

Research on the selection of OBE research experts based on the number of papers, the quality of the number of respondents and sustainability

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Abstract: using the econometric visualization research method, this paper selects the core journals in the core database of China Knowledge Network (CNKI) from 2000 to 2020, selects the papers containing OBE and achievement orientation, uses the CiteSpace research tool, first defines and selects the core authors, and then analyzes the occurrence frequency and persistence, research hotspots and evolution process of the core authors, Finally, it analyzes the distribution of core research institutions and the author's cooperation network. It is found that the core author group in the field of OBE and achievement oriented research leads the trend of OBE research in China, and the core author group has the attribute of domain experts. Through the analysis of the institutions and cooperation networks of core authors, it can be found that the cooperation research of core authors in this field in China is insufficient, but the cooperation has improved in recent years.

1. Introduction

In 2020, China's higher education has entered the popularization stage. With the transformation and upgrading of a large number of independent colleges and higher vocational colleges, the social demand for higher education and the accurate positioning of talent training are more urgent. Based on a result oriented OBE education concept proposed by the United States, it has attracted extensive attention and attention in China's educational circles in recent years. In particular, China officially joined the general standard for engineering education certification of the Washington Agreement in 2016. After the construction of a large number of Applied Technology Universities in China, the concept of OBE education has been widely recognized in the field of education in China in recent 20 years.

A large number of relevant studies on OBE Education theory have been carried out in the field of higher education, forming a large number of literature streams. The core author group of a field represents the orientation of a research field and indicates the future development direction of the discipline in the research field.

Firstly, this paper determines the domestic core authors in the OBE field, collects the OBE core literature published by the core authors in related fields in the past 20 years, constructs the research network and institutional network of the core authors in the domestic OBE research field, and analyzes the continuity and research track of the OBE core authors before and after the OBE field according to the time dimension. In order to have a relatively clear analysis of the attention and development trend of relevant disciplines in the field of OBE in China.

2. Research design

The core authors defined in this paper should first be experts in the field of OBE research, and the definition of experts is mainly researchers who continue to conduct high-quality research and publish relevant research results in this research field. The author searches based on the periodical literature in the Chinese Social Science Citation Index (CSSCI) database and with the theme of "achievement oriented education and OBE", The search year spanned from January 1, 2000 to December 31, 2020. A total of 322 articles were retrieved. The documents with the same author and novice author were removed manually. Secondly, unqualified meetings, news and documents containing three words OBE in English but inconsistent with Chinese achievement oriented

education were deleted. Finally, 198 Chinese documents were obtained.

Firstly, according to the research method of "square root law" of Derek John desolla price, the number of papers published by the core author is at least $0.749\max\text{ppm} \approx n(1)$. N_{\max} refers to the number of articles published by the most productive author, and the core author is the author whose number of articles is greater than or equal to n . Based on the statistics of the number of articles published by authors, the authors whose articles are published greater than or equal to n are determined to be the core authors in the OBE research field. For the core journal literature, CiteSpace makes a visual analysis of 198 core journal literature of OBE research from 2000 to 2020 by using the knowledge map, determines the core author group by analyzing the author's research continuity and frequency, analyzes the research institutions and authors, determines the authors and institutional network, and obtains the core author cooperation, research hotspots and evolution trend, It also makes a comparative analysis of the research at home and abroad.

3. Research results and discussion

(1) Core author group

Price pointed out that the number of high-yield authors is half of the total number of papers. According to the core data and literature statistics of this paper, Professor Li Zhiyi's number of papers is up to 6, that is, the authors who have published more than 3 papers are substituted into formula (1) for calculation. $N = 1.834$ represents the critical maximum number of papers, and N takes the integer 2. Therefore, the threshold is set in the CiteSpace analysis.If it is set to 2, the core author in this field can be determined.

Due to the limited number of articles issued by core authors, the author introduces the cited and downloaded amount of author literature in core journals as an index of core author group as an important index. 22 core authors and experts of OBE research were selected from two aspects. As shown in Table 1.

