# Evaluation and Decision making of Teacher Training Effectiveness Driven by Big Data: Practical Significance and Innovative Path

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**Abstract:** This article delves into the role of big data technology in evaluating and making decisions regarding the effectiveness of teacher training. By analyzing how big data comprehensively and accurately captures teachers' learning behavior during training, this paper elaborates on its important role in monitoring and decision-making of educational quality, and forms a data-driven evaluation basis for teacher training effectiveness. It reveals the changes that big data brings to educational evaluation and decision-making, and proposes innovative paths.

## 1. Introduction

The application of big data technology in teacher training provides a new perspective for teacher education evaluation and decision-making[1]. The use of big data technology enables researchers to more accurately identify problems in teacher training and propose targeted solutions based on individual needs.

## 2. The practical significance of teacher training driven by big data

### 2.1. Precise customization of training content

#### 2.1.1. Satisfy individual differences in needs

Big data can accurately identify the strengths and weaknesses of each teacher by analyzing multidimensional information such as their teaching behavior, student performance data, and teaching evaluation[2]. If it is found through analyzing teachers' classroom teaching videos that they perform poorly in interactive activities, the training content can focus on improving interactive skills, thereby achieving precise assistance and avoiding the drawbacks of traditional training's "one size fits all" approach.

#### 2.1.2. Adapt to the development trends of education

The knowledge and skills in the field of education are constantly updated, and big data can capture these changes in a timely manner and reflect them in teacher training content. For example, with the gradual popularization of artificial intelligence in education, big data can analyze the needs of teachers in using AI tools to assist teaching, adjust training content in a timely manner, and keep teacher training up with the pace of the times[3].

### 2.2. Effective evaluation of training effectiveness

#### 2.2.1. Comprehensive evaluation of learning outcomes

Traditional teacher training evaluation is often limited to simple exams or questionnaire surveys after training, while big data can evaluate teachers' learning outcomes from multiple perspectives[4]. Not only can the performance of teachers in post training knowledge tests be evaluated, but the impact of training on teachers' teaching abilities can also be comprehensively assessed by analyzing data on the improvement of classroom teaching quality and students' learning progress after teachers return to their work positions.

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### 2.2.2. Timely feedback promotes improvement

During the training process, big data can collect real-time learning data from teachers, such as the duration of online courses, participation in discussions, and completion of assignments. If a teacher is found to have learning difficulties in a certain training module, the training organizer can provide timely assistance, adjust the training pace and methods in a timely manner, and ensure the effectiveness of the training.

## 2.3. Optimization and allocation of training resources

### 2.3.1. Reasonably allocate teaching staff

By utilizing big data technology to analyze teachers' professional background, teaching level, training needs, and other information, it is possible to arrange training instructors reasonably[5]. For teachers with rich teaching experience but difficulties in applying new technologies, arrange training teachers who are proficient in educational technology to provide guidance; For teachers who lack subject knowledge, subject experts will be arranged to conduct targeted lectures.

### 2.3.2. Accurately allocate learning resources

According to the training needs and learning progress of teachers, big data can accurately push learning resources to teachers. If teachers have doubts about course design during training courses, big data systems can automatically push high-quality course design cases, relevant academic articles, expert lecture videos, and other resources to improve the utilization of training resources.

## 2.4. Promote the professional growth of teachers

### 2.4.1. Building a growth path plan

Relying on big data, teachers can draw a professional growth map, track various data during their teaching process from the beginning of their employment, and plan different stages of training and development paths for them. Provide basic teaching skills training for teachers who have been employed for 1-3 years, and training in curriculum development and teaching research for teachers who have been employed for 3-5 years, to help teachers clarify their career development direction.

### 2.4.2. Encourage teachers to develop independently

Relying on big data to provide teachers with rich teaching feedback and training resources can stimulate teachers' self reflection and self-development awareness[6]. Teachers can actively seek ways and means to improve themselves based on their own data profile, forming a good professional development atmosphere.

# 3. Analysis of Factors Influencing Teacher Training Effectiveness Driven by Big Data

## 3.1. Multi source data integration and analysis

### 3.1.1. Integrate training data and teaching data

We can integrate the learning data of teachers during the training process, such as online course learning duration, course homework grades, and forum speaking activity, with the actual teaching data after training, such as classroom teaching video analysis results, student performance changes, teaching feedback, and other related data. By comparing and analyzing a teacher's learning investment in innovative teaching methods during training and their frequency and effectiveness in using the innovative methods in subsequent classrooms, the impact of training on their teaching behavior can be comprehensively evaluated.

### 3.1.2. Linking multiple educational resource data

We can collect and analyze various resource data related to teacher training, including usage data of training materials and reference books, background and teaching effectiveness data of training instructors, as well as access and application data of teaching software and online resources used in

training. We can also analysis whether specific teaching concepts in a certain training material are reflected in the classroom after teacher training, and to what extent they are reflected.

