Research Hotspots of Online Education in China in The Past Ten Years
——Based on the CiteSpace' Visual Atlas Analysis

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Abstract:
This research is based on 3258 Chinese literatures about online education from 2012 to 2021, which were included in the CSSCI source core journals of CNKI (China National Knowledge Infrastructure), and uses the information visualization analysis software Citespace to conduct keyword analysis to reveal the classic literature, hot topics and trends in the field of domestic online education in China. The study found: The high citation frequency and literature of China's online education in the past ten years were mainly concentrated in the professional core journals "Journal of Distance Education", "Modern Distance Education Research" and "China Distance Education"; Research hotspots focus on five aspects: online teaching mode, online course construction, online higher education, online education evaluation, and online education technology; Based on the concepts of distance education and online education, future research hotspots tend to be "artificial intelligence + online education".

Keywords: *Online Education; Bibliometric Analysis; Citespace; Hot Topics; Cutting-edge Trends.*

1 INTRODUCTION

Online education is a teaching and learning activity developed by using information technology such as the Internet. The development of information technology represented by the Internet not only drives the development of online education but also changes the auxiliary status of online education in teaching activities, profound changes of the education ecology is coming. Especially after the outbreak of the COVID-19 in 2019, the domestic call for " no suspension of classes " has made online education the norm, education's dependence on the Internet environment has reached its peak, and a variety of new teaching products, teaching platforms, and teaching resources have been introduced to the market., but how to build a more scientific online education model is still under discussion. Therefore, this study uses CiteSpace visual analysis software to sort out the research results of online education in the CSSCI source database in the past ten years, which aims to analyze the hot topics, dynamic evolution and latest trends of domestic scholars' research in this field before and after the epidemic, explore their research directions and research priorities, put forward future prospects, and provide a reference for the construction of online education models.

2 RESEARCH METHODS AND DATA PROCESSING

2.1 Research Method

Firstly, using the research method of bibliometrics, this paper organizes the CSSCI source data exported from CNKI from 2012 to 2021; secondly, imports the documents into office software Excel and the citation visualization analysis software Citespace to draw a visual map, and interpret the information presented in it from multiple perspectives.

2.2 Data Processing

Based on the advanced search function in the CNKI database, select CSSCI source database, set subject = "*zaixian jiaoyu*" or "*wangluo jiaoyu*" or "*xianshang jiaoyu*" or "*yuancheng jiaoyu*", the period is 2012-2021, and the number of Chinese documents obtained after retrieval is 3258. After that, irrelevant documents such as no author, call for papers, preface, journal reprint information, etc. were eliminated, and finally, 2,471 valid documents were obtained. After literature retrieval, export Excel and Refwork formats respectively, and use

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Citespace to quantitatively analyze the included literature to generate a visual map.

3 THE SPATIOTEMPORAL DISTRIBUTION OF ONLINE EDUCATION RESEARCH

3.1 Yearly Distribution of Publications

Statistics on the annual publication volume of Chinese online education research in the CSSCI source database from 2012 to 2021 can show the research progress in this field in the past ten years, as shown in Figure 1.

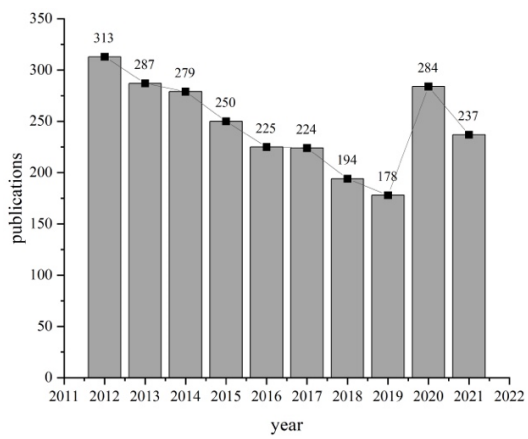

Figure 1 2012-2021 Chinese Online Education Research Annual Publishing Trend Chart

Judging from the number of papers published in CSSCI core source journals in the past ten years, the research on online education has gone through three stages: The first stage is from 2012 to 2019. During this period, the number of published papers has been showing a slow downward trend, but in general, the number of published papers is very considerable. The total number of published papers is 1,950, with an average of 243 papers per year; The second stage is 2020. In this year, the number of published articles has rebounded rapidly, reaching 284 articles; The third stage is 2021, and the number of published articles has dropped again, with 237 articles published.

