Application of Big Data Technology in Monitoring Teaching Quality in Universities

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Abstract: In order to monitor teaching quality more effectively, this paper uses big data technology to realize the monitoring work of collecting, storing and managing teaching information in colleges and universities. In the design process, data collection technology is used to obtain teaching quality data, and information about teachers and students across the university is collected, stored, and managed. In the data analysis, the main factors affecting teaching quality are regulated and controlled to make them optimal. The results showed that the overall monitoring accuracy of teaching quality reached an average of 4.72 points, and the highest average score of students' test reached 87.56 points. This shows that big data technology is beneficial to improve the monitoring accuracy of teaching quality and enhance teaching quality.

1. Introduction

Big data technology can filter out effective data from the massive and difficult to process data, and refine valuable information by analyzing the data to guide work practice. In this context, the teaching quality monitoring system comes into being. The construction and application of teaching quality monitoring system can adapt to the development trend of smart campus and also improve educational management achievements and enrich educational methods and approaches [1-2]. The educational application of big data technology can not only realize the tailor-made education for students, let parents know more detailed education information and provide objective and comprehensive teaching feedback for teachers' teaching. Education administrators can also obtain information and basis for teaching and learning, better organize educational resources and formulate measures for educational reform and development, thus realizing student-centered humanistic education ideology. Big data in education brings opportunities for monitoring and evaluation of teaching quality, allowing multiple subjects to work together and share information, which is the key to modernizing educational governance [3-4].

The application of big data technology is becoming increasingly mature in education, for example, literature [5] states that teachers in the era of big data need to have a new mindset of integration and innovation and a high quality of teaching, so monitoring the quality of teaching is crucial. The literature [6] provides an in-depth analysis of the relationship between big data and educational applications, providing opportunities for the development of data collection, assessment and evaluation, and research services for institutions. Although the above literature points out the importance of teaching quality monitoring, it is not specifically applied to practice to meet the current educational requirements.

This paper designs a teaching quality monitoring system for colleges and universities based on big data technology to achieve intelligent teaching quality monitoring and evaluation. In the design process, the content of teaching quality monitoring in colleges and universities is analyzed in depth to determine its influencing factors and characteristics, and the clustering structure characteristics of monitoring data are calculated with the help of big data technology in order to analyze the learning behavior process of students and groups more clearly. The simulation analysis from different perspectives and contents constitutes the overall teaching quality assessment analysis, thus providing reference for teaching reform.

2. Build a big data teaching quality monitoring system

2.1 The application path of big data technology

Big data technology is the ability to quickly obtain valuable and meaningful information from huge data by using some big data analysis methods [7-8]. The path of its application in teaching quality monitoring is shown in Figure 1.

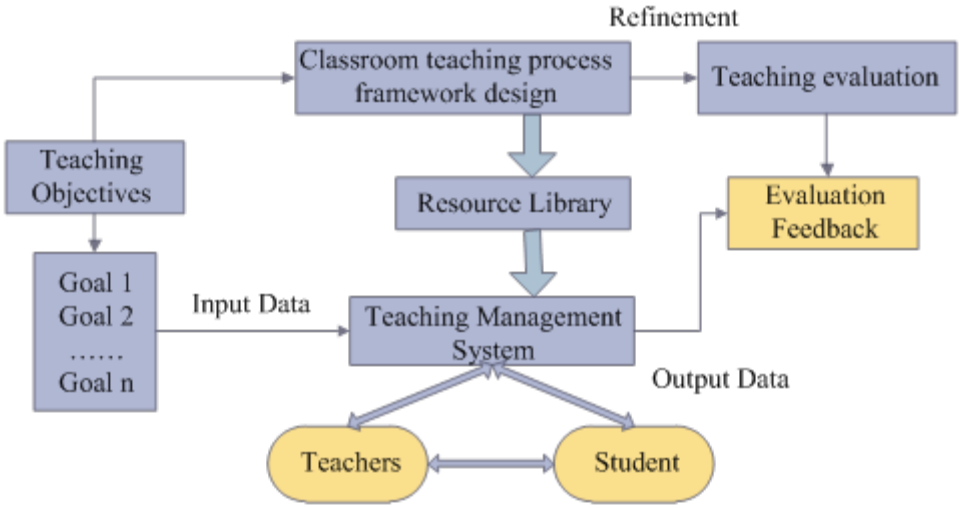

Figure 1 The application path of big data technology

As can be seen from Figure 1, big data technology can analyze the inter-class separability and compactness of the clustering structure in teaching quality data, and can obtain indicators that can reflect the relationship between single category data and other data, as well as data center of mass points, so as to achieve a balance between teaching quality monitoring and information campus construction. Big data technology can be used to evaluate teaching quality by adding inter-class and intra-class distances to compress data objects and determine the value range of indicators in the monitoring of teaching quality in universities. At the same time, these data resources can be integrated and intelligently analyzed to provide powerful support and assurance for school operation management, resource deployment and educational decision-making. This shows that big data technology can provide universities with more comprehensive and accurate teaching quality monitoring and decision support, thus improving teaching quality and student learning outcomes.

