Research on Classroom Teaching Evaluation Model Based on Big Data

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Abstract—In the digital society, education is faced with the problem of big data processing and application. The premise of using the comprehensive evaluation model to evaluate classroom teaching is how to deal with the huge original evaluation data. This paper uses the data cleaning technology of big data to preprocess the original evaluation data, so that the data is more standardized and effective, and important data can be extracted for calculation. Then the multi-level fuzzy comprehensive evaluation model is used to calculate the processed data, and the first level fuzzy comprehensive evaluation and the second level fuzzy comprehensive evaluation data are obtained. According to the maximum membership principle, the classroom evaluation results are obtained.

Keywords-data processing; fuzzy comprehensive evaluation; MATLAB; evaluating indicator;

1 INTRODUCTION

With the development of computer technology, various data processing and evaluation models have become increasingly mature. In colleges and universities, students have a heavy academic burden, many disciplines, and high-quality classroom has become the first choice of students. How to objectively and fairly select high-quality classes? Many colleges and universities have formulated classroom evaluation methods and corresponding evaluation index systems. However, the indicator system is highly subjective when it is formulated, and each indicator corresponds to a score. Generally, experts form a review team to listen to the lectures and score, and then carry out weighted average. This evaluation method is not only too simple in organizational form, but also rough in data calculation.

In order to objectively and impartially evaluate the high-quality classroom, the evaluation data in this paper are evaluated by an evaluation team composed of the leading group (20 people), relevant experts (10 people), peers (30 people) and students (2000 people). Because the objects participating in the evaluation are composed of members of different categories and there are many students, there are many data generated. This paper uses the "deep learning method" to mine and process big data, and converts the potential information of evaluation text into data, so that fuzzy comments can become useful data through machine learning. Through the processing of various kinds of data, the multi-level comprehensive evaluation model is used to scientifically calculate the data and evaluate the advantages and disadvantages of the curriculum.

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2 ESTABLISHMENT OF EVALUATION SYSTEM AND DATA PREPROCESSING

2.1 Establishment of Evaluation System

The evaluation system includes the first level indicators and the second level indicators. Each indicator contains the content of the evaluation and its weight in the evaluation system. The evaluation system specified in this paper includes five first level indicators. Each first level indicator contains different second level indicators. The first level and second level indicators and their weights are shown in Table I.

TABLE I. EVALUATION SYSTEM AND INDEX WEIGHTS

Primary indicators	Secondary indicators	Secondary index weight
Teaching preparation (20%)	Course content	0.3
	Teaching concept	0.1
	Graphic display	0.2
	Curriculum reconstruction	0.3
	Platform use	0.1
Teaching attitude (20%)	Succinct language	0.3
	Friendly attitude	0.4
	Generous appearance	0.3
Teaching implementation (30%)	Various methods	0.3
	Teacher led	0.2
	Teacher student interaction	0.2
	Teach students in accordance with their aptitude	0.3
Teaching effect (20%)	Achieve mastery through a comprehensive study of the subject	0.3
	Skill improvement	0.2
	Infer other things from one fact	0.5
Teaching reflection (10%)	Information application	0.5
	Capability objectives	0.5

The evaluation levels and weights of secondary indicators are shown in Table II.

TABLE II. EVALUATION LEVELS AND WEIGHTS OF SECONDARY INDICATORS

Evaluation level	Excellent	Good	Average	Poor
Weight	0.5	0.3	0.15	0.05

2.2 Data Preprocessing

Some evaluation data and text are obtained through the evaluation of classroom effects by various personnel at all levels. First, the evaluation data shall be cleaned to ensure that the cleaned data will not affect the classroom evaluation. Then, the evaluation language text shall be transformed into standard and objective evaluation data.[1]

2.3 Data Cleaning

Due to the large number of people involved in the evaluation, the data obtained will be messy, such as data values not within the normal range, missing or redundant data, duplication or abnormality of data. If these data are not processed, it will seriously affect the evaluation results, make the evaluation meaningless, and even affect the enthusiasm of teachers and the development of students. Data cleaning will normalize data and facilitate calculation.[2]

2.4 Processing of Comment Sets

Language evaluation means that the evaluation text can reflect the psychological activities of students or experts from multiple perspectives, but there will be some too simple comments in the comment collection, such as "satisfied", "poor", "good". Therefore, the computer software is used to classify such comments. If there are fewer comments, they will be kicked out directly. If there are more comments, they will reflect the attitude of the evaluator. The manager must give a certain score to warn for future evaluation.

