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Retraction

Retracted: Teaching Quality Evaluation and Feedback Analysis Based on Big Data Mining

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

In addition, our investigation has also shown that one or more of the following human-subject reporting requirements has not been met in this article: ethical approval by an Institutional Review Board (IRB) committee or equivalent, patient/participant consent to participate, and/or agreement to publish patient/participant details (where relevant).

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] J. Wang, C. Liu, and W. Gao, "Teaching Quality Evaluation and Feedback Analysis Based on Big Data Mining," *Mobile Information Systems*, vol. 2022, Article ID 7122846, 8 pages, 2022.

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Research Article

Teaching Quality Evaluation and Feedback Analysis Based on Big Data Mining

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Using large-scale data collection and analysis methods to develop educational models, study the relationship between educational variables, and provide effective support for educational reform will be the inevitable trend of modern information technology teaching in the future. At present, under the high level of higher education system and higher education reform, curriculum evaluation is an important tool to evaluate the quality of classroom teaching and an important basis to test the effectiveness of curriculum reform. On the basis of establishing the teaching evaluation index system based on students' participation, acceptance, and satisfaction index, this paper establishes three levels of evaluation system: curriculum micro evaluation index system, secondary college comprehensive evaluation index system and school macro evaluation index system. We use teaching quality evaluation to obtain evaluation data and develop CTQ evaluation and feedback system based on the analysis of broader data, so as to improve the quality of classroom teaching.

1. Introduction

Classroom teaching quality evaluation (TQE) and feedback is an important part of TQE, and TQE is an important part of teaching activities [1]. The existing teaching evaluation results are often comprehensive and macro. Without quantitative, micro, easily available, and functional evaluation models, it is difficult to implement management and teaching [2]. Combined with the historical teaching evaluation data, this paper studies the relevant knowledge retrieval methods, analyzes the main indicators of teaching evaluation index system, student participation, identity and satisfaction from the broader perspective of data analysis, studies the impact of curriculum reform projects on CTQ, evaluates the teaching level of secondary colleges, and analyzes the obstacles to improving teaching quality. The general teaching evaluation system of different disciplines has been found and studied, and the training management reference materials have been prepared for the heads of training institutions [3, 4].

Students' assessment data is the data obtained by students based on teachers' classroom conditions and teachers' subjective evaluations of teaching factors [12]. Students assess teachers, to some extent subjectively, and their assessment data can reflect the subjective characteristics of students, and student assessment data can also reflect teachers' performance in various teaching factors [13]. The main content of this paper is based on classroom teaching evaluation data and the study of corresponding knowledge discovery methods, which are used to help teachers establish an evaluation index system from teaching evaluation data, obtain the correlation between each teaching evaluation index, and analyze the main influencing factors in teachers' teaching process [14].

The system compares a wider range of research literature on education data, teaching evaluation indicators, and teaching evaluation methods at home and abroad [15]. On the basis of in-depth analysis of the current situation and existing problems of education evaluation indicators, an observation station of curriculum evaluation indicators is

proposed and established [16]. On the basis of the curriculum evaluation index system, we use the big data algorithm to analyze the index data and establish a functional comprehensive evaluation model, which is comprehensive and can be quantitatively evaluated at the microlevel [17]. We systematically collate the teaching evaluation data, analyze the teaching evaluation data, then compile the structural correlation diagram of relevant teaching evaluation tables, and finally see the charts for data analysis, so as to establish a long-term effective feedback system [18].

To provide a reliable guarantee for improving the quality of teaching. This paper discusses the comprehensive evaluation and feedback system of classroom quality based on BDA and its application in a college education evaluation system, and analyzes the application effect of the method from different angles. Then, form a three-level teaching evaluation system, establish an effective evaluation index system, and then build a general teaching evaluation system through the BDA of relevant data, which is of great significance to the current high-level professional construction.

2. Related Work

Establish an observation station for teaching evaluation indicators, formulate the two-level indicators shown in Figure 1, and study and implement flexible teaching evaluation indicators to meet the new changes of courses and the needs of different professional courses.

