction of the policy has increased the relevant research results. In order to enhance social recognition and carry out the reform of improving quality and cultivating excellence in vocational education, the state regulates the cultivation of students' skills from the institutional level, and excavates various social resources to help explore vocational undergraduates.

In the third stage, i.e., the rapid growth period (2019-2022), the annual number of articles published exceeded 300 in 2022, indicating that vocational undergraduate research has become a very hot research topic and is in a high-speed development stage, and the annual number of articles published in vocational undergraduate research shows a gush-like development trend. In the process of industrial transformation, guided by the social demand brought by economic development, it is urgent for vocational undergraduates with dual orientation of vocational type and undergraduate level to participate in vocational education. Adapting to the needs of economic development is one of the driving forces for the development of vocational undergraduates (Shi, Lan, & Liu, 2021).

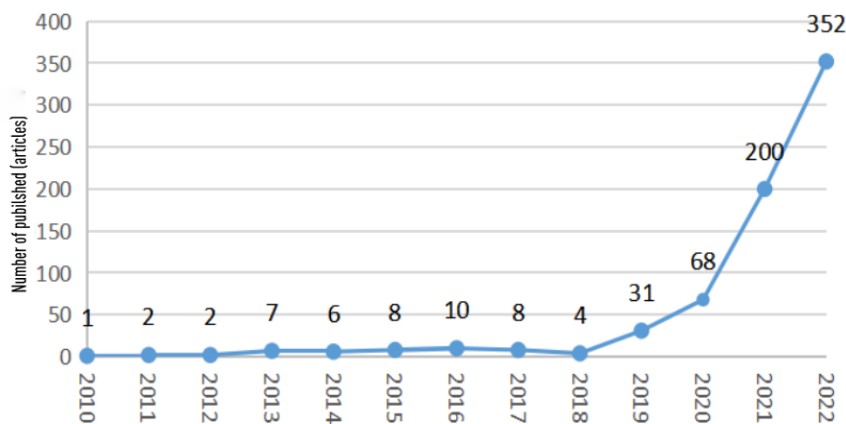


Figure 1. Distribution of the number of research documents of vocational undergraduates in China.

Analysis of Research Institutions

According to Figure 2, Guangxi City Vocational University (52 articles) and Guangzhou Vocational University of Science and Technology (32 articles) are the top two research institutions, and most of the publishing institutions are mainly vocational colleges, while universities of comprehensive and science and engineering nature are less involved, and the nature of institutions is relatively simple. Most of the publishing institutions are concentrated in Guangxi and Guangdong, accounting for 49%, and most of them are concentrated in economically developed cities. There are few research institutions in remote areas, and the geographical distribution of research institutions is uneven and varies considerably. From the upper left information column in the organization cooperation graph, it can be concluded that there are 197 institution network nodes, with 47 connections between nodes, the network density is 0, and the total number of samples is 699. It shows that there is less cooperation and less correlation between institutions, and that a close network partnership has not yet been

formed.



Figure 2. Knowledge graph of research institutions.

Analysis of Research Hotspots and Evolution Trend

Keyword cluster analysis. In this paper, after keyword co-occurrence processing of the data using CiteSpace software, the LLR algorithm is used to perform keyword cluster analysis to further understand the commonalities that exist among the research hotspots. According to the information above the keyword cluster graph of domestic vocational undergraduates in Figure 3, the cluster module value is $Q = 0.55$, which is greater than 0.3. It can be seen that the cluster module structure is reasonable and the average contour value $S = 0.917$, indicating that the cluster result is convincing. The cluster graph is divided into eight clusters: #0 vocational undergraduate, #1 vocational education, #2 talent training, #3 orientation, #4 school-enterprise cooperation, #5 industry-education integration, #6 specialty setting, and #7 undergraduate education.

By interpreting Figure 3 “Cluster information” and analyzing the reference, we obtained Table 2, which summarizes the hotspots of vocational undergraduate research into three research topic areas: vocational undergraduate basic theory, talent training mode, and major setting and orientation.