This is basically in line with the development of online education. 2012 was called the first year of online education. The development of foreign MOOCs promoted the new development of online education in China. During this period, research on MOOCs and distance education broke out. Therefore, as shown in Figure 1, the number of publications about online education in 2012 at the top. However, after that, the field entered the exploratory stage. Until 2019, the number of published papers on online education research has been showing a downward trend. At the end of 2019, the COVID-19 forced China's education to turn to online in an all-around way, the construction of educational informatization has become a research hotspot again, and the upward trend in the number of published articles in 2020 is obvious. Although the number of papers published in 2021 will show a downward trend, it can be seen from the number of papers published in its CSSCI core journals that online education has always been an important research area for academic circles.

3.2 Journal Distribution

Counting the distribution of literature journals can reveal the spatial distribution of journals in this field and provide a basis for further research. Through the statistics of journals with more than 100 articles in the CSSCI source database, it is found that a total of eight journals meet the requirements, and the remaining journals have less than 45 articles.

Table 1 Distribution of high-published journals in China's online education research from 2012 to 2021

Ranking	Journal title	Number of articles/ article	Cumulative percentage %
1	" Distance Education in China "	467	18.90
2	" Electronic Education in China "	230	9.31
3	"Modern Educational Technology"	132	5.34
4	" Research of Electrical Education "	132	5.34
5	" Research of Modern Distance Education "	126	5.10
6	"Journal of Distance Education "	112	4.53
7	"Modern Distance Education"	107	4.33
8	"Open Educational Research"	104	4.21

It can be seen from Table 1 that Among these eight journals, " Distance Education in China " has the highest number of publications, far exceeding other journals, followed by "Electronic Education in China", "Modern Educational Technology" and " Research of Electronic Education " tied for third. " Research of Modern Distance Education" and "Journal of Distance Education "followed. It can be seen that the journals of online education papers are mainly published in professional journals in this field, with distance education as the main focus.

3.3 Citations

The citation frequency refers to the frequency that a document has been cited by other papers as a reference after it is published, the number of citations can judge the quality of the literature and the degree of repercussions in the professional field [6]. This section presents the top 20 most influential literatures in online education research from 2012 to 2021, as shown in Table 2 (statistical time is May 1, 2022).

Table 2 Statistics of the top 20 most cited documents from 2012 to 2021

Article	Journal	Frequency of citations	Author	Year of publication
"An Analysis on SPOC: Post-MOOC Era of Online Education"	" Research of Tsinghua University Education "	1671	KANG Yeqin	2014
"MOOC: Characteristics Analysis Based on Typical Projects and Its Enlightenment"	"Journal of Distance Education "	804	Wang Ying, Zhang Jinlei, Zhang Baohui	2013
"From MOOC to SPOC: Construction of a Deep Learning Model"	" Electronic Education in China"	611	Zeng Mingxing, Li Guiping, Zhou Qingping, Qin Zunyue, etc.	2015
"Literature Analysis on the Current Situation of MOOC Research in China"	"Distance Education in China"	578	Hao Dan	2013
"Systematic Analysis of Micro-Course Research and Development Trend"	" Distance Education in China"	429	Jiang Yulian	2013
"A Coolheaded Response to Hot MOOCs: Reflections on the Six Problems of MOOCs"	"Journal of Distance Education "	421	Gao Di	2014
"Opportunities and Challenges of Chinese Distance Education in the "Internet +" Era"	" Research of Modern Distance Education "	402	Chen Li, Lin Shiyuan, Zheng Qinhua	2016
"Appeal and Response to the Development of MOOCs' Localization in China"	"Journal of Distance Education "	389	Gu Xiaoqing, Hu Yiling, Cai Huiying	2013
"From OCW Classroom to MOOC School: The Return to the Origin of Learning"	" Research of Modern Distance Education "	382	Zhang Zhenhong, Liu Wen, Han Zhi	2013
"Research Status and Future Trends of China's Mobile Learning in Recent 20 Years	" Research of Modern Distance Education "	373	Wang Youmei, Wang Juan, Yang Xiaolan, Wu Haiyan	2013