In the process of establishing the evaluation and feedback system of CTQ, we must establish and improve a scientific, unique, and effective classroom teaching evaluation system, provide correct guidance and incentive in the process of controlling and standardizing the process, content, and form of classroom teaching, and comprehensively improve the quality of classroom teaching and talent training. In terms of establishing classroom TQE system, Chinese universities are committed to reforming the old traditional classroom TQE paradigm to weaken the role of TQE classroom teaching management, and continuously enhance the enthusiasm of TQE classroom participants through all levels of TQE. In addition, through the evaluation of teaching quality at all levels, student satisfaction survey and student growth tracking, when evaluating teaching quality, we will continue to enhance students' subjectivity and enthusiasm in classroom learning and give full play to their role in the classroom and improve the evaluation system of CTQ [19]. TQE system in university classroom is constantly improved with the dissemination of OBE concept. However, there is still a lot of work to be done to maintain classroom order and improve the quality of classroom teaching.

Although many schools have recognized the importance, necessity, and urgency of these problems, the establishment of curriculum evaluation system based on the two concepts has failed due to several factors. On the one hand, the "student-centered and result-oriented" concept of OBE is not well understood, and the regular monitoring of CTQ is not satisfactory, which leads to little effect in self-evaluation and quality assurance of classroom teaching in schools. On the other hand, many universities in China, especially new undergraduate universities, do not match their classroom TQE system with their own orientation and characteristics, and although they have set up CTQ monitoring institutions and performed quality management functions, they still adopt traditional methods such as supervision of teaching, students' evaluation of teaching, teachers' evaluation of learning and students' information collection, and the effect of quality monitoring needs to be improved [5–11].

Due to the small degree of support of teaching data platform, the TQE means are single and simple, and the evaluation information is difficult to play a role in real time. More importantly, since the concepts of the two have not penetrated into the school curriculum [20], the control of CTQ is only normative, which cannot reflect the subject status of students, but weaken the participation of students and reduce the objectivity of the evaluation results. The evaluation of CTQ is limited to CTQ mainly by using the traditional classroom TQE index. The main feature of the system is that it adopts the traditional CTQ evaluation index. It is difficult to formulate the evaluation index. There is no difference between the evaluation index system and the whole school project. The CTQ evaluation is only limited to the form.

3. Methods

Classroom TQE information contains a large amount of information with complex structures and diverse types within the information, resulting in significant uncertainties in classroom TQE factors. Multisource information fusion is to form a consistent description of classroom TQE by complementing multiple data and information sources evaluating classroom teaching effectiveness in time and space and combining redundant information according to corresponding optimization guidelines.

The multisource information integration model is usually established at three levels: data level, feature level, and decision-making level. According to the characteristics of class comprehensive quality evaluation, combined with the different source information integration method, the different source information integration model of class comprehensive quality evaluation is established, which mainly includes three parts: data normalization algorithm is selected in the information preprocessing link to process classroom TQE index data for data-level fusion. Feature fusion link adopts neural network to fuse data features. Decision-level fusion adopts DS evidence fusion method, comprehensive analysis of data-level fusion and feature results, and finally output the data source required for classroom TQE process, which is used throughout the whole process of evaluation index construction, index evaluation level determination, and evaluation containing multiple information, combined with weighted synthesis, fuzzy evaluation, and other processes to achieve classroom TQE fusion.

DS evidence fusion is the key to multisource information fusion, and the process uses DS evidence theory, which can be understood as a fuzzy inference method in essence and has strong decision processing ability to fuse data from different sources and different manifestations of information

