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Visual Analysis of SPOC Based on Citespace

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Abstract: **In order to learn more about the current situation, hot areas and trends of SPOC research, this study used software such as CiteSpace, a visual analysis tool, took the English literature related to SPOC in CNKI database from 2009 to 2021 as the data source, and made a visual analysis of SPOC research from the aspects of overall trend. The keywords were co-occurrence network, clustering analysis and timezone map. The research found that the existing space and shortcomings of the current research, and tentatively put forward the direction of future research. It can provide reference for follow-up research.**

Keywords: SPOC; Research hotspots; Visual analysis; Citespace
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1.Introduction

With the development of information technology and network technology, blended learning has received great attention in China in recent years, it is a new learning method based on information and communication technology (ICT). Blended learning combines the advantages of traditional face-to-face learning and e-learning [1]. In blended learning, teachers can use all kinds of teaching designs and teaching methods to make students pay attention to what the teacher wants them to get. It need teachers to lead and inspire and control the teaching processes, and enable students to maintain a positive and innovative attitude in the learning process [2].

Small private online courses (SPOC) is a MOOC version used locally for students at school, It was first proposed and used by professor Fox of the University of California, Berkeley [3] . SPOC refers to a small, private, online courses. It is the product of the combination of information technology and education. The essence of SPOC is to combine MOOC with traditional classroom teaching, make use of the resources of MOOC and combine face-to-face classroom teaching, realize online sharing of high-quality resources, offline teacher-student interaction and emotional exchange. It is a new teaching mode that combines online or offline. SPOC is a new curriculum form that people pay attention to after the "MOOC boom" [4] .

The present paper teases out the relevant literature of SPOC presented in the data corpora of CNKI to show the mapping knowledge of SPOC. In order to know about the development of SPOC and enhance its application,we also review the distribution features of SPOC research and provide suggestions for the future research.

2.Data and methods

2.1 The source of data

The database of CNKI was used as the source of data in this research. The literatures were searched from the 1th January to 31th December 2022. The retrieval subjects were "SPOC" and "teaching". The retrieval method was advanced retrieval. A total of relevant articles were obtained and the time range was from the 1th January to 31th December. 256 papers were obtained, and the preliminary search results were manually screened. Finally, 226 papers were finally selected as effective research samples.

2.2 Research tool

The research tool used in this study is the visualization analysis software CiteSpace developed by Doctor Chaomei Chen and his team. The foundation of the CiteSpace is network analysis and visualization. Through network modeling and visualization, you can explore the intellectual landscape of a knowledge domain and discern what questions have been tried to answer and what methods and tools they have developed to reach their goals[5]. CiteSpace can help researchers understand the network patterns of a certain field, such as how it grows from a new topic to the present, what are the citation hotpots in the publications.

2.3 Research method

Firstly, The term "SPOC" and "teaching"was used to retrieve data from CNKI database, the relevant literatures

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in CNKI were downloaded as TXT document, and then manually screen the documents retrieved. Secondly, the research status of SPOC was analyzed and summarized by using the methods of word frequency analysis and cluster analysis to construct and interpret the knowledge graph. Thirdly, time zone view was drawn and keywords of different time nodes were analyzed. Therefore, the development trend of the research and explore the relationship between different topics were getted. Finally, the future of SPOC is prospected based on the knowledge graph.

