A Review of Research on the Application of Artificial Intelligence in Teaching Management and Evaluation

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Abstract

With the rapid development of artificial intelligence, the research and application of "AI+ Education" continues to deepen. This study uses journals included in China National Knowledge Infrastructure (CNKI) from 2000 to 2022 as data sources, uses CiteSpace software for visual analysis of sample data, and summarizes the research topics and hot trends of the application of artificial intelligence in teaching management and evaluation. Through data analysis, it is found that domestic researches on the application of Artificial Intelligence in teaching management and evaluation present the following characteristics: From the time knowledge graph, the researches on the application of artificial intelligence in teaching management and evaluation have increased significantly since 2017, and their scientific research results have been published intensively. According to the keyword clustering spectrum, the research hotspots include "Artificial Intelligence Technology", "Big Data" And "Data Mining". This paper probes into the research hotspot and development trend of artificial intelligence application in teaching management and evaluation, in order to provide beneficial reference for the integration innovation and practice of artificial intelligence, teaching management and teaching evaluation in China.

Keywords

Artificial intelligence; Teaching management; Teaching evaluation; CiteSpace; Visual analysis.

1. Introduction

Thanks to the promulgation of a series of documents such as "Action Plan of Artificial Intelligence Innovation in Universities" and "Action Plan of Education Informatization 2.0", the integration of artificial intelligence and education has become the top priority of national development. Education is fundamental to the development of a nation and relates to its future and future. As we are undergoing unprecedented changes in a century, we have realized that whether China's artificial intelligence can walk in the forefront of the world will be a decisive factor for China's social development in the future. At the same time, artificial intelligence will be the main driving force for all walks of life to enter a new stage of development, and it is an inevitable trend of the development of The Times and science and technology. Under this general premise, how to integrate artificial intelligence technology with teaching evaluation and teaching management, realize the role of 1+1>2, and how to adapt to the needs of The Times, is not only an important subject facing China's education circle, but also a major challenge to the field of education. The application of machine learning and deep learning in the current education field has been gradually improved, and the combination of education and artificial intelligence will bring unprecedented changes to the education field [1]. At present, China's intelligent education research is in the process of in-depth development, how to

translate the research results into the field of practical application, and achieve the expected results, still depends on the national policy and the joint efforts of researchers.

2.   Data Sources and Research Tools

2.1.   Data Sources

The data are from journals indexed by CNKI as the data source. A total of articles from January 1, 2000 to July 15, 2022 are retrieved with the keywords of "Artificial Intelligence Education", "Teaching Management", "Teaching Evaluation", "Teaching Management and Evaluation" and "Artificial Intelligence Technology". The irrelevant articles such as conferences, recruitment and reports were removed from the search results, resulting in a total of 1057 literatures with practical significance. Finally, the literatures were exported and saved in Refworks format on CNQI.

2.2.   Research Tools

CiteSpace is a software that can visually analyze the spatial relationship of citation, which can easily present the scientific knowledge structure, distribution law and distribution situation, and finally obtain the "scientific knowledge map" that can be analyzed, which can well deal with the potential relationship between articles and the potential knowledge in articles. The purpose of CiteSpace is to have an overall understanding of the research direction and get a hot map of papers, because if an article has been used for many times, it can be proved that the article is of high quality and worth reading, and it is easy to find pioneering articles in this area, so as to facilitate a faster understanding of the field. Cooperative network analysis, co-occurrence analysis and co-citation analysis can be carried out, and hot spots and time can be distinguished by nodes, lines and different colors when presenting results [2].