3 BRIEF DESCRIPTION OF FUZZY COMPREHENSIVE EVALUATION MODEL

There are many indicators for classroom evaluation, but there will be vague indicators in the evaluation that are difficult to quantify, such as teaching effect, teaching implementation. Even if a certain score is given artificially, it cannot quantitatively reflect the objectivity of this indicator. In addition, the number of participants in the evaluation is large, and the evaluators are very vulnerable to the impact of subjective factors such as experience and interpersonal relationships. Therefore, the evaluation of classroom teaching has a certain degree of fuzziness and empiricism.

According to the different evaluation index systems, there are first level fuzzy comprehensive evaluation, second level fuzzy comprehensive evaluation and so on, which are called multi-level fuzzy comprehensive evaluation.[3] The more levels of evaluation, the more accurate the results. The result of this fuzzy evaluation on the classroom evaluation is not just an evaluation score, but an evaluation level, such as excellent and good. This kind of fuzzy evaluation does not use accurate numbers to measure the advantages and disadvantages of the classroom, which reduces the pressure on the teachers and gives them motivation. Otherwise, the pursuit of

evaluation scores in teaching will lead to a vicious circle of repression and tension. Therefore, this paper uses the fuzzy comprehensive evaluation method to promote the application of this method in classroom evaluation.

4 DATA COLLECTION AND CLASSIFICATION

Although the evaluation criteria used by the personnel involved in the evaluation are the same, the perspective of different identity evaluation will be inconsistent. In order to evaluate classroom teaching more reasonably, the data of the leading group, relevant experts, peers and students are classified and calculated respectively. Classify the data of all evaluators of the leading group. First, calculate the total score of each secondary indicator, and calculate the total score of the course content. The course content is divided into four categories: excellent, good, average, and poor. Each category has a total score. Calculate the percentage of each category according to the percentage. Through calculation, 60% of the leading group's evaluation of the course content is excellent, 30% is good, 8% is average, and 2% is poor. Relevant experts have 50% excellent, 40% good, 5% average and 5% poor. Among peers, 70% are excellent, 20% are good, 7% are average, and 3% are poor. 80% of the students are excellent, 10% are good, 6% are average, and 4% are poor, as shown in Table III below.

TABLE III. EVALUATION DATA OF SECONDARY INDICATOR "COURSE CONTENT"

Evaluators	Excellent	Good	Average	Poor
Leading group	0.6	0.3	0.08	0.02
Relevant experts	0.5	0.4	0.05	0.05
Peer	0.7	0.2	0.07	0.03
Student	0.8	0.1	0.06	0.04

The above data are the percentage of the evaluation scores of the secondary indicators "course content" by all kinds of personnel, and similar data can be obtained for the other secondary indicators according to the same calculation method.

Because the total number of excellent, good, average and poor percentages obtained by each secondary indicator is different, which means that the dimensions of each secondary indicator are different. In order to compare and calculate the secondary indicators, the evaluation data must be dimensionless. The common method of dimensionless is normalization.[4]

Set $x_1, x_2, \mathrm{L}\ , x_n$ be a group of numbers with different dimensions, construct parameter combination $y = \sum_{j=1}^{n} x_j$, and let $z_i = \frac{x_i}{y}$, so that $x_1, x_2, \mathrm{L}\ , x_n$ can be transformed into a new group of numbers $z_1, z_2, \mathrm{L}\ , z_n$ through calculation. This new set of data is a dimensionless set of numbers. This set of data reflects the attributes between $x_1, x_2, \mathrm{L}\ , x_n$. The evaluation data of "teaching content" and other secondary indicators in excellent, good, general and poor

aspects are obtained through dimensionless calculation.[5] See Table IV - Table VIII respectively.

