

# An Innovative Study of Big Data Technology in High-Quality Teaching Evaluation System

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**Abstract.** With the development of educational informatization and the progress of data collection technology, the application of big data technology in high-quality teaching evaluation system has been increasingly emphasized. This paper mainly starts from the analysis of the shortcomings in the traditional course teaching evaluation, analyzes the feasibility of the application of big data technology in course teaching evaluation, and puts forward some implementation strategies for course teaching evaluation based on big data technology, clarifies the advantages of the application of big data technology in course teaching evaluation by examples, and has certain practical guiding significance for actively improving the level of school course teaching evaluation.

**Keywords:** Big data technology; teaching evaluation; high quality teaching; innovative research

## 1 Introduction

As educational reform deepens, high-quality teaching evaluation has become a pressing concern in the education sector. Traditional teaching evaluation methods often suffer from limitations such as strong subjectivity, insufficient sample size, and single evaluation dimension. These limitations make it difficult to comprehensively and objectively assess teaching effectiveness and student learning outcomes. However, the emergence of big data technology provides new ideas and methods to address these issues. Big data technology has great potential and application prospects in various fields, including education. Its massive data processing capability and efficient data analysis algorithms make it a valuable tool. The use of big data technology in education has been increasingly emphasized. A comprehensive and objective teaching evaluation system can be constructed by collecting, integrating, and analyzing multiple types and dimensions of data, such as students' learning behavior data, learning performance data, and teachers' teaching data. This system can provide a scientific basis and an effective feedback mechanism for realizing high-quality teaching.

## **2 Analysis of Problems in the Traditional Teaching Evaluation Process**

### **2.1 Inadequate evaluation mechanisms**

Traditional teaching evaluation has an imperfect evaluation mechanism. It tends to overemphasize students' performance and knowledge mastery, while neglecting the development of their abilities and the cultivation of their comprehensive qualities. This type of evaluation may result in teaching content that is biased towards mechanical memorization and test-taking skills, while neglecting the development of students' creative and critical thinking abilities.[2] Secondly, traditional methods of evaluating teaching often use a single standard and approach, which fails to consider the unique differences and individual needs of each student. As a result, it cannot accurately reflect the learning progress and potential of each student, nor can it provide effective personalized guidance and support. It is important to adopt a more personalized approach to teaching evaluation that takes into account the individual needs of each student. In the traditional process of evaluating teaching, students are often passive recipients of evaluations, lacking active reflection and evaluation of their own learning process and results.

### **2.2 Lack of timely feedback on evaluations**

In traditional teaching, a common issue is the delay in receiving evaluation feedback. Students often have to wait for an extended period before receiving the results of their tests, assignments, and classroom performance evaluations. This gap can cause confusion for students regarding their learning progress and hinder their ability to identify areas for improvement. School teachers may take a significant amount of time to process a large number of students' examination papers and results. Consequently, students may have to wait for weeks or even longer to receive their evaluation feedback. Additionally, course scheduling constraints may exist, where some courses may have a substantial amount of content to cover in one semester, making it challenging for teachers to complete all evaluations within a short period.

### **2.3 Incomplete data collection**

Incomplete data collection on student learning can lead to inaccurate or incomplete evaluation results, which can affect the assessment of teaching quality. One reason for this is that students may not actively participate or fully engage in the evaluation process, resulting in limited data and incomplete feedback. Secondly, teachers are primarily responsible for organizing and managing teaching. They can rely on their experience with the curriculum to make educational decisions. However, empirical decision-making and management lack a scientific basis, which is separate from the concept of accurate control of big data. Additionally, there is a lack of systematization in data collection and management. Teaching evaluation data is collected from various aspects of the teaching process, including student management. The type, quantity, and quality of the data collected can vary significantly, resulting in differences in collection costs and analytical value. Data is often aggregated based on existing resources without proper attention to data fusion and subsequent value mining, which can create difficulties in data analysis.

## **2.4 Unscientific evaluation methods**

The scientific nature of the teaching evaluation method directly impacts its results. The problem of unscientific evaluation methods in traditional teaching evaluations is mainly reflected in the following aspects: Firstly, traditional evaluation methods often rely on the subjective judgment of the teacher, which can be influenced by personal preferences, prejudices, and other factors, leading to non-objective evaluation results. Secondly, oral evaluations in traditional teaching are often uncertain due to factors such as language expression ability and emotions. This can lead to inaccurate and inconsistent evaluation results. Once again, traditional teaching evaluation mainly relies on examinations as the primary means of assessment, neglecting the evaluation of students' comprehensive abilities and creativity. This approach fails to provide a comprehensive reflection of students' true level of knowledge. Finally, traditional evaluation methods often focus solely on students' academic performance and knowledge mastery, disregarding personalized factors such as their interests, strengths, and development potential. This exclusion of personalized evaluation can affect the comprehensiveness and accuracy of the evaluation.