3.Research results and discussion

3.1 General trends of SPOC research

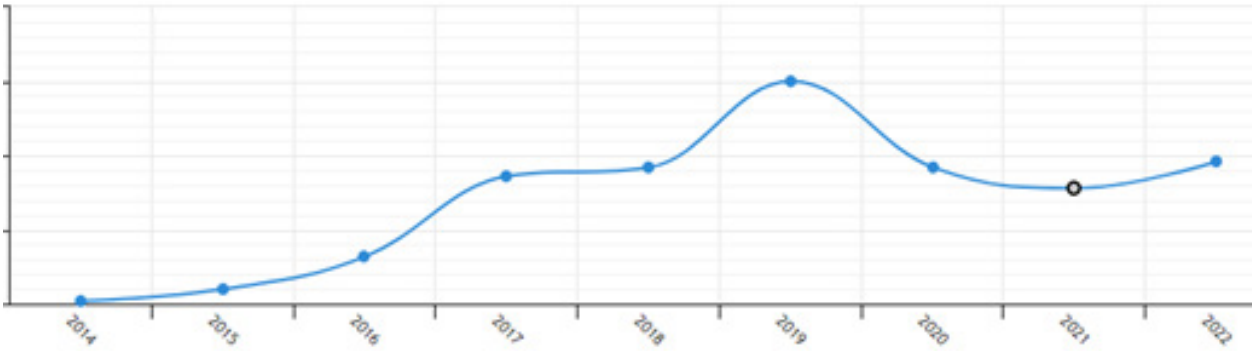

Figure 1. Annual Publications of SPOC research

Figure 1 presents the overall trend of SPOC research since 2009 and showed than there were few articles about SPOC before 2014. From 2014 to 2019, the number of articles published increased gradually. In particular, from 2015 to 2019, SPOC research showed a blowout developing, with the number of publications rising sharply from 5 to 75 and a peak of 75 in 2019. On the whole, the SPOC research can be divided into three periods: slow development, rapid development and stable development. From 2009 to 2014, the number of paper nember is very small, the growth is slowing. It means that the research has just started. From 2014 to 2019, the number of papers increased rapidly, SPOC began to attract the attention of many scholars. After 2019, The research of SPOC gradually tends to be stable, and the number of articles published each year is basically the same.

3.2 Keywords Co-occurrence Analysis

Research hotspots are the topics discussed in a large amount of literatures with inner link in a period of time. These issues are considered to be worthy studied in a certain fields. It are able to facilitate the understanding and interpretation of the topics under study and reveal the problems which have not been fully resolved[6]. Keywords are the core words that can reflect the topic hotspots and content of research. The network of co-occurring keywords can present the hot words about relevant research areas in certain timespan, makes clear the status quo of research and the development history. In CiteSpace, the “time slicing” is set as “from 2009 to 2021”, the “year per slice” as “1”, and the “node types” as “keywords”. The knowledge mapping of keyword co‐occurrence network can be constructed (Fig. 2). The circle size represents the frequency of one keyword, which means that the larger the circle, the higher the frequency.

The centrality is the most direct measure of node importance in network analysis. The greater the node degree of a node, the higher the centrality of the node, and the more important the node is in the network. Keywords in Table 1 are the ones with the centrality larger than 0.1. So we can get the research hotspots of SPOC by from the table, such as “flipped classroom,” “online education”,”blended teaching”, etc.

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Fig. 2. The network of co-occurring keywords

Table 1. The top ranked keywords by

Count	Centrality	Year	Keywords
3	0.21	2014	flipped classroom
3	0.19	2017	online education
8	0.18	2014	blended teaching
6	0.16	2016	english teaching
	0.16	2016	hybrid teaching mode
5	0.15	2015	small private online course
0	0.15	2014	traditional teaching mode
2	0.15	2016	blended teaching model
	0.15	2014	new teaching mode
	0.15	2017	autonomous learning
8	0.14	2015	teaching mode
1	0.14	2016	teaching effect
1	0.12	2017	autonomous learning ability
	0.12	2018	teaching evaluation
	0.11	2017	inevitable trend
6	0.10	2017	teaching model
8	0.10	2017	college english
	0.10	2018	learning experience
	0.10	2016	spoc teaching

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3.3 Keyword Cluster Analysis

In order to further understand the internal relationship between the above keywords, this paper cluster the keyword co-occurrence network and divide the keywords into different subgroups. The log likelihood ratio (LLR) method was used. The clustering results are shown in Figure 3. Generally speaking, the smaller the number of keywords in the figure, the more keywords are contained in the cluster[7]. We generally selected the first nine clusters.

