

# Visualization Analysis of College Teaching Quality Monitoring Based on CiteSpace

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## Abstract:

With the progress of science and technology and the continuous advancement of teaching reform, the teaching quality of colleges and universities has become the most important issue in the reform and development of colleges and universities. This paper uses the file metrology software Citespace to study the current research situation and hot spots of teaching quality monitoring in the field of social science, through author co-occurrence analysis, research hotspot analysis, cluster analysis, research frontier analysis and other methods to sort out and explore the research object.

**Keywords:** Citespace, Teaching quality, Monitoring.

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## I. INTRODUCTION

The core task of higher education is to improve personnel training quality. The society calls on colleges and universities to fully implement the party's education policy, implement the fundamental task of fostering virtue through education, and comprehensively improve teaching level and talent training quality. In recent years, colleges and universities continuously promote the reform of education and teaching, thus greatly improving personnel training quality. However, some colleges and universities still have problems such as backward educational and teaching concepts and inadequate teaching quality monitoring. Teaching is the central task of schools, teaching quality is one manifestation of educational value, and teaching quality monitoring is to guarantee that teaching process achieves the expected goals in each stage through monitoring and control. Based on Citespace visualization analysis, this paper sorts out the domestic scholars' research on teaching quality monitoring, analyzes the current research hotspots and status, and provides useful references for research in the field of teaching quality monitoring.

## II. MATERIALS AND METHODS

### 2.1 Research Data Sources and Research Methods

#### 2.1.1 Research data

In order to better understand the development status of teaching quality monitoring research, the research adopts bibliometric method and scientific knowledge map method, selects the domestic resource platform CNKI as the data source, ticks "Advanced Search" in CNKI, and sets "Keywords Search" with keyword of "teaching quality monitoring". By setting the search time span as 2017-2021, and selecting "all journals" in

journal category, a total of 967 related papers were retrieved, a total of 700 valid literatures including fields such as author, title, keywords, and author unit were obtained after manually deleting unqualified ones such as reports, conference notices, documents, etc[1].

### 2.1.2 Research methods

CiteSpace, bibliometrics software developed by Dr. Chen Meichao, can visualize the data information of documents, display the development process and structural relationship of scientific knowledge through graphics, so as to intuitively present the links between documents to readers, letting readers understand the development process and frontiers of related research fields[2]. This paper will use the CiteSpace software to conduct knowledge map visualization analysis on the selected data, and discuss the research hotspots and frontier trends of the Yangtze River Delta integration from multiple aspects of number of author's publications, literature and journal co-citations, and keyword clustering, etc.

## 2.2 Literature Statistical Analysis

### 2.2.1 Author co-occurrence analysis

With the help of CiteSpace software, the visualization map analysis of 700 pieces of data was performed with Node Types as author, resulting in Fig 1 below. The text in the upper left corner of the figure shows the relevant data. Take "N=178, E=57" as an example. Where, "N" represents the node, that is, the location node where the author appears. Greater font size of the author's name means higher appearance frequency of the author in the 700 pieces of data. "E" represents connecting line, and the connecting line between the nodes represents connection between authors. Thicker connecting line means higher frequency of appearance in the same literature, thus revealing cooperative relationship between authors. There are 178 nodes in the author cooperation graph, with 57 connecting lines and network density of 0.0036. The most prolific author publishes 7 articles. According to Price's Law, author with 3 or more papers is prolific, so there are 9 such authors in total.