——A Review Based on the Comparison between China and the West"				
Do Not Repeat the Mistakes of “Integration of Information Technology into Classroom”: Reconsideration on the Application of Micro-lesson	"Journal of Distance Education "	347	Wang Zhuli	2014
"An Analysis of the Current State of Blended Learning Research in China"	"Journal of Distance Education "	336	Wang Guohua, Yu Shuyu, Huang Huifang, HuYan	2015
"China’s Online Education Current Situation, Trend and Experience for Reference"	" Electronic Education in China"	319	Guan Jia, Li Qitao	2014
" Calm Reflections on the Upsurge of MOOC"	" Educational Research"	314	Wang Jide, Feng Yingying & Wang Ying	2014
"Network Ideological and Political Education in the Era of Big Data"	"Studies in Ideological Education"	309	HuShuxiang, Xie Yujin	2013
"A Study on the Blended Learning based on MOOC and Rain Classroom ——Taking the Teaching Practice of “Conversational English Skills” MOOC and Rain Classroom as an Example"	"Modern Educational Technology"	307	Yang Fang, Zhang Huanrui, Zhang Wenxia	2017
"Characteristics, Problems and Innovations of Online Teaching of "No Suspension of Classes" during the Period of Epidemic Prevention and Control"	"Research of Electronic Education "	303	Xie Youru, Qiu Yi, Huang Yuling, Wang Qinlei	2020
"MOOCs R evolution: The Emergence of Independent Course Markets and the New World Higher Education Market Structures"	"Open Educational Research"	284	Li Minghua	2013
"How Should Education be Transformed in the Post-epidemic Era ? "	" Research of Electrical Education "	269	Wang Zhuli	2020

"Exploration on New Teaching Mode of Universities in the Post-MOOC Era "	"Research of Higher Engineering Education "	241	Li Hongmei, Lu Guodong, Zhang Jianping	2014

Among the top 20 most cited papers, from the perspective of the authors of the papers, Wang Zhuli published two papers with a total citation frequency of 616; from the perspective of published publications, 4 papers were published in the "Journal of Distance Education", "Research of Modern Distance Education" and “Distance Education in China” each published 3 articles; in terms of content, the above documents focus on auxiliary learning resources for online learning, especially the exploration of MOOC teaching mode. This provides some guidance for future research.

4. HOT TOPICS OF ONLINE EDUCATION RESEARCH IN CHINA

A hot topic is a special subject that is discussed in a certain discipline or field for a certain period. The keyword is the overview and conciseness of the content of the article. By analyzing the keywords in China's online education research, Citespace is used to eliminate the keywords that cannot reflect the hot topics, and the keywords with similar meanings are combined and sorted. After data collation, we can obtain the keyword co-occurrence map of China's online education research, as shown in Figure 2.