3.   Analysis of Research Results

3.1.   The Time Distribution Map of Artificial Intelligence Application in Teaching Management and Evaluation

On the annual number of literature in the field of statistical analysis, can be in the field of research and the overall development level have a general understanding of the current state of research, in this paper, a total of from 2000 to 2022 years of artificial intelligence in education teaching management and evaluation of the article has carried on the statistical analysis, finally get the article number of the field distribution is shown in Figure 1.
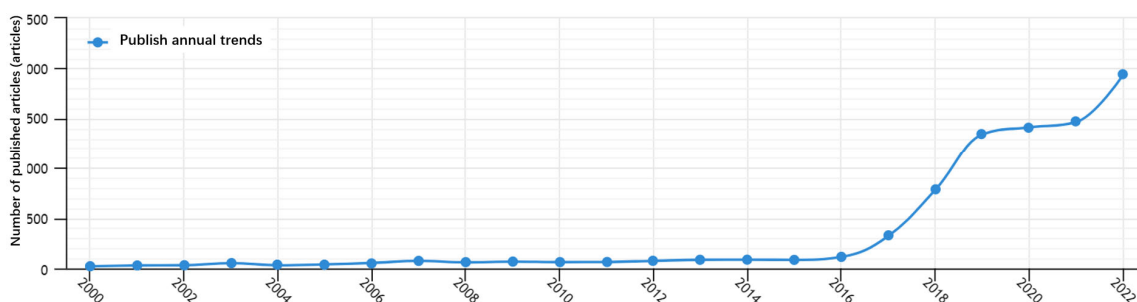
Figure 1. Literature statistics on the application of artificial intelligence to intelligent management and evaluation in the past 20 years

Can be analyzed from the figure, between 2000 to 2006, the burgeoning field, on the contrary direction of research focused on the teaching management system, teaching management in

colleges and universities and the work-integrated learning, etc., in 2017, after about artificial intelligence in the direction of the teaching management and evaluation of the research heat, research results more gradually, the direction of the subject is on the rise, Show that heat heats up in the field, there may be hope to become a hot topic, not only because the teaching management system, college teaching management, the combination of the wide application of artificial intelligence, make the research direction gradually become a hot direction, and the guidance and the support of national policy, makes the topic focus on personnel and institutions, More and more scale and volume. [3]

3.2. The Spatial Distribution Map of the Application of Artificial Intelligence in Teaching Management and Evaluation

3.2.1. Author Analysis

By analyzing the papers of the core authors in this field, we can get the main leading tasks and main ideological research routes in this discipline. This paper uses CiteSpace software and selects "Author" in the Nodetype box as the key word to generate the Author cooperation network atlas of artificial intelligence applied in teaching management and evaluation, as shown in Figure 2. Results Statistics show that gu Xiaoqing, Yang Xin, Liu Min and Zhao Leilei are representative scholars when artificial intelligence is applied in the field of teaching management and evaluation. In particular, Professor Gu Xiaoqing from the Faculty of Education of East China Normal University has published as many as 10 articles. Specifically, there were 210 nodes and 444 lines in the graph, but the overall density of the network was only 0.0021. Each node presented an isolated point-like distribution, and only some points were connected. It can be seen that most researchers in this field are in the state of independent research, without effective cooperation, the research scale has not reached, and the core team has not been formed.
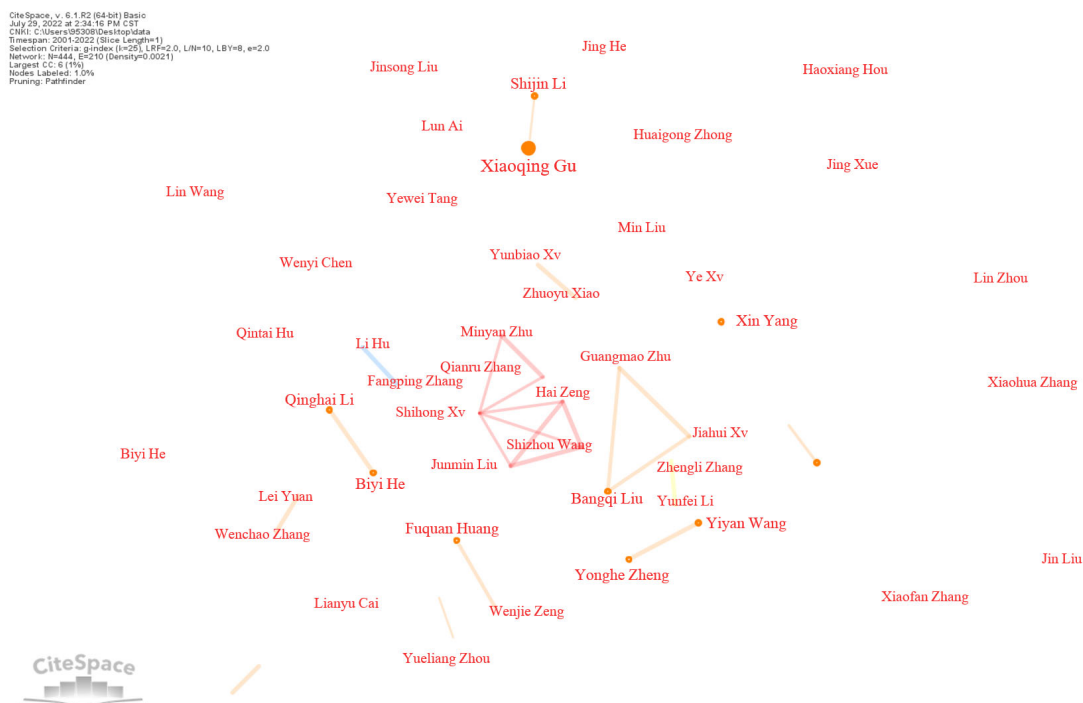
Figure 2. Collaborative map of authors on the application of artificial intelligence in teaching management and evaluation