TABLE IV. EVALUATION DATA OF SECONDARY INDICATORS OF TEACHING PREPARATION

Teaching preparation	Excellent	Good	Average	Poor
Course content	0.6500	0.2500	0.0650	0.0350
Teaching concept	0.6010	0.2013	0.0900	0.1077
Graphic display	0.6170	0.2203	0.0816	0.0812
Curriculum reconstruction	0.6070	0.2303	0.0815	0.0811
Platform use	0.6269	0.2202	0.0769	0.0761

TABLE V. EVALUATION DATA OF SECONDARY INDICATORS OF TEACHING ATTITUDE

Teaching attitude	Excellent	Good	Average	Poor
Succinct language	0.6302	0.2403	0.0649	0.0647
Friendly attitude	0.7012	0.1022	0.0985	0.0981
Generous appearance	0.7023	0.2011	0.0486	0.0480

TABLE VI. EVALUATION DATA OF SECONDARY INDICATORS FOR TEACHING IMPLEMENTATION

Teaching implementation	Excellent	Good	Average	Poor
Various methods	0.6678	0.1102	0.1110	0.1110
Teacher led	0.6912	0.2213	0.0533	0.0342
Teacher student interaction	0.6689	0.2303	0.0214	0.0794
Teach students in accordance with their aptitude	0.7011	0.1254	0.0025	0.171

TABLE VII. EVALUATION DATA OF SECONDARY INDICATORS FOR TEACHING EFFECT

Teaching effect	Excellent	Good	Average	Poor
Achieve mastery through a comprehensive study of the subject	0.6825	0.2204	0.0325	0.0646
Skill improvement	0.6903	0.2504	0.0251	0.0342
Infer other things from one fact	0.7028	0.2203	0.0406	0.0363

TABLE VIII. EVALUATION DATA OF SECONDARY INDICATORS OF TEACHING REFLECTION

Teaching reflection	Excellent	Good	Average	Poor
Information application	0.8011	0.1024	0.0026	0.0939
Capability objectives	0.7622	0.2058	0.0018	0.0302

It can be seen from the Tables that the excellent indicators account for a relatively high proportion, followed by the good indicators, and the average and poor indicators account for a relatively small proportion, among which the application of information technology in teaching is the best.

5 USE THE COMPREHENSIVE EVALUATION MODEL TO CALCULATE THE ADVANTAGES AND DISADVANTAGES OF THE CLASSROOM

Let the weight of the primary index be expressed as

$$A = [0.2, 0.2, 0.3, 0.2, 0.1],$$

The weight of secondary indicators is expressed as

$$A_1 = [0.3, 0.1, 0.2, 0.3, 0.1],$$

$$A_2 = [0.3, 0.4, 0.3],$$

$$A_3 = [0.3, 0.2, 0.2, 0.3],$$

$$A_4 = [0.3, 0.2, 0.5],$$

$$A_5 = [0.5, 0.5],$$

The data of secondary indicators calculated by dimensionless method are recorded as matrix R_1, R_2, R_3, R_4, R_5 ,the evaluation matrix of secondary indicators is

$$R_1 = \begin{bmatrix} 0.6500 & 0.2500 & 0.0650 & 0.0350 \\ 0.6010 & 0.2013 & 0.0900 & 0.1077 \\ 0.6170 & 0.2203 & 0.0816 & 0.0812 \\ 0.6070 & 0.2303 & 0.0815 & 0.0811 \\ 0.6269 & 0.2202 & 0.0769 & 0.0761 \end{bmatrix},$$

$$R_2 = \begin{bmatrix} 0.6302 & 0.2403 & 0.0649 & 0.0647 \\ 0.7012 & 0.1022 & 0.0985 & 0.0981 \\ 0.7023 & 0.2011 & 0.0486 & 0.0480 \end{bmatrix},$$

$$R_3 = \begin{bmatrix} 0.6678 & 0.1102 & 0.1110 & 0.1110 \\ 0.6912 & 0.2213 & 0.0533 & 0.0342 \\ 0.6689 & 0.2303 & 0.0214 & 0.0794 \\ 0.7011 & 0.1254 & 0.0025 & 0.1710 \end{bmatrix},$$

$$R_4 = \begin{bmatrix} 0.6825 & 0.2204 & 0.0325 & 0.0646 \\ 0.6903 & 0.2504 & 0.0251 & 0.0342 \\ 0.7028 & 0.2203 & 0.0406 & 0.0363 \end{bmatrix},$$

$$R_5 = \begin{bmatrix} 0.8011 & 0.1024 & 0.0026 & 0.0939 \\ 0.7622 & 0.2058 & 0.0018 & 0.0302 \end{bmatrix},$$