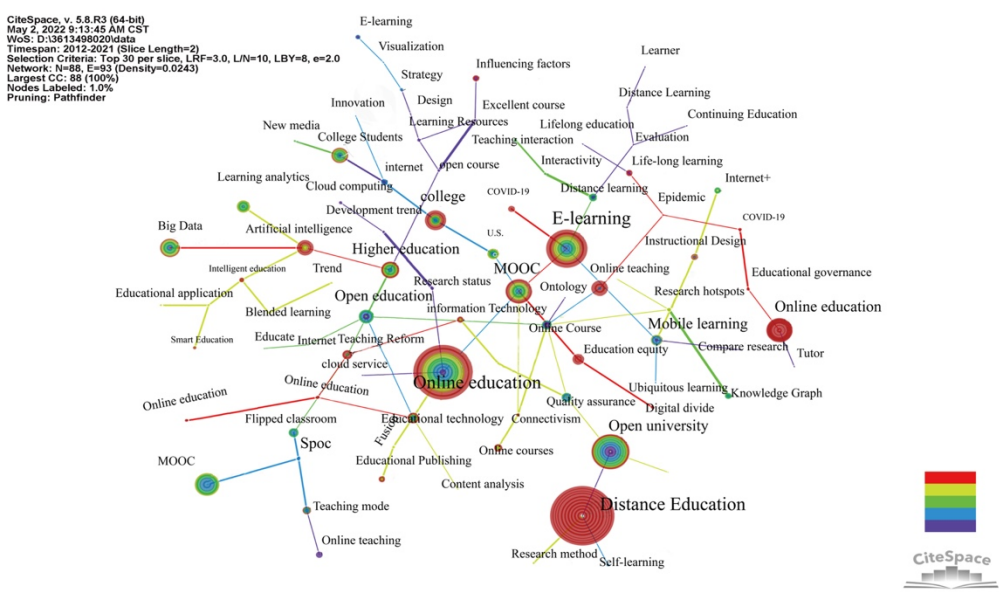

Figure 2 Keyword co-occurrence map of online education research in China

Keyword co-occurrence is to analyze the degree of connection of keywords in several articles to obtain research hotspots and evolution trends in the research field. The connection between the keywords indicates that the keywords are related, and the thickness of the connection indicates the correlation between each other, and the larger the node of the keyword, the higher the frequency of the keyword in the literature statistics. From this analysis, the corresponding data is derived for sorting, and the top 20 high-frequency keywords in the research literature are obtained, as shown in Table 3.

Table 3 Top 20 keywords in China's online education research rankings

Frequency	Centrality	Time	Keywords
272	0.09	2012	distance education
264	0.31	2012	online education
154	1.1	2013	MOOC
118	0.54	2012	e-learning
117	0.18	2012	open university
86	0.05	2012	network education

77	0.3	2014	online teaching
57	0.18	2012	college
50	0.9	2012	higher education
47	0.05	2012	college students
44	0.1	2012	educational technology
43	0	2014	big data
34	0.94	2012	open education
32	0.09	2014	learning analytics
32	0.43	2018	artificial intelligence
29	1.33	2012	online course
28	0.05	2012	teaching mode
28	0.27	2012	quality assurance
27	0.26	2012	U.S.

Combined with the analysis of high-frequency keywords and centrality, it can be seen that the hot topics of online education in China in the past ten years are mainly divided into five aspects: online teaching mode, online course construction, online higher education, online education evaluation, and online education technology.

4.1 Online Teaching Mode

Online education has become an important form of learning in today's information society. Combining with the secondary search of literature, it can be found that the keywords related to online education mode are "distance education", "online education", "network education", "teaching mode", "online teaching". "Open University", etc., among which "distance education" has the highest frequency.

"Distance education", also known as online education, "refers to the form of education in which teaching is carried out between students and teachers, between students and educational organizations through media" [7], and it is also a teaching model that spans time and space. In China, distance education has received great attention. In 1999, the government issued the "Action Plan for the Revitalization of Education in the 21st Century", which pointed out that the distance education project should be vigorously developed, and pilot projects were set up in many universities. The establishment of the Open University inherits and develops the model of the Radio and Television University. With the development of the Internet, the dependence of distance education on radio and television media has turned to the network platform, and network education has developed accordingly. "Modern distance education not only pays attention to teaching design, media design, and development of multimedia courses to meet the needs of large-scale teaching, but also pays more and more attention to flexible personalized needs, tailor-made, intelligent push, and provide targeted education and all-round learning services and other aspects" [9].