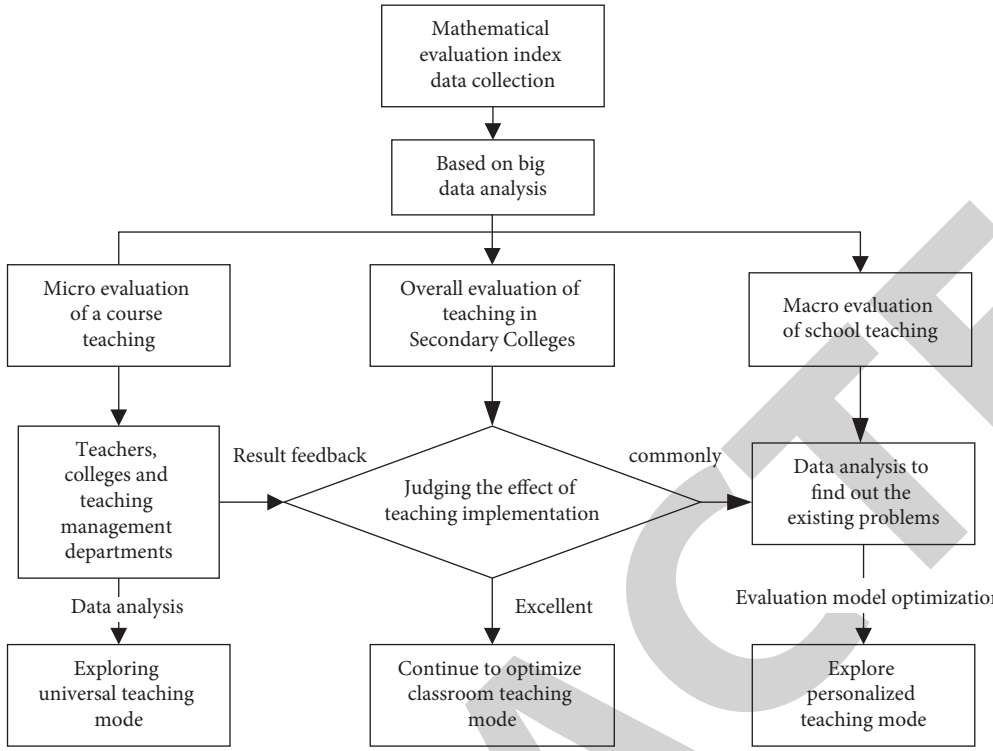

Figure 1: Research content of teaching evaluation system based on BDA.

to evaluate the effectiveness of classroom teaching and learning, thus obtaining more effective information. Therefore, it is commonly used in fuzzy information reasoning and information decision fusion problems. In view of the fuzziness of the target to be dealt with, the concepts of probability distribution function and likelihood function are introduced within DS evidence theory, and the concept is applied to the problem of classroom TQE, which can deal with the fuzziness caused by different types of information and improve the robustness of the evaluation process and the accuracy of the evaluation results.

The classroom quality assessment framework is denoted by $U = \{u_1, u_2, \ldots, u_n\}$, in which any element is independent. All elements can be formed into a set, which can be defined as a power set of U, using 2^U representation.

If m: $2^U \longrightarrow [0,1]$, both of the following requirements are met.

(1) The probability is 0 for those that cannot be generated, which can be expressed by $m(\phi) = 0$

(2) The probability of locating 1 for all that are likely to occur can be expressed by $\sum_{A \subset U} m(Y) = 1$

The basic probability assignment of a proposition Y on U is defined as m. It can also be defined as a mass function, and the trustworthiness of Y can be expressed as $m(Y)$.

$$\begin{aligned} &f\colon 2^U \longrightarrow [0,1], \\ &f(Y) = \sum_{B \subset A} m(B) \quad \forall Y \subseteq U. \end{aligned} \tag{1}$$

Definition $\begin{matrix} P\colon 2^U \longrightarrow [0,1] \\ P(Y) = 1 - f(\overline{y}) \quad \forall Y \subseteq U. \end{matrix}$, where $P(Y)$ denotes the likelihood function of Y.

Under the condition of $\forall Y \subseteq U$, the evidence synthesis process for the elements on U can be represented by the following equation:.

$$\begin{aligned} &\left(m_n \oplus m_2 \oplus \cdots\cdots \oplus m_n\right)(Y) = \\ &\frac{\sum_{Y_1 \cap Y_2 \cap \cdots \cap Y_n} m_1(Y_1), m_2(Y_2) \cdots m_n(Y_n)}{C}, \end{aligned} \tag{2}$$

where C denotes the conflict coefficient, which is calculated as follows:

$$C = 1 - \sum_{Y_1 \cap Y_2 \cap \cdots\cdots \cap Y_n} m_1(Y_1) m_2(Y_2) \cdots\cdots m_n(Y_n). \tag{3}$$

The level of conflict between the evidence is described by the C value, and the larger the value, the more significant the conflict between different evidences. The credibility of the evidence decreases under the condition that the C value is large enough, which results in poor information fusion results.