3.2.2. Institutional Analysis

By analyzing the attributes of research institutions in the research data, their relationship can be obtained from a large number of educational research institutions. Using CiteSpace, select "Institution" in the Nodetype box as the keyword. Then the program is run to obtain the

network atlas of cooperation between institutions in the direction of teaching management and evaluation by ARTIFICIAL intelligence, as shown in Figure 3. The larger the node is, the more articles are published, the larger the font of the label is, the higher the centrality is, and vice versa. The line segment is connected to the cooperative organization [4]. Specifically, there are 82 nodes and 25 line segments in the atlas, and the structural tightness of the network is 0.0075. Therefore, it can be seen that most research institutions in this field are in the state of independent research, relatively discrete, without effective cooperation, the research scale has not been reached, and the core research institution team has not been formed. Further, it can be seen from Table 1 that research departments of universities and colleges account for the top 10 institutions with the most publications in this field, and research centers and education and teaching departments account for the majority. Among the top 5 institutions with the most publications, 2 are independent education departments of universities and colleges. Therefore, independent education departments in colleges and universities are more likely to focus on the popular research direction in this field and get more scientific research results.

Table 1. Research institutes on the application of artificial intelligence to teaching management and evaluation

Number	Count	Year	Institutions
1	12	2019	Department of Education, Beijing Normal University
2	11	2017	Department of Education, Southwest University
3	8	2009	East China Normal University
4	7	2019	School of Wisdom Education, Jiangsu Normal University
5	6	2018	Department of Educational Information Technology, East China Normal University
6	5	2020	School of Education, Zhejiang University
7	5	2020	Guangxi Normal University Education Department
8	5	2010	College of Education Science, Hunan Normal University
9	4	2021	Center for Basic Education Research, Southwest University
10	4	2020	Northeast Normal University

Figure 3. Application of ARTIFICIAL intelligence to teaching management and evaluation research institute collaboration atlas

4. Analysis of Research Hotspots and Research Frontiers

4.1. Analysis of Research Hotspots

4.1.1. Research Hotspot Analysis Based on Keywords

Keywords are words with high frequency and high centrality characteristics. At the same time, they can reflect the mainstream issues that experts and scholars in the field of artificial intelligence application in teaching research and evaluation research pay attention to at a certain point in a certain period of time, which is generally called research hotspots. The visual analysis software CiteSpace is used to analyze the keywords, and the keyword network shown in Table 2 and Figure 4 can be obtained.