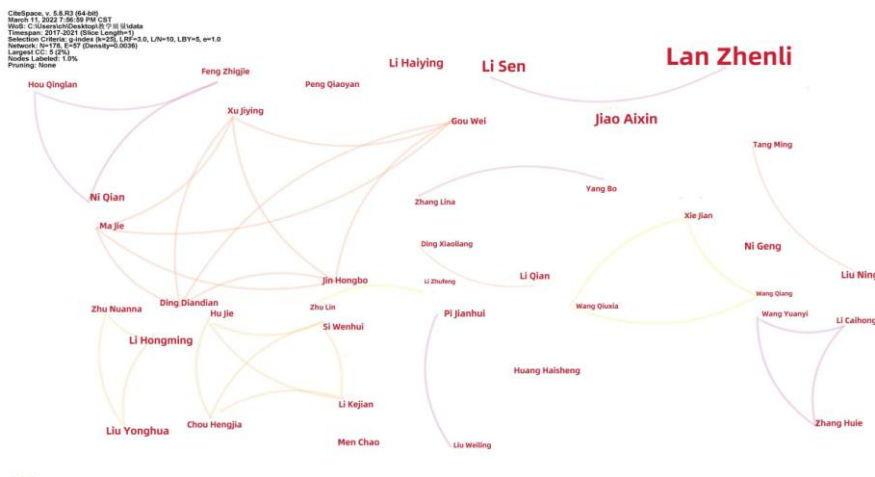


Fig 1: Author collaboration map

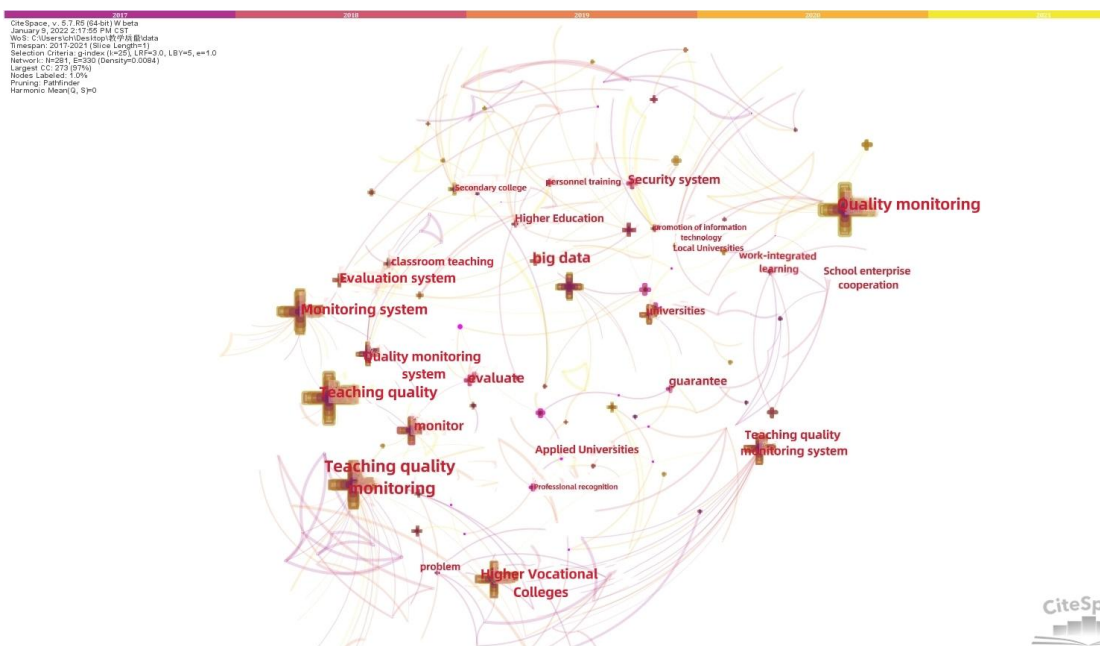
In the CNKI database, Lan Zhenli is the scholar with the largest number of publications on teaching quality monitoring research, with a total of 7 papers. Lan Zhenli is currently an associate professor at Zunyi Normal University. Focusing on curriculum and teaching theory, higher education teaching, history curriculum and teaching theory, she has conducted continuous research on teaching quality monitoring.

Associate Professor Jiao Aixin ranks the second in number of publications, with a total of 4 papers. Jiao Aixin, now an associate professor of Huanggang Polytechnic College, presided over the Hubei Provincial Educational Planning Project "Research on the Construction of Higher Vocational Teaching Quality Monitoring System Based on the Work-Study Combination". This reveals his research on teaching quality monitoring.

The above figure indicates that there are some obvious cooperation teams in teaching quality monitoring, but with limited scope, mainly small team cooperation. There is little cooperation with other authors, few core author communities and loose interaction between authors.