Considering the actual application of classroom TQE, the classroom TQE level is determined based on the data of classroom TQE indexes and combined with the results of multisource information fusion. The classroom teaching effect of each factor in classroom TQE is divided, thus generating evaluation set $V = \{v_1, v_2, v_3, v_4, v_5\}$, in which different elements indicate no classroom teaching effect, low classroom teaching effect, medium classroom teaching effect, high classroom teaching effect, and extreme classroom teaching effect, respectively.

The fuzzy evaluation model is one of the fuzzy mathematical operations within the BDA algorithm, and because its evaluation index is influenced by various factors, the index is evaluated. The comprehensive evaluation of the index needs to be considered. In evaluating the effectiveness of classroom teaching, the use of fuzzy evaluation model is completed. The process is as follows.

Let $C = \{c_1, c_2, .., c_n\}$ denote the set of classroom TQE indexes and use the vector form to represent the ratings corresponding to this set. Then, the standard evaluation set of this evaluation index set can be represented by $E = \{e_1, e_2, .., e_n\}$. A fuzzy matrix is established X_{ij}. Let $O_{ij}^{(t)}$ denote the dimensional values of this matrix labeled as t and its expression formula is as follows:

$$O_{ij}^{(t)} = \frac{\max\left\{O_{ij}^{(t)}\right\} - O_{ij}^{(t)}}{\max\left\{O_{ij}^{(t)}\right\} - \min\left\{O_{ij}^{(t)}\right\}}. \tag{4}$$

The evaluation vector of the fuzzy matrix X_{ij} of classroom teaching effectiveness criteria evaluation is calculated. The expression formula is as follows:

$$K_i = \omega_i R_i \left(k_{i1}, k_{i2} \ldots\ldots K_{in}\right), \tag{5}$$

where $R_i = \left\{O_{ij}^{(t)}\right\}$, $i = 1, 2 \ldots n, j = 1, 2 \ldots k, t = 1, 2 \ldots m$, and K_i denote the i-th evaluation vector of the fuzzy matrix and ω denotes the evaluation vector weight value [21–25].

The fuzzy conforming evaluation vector within the fuzzy matrix of classroom teaching effectiveness criteria evaluation is calculated, which is represented by U and its expression formula is as follows:

$$U = \mathrm{WK} = \left(u_1, u_2, \ldots, u_m\right). \tag{6}$$

In the above formula, W denotes the set of classroom teaching effectiveness criteria evaluation index weights, K denotes the set of classroom TQE vectors, and u_t expression formula is as follows:

$$u_t = \sum_{j=1}^{k} u_j = \min\left\{1, \sum_{j=1}^{k} u_{jt}\right\}. \tag{7}$$

When the value of u_t is not equal to 1, normalizing equation (7), we have the following equation:

$$u_t' = \frac{u_t}{\sum_{j=1}^{k} u_j}. \tag{8}$$

The standardized matrix of classroom teaching effectiveness compliance evaluation vectors was obtained from equation (8) as follows:

$$U' = \left(u_1', u_2' \ldots u_m'\right). \tag{9}$$

After the above steps, the value of CTQ assessment was calculated. The expression formula is as follows:

$$L = \mathrm{EU}^T, \tag{10}$$

where$L$ represents the classroom TQE value, and the classroom TQE result is obtained.

4. Experiments and Analyses

The quality evaluation report of 155 random listening and checking classes of classroom teaching of a department in the spring semester of 2019 by the experts of a university teaching steering committee was used as the object of the study. The evaluation report was uniformly completed using a university's "Teacher Classroom TQE Form" (see Table 1), which included two aspects and 12 judgment indexes and was comprehensively evaluated by the experts of the university's teaching steering committee according to the quantitative scores and comments of the audited classes.