### 3.2. Deep mining of data value

#### 3.2.1. Discovering potential patterns and relationships

Using data mining techniques to discover potential patterns from massive amounts of teacher training and teaching data[7]. For example, through data mining of training effectiveness for teachers in different disciplines, it may be found that certain subject teachers have similar patterns of improvement in effectiveness under specific training content (such as experimental teaching training for physics and chemistry teachers). It is also possible to analyze the hidden relationship between teachers' background characteristics (teaching experience, education, profession, etc.) and training effectiveness, providing a basis for personalized training in the future.

#### 3.2.2. Building a predictive model

Build a teacher training effectiveness prediction model based on historical training data. Machine learning algorithms such as decision trees and neural networks can be used to predict the degree of improvement in teaching effectiveness after training by inputting basic information of teachers, types of training courses, and previous teaching performance data. This way, in subsequent training, adjustments and optimizations can be made in advance for training that may not be effective.

### 3.3. Real time dynamic feedback mechanism

#### 3.3.1. Real time feedback during training

During the training process, real-time analysis of teachers' learning data is used to provide timely feedback on their learning status and existing problems. For example, if we find that the teacher's learning progress is slow or the homework error rate is high in a certain training module, the training organizer can provide timely assistance and adjust the training content or method. At the same time, real-time analysis of teachers' discussion data during training can be used to understand the hot topics and confusion that teachers are concerned about, providing a basis for improving subsequent training activities.

#### 3.3.2. Continuous tracking and feedback after training

Utilize big data to continuously track teachers' teaching practices after training, and regularly collect and analyze relevant data. Not only should we focus on short-term effects, such as teachers' teaching behavior and student feedback within the first month after training, but we should also study long-term effects, such as teachers' professional development and whether they have achieved teaching results six months or a year later. Through long-term tracking, we can comprehensively evaluate the role of training in promoting teachers' professional growth.

### 3.4. Visualize the evaluation results

#### 3.4.1. Create intuitive evaluation reports

Present the teacher training effectiveness obtained from big data analysis in intuitive forms such as charts, graphs, etc. A radar chart of teacher training effectiveness can be created to display teachers' scores on different evaluation dimensions (such as teaching skills improvement, educational philosophy updates, student achievement promotion, etc.), and compare the differences in effectiveness between different teachers or training batches.

#### 3.4.2. Building an interactive evaluation platform

Develop an interactive teacher training effectiveness evaluation platform, allowing users from different roles such as training managers, teachers themselves, and school leaders to easily view evaluation results and conduct in-depth analysis. Through the platform, detailed data on the effectiveness of teacher training can be viewed, and teachers can be classified, evaluated, and compared based on different dimensions such as subject, grade, and school.

## 4. Evaluation criteria for teacher training effectiveness driven by big data

### 4.1. Evaluation criteria based on training process data

#### 4.1.1. Participation data

Online learning duration: In the big data environment, online learning platforms can accurately record the duration of teachers' participation in training courses[8]. If a teacher's online learning time in a certain series of training courses reaches or exceeds the prescribed hours, and the duration of stay in key parts of the course is reasonable, it usually means that the teacher actively participates in the training, reflecting their level of importance and learning commitment to the training content.

Frequency of access to course resources: The frequency of teachers' access to training course resources (such as teaching cases, expanded materials, expert lecture videos, etc.) can also serve as an important reference. For example, teachers who frequently access resources related to classroom interaction skills may have a need for improvement in classroom interaction and a high level of attention to this part of the training content. If the overall number of resource visits is high, it indicates that teachers have a high recognition of the value of training resources, and the training effect may be better.

#### 4.1.2. Interactive data

Forum speaking volume and quality: The performance of teachers in training forums is a key dimension for evaluation. Teachers who actively express valuable viewpoints, ask questions, and share teaching experiences demonstrate their deep involvement in training, constantly reflecting and improving teaching through thinking collisions. If a teacher shares their ideas on redesigning a course based on the training content on a forum during a course design training, and receives positive responses from other teachers and experts, this reflects the positive impact of the training on their teaching thinking.

The frequency of interaction with trainers and other teachers: The interaction and communication between trainers and peers have a significant impact on the effectiveness of teacher training. The number of interactions through instant messaging tools or offline communication activities can determine whether teachers actively integrate into the training environment. Frequent interaction means that teachers actively obtain feedback, solve confusion, and are more conducive to internalizing training content.

### 4.2. Evaluation criteria based on teacher competency improvement data

#### 4.2.1. Teaching ability data

Changes in classroom teaching behavior: With the help of classroom observation techniques and data analysis, it is possible to compare the classroom teaching behavior before and after teacher training. If the teacher's questions before training are mostly closed ended questions, the proportion of open-ended questions significantly increases after training, which reflects the improvement of the teacher's teaching methods, shifting from mainly imparting knowledge to guiding students' thinking development, and reflecting the positive shaping effect of training on the teacher's teaching ability.

Diversity in the application of teaching strategies: Observe the types of strategies used by teachers in teaching, such as whether new strategies such as group cooperative learning and project-based learning have been adopted. If teachers can flexibly apply multiple teaching strategies after training, it indicates that the training has broadened their teaching horizons and improved their teaching abilities.

