Research on Online Teaching Evaluation Based on CiteSpace

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Abstract. In this study, Cite Space software was employed to analyze the keywords co-occurrence of 1000 literatures in the field of online teaching evaluation based on the core collection database of Web of Science. Combined with the content analysis of literature, the research frontiers and hot spots of online teaching evaluation were discussed. In general, the research focus of online teaching evaluation mainly includes online learning, peer assessment and distance education. The attention of online teaching evaluation has demonstrated a fluctuating upward trend, but there is still no core author cluster and close institutional cooperation network. From the perspective of time dimension, the hot spots of online teaching evaluation research are constantly changing, and feedback and big data have become the emerging themes in recent years. This study intends to provide some references for researchers and practitioners in the field of online teaching based on the visual analysis of the literature related to online teaching evaluation.

Keywords: Online teaching · Online teaching evaluation · CiteSpace

1   Introduction

Online teaching is a teaching activity conducted by Internet technology [1]. Its main feature is that it overcomes the limitation of time and space of traditional teaching and enables teachers and students to interact with each other through online situations [2]. Under the impact of COVID-19, teachers and students are forced to stay at home, and students and teachers around the world have to adopt online methods to ensure teaching. It is of great significance to explore the hot spots and research trends of online teaching evaluation research to further deepen the research on online teaching evaluation. Based on the visual analysis of the literature related to online teaching evaluation, this study intends to explore the current status of online teaching evaluation research, hot issues and frontier topics, as well as the changing trend of research hot topics, in order to provide some references for researchers and practitioners in the field of online teaching.

2   Data Sources and Research Tools

2.1   Source of Data

In the Web of Science Core Collection, the time span is all years, the search date is December 1, 2022, a total of 1004 results has been retrieved by "(TI = (online teaching or online learning or distance education or online course)) AND TI = (assessment or evaluation or quality or assurance) ", which is the search condition. After manual checking and screening, 1000 effective literatures has been finally obtained by eliminating literatures unrelated to online teaching evaluation research.

2.2   Research Tools

CiteSpace is a multi-component, dynamic and time-sharing information visualization software developed by Professor Chen Chaomei from Drexel University based on the theory of scientific development mode and citation analysis method and other applications of Java language [3]. As the most characteristic and influential information visualization software in recent years, CiteSpace is timely updated and convenient to operate which can process the citation records derived from WOS, CNKI, CSSCI and other databases, and can reflect the research status in related fields comprehensively combined with the content analysis of literature. With the word frequency and co-word analysis function of CiteSpace software, it can realize the analysis of the cooperation network of authors, institutions and countries/regions, through which the structure, law and distribution of scientific knowledge can be presented by visual means, and on this basis, the research foundation, frontiers and hot spots in this field can be explored [4]. In this study, the software CiteSpace6.1R3 was used to conduct keyword co-occurrence and literature co-citation analysis of the retrieved literature, and the knowledge map was drawn to analyze the research frontiers, research hot spots and changing trends in the field of online teaching evaluation.

3   Results of the Study

3.1   Research Hot Spots

Combined with the literature analysis function of Web of Science, this study has analyzed the publication and citation of online teaching evaluation research. From the perspective of the total number of publications and citations, the attention of online teaching evaluation is on the rise as the total citation frequency of 1000 effective literatures is 7374 times, and the average citation frequency of each literature is 7.37 times, indicating that the quality of the selected literatures is relatively reliable and has a certain influence in this field. A research hot spot is a scientific problem or topic discussed by a relatively large group of interrelated papers in a certain period of time [5]. CiteSpace extracts nominal terms from data set titles, keywords, system supplementary keywords and abstracts. Compared with keywords, the co-occurrence analysis of subject words can more comprehensively reflect the research topic of a certain field, and the high-frequency subject words extracted accordingly can also reflect the hot topics of related research [6]. In
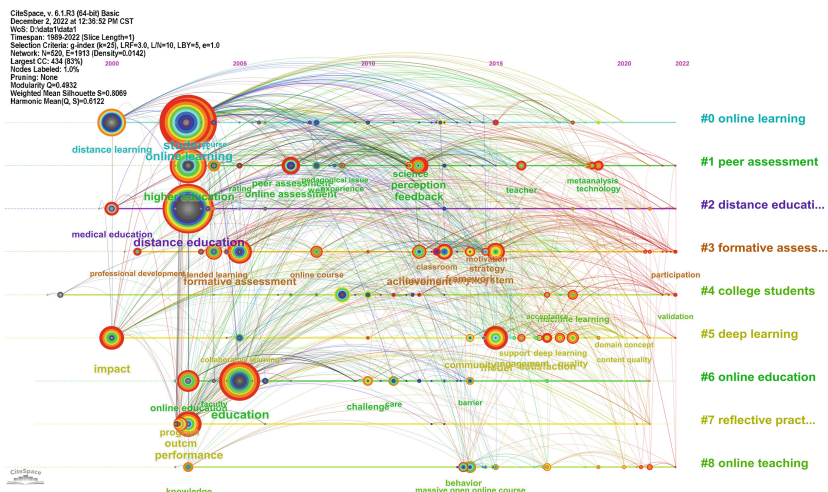
Fig. 1. Keywords clustering time graph [self-painted]