4.2 Online Course Construction

The construction of online resources is related to the quality of online education development. Combined with the analysis of the research framework and the secondary retrieval of literature, the keywords related to the construction of online education courses are "MOOC" and "network course". According to the "Internet Educational Communication Model", [3] Online courses are divided into Class I, Class C, and Class I+C. Among them, digital teaching resources such as the new century online courses and the construction of national excellent courses developed under the drive of distance education belong to Class I online courses, which are mostly limited to resource construction and lack effective teaching activities; After 2012, the MOOC online courses that began to be discussed rapidly in China belong to the "I+C" category, which has teaching resources and teaching activities, but still focuses on teaching resources and lacks interactive teaching activities between teachers and students. At present, domestic MOOC construction has noticed this problem, and online education has entered the "post-MOOC" era, gradually moving from static shared resources to interactive open classrooms. [8]

4.3 Online Higher Education

Based on the analysis of the research framework and literature, the keywords related to online higher education are "college students", "colleges" and "higher education".

In the face of the development of network technology, college education is the main front to meet the educational ecological change. The development of online education models, the construction of teaching resources, and the use of information technology are closely related to the development of online higher education. Especially with the advent of the era of globalization, international universities continue to strengthen cooperation, and the combination of academic education and non-academic education all bring greater

opportunities and challenges for colleges and universities to develop online education models.

4.4 Online Education Evaluation

Learning Analytics uses a variety of data collection tools and analysis techniques to study student engagement, learning performance and progress in teaching practice, providing important support for real-time adjustment and improvement of curriculum, teaching and assessment [4]. Combining keywords and literature analysis, the keywords related to online education evaluation are "online learning", "learning analysis" and "quality assurance".

The construction of an online education evaluation system involves multiple subjects, including teachers, students, learning platforms, learning resources, and learning environments. To ensure the quality of teaching, it is necessary to consider various factors that affect learners' online learning experience and build a quality evaluation index system.

4.5 Online Education Technology

The development of online education is inseparable from the development and application of technology. Keywords related to online education technology in this research include "artificial intelligence" and "big data".

In recent years, with the rapid development of emerging technologies such as big data, cloud computing, Internet of Things, sensors, simulation and virtual reality, a new generation of artificial intelligence (AI 2.0) is booming and widely used, which is called the greatest technological change since the Industrial Revolution. [5] The application of artificial intelligence and big data in education will have a revolutionary impact on the formulation of educational policies, the establishment of learning plans and evaluation methods, the construction of learning platforms, promoting the creation of a personalized learning environment and a precise learning model, and further improve the relationship between "teaching" and "learning". However, the generalization of artificial intelligence has also brought great challenges to the healthy development of education, and it is necessary to build a global governance framework for artificial intelligence education.

5 EVOLUTIONARY TRENDS OF ONLINE EDUCATION RESEARCH IN CHINA

Using Citespace to form a timeline view, we can display the time span and research progress of the development and evolution of each cluster, and more intuitively display the evolution process of the hot topic of the study in the literature, as shown in Figure 3.

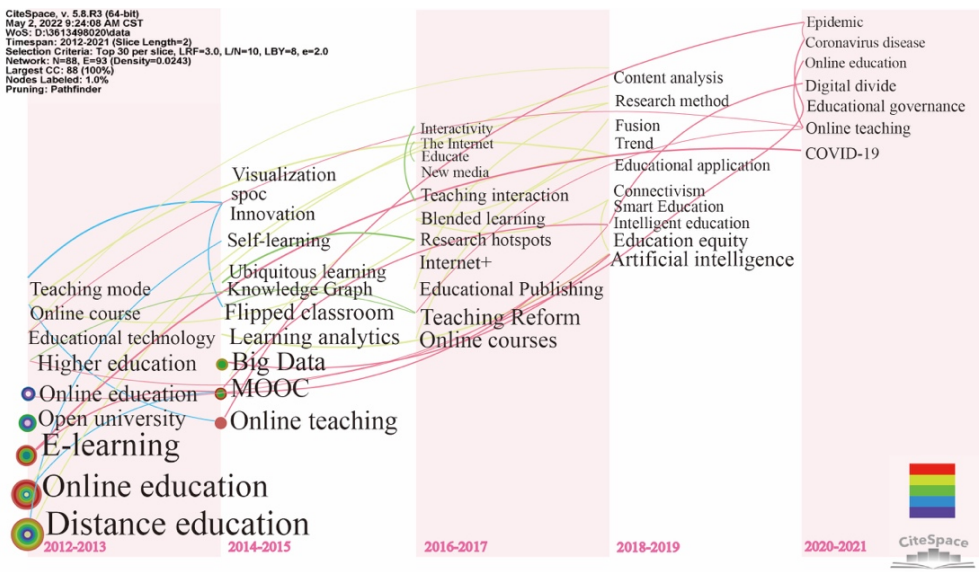

Figure 3 Year-by-year distribution of topics of online education research in China