Table 2. Keywords Distribution Table of artificial Intelligence Education in China (Part)

Number	Count	Centrality	Year	Keywords
1	503	0.28	2010	Artificial Intelligence
2	99	0.21	2007	Teaching Management
3	51	0.34	2016	Big Data
4	46	0.11	2002	Teaching Evaluation
5	40	0.09	2009	The Teaching Reform
6	34	0.26	2003	Data Mining
7	32	0.18	2005	Colleges and Universities
8	27	0.05	2019	Wisdom Education
9	26	0.03	2020	Intelligence Education
10	23	0.01	2017	Higher Education

As can be seen from Table 2, in the relevant research literature on the application of artificial intelligence in the field of teaching management and evaluation, the keywords that appear more frequently are "Artificial Intelligence", "Teaching Management", "Big Data", "Teaching Evaluation", "Teaching Reform", "Data Mining", "Universities", "Intelligent Education", etc. At the same time, it can be concluded from Table 2 that the keywords with high frequency in the application of artificial intelligence in the field of teaching management and evaluation will change with the change of time. These changes reflect the different emphasis of experts and scholars in different stages in the process of further research and development of this field. In terms of centrality value, if the centrality value is sorted in descending order, They are "Evaluation System (0.56)", "Management (0.48)", "Education (0.40)", "Big Data (0.34)", "Artificial Intelligence (0.28)", "Data Mining (0.26)", "Teaching Management (0.21)", "Technology Empowerment (0.12)" and so on. This phenomenon shows that in the related research on how to apply artificial intelligence technology in the field of teaching management and evaluation, the main content of the research is how to embed and integrate artificial intelligence technology in the traditional teaching management and evaluation, which is essentially based on the breakthrough and innovation of the two based on intelligent technology [5].
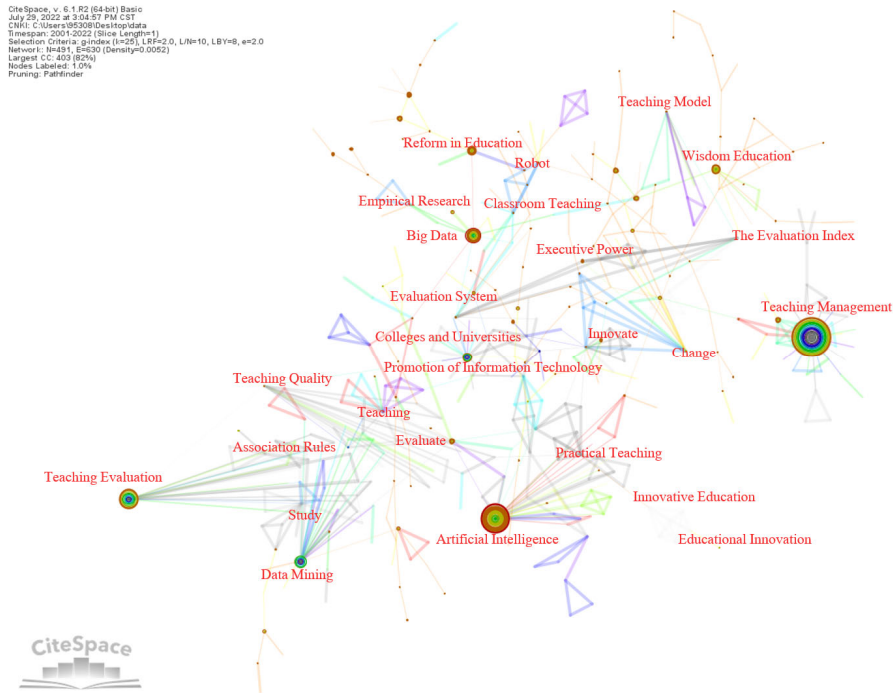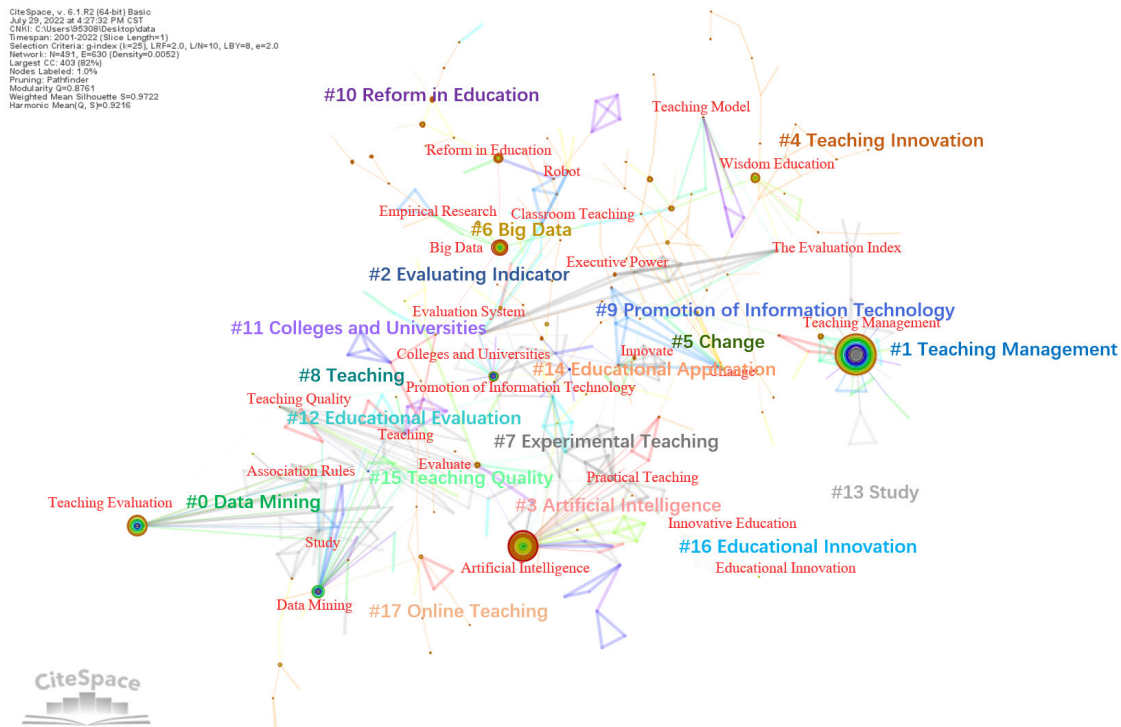
Figure 4. Application of artificial intelligence in teaching management and evaluation of keyword co-occurrence atlas