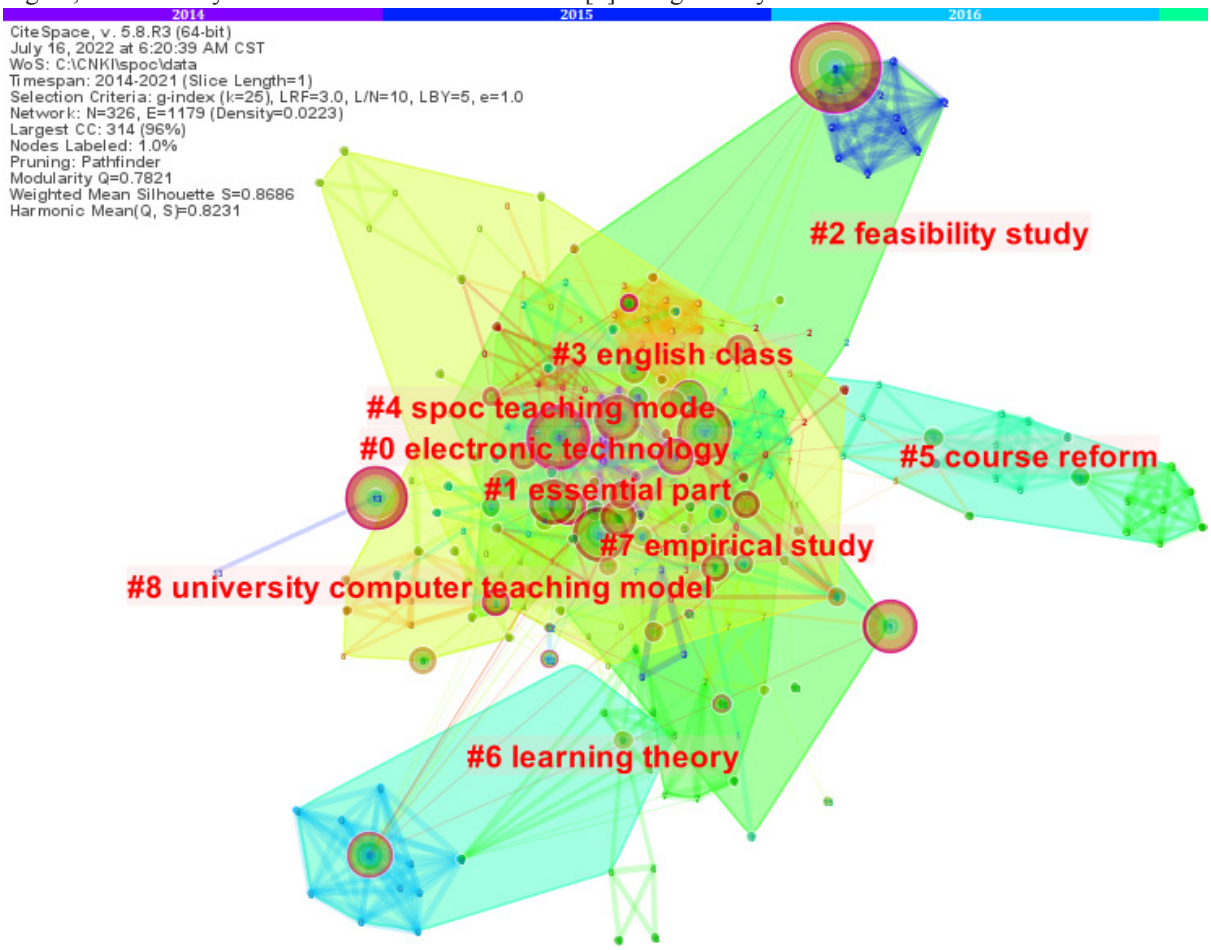

Figure 3. Keywords Cluster atlas

In CiteSpace, Q (Modularity) value and S (Silhouette)value are important indicators to evaluate the rationality and effectiveness of clustering. It is generally believed that when Q>0.3, it means that the cluster structure is significant. When S>0.5, clustering is reasonable, and S>0.7 means that clustering is convincing[8]. We can see from Figure 3 that Q=0.7821 (>0.3) and S=0.8686 (>0.7) of the keyword clustering graph. It means that the research topics of SPOC are concentrated, and the clustering results are significant and convincing. Therefore, three major topics can be summarized in SPOC research. The first is blended learning, including online discussion, blended learning, blended teaching model, etc. The second is flipped classroom and the third is online education and offline education.

3.4 Analysis of Timezone Map

CiteSpace can generate a time zone view in a timely fashion that emphasizes the relationship between the research frontier and its knowledge base. Figure 4 shows the development of SPOC research in recent years. According to the time when the keyword first appears, the corresponding nodes are set in different time zones, and the node positions are upward along the time axis [9]. The recommended domain keyword “Time Zone View” of SPOC shown in Figure 4.