As can be seen from Figure 3, "distance education", "online education", "Open University", "network education", "MOOC", "online teaching", and "artificial intelligence" are marked with bold solid lines, indicating key hubs connecting different fields., which also represents the development of research hotspots. It can be seen from this that the development of online education in recent years is based on the research conducted in 2012-2013. Only with the development of time, the focus of research has shifted slightly. Based on the concepts of distance education and online education, "MOOC", "online courses", "artificial intelligence", "epidemic" and "education governance" have become research hotspots in turn. This can be also judged in Figure 4.

Figure 4 Ranking chart of emerging words in the frontier topics of China's online education

Emerging words refer to topics with significant changes in a certain field over a period of time. Analyzing the topics explored by emerging words can clearly grasp the research frontiers in this field within a period of time. [2] Running Citespace, I got 5 cutting-edge thematic emergent words, namely: distance education, online education, MOOC, flipped classroom, and artificial intelligence. Judging from the development history of online education in China, the occurrence and development of distance education have always been accompanied by the advancement of information technology and educational technology. Different technological applications have resulted in different historical stages of distance education. [10] In this study, online education research from 2012 to 2021 has entered a new stage of development. From 2012 to 2013, words such as “distance education” and “network education” were the main ones, and the mutation time was one year. During this period, distance education has entered a new period of development. With the policies of "building a flexible and open lifelong education system" and "building an 'overpass' for lifelong learning" proposed in the 2010 "Outline of the National Medium and Long-Term Education Reform and Development Plan (2010-2020)", network education or distance education relying on computer network technology and multimedia technology has played a new role, showing a more open and flexible learning method; From 2014 to 2017, words such as "MOOC" and "flipped classroom" dominated, and the mutation duration was 4 years. At this stage, the research hotspots were concentrated. In 2012, MOOC triggered a "digital tsunami" in the national higher education, online education achieved a blowout development, and carried out various researches on new online education models； After 2018, the development of artificial intelligence technology has enabled the application of educational technologies such as "big data + education" and "AI + online classroom", which has promoted the trend of education towards intelligence and informatization. In the post-epidemic era, the development of 5G technology provides a strong technical guarantee for the "mobility" of online learning.

Nowadays, the combination of artificial intelligence and online education has become a hot topic and frontier topic of research. Through the secondary retrieval of the citation history, it can be found that the analysis of "artificial intelligence + education" in the citation revolves around various aspects of education, such as speech recognition, image recognition, intelligent video tracking and analysis, learning analysis technology and other educational technology changes, which promotes the development of education in the direction of humanization, individualization and refinement. "A series of changes are taking place from the generation and flow of knowledge, the form and interaction of learning, the form and construction of learning resources, the organization and implementation of teaching content, to the evaluation and management of teaching performance." [1]

6 CONCLUSION

Through the quantitative and visual analysis of online education in the past ten years, the article shows the hotspots and development trends of China's online education research recently. It can be seen that domestic-related research has always maintained a good development trend during this period, with rapid research progress, expanding research horizons, more comprehensive research content, and increasingly prominent application value of research, but the theoretical basis of the research is relatively weak, and at present, the teaching mode of online education in China is still in the stage of active exploration. Although the research topics in the past ten years have shifted slightly, they are basically carried out in the historical framework of online education or distance education, and with the continuous updating of educational technology, different research focuses have been presented. In the post-epidemic era, the application of big data, artificial intelligence, AI and other technologies in online education is a frontier topic of research.

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