Table 1 Statistics of core authors in OBE field

1. Li Zhiyi	2. Gong Jianmin	3. Yang Yigang	4. Gu Peihua
5. Jiang Bo	6. Shen Tianen	7. Zhou Chunyue	8. Liu Yancong
9. Yong Quan Wang	10. Li Qing	11. Zhang Nanxing	12. Yan Qun
13. Song Yue	14. Ding Yuanchun	15. Li Hong	16. Yang Changlong
17. Li Hongmei	18. Li shuangshou	19. Sun Jing	20. Shi Xiaoqiu
21. Baijing	22. Hu Wenlong	-	-

(2) Time distribution analysis of core journals

The change of the time axis of the number of papers published in core journals in the OBE field can well reveal the research and development speed of OBE field in China and predict its development trend. As shown in Figure 1

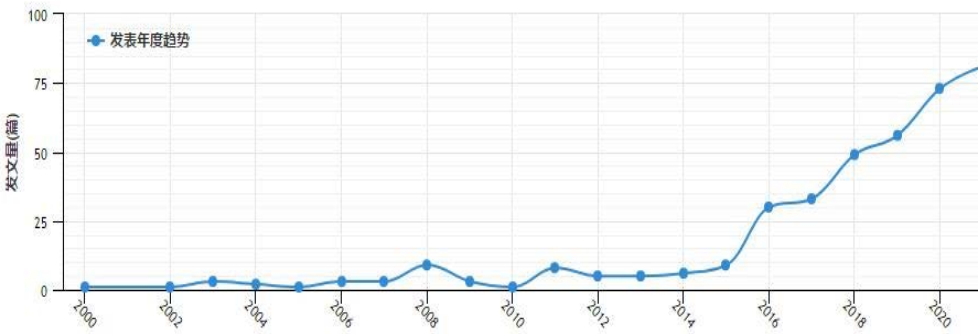


Figure 1 annual trend of papers published in OBE achievement oriented core journals from 2000 to 2020

As can be seen from Figure 1, the number of published research papers on Physical Education in China showed a sudden increase, which can be roughly divided into three stages: the first stage was 2000-2007, and the number of papers published in this stage was relatively low. Until 2003,

Professor Jiang Bo began to publish the first core journal paper in the core journal, and the annual number of papers published was one. Stage 2: from 2008 to 2015, the number of OBE related research results was in a stable period, and the first related research increased greatly since 2014. Professor Li Zhiyi, as an expert of the core author group, has continued to pay attention to higher engineering education and OBE achievement oriented research since this year. The third stage is the rapid growth stage from 2016 to 2020. Since 2016, there have been rich relevant research results in recent years, the number of papers has increased by double digits, and the number of papers has been expanding. Professor Gong Jianmin began to pay attention to the basic research of OBE and became the core author with a high number of articles.

(3) Knowledge map analysis of core author group

Using the CiteSpace tool, the network node selects the author, sets the analysis parameters to one year, and draws the core author cooperation network map, as shown in Figure 2. In the figure, each node represents an author, and the connection between nodes indicates the author's cooperation. The lines go beyond the connection to show the times of cooperation. It can be seen that the cooperation network that has begun to take shape is composed of scholars such as Li Zhiyi, Ding Yuanchun, Zhou Chunyue, sun Yingjie, Yang Yigang and Li Hongmei, It can be seen from the atlas that there are many research authors in the field of OBE research in China, and a relatively stable core author group has been formed.



Figure 2 author knowledge map of OBE achievement oriented core journals from 2000 to 2020

(4) Knowledge map analysis of research institutions

Mutation analysis in CiteSpace software can locate and analyze outstanding institutions in a short time. The mutation analysis results of the research institutions show that the corresponding origin of the research institutions of Heilongjiang Vocational College, Dalian University of technology, Dezhou University, Beijing Jiaotong University, Beijing University of science and technology and Dongguan Institute of technology is the mutation center, which expands greatly outward. Among them, Heilongjiang Vocational College is the most prominent, indicating that its research institutions are more prominent in OBE achievement oriented research. As shown in Figure 3. The author integrates the authors of the core author group, the number of citations downloaded and the research institutions, and obtains Table 2. As can be seen from table 2 and figure 3, Li Zhiyi has the largest number of core papers and published 6 papers; Secondly, Gong Jianmin published 4 papers; The third is Yang Yigang, who published three papers. It can be seen from this situation that the number of articles published by the OBE achievement oriented core author group is not high, and the highest is only 6. However, the members of the core author group are high-level researchers such as professors and doctoral guides, which shows that the research ability and research level of the core author group in the OBE achievement oriented field in China are high, and the

disadvantage is that there is little cooperative research among the core authors in China, Some existing cooperative research is limited to one research institution.