### **2.2.2 Analysis of research hotspots**

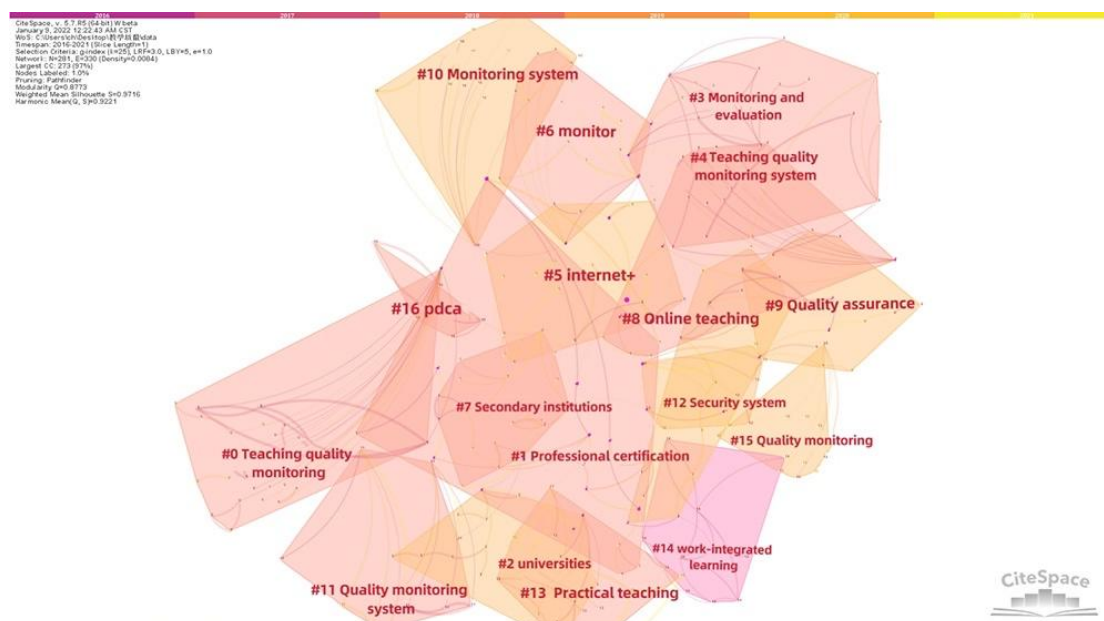
The node type of CiteSpace operation interface is selected as keyword for visualization analysis, and the keyword co-occurrence graph as shown in Fig 2 below can be obtained. The figure has 281 nodes and 330 connecting lines, with network density at 0.0084. The nodes in the figure represent the occurrence frequency of keywords. The higher the frequency, the bigger the node. According to Fig 3, the keywords with high frequency include: "teaching quality monitoring", "monitoring system", "teaching quality", "teaching quality monitoring system" and so on. National development depends on talents, talent training depends on schools, and teaching quality in schools is the top priority of talent training. Many colleges and universities measure teachers' work performance based on papers and projects in professional title evaluation. Teaching is only a basic condition, attention to quantity rather than quality is quite detrimental to talent training. Another possible reason for this phenomenon is that the rating of teaching quality is not easy to quantify, and there is a lack of scientific evaluation methods. With the progress of the times, many schools have realized this problem and found that a scientific tool in teaching quality is quality monitoring system. Hence, many colleges and universities begin to value the evaluation of teaching quality and the construction of teaching quality monitoring system by making it a long-term mechanism.



**Fig 2: Keyword map of teaching quality monitoring research**

The keywords in the map are clustered and summarized according to relevant algorithms, and the keyword cluster map as shown in Fig 3 below is obtained. The cluster map mainly reflects the structural characteristics between clusters by highlighting key nodes and important connections. By combining the relevant keyword data in the two figures, we can analyze and summarize the main research areas of teaching quality monitoring in the core research circle.

There are many keywords in Fig 2. In order to increase the accuracy in summarizing the research field, using the keyword clustering function of CiteSpace, this paper adopts LLR (log-likelihood method) to cluster high-frequency keywords (see Fig 3) based on the closely related keywords in Fig 2. The derived specific clusters include "teaching quality monitoring", "work-study combination", "online teaching", "practical teaching", "monitoring and evaluation", "guarantee system", "monitoring system", "professional certification", "university", "secondary college", etc. Clustering module value (Q value) = 0.8773, indicating obvious clustering structure. According to the network structure and clustering clarity, CiteSpace provides two indexes: the module value (Q value, namely Modularity) and the mean silhouette value (S value, namely Mean Silhouette). When the Q value is  $>0.3$ , the clustering structure is obvious. When S value reaches 0.7, the clustering can be considered convincing. The data in the upper left corner of Fig 3 shows Q value = 0.8773, S value = 0.9221, so the cluster map has quite obvious clustering structure and convincing results.



**Fig 3: Keyword clustering knowledge graph**

Clusters 0, 1, 3, 4, 6, 9, 10, 11, 12, and 15 illustrate the importance of keywords such as "teaching quality", "quality and evaluation", "quality assurance", and "quality monitoring" in the research. With the reform and development of higher education, colleges and universities develop a deeper understanding of teaching quality, and the construction of double first-class universities is on-going in depth in colleges and universities[3,4]. With it, curriculum construction has also become a highlight in the construction of college teaching quality engineering.