As shown in Figure 4, "Artificial Intelligence" has the highest centrality among all keywords, followed by "Teaching Evaluation", "Teaching Management", "Artificial Intelligence Technology", etc. The network density of the keyword co-occurrence graph applied by artificial intelligence in the field of teaching management and evaluation is 0.0052, and node E has 630 and 491 lines. Compared with the institutional cooperation map, it can be found that the network structure density of the keyword co-occurrence map has been greatly improved, but it is still relatively loose in general.

4.1.2. Analysis of Research Hotspots Based on Keyword Clustering

Keywords clustering auxiliary options in visual CiteSpace software are used to show the hot content and development trend of a certain research field [6]. Through the "Cluster Analysis" function in CiteSpace visualization software, the keywords of literature from 2000 to 2022 were analyzed. Finally, the module value Q was 0.8761, and the average contour value S was 0.9722, which directly indicated that the structure of the cluster group divided by the software's clustering operation was obvious enough. And S value greater than 0.7 indicates the credibility of the clustering results. As shown in Figure 5, the application of artificial intelligence in the field of teaching management and evaluation research can obtain 19 cluster cliques after cluster analysis.

Figure 5. Application of artificial intelligence in teaching management and evaluation of keyword co-occurrence clustering atlas

It can be seen from the time line network map of keyword clustering that the ordinate is set as the clustering result, the abscissa is the time, and then the keyword is corresponding to its corresponding clustering category according to the year in which it appears [7]. After the cluster analysis, we can get the keywords of each cluster group. The keywords in cluster #0 are Data Mining, Association Rules, Mining; The key words in cluster #1 are Teaching Academic, Teaching Evaluation, System Innovation; Keywords in cluster #2 include Robot, Evaluation Index, Evaluation System; Keywords in cluster #3 are Technology Empowerment, Ethics, Learner; The keywords in cluster #4 include Knowledge Graph, Teaching Innovation, Intelligent Algorithm, Cloud Computing; Keywords in cluster #5 include Change, Digital Divide, Innovation; The keywords in cluster #6 include Teachers, Higher Vocational Education, Wisdom Education; The keywords in cluster #7 include College Students, Practical Teaching, Innovation Ability; Keywords in cluster #8 include School Education, School, Education, Technology; Keywords in cluster #9 include Teaching Model, Development Path, Technology; In cluster #10, key words include Teaching Reform, New Engineering, Teaching Methods; In cluster #11, key words include Countermeasures, Universities, Teaching Management; Keywords in cluster #12 include Teaching Evaluation, Core Literacy, Data Collection; Keywords in cluster #13 include Learning, Primary And Secondary Schools, Evaluation; In cluster #14, the keywords include Teaching Application, Teaching Design, Path Exploration; In cluster #15, key words include Teaching Quality, Management System, Influencing Factors; Keywords in cluster #16 include Educational Innovation, Artificial Intelligence; In cluster #17, keywords include Online Teaching, Blended Teaching, Evaluation Model.

4.2.   Research Frontier Analysis

4.2.1. Research Frontier Analysis Based on Keyword Emergence

The research frontier is some popular or potential research problems, and the words that are cited very frequently in a short period of time or appear in relevant literature with high frequency are emergent words. Within a specified period of time, a kind of literature based on

emergent words or issues discussed by experts and scholars can be used as a criterion for judging the research frontier [8]. In this study, CiteSpace, a visualization software, was used to analyze and study the relevant data used by artificial intelligence technology in teaching evaluation research field and teaching management, and 12 emergent words (including keywords that coincide with search terms) were obtained as shown in FIG. 7. "Teaching Quality", "Association Rules", "Innovation", "College", "Evaluate", "Teaching Management", "Work-Integrated Learning", "Data Mining", "Teaching Evaluation", "Big Data", "Intelligence Education".
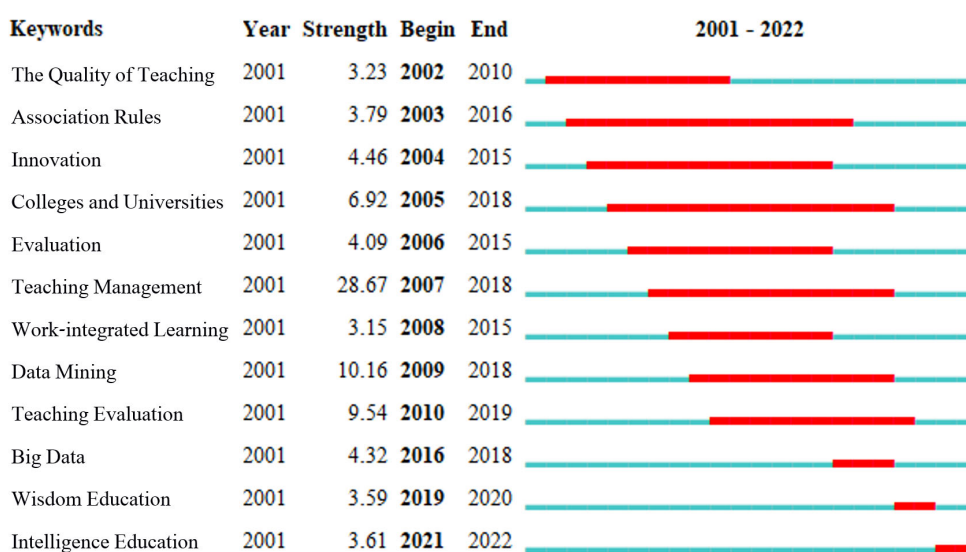