2.2 Building a teaching quality monitoring system

The construction of the monitoring index system is the core element of monitoring, which is an organic whole composed of various monitoring indicators and monitoring standards at all levels, and helps to analyze the teaching quality quantitatively and qualitatively. In the era of big data, universities need to build a teaching quality monitoring system with big data technology as the core in order to improve teaching quality. This system detects the main factors affecting teaching quality through continuous supervision of teaching quality. And through certain means and methods, it regulates, supervises and controls the main factors affecting teaching quality. It is constructed from four perspectives: data collection, data analysis, problem diagnosis and intelligent decision-making. Figure 2 shows the framework of teaching quality monitoring system in colleges and universities.

As can be seen in Figure 2, the data collection technology enables access to basic data on teaching quality. Collecting, storing and managing information about teachers and students across the school facilitates teachers, schools and the Education Bureau to carry out inquiries, statistics and data reporting work on teaching quality data. When the data is reported, data analysis techniques are used to regulate, monitor and control the main factors affecting teaching quality to make it optimal and accomplish teaching goals. The process is specified as follows:

(1) After completing the collection of teaching data, colleges and universities need to conduct in-depth analysis of the collected data. This includes methods such as judging, refining and digging deeper to obtain data on teachers' teaching situation and other aspects, and then explore the teaching

laws in it.

(2) By using scientific and systematic diagnostic tools, colleges and universities can discover the root causes of educational problems and better improve teaching and learning. Using teaching data analysis, colleges and universities can conduct educational diagnosis in different dimensions such as teachers, students and institutions, and make horizontal and vertical comparisons, temporal comparisons, subject comparisons and multi-factor synergistic comparisons in order to obtain diagnostic cause analysis, so as to accurately determine the educational problems in the teaching process and the causes behind them.

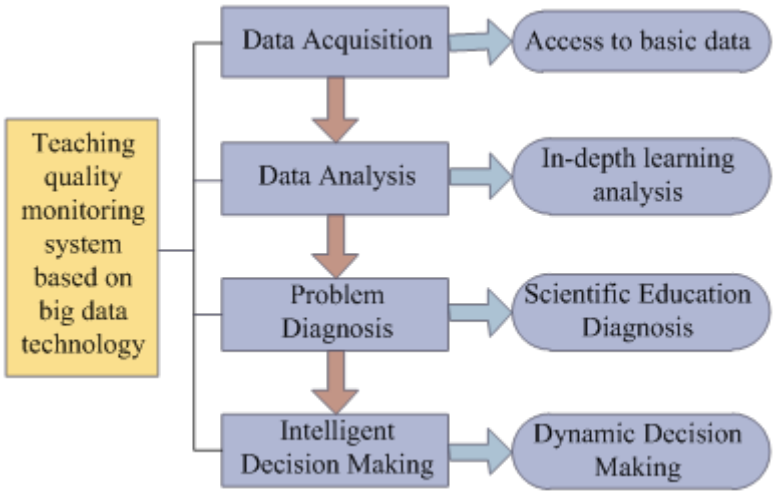

Figure 2 Framework of teaching quality monitoring system

2.3 Path selection of monitoring system

2.3.1 Building a data warehouse

Establishing a data warehouse based on teaching process is the foundation and premise of quality monitoring system construction. To build a data warehouse in line with the school construction orientation, colleges and universities firstly need to make full use of the basic teaching status data, ensure the efficiency of data collection work, and use the existing teaching status data as the main data basis of the school teaching quality monitoring platform. Secondly, it should open up the third-party data channels, leverage the power of third-party professional data companies, use big data technology, integrate teaching-related data such as status data, research data and Internet data, and build a whole-process, all-round structured big data warehouse. Finally, it should combine data application scenarios and database components to build a new era college teaching quality assurance platform.

2.3.2 Carry out three-level teaching quality regular monitoring

We use big data technology to carry out regular monitoring of teaching quality at three levels by establishing a "three levels +" management system. To carry out the evaluation and diagnostic analysis of majors, we need to formulate quality standards for professional development, including quality standards for professional training and quality standards for each teaching link. From the requirements of the profession itself, the teaching quality standards of the profession are formulated and the evaluation index system of the profession is formed by combining the social market demand.