this study, the time partition is set to 1 year, and "keyword" is selected as the node type for keyword co-occurrence analysis. The logarithm likelihood algorithm (LLR) in CiteSpace is adopted to cluster high-frequency keywords, and the keyword clustering time graph is finally generated (Fig. 1). Clustering is the clustering of closely related keywords, which helps us to grasp the main research topics at present [7]. The module value Modularity Q = 0.4932 > 0.3 indicates that the clustering results will be credible. The Mean Silhouette = 0.8069 > 0.7 indicates that the clustering will be convincing.

According to the theme word co-occurrence map and the ranking table of high-frequency words, combined with the literature reading and combing, it is found that the research related to online teaching evaluation mainly includes online learning, peer assessment and distance education.

3.2 Distribution of Mechanism

Based on the institutional co-occurrence and word frequency statistics function of CiteSpace, this study combined with the analysis function of Web of Science has explored the distribution of institutional cooperative network in the research field of online teaching evaluation. A total of 1000 literatures were retrieved from 453 research institutions, among which 338 published only 1 paper and only 115 published more than 2 papers. As can be seen from Table 1, the top three institutions with the number of publications are: Arizona State Univ (7 articles), Harvard Univ (7 articles) and Univ Wisconsin (7 articles). The co-occurrence results of CiteSpace institutions has revealed that there are few connections among research institutions and their distribution is scattered, which indicates that there is less cooperation among institutions in the field of online teaching evaluation research and no close institutional cooperation network has been formed.

Table 1. Statistical Table of the number of publications of research institutions (number of publications ≥ 5) [self-painted]

S/N	Institutions	Count	S/N	Institutions	Count
1	Arizona State Univ	7	6	Shanghai Jiao Tong Univ	6
2	Harvard Univ	7	7	Emory Univ	6
3	Univ Wisconsin	7	8	Univ Sydney	6
4	Univ Oberta Catalunya	6	9	Open Univ	5
5	Cent China Normal Univ	6	10	Washington Univ	5

Table 2. Study the statistical table of the number of published papers in the country (number of published papers ≥ 15) [self-painted]

S/N	Country	Year	Count	S/N	Country	Year	Count
1	USA	1992	257	7	TURKEY	2004	29
2	CHINA	2002	195	8	GERMANY	2007	27
3	AUSTRALIA	1998	70	9	INDIA	2004	25
4	SPAIN	2003	51	10	BRAZIL	2003	23
5	ENGLAND	2000	48	11	MALAYSIA	2013	15
6	CANADA	2003	44	12	SCOTLAND	2005	15

3.3 Distribution of Countries

By analyzing the distribution of the publishing countries of literature related to higher education quality assurance research, we can understand the main academic positions in this research field. There are 12 countries with more than or equal to 15 published papers, up to 771, accounting for 74.78% of the total, indicating that the published papers of higher education quality assurance research are relatively dispersed. According to Table 2, the distribution of countries with the number of published articles ≥ 15 is analyzed. First, USA is the country with the largest number of published articles on online education, with 257, which is much higher than other institutions. Thus, USA occupies the main position of online education research and the main force in this research field. Second, the top 12 countries in terms of publication volume include USA, CHINA, AUSTRALIA, SPAIN, ENGLAND, CANADA, etc., reflects that European and American countries are the main battleground of online teaching evaluation research, and there is a phenomenon of regional differentiation in research. The year in Table 2 is when the first relevant paper was published in that country.