**Figure 7.** Top 12 emergent keywords

In the research sample data, as a necessary way to implement school management, the keyword Teaching Quality first appeared in 2002, and its related research continued until 2010. Similarly, association rule technology in Data Mining has become a new research direction in the field of Artificial Intelligence applied to teaching management and evaluation since 2003. Since 2004, this research field has paid more attention to the innovative application of artificial intelligence in Teaching Management and Teaching Evaluation. Since 2005, Colleges and Universities have gradually become the main force in Teaching Management and Evaluation using artificial intelligence technology. In 2009 and later, Data Mining, Big Data, Intelligent Education and Intelligent Education have gradually become the new directions of Artificial Intelligence applied to teaching management and evaluation research. It can be seen that the intelligent application of Artificial Intelligence is gradually expanding and reaching a climax. According to the intensity of keywords, "Teaching Management" is the keyword with the greatest intensity of emergence, followed by "Data Mining", "Teaching Evaluation", "University", "Innovation" and "Big Data". Teaching Management is to deal comprehensively with the various elements of the teaching process, make its implementation process and orderly operation [9], at the same time, the concept of Artificial Intelligence will profoundly affect the reform of education evaluation, and even affected the progress of the reform of education evaluation and direction [10], and the key factor affecting the quality of teaching, so it has an important role in the education teaching both types.

4.2.2. Research Frontier Analysis Based on Keyword Time Zone Graph

Through the keyword path analysis based on the keyword class analysis in this study, the keyword atlas as shown in FIG. 6 is obtained. By analyzing the picture you can see, so far, our

country education course of artificial intelligence course can be roughly divided into three stages: the first stage is from 2000 to 2007, as the preliminary exploration phase, mainly technical perspective to look at development of artificial intelligence in education, in the stage of artificial intelligence is a new kind of technology, its corresponding keywords node scarce; The second stage is from 2007 to 2016. In order to explore the development period, in the era of information 1.0, artificial intelligence technology is mainly applied to education [11] to promote the innovation of education and teaching, and the keyword nodes are gradually increasing. The third stage is after 2017 to now, for the development of mature period, the period of applying artificial intelligence in the field of education is widely recognized by scholars, and then focus on artificial intelligence technology to the teaching management and evaluation of education teaching reform, caused by node peaked in dense distribution, research depth and breadth in the field has greatly improved. [12]
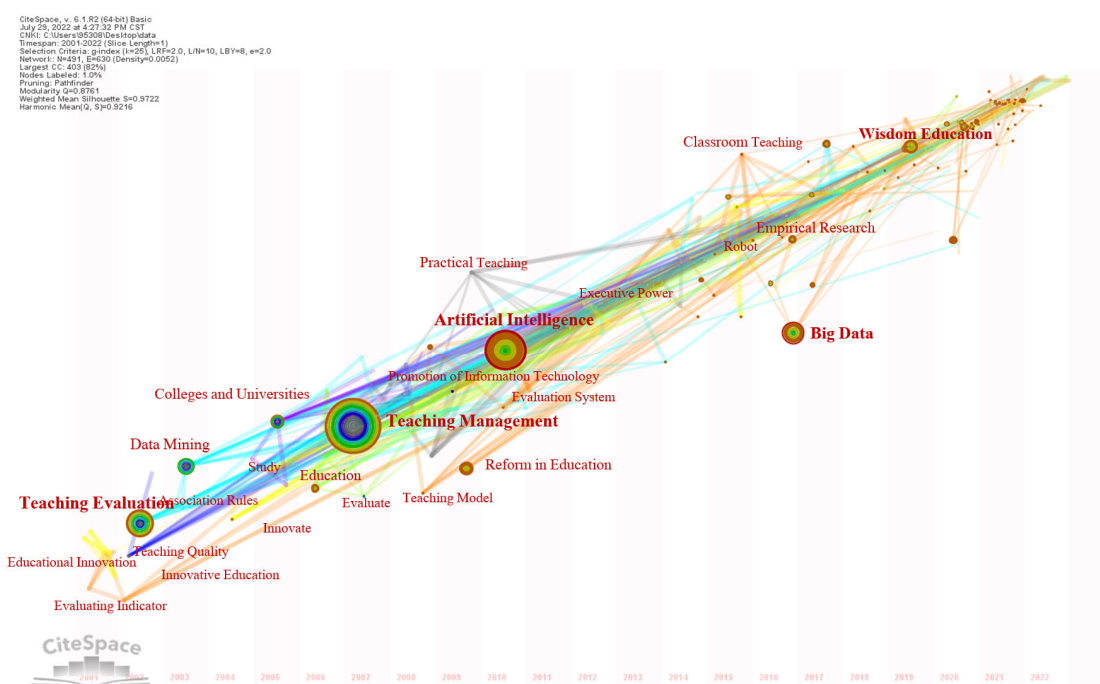
Figure 8. Artificial intelligence used in teaching management and evaluation keywords contribute to time zone view