Teachers will be evaluated according to the quality of classroom teaching, excellent (≥90 points), good (80 ~ 89 points), passing (70 ~ 79 points), and failing (≤69 points). The experts of the university's teaching steering committee randomly listened to the classroom teaching for 155 times, all of them were theoretical lecture classes, and the teachers were all with master's degree, lecturer, or above, and all of them were teachers with high teaching titles. According to the evaluation standard of CTQ, the overall quality of teaching was good, with 70 excellent teachers (45.7%), 80 good teachers (53.2%), 5 passing teachers (3.2%), and no failing teachers [26, 27].

As shown in Table 2, the statistical analysis of the CTQ evaluation data of teachers by gender shows that there is no statistical difference in the CTQ evaluation of male and female teachers. The results of classroom TQE of teachers with different titles are shown in Table 3. According to the analysis of the total number of times that each title was listened to and checked by excellent, good, and pass, the proportion of excellent is Professor > Associate Professor > Lecturer, and the proportion of pass is Lecturer > Associate Professor > Professor, which shows that the higher the title is, the higher the quality of classroom teaching is.

Through the analysis of the data in Table 4, it is found that doctoral teachers are significantly better than master teachers. At the same time, the academic performance of these two groups is higher than that of doctoral students.

The quality of classroom teaching of teachers of different teaching ages is shown in Table 5. In terms of learning age, the older the education age is, the higher the achievement is. The academic achievement of teachers aged 20 or above is also higher than that of other age groups. It can be seen that the quality of teaching is of great importance to the accumulation of knowledge. Academic performance is high in all age groups, with the highest proportion of students under the age of 10 [28, 29].

Due to the obvious correlation between teachers' age and students' age, the ODC analysis results of teachers of different ages are consistent with the indicators of learning years (Table 6), and the academic performance of teachers over 50 years old is significantly higher than that of other ages. Among all age groups, the qualified rate of the age group under 30 is the highest.

According to the results of the 12 evaluation indexes of basic requirements and quality requirements in the classroom TQE form, the number of scores lost in the basic

Table 1: Teacher's classroom TQE table.

Evaluation indicators	Main evaluation points (observation points)	Evaluation score	
		Full score	Score
1. Basic requirements (40 points)	1.1. The lecture is concise and accurate, and the ideological viewpoint is correct.	10	
	1.2. The lesson plan is standardized, the five major components are all available, and the teaching content is in line with the curriculum standards.	10	
	1.3. Classes are held on time, and class time is allocated according to the design of the lesson plan.	10	
	1.4. The teacher has a good temperament, accurate reporting, and a loud and clear teaching voice.	10	
2. Quality requirements (60 points)	2.1. Classroom design and lecture meet the requirements of the training objectives of the teaching target.	10	
	2.2. The teaching content is focused, in line with the application and clinical orientation.	10	
	2.3. New knowledge and new advances are appropriately supplemented.	5	
	2.4. Emphasis on interdisciplinary and humanistic infiltration.	10	
	2.5. Good teaching inspiration and interaction between teachers and students.	5	
	2.6. Reasonable use of foreign languages, board books and information technology teaching methods	5	
	2.7. Rigorous teaching, strict requirements, strong classroom management ability, and good order.	10	
	2.8. Strong physical and mental commitment, infectious, and distinctive teaching style.	10	

Note. The five major items are: teaching materials, lesson plans (slides), course teaching design, course standards, and teaching schedule.

Table 2: Classroom TQE of teachers of different genders.

Sex	n	Excellent		Good		Pass	
		n	%	n	%	n	%
Male	75	33	44.9	32	48.6	2	2.4
Female	80	37	45.6	48	56.9	3	4.3
Total	155	70	45.7	80	53.2	5	3.2

Note. $x^2 = 0.747$, $P = 0.688$.

Table 3: Evaluation of CTQ of teachers with different titles.