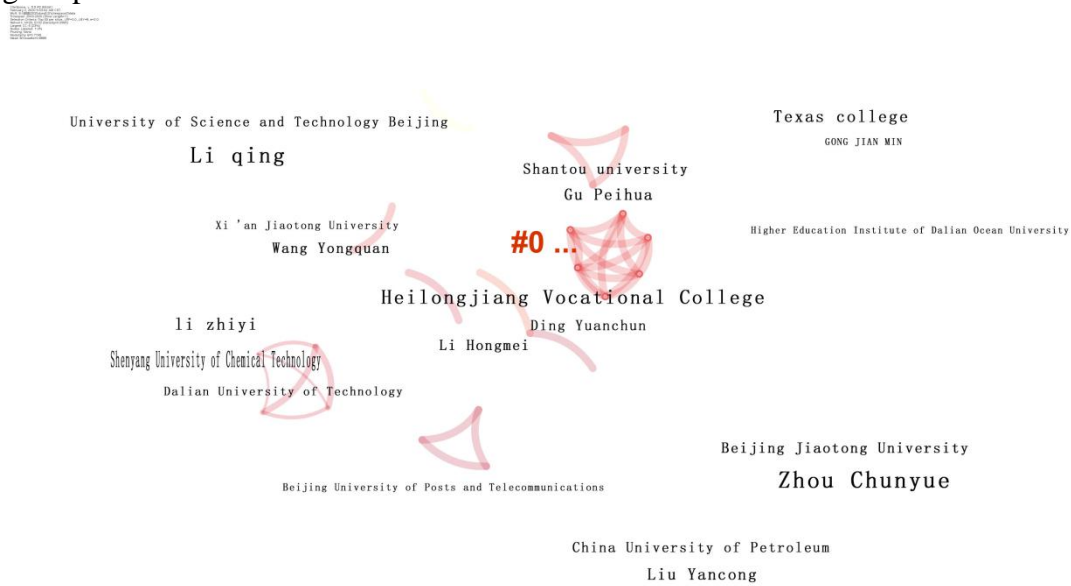


Figure 3 organization chart of OBE achievement oriented core journals from 2000 to 2020
Table 2 number of articles issued by core authors of China's OBE (results oriented) and cited institutions from 2000 to 2020

Serial number	author	the number of articles published in core journals	Cited times	Author research institute
1	Li Zhiyi	6	800	Shenyang University of chemical technology, Dalian University of Technology
2	Gong Jianmin	4	63	Dezhou university
3	Yang Yigang	3	174	Beijing University of Posts and Telecommunications
4	Gu Peihua	2	1074	Shantou University
5	Jiang Bo	2	282	Hangzhou Institute of Business
6	Shen Tianen	2	209	Institute of higher education, Dalian Ocean University
7	Zhou Chunyue	2	82	Beijing Jiaotong University
8	Liu Yancong	2	70	China University of petroleum
9	Yong Quan Wang	2	56	Xi'an Jiaotong University
10	Li Qing	2	41	Beijing University of science and technology

(5) Research path analysis of core author group

Keywords can reflect the research focus of researchers in their research field and the academic frontier of interest to researchers. Using CiteSpace software, the network node selects keyword to display the time zone of time zone in the co-occurrence network, so as to further reflect the time characteristics concerned by clustering. This paper focuses on the division of time zones to find the research focus path and research focus direction of core authors. According to the software operation results (see Figure 4), the research and development path of OBE (achievement oriented) core authors in China is as follows:

