
Study on the evaluation method of students' English classroom performance based on big data analysis

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Abstract: In order to overcome the problems of low rationality, low significance and low accuracy of the current evaluation methods of students' English classroom performance, this paper proposes a method based on big data analysis. It uses the method of questionnaire to obtain the evaluation indicators of experts and students, uses the method of vector normalisation to deal with the original decision matrix, and uses the information entropy to calculate the corresponding weight of the evaluation indicators of students' English classroom performance. It also uses the product operator to aggregate the evaluation matrix, combines the reference point method model, the total multiplication model and the ratio system to obtain the evaluation value of students' English classroom performance, and to achieve the evaluation of students' English classroom performance. The experimental results show that the proposed method is more than 90% reasonable, more than 90% significant, and more than 93% accurate.

Keywords: big data analysis; evaluation indicators; classroom performance; evaluation methods.

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1 Introduction

In the field of education, the evaluation of middle school students' classroom performance is a hot topic of discussion. Students' classroom performance is the core of school development and survival. The evaluation method of students' classroom performance has a certain degree of objective laws, but also has a great deal of subjectivity, so it needs more scientific calculation data and methods to improve the reliability of the results (Zhou et al., 2016). School administrators can fully understand the teaching situation through the evaluation of students' English classroom performance, for example, English teachers pay attention to individualised teaching, improve

classroom teaching methods, use modern teaching media, pay attention to the interaction with students, improve the quality of English teaching through the above aspects, and provide scientific standards for the formulation of teacher planning and discipline development direction (Lombarts et al., 2016; Sha et al., 2018). The evaluation of students' English classroom performance is a difficult problem, which has been widely concerned in recent years. At present, the evaluation methods of students' English classroom performance have the problems of low rationality, significance and accuracy. Therefore, it is necessary to study the evaluation methods of students' English classroom performance (Dayanandan and Kalimuthu, 2018; McNeill et al., 2016).

Fan and Ma (2017) puts forward the evaluation method of students' classroom performance based on Markov chain. According to the Markov nature existing in the process of English teaching, the fuzzy comprehensive evaluation method is used to evaluate students' English classroom performance based on Markov theory. According to the predictability and ineffectiveness of Markov chain, the evaluation model of students' English classroom performance is constructed to realise the evaluation of students' English classroom performance. The evaluation results obtained by this method are not consistent with the actual situation, and there is a problem of low evaluation accuracy. Tang and He (2017) puts forward a method of evaluating students' English classroom performance based on PAC-Bayes theory. In the process of evaluating students' English classroom performance, PAC-Bayes boundary and SVM algorithm are introduced to build a model of evaluating students' English classroom performance based on PAC-Bayes theory, so as to realise the evaluation of classroom performance. However, the evaluation indicators selected by this method are unreasonable, and the rationality of evaluation indicators is low. Liu (2016) puts forward the method of evaluation of students' English classroom performance based on AHP, which analyses the external and internal factors that affect students' English classroom performance on the basis of system theory, obtains the evaluation indicators of English classroom performance through the combination of quantitative analysis and qualitative analysis, constructs the evaluation model of English classroom performance, and realises the evaluation of students' English classroom performance, but The significance of the evaluation indicator obtained by this method is low. Gao et al. (2016) puts forward a method of classroom performance evaluation based on AHP-DEA. This method determines the influencing factors of English classroom performance by expert survey, determines the corresponding weight of the influencing factors by AHP, establishes the evaluation model of English classroom performance by mathematical envelopment analysis, and realises the evaluation of students' English classroom performance. However, there are errors in the process of calculating the weight of indicators, resulting in the accuracy of evaluation results is low.

Because the current method does not obtain the expert evaluation index and student evaluation index through the questionnaire survey method, the rationality and accuracy of the student English classroom performance evaluation method are reduced. In order to further improve the reliability and accuracy of the evaluation method and effectively evaluate students' English classroom performance, this paper proposes a method of evaluating students' English classroom performance based on big data analysis to better realise the evaluation of students' English classroom performance.