Title	n	Excellent		Good		Pass	
		n	%	n	%	n	%
Lecturer	42	10	23.2	26	65.9	3	11.2
Associate professor	81	33	39.8	47	60.5	1	1.3
Professor	32	28	82.2	7	18.6	0	0.0
Total	155	71	45.2	80	53.8	4	3.3

Note. $x^2 = 33.072$, $p < 0.0001$.

Table 4: Classroom TQE of teachers with different degrees.

Education	n	Excellent		Good		Pass	
		n	%	n	%	n	%
Master	18	5	19.2	15	77.1	1	6.1
Doctor	137	63	45.3	68	52.6	3	3.1
Total	155	68	44.9	83	55.2	4	3.4

Note. $p = 0.04$

requirements is relatively small, and the three items with the most scores lost are mainly concentrated in item 7 of the quality requirements, "rigorous teaching, strict requirements, strong classroom management ability, and good order". 136 people (87.74%) lost points to varying degrees, item 5 "good teaching effect, focus on teacher-student communication and interaction", 124 people (80%) lost points to varying degrees, item 2 "teaching content is focused, in line with the application of close to", a total of 120 people (77.42%) lost points in different degrees.

Compared with the total scores of the corresponding items in the 155 classroom TQEs, the quality requirements of item 2, teaching content is focused and in line with close application and clinical orientation, accounted for 34.84% of the lost scores, item 7, heuristic teaching is effective, focusing on teacher-student communication and interaction,

Table 5: Classroom TQE of teachers with different teaching ages.

Teaching experience	n	Excellent		Good		Pass	
		n	%	n	%	n	%
Less than 10 years	19	6	3.9	10	62.5	1	10.1
10 years ~ 20 years	48	12	25.4	35	73.7	2	4.6
20 years or more	88	51	55.9	36	42.2	2	3.5
Total	155	69	44.6	81	54.2	5	3.3

Note. $x^2 = 20.341$, $p < 0.0001$.

Table 6: Evaluation of CTQ of teachers of different ages.

Age	n	Excellent		Good		Pass	
		n	%	n	%	n	%
Under 30 years old	19	6	3.6	12	62.8	1	12.3
30 ~ 50 years old	49	10	25.1	33	75.2	2	4.5
50 years old or above	87	53	58.8	38	42.2	2	3.6
Total	155	69	45.7	82	55.8	5	3.4

Note. $x^2 = 20.341$, $p < 0.0001$.

accounted for 32.26% of the lost scores, item 5, rigorous teaching, strict requirements, and classroom The 5th item of rigorous teaching, strict requirements, good classroom management ability, and good order, lost 480 points, accounting for 30.97%. This coincides with the statistical results of the number of points lost, which show that teachers lost the most points in these three items.

In order to further explore this classroom teaching effect evaluation method, a total of 3000 samples were collected, including 2000 teaching samples and 1000 student samples.

Figures 2 and 3 illustrates the training and testing of the iterative teaching results of the above two samples by using the fuzzy evaluation model of classroom teaching results.

The results show that with the increase of the number of iterations, the value of the fitting error of this method decreases rapidly from 0.083 to 0.0 when the number of iterations is about 24, and the value is always kept at 0 with the increase of the number of iterations. This result indicates that the method of this paper does not appear to be underfitting when obtaining the evaluation results of CTQ, and its evaluation results are more accurate.

Using the number of student feedback questions as a measure, the effectiveness of classroom teaching was tested from the perspective of the age group of students receiving the classroom teaching within a certain classroom learning period, and the test results are shown in Figures 4 and 5.