3.4 Distribution of Authors

In this study, the author co-occurrence function of CiteSpace was utilized to analyze the high-producing authors and their distribution in online teaching evaluation. The results
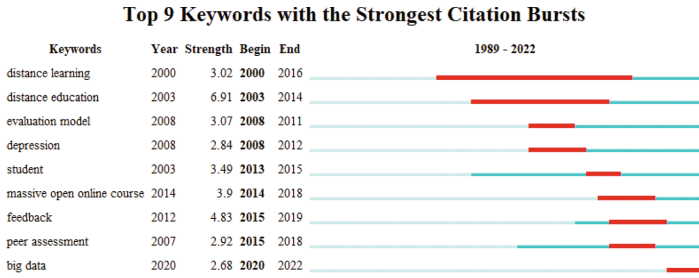
Top 9 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	1989 - 2022
distance learning	2000	3.02	2000	2016	
distance education	2003	6.91	2003	2014	
evaluation model	2008	3.07	2008	2011	
depression	2008	2.84	2008	2012	
student	2003	3.49	2013	2015	
massive open online course	2014	3.9	2014	2018	
feedback	2012	4.83	2015	2019	
peer assessment	2007	2.92	2015	2018	
big data	2020	2.68	2020	2022	

Fig. 2. Top 9 Keywords with the Strongest Citation Bursts [self-painted]

presented that Professor Caballe and Santi from Open Univ Catalonia ranked the top with 4 papers. Becra-alonso, Professor David of Univ Loyola Andalucia, Professor Barbera and Professor Elena of Univ Oberta Catalunya followed with 3 papers each. According to Price's law [8], the amount of publication of core authors $M = 0.749 \times \sqrt{Nmax}$, where Nmax represents the amount of publication of the most productive authors in the field. If the number of published papers is greater than M, the author can be judged as the core author in the field. In this study, Hali Budi Santoso, the most prolific author, published 4 articles, M≈2. 50 authors with more than 2 publications can be regarded as core authors, accounting for 8.45% of all authors, and 104 publications in total, accounting for 10.4% of the total number of papers, which is less than 50%. It can be seen that the core author cluster has not been formed in the field of online teaching evaluation.

3.5   Frontiers of Research

Research frontier is a group of emergent dynamic concepts and potential research problems [9]. Through the emergent word analysis of CiteSpace software, the research frontier and trend of a certain field can be detected [10]. In order to explore the cutting-edge topics in online teaching evaluation research in recent years, this study refines the high-frequency emergent words and finds 9 keywords that are cited most, as shown in Fig. 2.

4   Conclusion and Suggestion

4.1   Analysis Conclusion

With the help of CiteSpace software, combined with literature review and content analysis, this study has explored the core institutions, authors, frontiers and hot issues of foreign online teaching evaluation research, and has drawn the following conclusions:

Firstly, the research hot spots of online teaching evaluation mainly include online learning, peer assessment and distance education. With the development of research methods and breakthroughs in research theories, researchers have been attaching more importance to the role of qualitative methods in online teaching evaluation.

Secondly, the attention of online teaching evaluation reflects a fluctuating upward trend, and scholars' attention to online teaching evaluation is gradually increasing. A

number of authors and institutions with high yield and high citation have emerged in the field of online teaching evaluation, but there is still no core author cluster and close institutional cooperation network.

Thirdly, from the perspective of time dimension, the hot spots of online teaching evaluation research have changed continuously in the 20 years since the 21st century, and feedback and big data have become the emerging themes in recent years.

4.2 Research Recommendations

Based on the above analysis, in order to further deepen my country's online teaching evaluation and promote the development of online teaching evaluation practice, the following suggestions are put forward:

Broaden Online Teaching Evaluation Research Scope
Before the COVID-19 pandemic, the discussion of online teaching evaluation was largely focused on higher education. In the post-epidemic era, researchers should pay more attention to the integration of online teaching and traditional teaching, and think more about the role of online teaching in bridging the shortcomings of traditional teaching and improving the overall teaching quality.

Focus on the Core Topics of Online Teaching Evaluation
From the above analysis, it can be seen that the theoretical research of online teaching evaluation, the evaluation research of online teaching process and output has been a hot topic of online teaching evaluation. However, the relevant research scope is small, the basic research depth of the research topic is not enough, and the research conclusions are the same.

Keep up with the Forefront of the Innovation of Online Teaching Evaluation.
In recent years, with the continuous development of big data, artificial intelligence, machine learning and other technologies, how to integrate artificial intelligence and other new technologies into online teaching and online teaching evaluation process has attracted more and more attention from researchers. These new forms of online teaching pursue the autonomy of learning and research and the personalized content, and emphasize the cultivation of students' collaborative ability and problem solving ability in online teaching, which reflects the trend of future education reform and development to a certain extent.

Enriching Research Methods
Through reviewing the literature, this study finds that with the breakthrough of research methods and theories, more and more researches combine quantitative and qualitative research methods to carry out online teaching evaluation research. The rapid development of big data, artificial intelligence and other technologies also provides important opportunities for learning analytical techniques. Future research should change the research paradigm, promote the development of empirical research, pay attention to the diversification of research data collection methods, and improve the standardization of research.

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