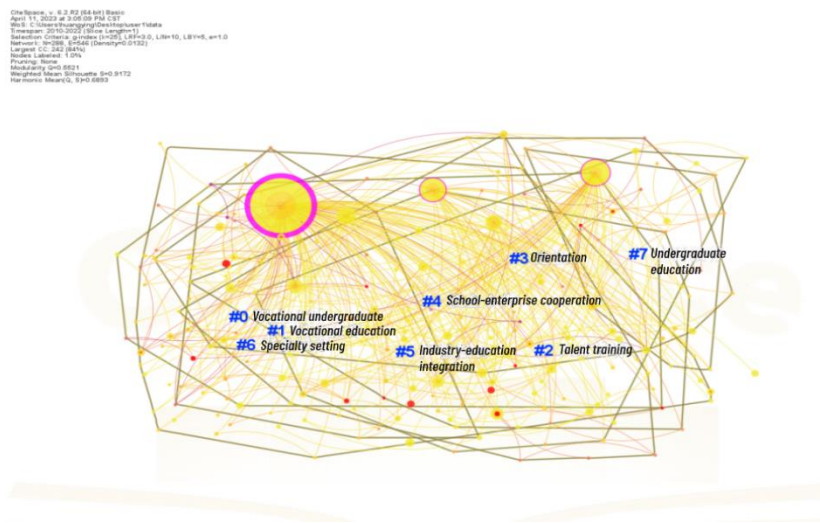


Figure 3. Keyword cluster graph of domestic vocational undergraduates.

Table 2

Cluster Analysis of Keywords for Vocational Undergraduates

Cluster S.N.	Cluster name	Cluster quantity	Research focus
# 0	Vocational undergraduate	7	Basic theory of vocational undergraduate
# 1	Vocational education	63	
# 7	Undergraduate education	9	
# 2	Talent training	8	Talent training mode
# 4	School-enterprise cooperation	32	
# 5	Industry-education integration	25	
# 3	Orientation	24	Specialty setting and orientation
# 6	Specialty setting	10	

The first category is the basic theoretical research of vocational undergraduate education, which mainly includes three clusters: #0 vocational undergraduate education, #1 vocational education, and #7 undergraduate education. The corresponding keywords are “teaching criteria”, “training mode”, “general undergraduate education”, and “reform of teachers, textbooks and teaching methods”. Some scholars believe that the emergence of vocational undergraduate undertakes the mission of training high-level skilled talents, and its connotation includes two dimensions: academic and professional. The academic dimension of vocational education requires the trained skilled talents to be more and more professional and innovative in skills. Applied academics in vocational education become reflective practitioners of practice as they move from theory to practice and from practice to theory in the application of technology, thereby generating new theoretical knowledge of technology. Vocational dimension is reflected in the training process, following the law of vocational education talent training, and integrating theoretical programs, technical programs, and situational application programs into the framework of undergraduate vocational education talent training. From the research results, the theoretical connotation of vocational undergraduate in China needs to be improved, so it will be an important topic in the research field in the future.

The second category is the research on talent training mode. #2 talent training includes high-frequency keywords such as “ideological and political programs”, “big data”, and “cross-border e-commerce”, #4 school-enterprise cooperation covers high-frequency keywords such as “specialty construction”, “curriculum construction”, and “labor education”, and #5 industry-education integration brings together high-frequency keywords such as “curriculum system”, “teaching reform”, and “practical teaching”. It can be seen that scholars explore the training mode of vocational undergraduate talents, give full play to the demonstration role of vocational education pilot at undergraduate level, advocate practical teaching under the industry-education integration, establish teaching practice bases, integrate superior resources of enterprises, break through barriers between universities and enterprises, and build innovative and entrepreneurial training bases. Schools join hands with advantageous enterprises to run schools together, with schools providing venues, facilities, teachers and management, etc., while enterprises provide technology, part of the training base, etc., and the two sides build industrial colleges, realizing the in-depth fusion of curricula and industries, and broadening the avenues of industry-education integration. Combining talent training with ideological and political programs, the purpose of talent training is cooperative education. Enterprises are prone to be quick-witted and oriented to scientific and technological goals, neglecting the nurturing value of talent cultivation. School-enterprise cooperative education can better achieve the goal of cultivating high-quality innovative skilled talents.