## **2.5 Incomplete evaluation contents**

It is important to evaluate all three dimensions in order to provide a comprehensive evaluation of teaching effectiveness. Traditional teaching evaluations often suffer from incomplete content, focusing solely on students' cognitive objectives and neglecting the cultivation of comprehensive qualities such as ability and emotion. In China, teaching objectives are typically divided into three dimensions: cognition, ability, and emotion. Secondly, traditional teaching evaluations often focus solely on students' academic performance, disregarding their interests and motivation. These evaluations often overlook aspects such as students' participation, motivation, and preferences for learning topics, which can impact their initiative and subjective motivation towards learning.

# **3 Advantages of Big Data Technology in High-Quality Teaching Evaluation System**

## **3.1 Big data technology realizes personalized evaluation for teaching evaluation system**

Big data technology can achieve personalized evaluation and guidance for each student by analyzing and processing a large amount of student data, as well as combining the teaching situation of teachers and the educational objectives of schools, as shown in Fig.1.[6] The technology collects and analyzes various data generated by students in the learning process, and analyzes them through data mining and machine learning algorithms to derive the students' learning characteristics, habits, progress, and other information. Secondly, based on the results of these analyses, students can be evaluated individually using big data technology. For instance, students with faster learning progress can receive higher evaluation and encouragement, and more challenging tasks can be provided. Students with slower learning progress can receive more tutoring and assistance to meet their learning needs. Finally, big data technology can combine students' evaluations with teachers' teaching situations for personalized analysis of teaching evaluations. By analyzing data such as students' learning performance, participation, and feedback, and combining it with information on teachers'

teaching design, methods, and effects, it is possible to assess the quality of teachers' teaching and provide guidance and suggestions for improvement.

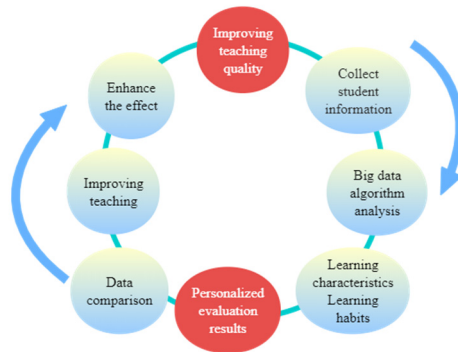


Fig. 1. Implementing personalized evaluation through big data technology

### 3.2 Big data technology realizes dynamic evaluation for teaching evaluation system

The use of big data technology in the teaching evaluation system can enable dynamic evaluation, resulting in more accurate and objective evaluation results. Big data technology collects a large amount of student learning data and related data through school management systems or education platforms to form a huge dataset. This data is then processed and analyzed using big data analysis algorithms and models to discover patterns and laws of students in the learning process. For instance, machine learning algorithms can mine information about students' learning styles, mastery of knowledge points, and learning abilities. The system can then assess students' learning performance in real-time and provide personalized learning advice and counseling. Additionally, big data technology can assist teachers in evaluating their teaching methods. The system enables teachers to monitor students' learning progress and performance, providing insight into their level of mastery and areas of difficulty. This information can be used to tailor teaching content and methods to better meet the needs of individual students.[7]

### 3.3 Big data technology provides data support for teaching evaluation system

Big data technology can provide the necessary support for the teaching evaluation system by collecting, processing, and analyzing data. This data can be used to analyze students' learning, mastery, and academic progress. By collecting and analyzing a large amount of student data, teachers and education administrators can gain a better understanding of students' learning characteristics and needs. This allows for the formulation of personalized teaching plans and targeted tutoring. Additionally, big data technology can provide the necessary data support for teaching effectiveness and teachers' teaching level. Comprehensively analyzing students' learning data can assess the effectiveness of different teaching methods and strategies, improving the teaching process and enhancing teaching quality. [4] Additionally, big data can provide feedback and guidance to teachers, helping them identify their own teaching strengths and weaknesses and conduct further professional development. Finally, big data technology can support educational decision-making with data. Analyzing teaching data on a larger scale

can help identify imbalances in the allocation of teaching resources and differences in teaching quality. This information can be used to formulate policies and measures to make necessary adjustments and improvements.