#### 4.2.2. Student learning achievement data

Student performance improvement: Student performance is an important indicator for measuring the effectiveness of teacher teaching and an indirect basis for reflecting the effectiveness of teacher training. If after training, the average score, excellent rate, pass rate, etc. of the students in the class taught by the teacher have significantly improved in subject exams, it indicates that the teacher may apply the knowledge learned in the training to teaching practice, which has a positive promoting

effect on students' learning.

Student learning interest and participation: Collect data on student learning interest and participation through classroom observation, student questionnaire surveys, and other methods. For example, an increase in the number of students taking the initiative to speak up in class and an increase in their attention to the learning content after training indicates that the teacher may have adopted new teaching methods or strategies, which have stimulated students' learning enthusiasm and reflected the positive effects of the training.

### 4.3. Evaluation criteria based on teacher career development data

#### 4.3.1. Professional Growth Plan

Short term goal achievement: After the training is completed, observe whether the teacher has formulated short-term career development goals based on the training content and their own development needs, and analyze the achievement of the goals. For example, if a teacher is exposed to new educational technologies during training and sets a short-term goal of applying them to teaching within a month, and successfully implements it, it indicates that the training has a positive guiding effect on the professional development of teachers.

Long term planning rationality: Evaluate whether teachers' long-term career development plans have become more scientific and reasonable under the influence of training. Can teachers adjust their 5-10 year career plans based on the analysis of educational trends in training, and focus their professional development direction on interdisciplinary teaching? This reflects the deep inspiration of training for teachers' career development.

#### 4.3.2. Career Development Achievements

Teaching achievement awards: The various levels and types of teaching achievement awards obtained by teachers after training are a direct reflection of the training effect. The receipt of these awards signifies that teachers have reached a high level in teaching philosophy, teaching methods, teaching design, and training may be an important factor in driving them to achieve this level.

Professional title promotion and job advancement: If a teacher makes progress in professional title promotion or job advancement after training, it indicates that the training has a positive impact on the teacher's professional recognition and status within the school organization. For example, a teacher who has improved their educational research abilities through training has gained an advantage in professional title evaluation, which reflects the important value of training in the career development of teachers.

## 5. Innovative Path to Improve Teacher Training Effectiveness Driven by Big Data

### 5.1. Personalized training program design

By analyzing the advantages of big data technology, we can gain multidimensional information about teachers' teaching styles, mastery of subject knowledge, and ability to apply educational technology. By utilizing teachers' classroom performance data, student performance data, teaching evaluation data, etc. from past teaching, customized training plans can be created for each teacher to accurately meet their development needs and improve the pertinence of the training.

### 5.2. Dynamic adjustment of training content

Based on the feedback of big data on hot topics in the education field and common problems encountered by teachers in actual teaching, we should timely update and optimize training content. When data analysis shows that a large number of teachers have difficulty understanding a certain chapter in the use of new textbooks, relevant explanations and case studies can be quickly added to the training content to dynamically follow up on the training progress and adjust the training content dynamically.

### 5.3. Training Effect Prediction and Intervention

Build a prediction model based on big data to predict in advance the level of knowledge and skill improvement of teachers after training. During the training process, if it is predicted that a certain teacher may not be able to achieve the expected results, targeted coaching and intervention can be provided in a timely manner. Additional practical exercises or guidance from mentors can be arranged to achieve training goals as close to expectations as possible.

### 5.4. Long term effect tracking

We should continuously track teaching data after teacher training, and also evaluate the long-term impact of training on teaching quality, finally we can establish a distinctive teacher training growth portfolio, and provide a basis for subsequent training improvement.

## 6. Challenges faced by teacher education evaluation driven by big data

### 6.1. Data quality issues

The sources of educational data are diverse, and the quality of the data varies greatly. There may be issues such as inaccurate, incomplete, and inconsistent data. For example, information that students freely fill in on online learning platforms, or inconsistent data formats between different systems, can affect the reliability of data analysis results and decisions.

### 6.2. Data Privacy and Security

Educational data involves a large amount of personal information of students and teachers, such as grades, family background, psychological status, etc. There are privacy breaches and security risks involved in the storage, transmission, and use of data. Once data is leaked, it may cause serious harm to students and teachers.

### 6.3. Data literacy of teachers and educational administrators

Big data-driven education evaluation and decision-making require teachers and education managers to possess certain data literacy, including data understanding, data analysis, and data application abilities. However, many educators still need to improve their abilities in this area, which may result in the inability to fully utilize the advantages of big data.

## 7. Conclusion

Big data technology has brought unprecedented opportunities for teacher education evaluation and decision-making. By comprehensively analyzing the learning behavior of teachers in teacher training, real-time monitoring of educational quality, and constructing data-driven decision-making models, the quality of education and the scientificity of decision-making can be significantly improved. Despite facing challenges such as data quality, privacy security, and data literacy of educators, effective response strategies can fully leverage the potential of big data in teacher education and training, promote the development of education and training towards a more intelligent and personalized direction, and provide strong support for cultivating teachers who meet the needs of the times. In future educational practices, we should further explore the application of big data and continuously improve the teacher education evaluation and decision-making system.

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