5. Conclusion and Prospect

With the continuous development and progress of the intelligent society, for example, "Big Data", "data mining" and other artificial intelligence technologies have gradually deepened in the field of teaching management and evaluation, governments around the world have also issued policies related to artificial intelligence as the guiding document of the intelligent era. Based on the data platform of China National Knowledge Infrastructure (CNKI), this study visually analyzed relevant literature from 2000 to 2022 by using CiteSpace software. The main conclusions and suggestions of this study are as follows.

First of all, the author believes that artificial intelligence technology will greatly promote the reform of teaching management and evaluation, such as education and teaching methods, management system, evaluation mode and so on. In the context of the intelligent society, how to use artificial intelligence technology to promote the reform of the traditional mode of education management and evaluation is a major issue for all countries at present. From the perspective of national policies issued over the years, the United States, China and the European regions represented by the United Kingdom have successively promoted the development of

artificial intelligence technology to a national strategic level since 2014. Therefore, intelligentizing teaching management and evaluation is an inevitable development trend under the changing times.

Secondly, according to the results of this study, most of the research institutions are independent institutions of universities, which reflects the professionalism of the research. However, the cooperation between researchers and relevant institutions is not satisfactory. There is little connection between individuals and institutions, and there is little cooperation. As for the problems exposed in the research and the future research, researchers should carry out extensive academic activities, actively participate in and communicate with each other to jointly improve the quality of research.

Finally, the research hotspots of artificial intelligence applied to teaching evaluation and management are divided into the following aspects. One is the artificial intelligence technology (such as data mining, deep learning, etc.) is used to increase the efficiency of teaching management, the intelligent use of the existing education management system, including primary and secondary schools, colleges and universities own a set of education management system, thus to simplify the traditional process of teaching management, at the same time of saving the cost of management, to improve management efficiency. Wiley and Hastings et al. pointed out that the collection of big data can be realized through machine learning and communication technology, and the data processing and other problems in education management can be solved through deep learning. Second, artificial intelligence is used in the reform of teaching evaluation. Due to the limitations of traditional evaluation methods, it is difficult to effectively achieve process-based targeted evaluation. Therefore, by introducing new artificial intelligence technology for teaching evaluation to form intelligent assessment, so that intelligent assessment in a more reliable and effective way to integrate information, forming an accurate assessment scheme. For example, at present, the evaluation of students' knowledge and skills in intelligent assessment has changed from a single examination form to a process evaluation and comprehensive ability evaluation.

Artificial intelligence is the main technical direction of the present and future education reform. In the process of technological development, we should not ignore the core view of "people-oriented" while promoting the development of technology. The implementers and recipients of teaching are all human beings, so the starting point and foothold of educational reform are also human beings. To sum up, the application of artificial intelligence in teaching management and evaluation is a further in-depth integration of artificial intelligence and education, and school education will step into a new era of intelligent "intellectual" theory from the stage of traditional management and evaluation.

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