The third category is the research on specialty setting and orientation. #3 orientation and #6 specialty setting reflect the policy orientation and research focus in the field of relative vocational undergraduate research. Among them, #6 specialty setting contains high-frequency keywords such as “development path”, “school-running orientation”, and “technical skills”. Since 2019, the academic research reference on vocational undergraduates has been increasing day by day. Vocational undergraduates should not only tap the existing resources of the school, but also combine the needs of social industries. Instead of following a set of professional criteria like general undergraduates, they should flexibly set professional programs, develop digital program resources, and integrate information technology into the construction of professional programs. Under the trend of industrial transformation and upgrading, enterprise product innovation no longer relies solely on breakthroughs at the front-end R&D stage, but also focuses on continuous innovation at the back-end of production. This means that innovation no longer relies solely on scientific research and innovation by scientists, but all those involved in the production process can carry out research and innovation activities.

Keywords timeline graphical analysis. In order to further reflect the evolution process of research hotspots of domestic vocational undergraduates, CiteSpace software is used in this paper to create a path graph of the research evolution of domestic vocational undergraduates.

The research evolution path of vocational undergraduate education in China is generally divided into three stages:

The first stage, i.e., before 2012. The key words in this stage are “vocational education”, “teaching structure”, and “teaching scale”. The context of research is also relatively clear. Scholars mainly focus on training low-skilled talents based on traditional vocational education, which cannot meet the needs of industrial transformation and upgrading. They shall explore vocational undergraduate education and break the limitations of vocational education college level.

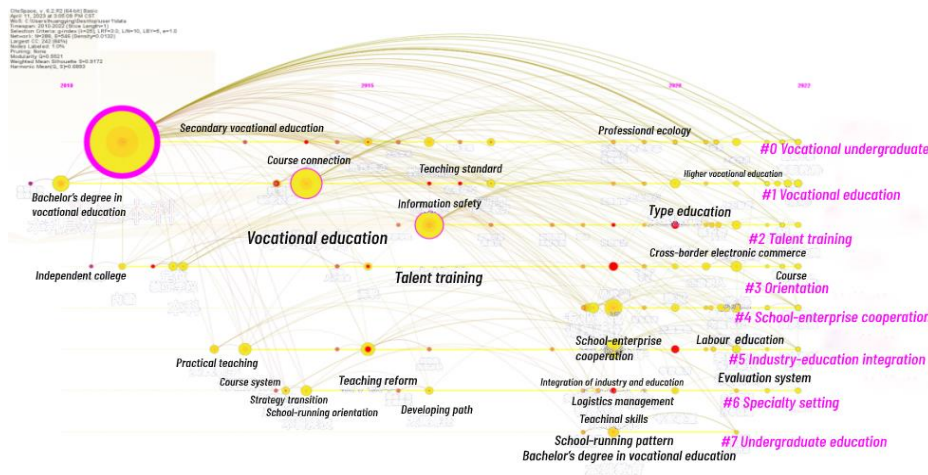


Figure 4. Research evolution path diagram of domestic vocational undergraduates.

The second stage, i.e., 2013-2018. The key words at this stage are “talent training”, “industry-education integration”, “school-enterprise cooperation”, “program construction”, “professional groups”, etc. Many scholars have begun to research around the talent training mode, and the industry-education integration, school-enterprise cooperation has gradually become a hotspot for research. A series of problems, such as the lack of double-position

teachers in schools, actual demand motivation of enterprises, sense of responsibility in talent training in cooperation, and the difficulty in realizing school-enterprise cooperation, have gradually become prominent. Coordinate and deepen cooperation between the two sides through policy and financial support from the government to maximize the overall social benefits. Shi et al. (2021) believe that vocational education is not guided by discipline and professional knowledge, but by applied skills and knowledge. The driving force comes from the social and economic development. Vocational undergraduates, by tapping the advantageous resources of the school, combination with the characteristics of local economic development, guide schools to build distinctive professional groups to serve the local economy (Shi et al., 2021).