2.3.3 Monitoring system evaluation criteria

Teaching quality monitoring and evaluation mainly includes immediate evaluation, stage evaluation and result evaluation. Result evaluation, similar to final teaching evaluation, is still one of the main means of teaching quality monitoring and evaluation as the summative evaluation of the teaching cycle.

Immediate evaluation refers to teaching evaluation that can be freely initiated at any teaching

point in time, and is the main means for individual teachers to participate in teaching management, such as in-class evaluation. Teachers can initiate evaluations in the middle or near the end of the class according to the issues they want to understand, and the frequency and time are controlled by teachers. Phase evaluations are usually surveys initiated at specific points in the teaching process. Both schools and faculties can initiate phase evaluations, and the results can be used to view fluctuations and changes in teaching quality.

3. Analysis of simulation results of teaching quality monitoring system

3.1 Teachers' teaching quality monitoring results

The teaching quality assessment based on teachers' teaching process reflects the problems that will help educational management institutions and schools to make management decisions and help teachers to improve their teaching. The teaching quality monitoring system of universities based on big data technology is compared with the traditional monitoring system, and the results of teachers' teaching quality monitoring are shown in Table 1.

Table 1 Results of teachers' teaching quality monitoring

	Traditional monitoring system	Big Data Technology
Teaching Skills	3.45	4.13
Teaching Status	3.56	4.89
Teaching content	3.78	4.68
Teaching attitude	4.05	4.92
Teaching Grading Results	3.99	4.83

As can be seen from Table 1, the monitoring accuracy of the traditional monitoring system is 3.45 for teachers' teaching skills, 3.56 for teaching status, 3.78 for teaching content, 4.05 for teaching attitude, and 3.99 for teaching rating. The accuracy of monitoring teachers' teaching quality is low and basically maintained at the average level. The overall monitoring accuracy of the teaching quality monitoring system based on big data technology is above 4.13, with an average of 4.72 points. The results show that the monitoring accuracy of this monitoring system is high, which can promote a whole process, quantitative and sustainable teaching quality assessment standard in universities.

3.2 Quality monitoring analysis of students' performance

In this section, we conducted a quality monitoring analysis of the academic performance of six classes in School A for one semester using a university teaching quality monitoring system based on big data technology. We conducted the first monitoring before the examination and concluded the whole system after the midterm examination. Through the data analysis of students' achievement, we found out the changes in students' academic level, learning ability and learning attitude, so that we could better grasp students' learning status and provide teachers with more effective teaching management suggestions so that they could better understand the changes of students in the learning process. The results of students' performance quality monitoring analysis are shown in Figure 3.

As shown in Figure 3, the academic performance of all six classes in the university improved after using the big data technology-based university teaching quality monitoring system, with the highest average score reaching 87.56. After the midterm exam, the academic performance began to decline, but it was still higher than the first model exam. It shows that the teaching quality monitoring system of universities based on big data technology can analyze students' test paper answers as data to pinpoint students' learning problems and find where the weak points are in terms of question types or knowledge points. This analysis can provide a comprehensive grasp of the class or students' mastery of each knowledge point, and thus provide a reference basis for teachers to effectively carry out their teaching work.

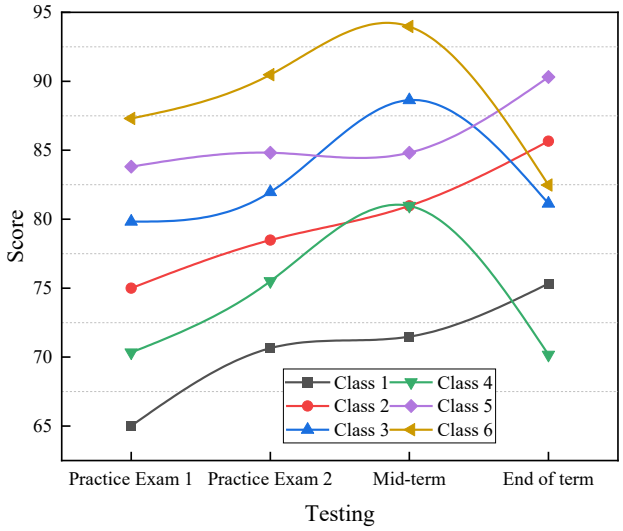

Figure 3 Analysis of students' performance quality monitoring

4. Conclusion

In this paper, big data technology is applied to the monitoring process of teaching quality in colleges and universities. In the actual application, the overall monitoring accuracy of teaching quality is above 4.13, and the highest average score of students reaches 87.56. It can be seen that the system can ensure the accuracy and reliability of teaching quality monitoring and provide accurate reference for the teaching work in universities.

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