Cluster 2 "University" and Cluster 5 "Internet +". In the era of big data, the construction of teaching quality monitoring system in colleges and universities is inseparable from the Internet and the extensive use of information technology. Monitoring of teaching quality in colleges and universities is a systematic project. By using Internet technology to monitor the teaching quality in a controllable way from the four stages of planning, implementation, inspection and processing based on massive databases, it is possible for teaching quality monitoring to embark on a more scientific, standardized road.

Cluster 8 "Online Teaching". With the advancement of science and technology, teaching methods are increasingly diversified. Online teaching has become an important teaching method[5]. Online teaching plays a great role during the epidemic, which solves practical problems such as prohibition of classroom teaching. However, its function is much more than that. Online teaching conducted remotely has created various forms of classrooms, making knowledge acquisition more convenient. Online teaching provides a powerful tool for teaching innovation in colleges and universities, so that teaching of courses via flipped classroom has a better foundation.

Cluster 13 "Practical teaching". Classroom teaching has always been the main battlefield of the education front. However, in recent years, it is realized that students will have poor ability to deal with

problems if we completely rely on classroom and get rid of practice. Practical teaching has thus received more and more attention, and graduation design now requires solution of practical problems. For local application-oriented colleges and universities, practice is an important measure for schools to build professional strength[6].

### 2.2.3 Research frontier analysis

Teaching quality monitoring has experienced different stages of development since its proposal, showing different research focus in different periods. Through burst analysis of keywords, this paper discusses the research trends and research frontiers of teaching quality monitoring, and predicts the future development direction of this field.

#### Top 10 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2017 - 2021
Higher vocational education	2017	1.72	2017	2018	
architecture	2017	1.72	2017	2018	
Work-integrated learning	2017	1.72	2017	2018	
sports	2017	1.14	2017	2018	
Practice teaching	2017	1.14	2017	2018	
University-enterprise cooperation	2017	1.14	2017	2018	
Credit system	2017	1.14	2018	2019	
Undergraduate teaching	2017	1.14	2018	2019	
Continuous improvement	2017	1.21	2019	2021	
applied	2017	0.96	2019	2021	

Fig 4: Top 10 burst keywords in 2017-2021

As shown in Fig 4, in the early stage of teaching quality monitoring research, keywords such as higher vocational education, system construction, work-study combination, and practical training teaching are highlighted, and this period focuses on burst keywords in research.

In 2018, keywords such as "undergraduate teaching" and "credit system" appeared, and in 2019, keywords such as "continuous improvement" and "application type" appeared. In rapid development of education, teaching quality monitoring provides an important means to guarantee the improvement of education and teaching quality, so teaching quality monitoring has received more and more attention. However, in the actual teaching management process, how to achieve teaching quality monitoring has always been a pain point and also a difficult point in the teaching process. For application-oriented colleges and universities, teaching means the most important responsibility, and how to improve undergraduate teaching quality is an urgent problem to be solved for them[7].

### III. CONCLUSION

In research, effective use of research tools can facilitate researchers. This paper uses CiteSpace, a visualization software, to investigate the general development of domestic teaching quality monitoring

research. With the help of this analysis software, this paper summarizes important information about prolific authors, leading institutions, research areas and hotspots in teaching quality monitoring research. Paper research in this area has led to the following conclusions:

Colleges and universities pay increasing attention to teaching quality monitoring. From the number of papers published in the past five years, it can be seen that teaching quality monitoring is a research hotspot for experts and scholars[8,9]. The attention of colleges and universities to teaching quality monitoring reflects that colleges and universities have begun to abandon some relatively utilitarian development ideas, but implement "student-oriented" education to strengthen the country.

Research on teaching quality demands strong researcher cooperation. It can be seen from the cooperation network of authors and institutions that cooperation between domestic authors and institutions is weak, with spare links between the results of various studies. In the future, cooperation between authors and among institutions should be strengthened to promote further research in this field[10].

The construction of a teaching quality monitoring system in the era of big data is the core to teaching management. Seen from keyword clustering, the research hotspots in teaching quality monitoring include "teaching quality monitoring", "Internet", "professional assessment" and so on. Seen from the prominent keywords, the development focus varies in different stages. In the era of big data, how to use information technology to integrate various resources, create an efficient teaching quality monitoring system, and conduct scientific and effective teaching management is the core link in future teaching management.

### **ACKNOWLEDGEMENTS**

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