## **4 Strategies for Utilizing Big Data Technology in High-Quality Teaching Evaluation Systems**

### **4.1 Developing educators' awareness of the application of big data technologies**

With the advent of the information technology and artificial intelligence era, integrating big data technology into college and university teaching quality evaluation is an inevitable trend. As educators, we must change our approach to teaching quality evaluation, considering the significance and necessity of big data technology from a macro perspective. We should strengthen our own construction, and study and utilize big data technology seriously. Starting with data analysis, we should incorporate modernized big data technology into teaching quality evaluation. This involves implementing the concept of big data technology in every aspect of the teaching process, mastering the skills of information collection, analysis, and processing, and combining big data technology with traditional education and teaching evaluation. By doing so, we can greatly improve the comprehensiveness, multidimensional, and accuracy of teaching evaluation.

### **4.2 Enhancing the integration of big data sources for teaching evaluation**

The data used for evaluating teaching quality comes from various sources within school management and various application systems. These sources contain rich factors for evaluating teaching quality. However, due to the different standards of data collection in various sources or application systems, the data structure varies greatly. To evaluate teaching quality objectively and scientifically, it is necessary to integrate the data, formulate unified data standards, and share the data. Based on the Ministry of Education's teaching informational standards, colleges and universities can improve and refine their own teaching quality management to create a big data platform for teaching quality evaluation that reflects their unique characteristics. This will make teaching quality evaluation more scientific.

### **4.3 Three-dimensional construction of big data teaching evaluation mechanism**

Teaching evaluation mechanisms are crucial components of education and teaching reform. The three-dimensional construction of a teaching evaluation mechanism based on big data technology provides comprehensive and accurate data support for teaching evaluation. The use of data technology enhances the accuracy and comprehensiveness of the evaluation process. The mechanism for evaluating big data teaching mainly consists of four parts: a data collection mechanism, a data analysis mechanism, a result feedback mechanism, and a result application mechanism, as shown in Figure 2.

#### **4.3.1 Data collection mechanism.**

The data collection mechanism is the entry point for information flow into the teaching quality evaluation big data platform. Its main responsibility is to collect all kinds of education-related big data related to the teaching quality of colleges and universities. This data is generally

divided into two categories: evaluation data of teachers' 'teaching' and students' 'learning'. It can be collected through various links and application systems of teaching management. Data can be collected from various links and application systems for teaching management. For instance, student data standards are obtained from the academic labor system, teaching data standards from the teaching affairs system, and data standards generated during the teaching process from the online teaching platform and reporting system.[3]

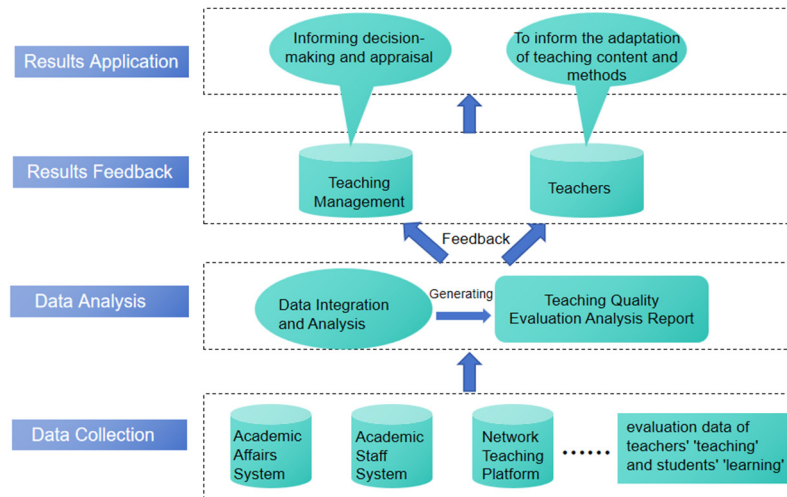


Fig. 2. Teaching quality evaluation mechanism based on big data technology

#### 4.3.2 Data analysis mechanism

After collecting big data, effective data is integrated and mined from the collection mechanism based on specific needs for teaching quality evaluation. Artificial intelligence is used to establish a corresponding data model, and advanced big data algorithms are employed to analyze all types of data. This process results in the formation of a teaching quality evaluation analysis report. The evaluation results can be intuitively fed back to teachers and students through the analysis and processing mechanism of big data technology.