Analysis of Figures 4 and 5 shows that, the younger the age of the students participating in the course, the higher the number of questions feedback during their classroom learning phase. In the age range of 17 to 20 years old. The number of questions given by male students during their classroom learning phase was slightly higher than that of female students, and as the age group increased, the number of questions given by male students decreased. The number of question feedback for male students gradually decreased. In contrast, the number of question feedback for female students in the age range of 20 to 22 years old was always 14, and the number of question feedback decreased more than that of male students as the age range increased. In the age

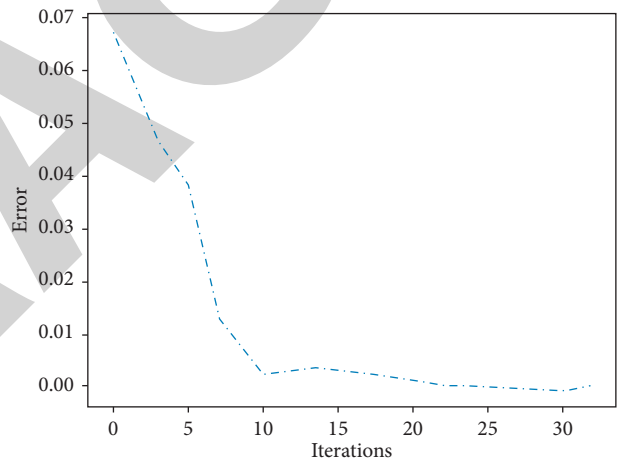

Figure 2: Fitting ability of training results.

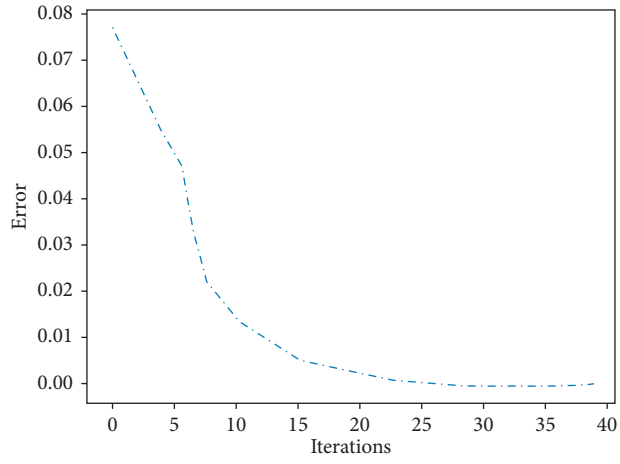

Figure 3: Fitting ability of testing results.

Figure 4: Number of feedback training questions for students of different age groups.

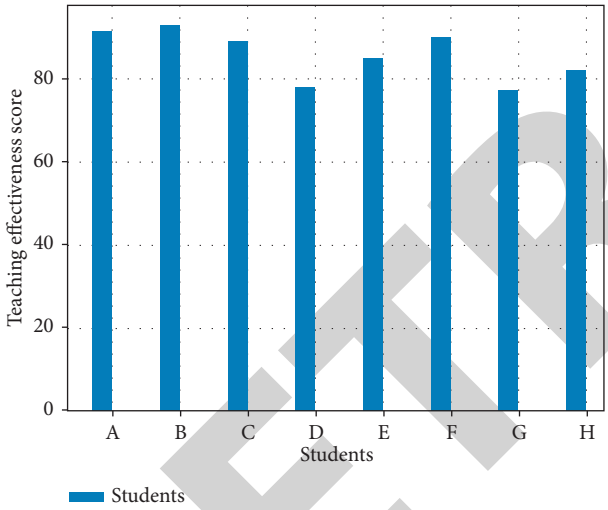

Figure 5: Teaching effectiveness score of different students.

group between 22 and 24 years old. The number of problem feedback was lower for both male and female students. These results indicate that students in the younger age groups had more question feedback during their participation in the classroom, were more active in the classroom, and male students were more active than female students.

5. Conclusion

With the increasing application of big data acquisition methods in the field of education, the establishment of teaching evaluation index system based on BDA method will be conducive to curriculum reform and the formation of teaching staff and provide a reliable guarantee for improving teaching quality. This paper discusses a comprehensive classroom quality evaluation and feedback system based on BDA and its application in the education evaluation system of a university and analyzes the application effect of this method from different angles.

The results show that the method of this paper has strong fitting ability and the evaluation results have high scientificity. Subsequently, a three-level teaching evaluation system can be formed to establish a proven evaluation index system, and then a universal teaching evaluation system can be established through BDA of relevant data, which is of great importance to the current high-level professional construction.

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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