First level fuzzy comprehensive evaluation of secondary indicators and evaluation data,

$B_1 = A_1 \cdot R_1, B_2 = A_2 \cdot R_2, B_3 = A_3 \cdot R_3, B_4 = A_4 \cdot R_4, B_5 = A_5 \cdot R_5,$ Calculated by MATLAB as follows:

$$B_1 = [0.6233, 0.2303, 0.0770, 0.0694], \quad B_2 = [0.6802, 0.1733, 0.0735, 0.0730],$$
$$B_3 = [0.6827, 0.1610, 0.0490, 0.1073], \quad B_4 = [0.6942, 0.2264, 0.0351, 0.0444],$$
$$B_5 = [0.7816, 0.1541, 0.0022, 0.0621],$$

Make

$$B = [B_1, B_2, B_3, B_4, B_5],$$

Calculate the second level comprehensive evaluation for the first level indicators and above:

$$C = A \cdot B = [0.2, 0.2, 0.3, 0.2, 0.1] \begin{bmatrix} 0.6233 & 0.2303 & 0.0770 & 0.0694 \\ 0.6802 & 0.1733 & 0.0735 & 0.0730 \\ 0.6827 & 0.1610 & 0.0490 & 0.1073 \\ 0.6942 & 0.2264 & 0.0351 & 0.0444 \\ 0.7816 & 0.1541 & 0.0022 & 0.0621 \end{bmatrix}$$

$$= [0.6825, 0.1897, 0.0520, 0.0758],$$

The MATLAB program for calculating the second level comprehensive evaluation of the first level indicators and above is as follows:[6]

```
clc,clear
s=load('mhdata.txt');
a=[0.2 0.2 0.3 0.2 0.1];
a1=[0.3 0.1 0.2 0.3 0.1];
a2=[0.3 0.4 0.3];
a3=[0.3 0.2 0.2 0.3];
```

a4=[0.3 0.2 0.5];

a5=[0.5 0.5];

b(1,:)=a1*s([1:5],:);

b(2,:)=a2*s([6:8],:);

b(3,:)=a3*s([9:12],:);

b(4,:)=a4*s([13:15],:);

b(5,:)=a5*s([16:end],:)

c=a*b

The teaching quality evaluation results can be obtained as shown in Table IX.

TABLE IX. TEACHING QUALITY EVALUATION RESULTS

Classroom evaluation grade	Excellent	Good	Average	Poor
Evaluation results	0.6825	0.1897	0.0520	0.0758

According to the principle of maximum subordination, the classroom teaching quality is excellent. The proportion of average and poor evaluation of the class is very small, which indicates that the class has been recognized by most people during the evaluation. In the case of a large number of participants in the evaluation, the absolute advantage of excellence shows that the classroom is a high-quality classroom.

The results of classroom teaching quality evaluation are shown in Figure 1.

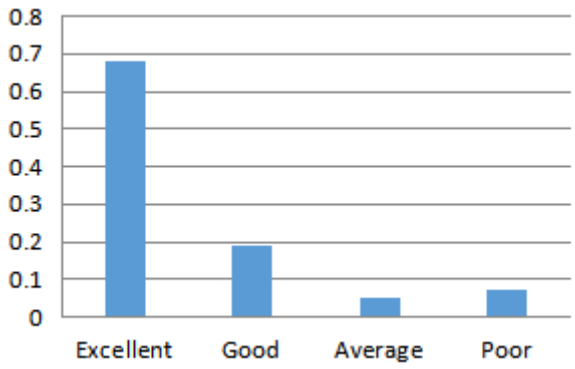

Figure1. Evaluation chart of classroom teaching quality

As shown in the figure above, although the number of participants in the evaluation is large and the data is large, the results are generally excellent for the classroom evaluation, while the number of students with poor evaluation is relatively small.

6 CONCLUSIONS

In the evaluation process, due to the large number of people participating in the evaluation, especially the large proportion of students, it is easy to have bad data or missing data in the evaluation. However, after the processing of big data in this paper and the application of multi-level fuzzy comprehensive evaluation, the results obtained are relatively objective, and the proportion of excellent and good is relatively large, which indicates that the error generated in data processing and calculation is small, which objectively evaluates the quality of the classroom participated by many people, and provides technical support for the evaluation of teaching quality in the future.

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