The third stage, i.e., from 2019 to now. The key words at this stage are “ideological and political programs”, “cooperative education”, “artificial intelligence”, “type orientation”, “evaluation system”, etc. Strengthen the reform and innovation of modern vocational education system, and explore in the direction of alleviating the contradiction in the demand for skilled talents. Vocational undergraduates play the role of cooperative education by ideological and political programs, aiming at training high-level skilled talents. Artificial intelligence provides a powerful tool for training high-skilled talents, helps people liberate from complex vocational education activities, and promotes the high-quality development of vocational undergraduates. Xing and Guo (2022) believe that the type orientation of vocational undergraduate education is an important foundation for perfecting the modern vocational education system. The discussion on the transformation of different types of colleges into vocational undergraduate colleges is an important way to help the innovation and development of vocational undergraduate colleges (Xing & Guo, 2022).

Top 15 Keywords with the Strongest Citation Bursts

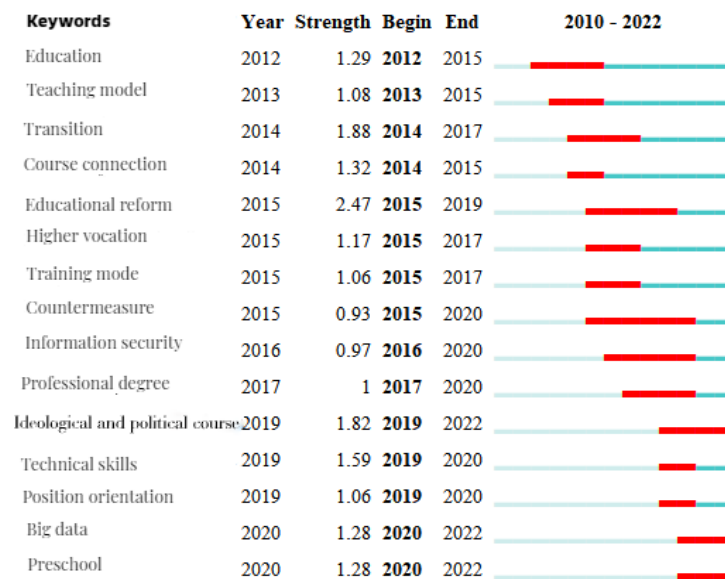


Figure 5. Keyword prominence graph of domestic vocational undergraduate reference, 2010-2022.

Mutation words. Mutation words are keywords whose frequency contribution suddenly increases in different time periods (Liu, Zhang, & Yan, 2016). In Citespace software, in order to plot the top 15 keywords of

mutation rate, the minimum duration in mutation algorithm is set to 1, $\gamma = 0.3$, as shown in Figure 5.

From the mutation analysis graph, the highest mutation intensity is teaching reform (2.47), which shows that scholars focus on teaching reform in this stage. Li and Shi (2022) believe that by joining forces with advantageous enterprises and taking the training of special professionals needed for social development as the starting point, the reforms of the programs, teachers, textbooks, teaching methods, and other related teaching elements are carried out to improve the characteristic talent training system while realizing the goal of developing the characteristics of vocational undergraduate programs (Li & Shi, 2022). In terms of teachers, a digital teaching team can be created to improve the teaching team's practical teaching ability and professional construction capacity, strengthen teachers' digital training, build a digital learning resource base, enhance the information literacy level of teachers in the digital era, take the initiative to learn to use digital tools to empower teaching practice, and adopt digital tools to design teaching cases. In terms of textbooks, enterprises are invited to participate in the development of textbooks for vocational education, so as to realize the advantageous sharing of resources, incorporate the new viewpoints of enterprises into the textbooks that keep up with economic and social needs, locate the vocational undergraduate type of education, and stimulate the vitality of the development of textbooks. In terms of teaching method, the theory-practice integration of classroom teaching is constructed to realize the theory and practice of mutual integration, and enrich the classroom teaching method. The theory-practice integration aims at developing students' comprehensive vocational ability, and integrates teaching with problems and situations, so as to realize students' migration ability to adapt to the switching of different working scenes and successfully connect with the future production process of enterprises.