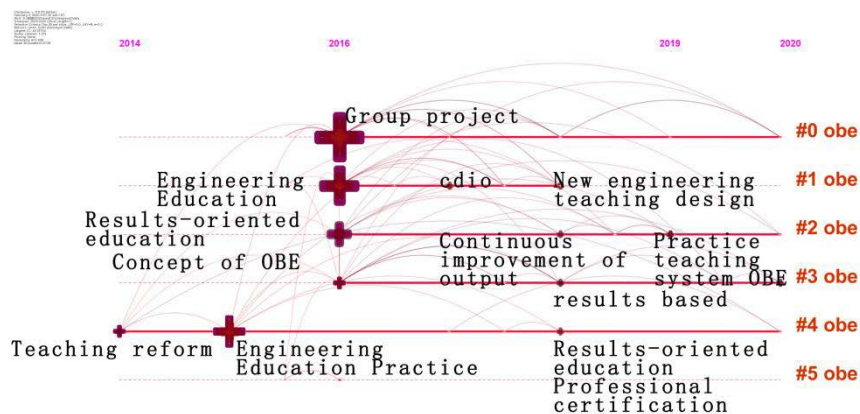


Figure 4 Network time zone chart of keyword co-occurrence of OBE (result oriented) core journals from 2000 to 2020

(1) From 2003 to 2008, OBE (result oriented) began to be concerned by Chinese scholars and conducted relevant research in the field of education. On behalf of the core author Professor Jiang Bo, OBE: result based education has been cited 282 times as of December 2020. The article mainly analyzes "how to do OBE education and teaching well in the result based education reform". Professor Liu Jianhong et al. (2008) results based education reform in South Africa proposed OBE results based education theory and implementation principles. From the analysis of research time, this is a relatively early basic research of OBE (achievement oriented), which introduces OBE research into China's educational research. In 2007, educational policies and achievement oriented education appeared as the core key words for the first time, and became the main research focus of core authors in China in a certain period. This stage is mainly the introduction and concept introduction of scholars on the application of OBE in the field of education.

(2) From 2009 to 2014, this stage is the development period of OBE (achievement oriented) in China. The key words such as OBE concept, engineering certification, higher engineering education and achievement oriented education theory have gradually become the new research concern of the core authors, especially Professor Gu Peihua et al. (2014) engineering education model based on "learning output" (OBE) - practice and exploration of Shantou University This paper mainly expounds the practical structure, implementation characteristics, implementation focus, implementation characteristics and difficulties of engineering education mode in detail. Li Zhiyi et al. (2014) guiding the teaching reform of higher engineering education with the concept of achievement oriented education puts forward the basic ideas, characteristics, implementation principles and key points of achievement oriented education, and puts forward the teaching reform of higher engineering education based on achievement oriented education. This stage indicates that OBE (result oriented) has begun to deeply affect the teaching reform of higher education in China. At the same time, a new OBE engineering education model has been fully practiced in the field of engineering education.

(3) From 2015 to 2020, the research on OBE (result oriented) was gradually deepened and expanded. At this stage, the number of documents and keywords increased sharply, the depth and breadth of research continued to extend, and the research perspectives of core authors were more diverse. It mainly continued to pay attention to the theoretical connotation and extension of OBE, the reform of engineering education and teaching and the personalized education reform of talent training. Teaching evaluation and teaching effect, virtual simulation, industry education integration and collaborative innovation began to receive attention. Professor Gu Peihua et al. (2017) CDIO from China to China: development path, impact and causes, Professor Sun Jing et al. (2017) achievement oriented evaluation of achievement degree of graduation requirements for engineering education certification, Liu Yancong et al. (2018) design of training scheme for applied technical talents based on OBE concept, Professor Wang Yongquan (2019) Output Oriented Curriculum Teaching: design, implementation and evaluation, Professor Zhang Nanxing et al. (2020) understanding OBE: origin, core and practice boundary -- Also on the paradigm transformation of

professional education And other core authors' articles respectively represent the forefront of research in relevant keyword fields. OBE has gradually changed from the field of Engineering Education in the development period to the demand of education reform, and has quickly become the focus of higher education teaching reform research.

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