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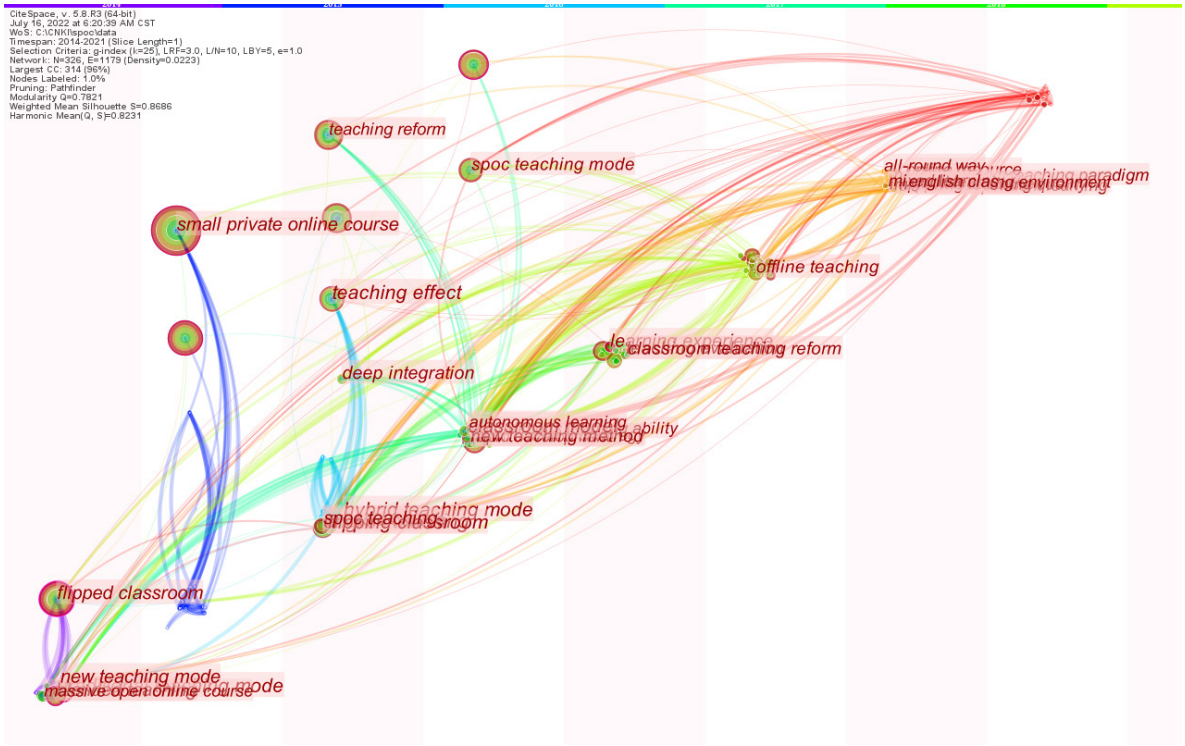

Figure 4. Keywords Timezone view

From the evolution of keywords, there were many time zone view nodes in 2014-2017, and most high-frequency keywords appeared in this stage. These high-frequency keywords not only appeared early, but also ran through the whole time line of SPOC. The number of nodes in 2018-2021 is small, indicating that the research on SPOC in this stage is still based on the research of previous years, and innovation is few.

4.Conclusions

This paper took 283 literatures related to SPOC in CNKI database as the object of analysis, and carries out knowledge. Mapping analysis from keywords co-occurrence network, cluster analysis, timezone view analysis and obtains the knowledge structure and evolution process in the field of SPOC.

CiteSpace was used to sort out the relevant documents related to SPOC research in the core database of CNKI database, analyze the knowledge map of SPOC research and its evolution, and draw the following conclusions.

First, in terms of the number of publications, the number of SPOC research core journals in China has increased rapidly in recent years. After 2019, it gradually stabilized. This should be with the convening of the 2019 China Muke conference.

Second, SPOC research has mainly formed research hotspots such as flipped classroom, mooch, SPOC, curriculum reform, mixed teaching and so on. Among them, flipped classroom clustering, mooch clustering and hybrid teaching clustering are closely related, and online courses and course construction nodes are less related, which shows that SPOC research is constantly evolving, and the relationship between research topics is not balanced. In the future exploration, the research field of SPOC will continue to expand, and the research framework and architecture of SPOC will gradually improve.

Third, many researchers have proposed different SPOC teaching modes from the perspective of the application of SPOC, teaching mode, and the application of these modes has not been fully practiced and recognized. There are still many factors affecting this teaching mode that need to be practiced and explored.

In addition, there are still some deficiencies in this study. First of all, this article only takes “SPOC” as the theme word and entry point, which is not accurate enough. Secondly, the research object is not comprehensive enough. Since the research samples are from CNKI database and do not involve other databases, such as master’s and doctoral dissertations. The survey results may have some limitations. It is believed that based on larger samples and multidimensional perspectives, research will enrich the existing findings of this study.

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