The second mutation intensity is vocational education transformation (1.88), indicating that school transformation is the frontier issue in the field of vocational undergraduate research. In 2020, the Ministry of Education (2020) issued the *Action Plan for Improving Quality and Cultivating Excellence in Vocational Education (2020-2023)*, which pointed out: "Promote qualified general undergraduate colleges to transform into application-oriented, and encourage independent colleges and higher vocational colleges to be transformed into vocational undergraduate universities." The difference between vocational undergraduate and higher vocational colleges is that they are at different levels, and the difference from general undergraduate is that both vocational undergraduate and higher vocational colleges belong to different types. Vocational undergraduate has the dual attributes of "level + type". In the process of transformation, it is necessary to integrate independent colleges and higher vocational colleges with "level + type". Under the influence of adapting to the needs of economic development and "level + type" innovation, vocational undergraduates have formed a characteristic development direction that meets the needs of economic and social development and conforms to the actual situation of school-running. Vocational undergraduate breaks through the discipline-based school-running mode of general undergraduate and highlights the technical-based school-running characteristics of higher vocational education. Therefore, it is necessary to explore and innovate to promote the transformation of general undergraduate, independent colleges, and higher vocational colleges into vocational undergraduate.

From the analysis of mutation words in vocational undergraduate conference from 2010 to 2022, it is concluded that the emergence of keywords such as "ideological and political program", "professional development", and "specialty setting" reflects the original intention of academic circles to build a modern vocational education system. The professional program focuses on both knowledge and skill acquisition, as well as the function of developing students' political literacy. In school-enterprise cooperation, enterprises mostly focus on economic interests and are unable to balance the relationship between intelligence and moral education,

which is not conducive to promoting the overall development of students. Competence development shall be based on moral development and emphasize both moral and technical skills. Gao (2021) believes that there is a need to clarify the direction of professional development, and that specialty settings should be socially adaptable, and that it is necessary to pay attention to new occupations and new positions, and actively open specialties compatible with new occupations and new positions to meet the demand for vocational education and promote the rapid development of the new economy (Gao, 2021).

Conclusions and Prospects

By analyzing the academic reference of domestic vocational undergraduate education research from 2012 to 2022, and integrating the research status, research hotspots, and future trends of vocational undergraduate education in China in the past 10 years, the conclusions of the research are as follows:

First, the annual publication volume of vocational undergraduate education reference is growing at a spurt, and due to the late start, the overall publication volume is low, which needs to increase the research and innovation in theory and practice. Third, the research institutions are mainly concentrated in Guangxi and Guangdong, mostly concentrated in economically developed cities, and there are few research institutions in remote areas, the geographical distribution of research institutions is unbalanced, and the cooperative network of research institutions has not yet been formed. Fourthly, the research mainly focuses on the training mode of vocational undergraduate talents, industry-education integration, school-enterprise cooperation, and other research topics. Fifthly, it is categorized by cluster graph to reflect the three major areas of vocational undergraduate hotspots, such as the basic theory of vocational undergraduate education, vocational undergraduate talent training mode, and specialty setting and orientation.

The above conclusions anticipate trends that should be captured by future research: First, the empirical research using knowledge graph analysis enriches the diversified research methods of vocational undergraduates, provides new techniques of information processing within vocational undergraduates, objectively reveals the evolution of vocational undergraduates and the future development trend, focuses on the cutting-edge issues and hot topics of vocational undergraduates, and discovers the knowledge network relationship between the research topics. Secondly, track the research evolution path of vocational undergraduate research, predict the overall research trend, dynamically adjust the research direction according to the practical needs, scientifically summarize the research themes and research hotspots, and search for new directions in the basic theories of vocational undergraduate researches. Third, enhance the academic status and level of vocational undergraduates, find interdisciplinary points, absorb the advantages of virtual reality technology, artificial intelligence, big data, and other disciplines, and broaden the knowledge field of vocational undergraduates. Fourth, build an influential professional undergraduate academic research group and give full play to the unique advantages of the academic community. In the process of educational research, actively participating in effective communication and dialogue is helpful to form a professional research team for vocational undergraduates.

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