#### 4.3.3 Results feedback mechanism

The teaching quality evaluation analysis report is formed through big data technology analysis. The report includes data results in the form of various tables and graphs, which are then provided as feedback to the relevant teaching and student management departments and teachers. [3] This approach is more intuitive and clear compared to traditional single, stereotyped, and boring data analysis. It aims to improve the participation of staff from various departments and students in the process of evaluating teaching quality. Simultaneously, information can be delivered in a timely manner through various channels such as WeChat, QQ, and WeChat public numbers. This expands the feedback mechanism and enhances its timeliness and flexibility, ensuring the effectiveness of teaching quality evaluations.

#### 4.3.4 Results application mechanism

The analysis presents comprehensive and accurate conclusions regarding students' learning interest, motivation, learning attitude, and the teaching methods and level of teachers. This facilitates appropriate adjustments to teaching content and methods by lecturers and timely identification and resolution of problems by teaching management. It also serves as a reference for educational decision-making and appraisal.

#### 4.4 Multi-dimensional establishment of a big data teaching evaluation system

A high-quality teaching evaluation system requires a multiple evaluation system that assesses both teachers' teaching and students' learning. The multiple teacher evaluation system, as shown in Figure 3, is divided into an external evaluation system and an internal evaluation system, which are established based on big data technology. The evaluation of teachers in the external system is primarily conducted by school management personnel, including school leaders, teaching supervisors, relevant staff of the Academic Affairs Office, leaders of teaching units, leaders of teaching and research departments, teachers' peers, and other evaluators who are not involved in classroom teaching activities.[5] The internal evaluation system, on the other hand, involves teachers' self-assessment, students' assessment of teaching, evaluation of teaching informants (students), and other relevant stakeholders who are directly engaged in classroom teaching activities. Internal evaluation involves teachers' self-evaluation, students' evaluation, and evaluations from teaching informants who are directly involved in classroom activities. The evaluation system for courses includes internal and external evaluations. It is considered an endogenous factor and is crucial for course improvement. A diversified student learning evaluation system is established using big data technology, as shown in Fig. 4. The system aims to provide objective and comprehensive feedback on student learning. Student data is analyzed from four dimensions: performance evaluation of the learning process, stage evaluation of academic level, value-added evaluation of the learning environment, and value-added evaluation of the quality of study through big data technology. This analysis can help teachers gain a more comprehensive understanding of students' learning habits, interests, hobbies, subject knowledge, abilities, thinking, emotions, and academic achievements.[1]

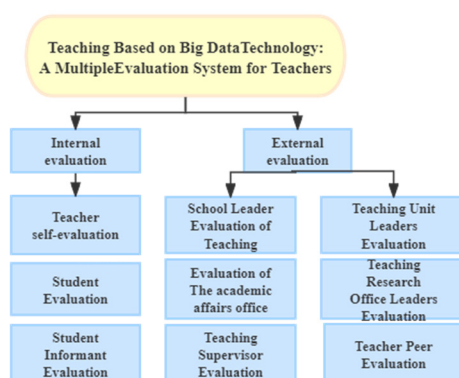


Fig. 3. Teacher Teaching Multiple Evaluation System Based on Big Data Technology

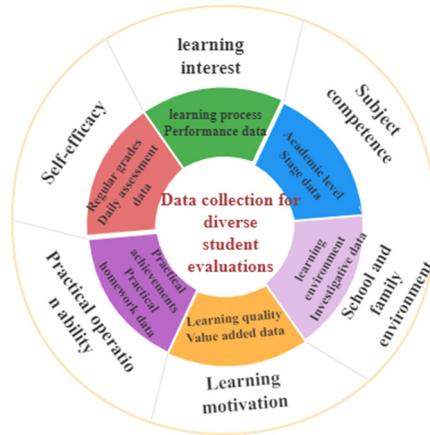


Fig. 4. Student Multiple Evaluation Data Collection System Technology

## 5 Conclusions

The use of big data technology in the high-quality teaching evaluation system has significant potential and value. With the support of big data technology, a more comprehensive and objective teaching evaluation system can be established to provide scientific teaching feedback and improvement suggestions, promoting the continuous optimization of education and teaching. However, when utilizing big data technology for evaluating teaching, it is crucial to fully consider issues such as data privacy protection and security to ensure the reasonable handling and protection of students' and teachers' information.[8] Simultaneously, it is crucial to prioritize the integration of substantial data, establish mechanisms and systems for evaluating big data, and enhance teachers' awareness and ability to apply big data technology and analyze data. This will enable better utilization of big data technology to advance education and teaching.

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