2 Assessment indicators of English classroom performance

2.1 Establishment principle of evaluation indicator

- 1 Orientation principle: The assessment of students' English classroom performance needs to be consistent with the national and party's policies and educational policies, fully reflect the direction of comprehensive development and socialist school running, enhance the efficient competitiveness and vitality in the economic situation and culture change, and promote the reform of the school (Li, 2017).
- 2 Objectivity principle: Seeking truth from facts is the basic principle of objectivity, and the evaluation indicator system needs to meet the principles of rationality and scientificity.
- 3 The principle of comprehensiveness: In the process of teaching, we should prevent overemphasis on every aspect of factors, resulting in one sidedness of teaching work in classroom performance evaluation, preventing one tendency from being covered up by another, and comprehensively collecting the information existing in the classroom environment and process. This paper makes a comprehensive analysis of the three basic elements of teaching activities, namely, intermediate media, students and teachers (Neff et al., 2016; Pan et al., 2016).
- 4 Feasibility principle: It is required that the evaluation indicator system and scheme meet the simple, convenient, measurable and comparable conditions based on the requirements of feasibility principle. In the assessment, the development trend and current situation of the school should be taken into account, while the basic requirements of national education should be considered.
- 5 Incentive principle: The evaluation of students' English classroom performance is not only a single description of classroom performance, but also a judgment and measurement of the school's teaching work through advanced standards and comparative objectives, so as to improve the quality of education, summarise experience, promote work, affirm achievements, determine the direction, tap potential, diagnose problems and other purposes. Therefore, it is necessary to formulate corresponding incentive and management policies, combine personal interests and evaluation results in a certain period of time, and encourage teachers to work hard in teaching work, so as to improve the learning quality of students' English classroom (Poza-Lujan et al., 2015; Crowley et al., 2016).

2.2 Evaluation indicator factor screening

2.2.1 Expert indicators

By querying the relevant materials of students' English classroom performance evaluation, the expert evaluation indicators of students' English classroom performance are preset, as shown in Figure 1.

Figure 1 Expert evaluation indicator preset system

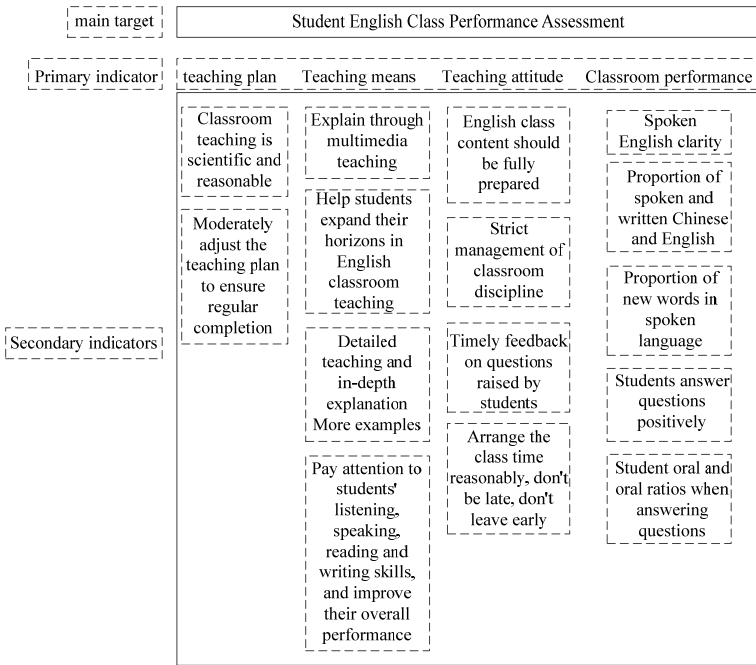


Figure 2 Expert evaluation indicators

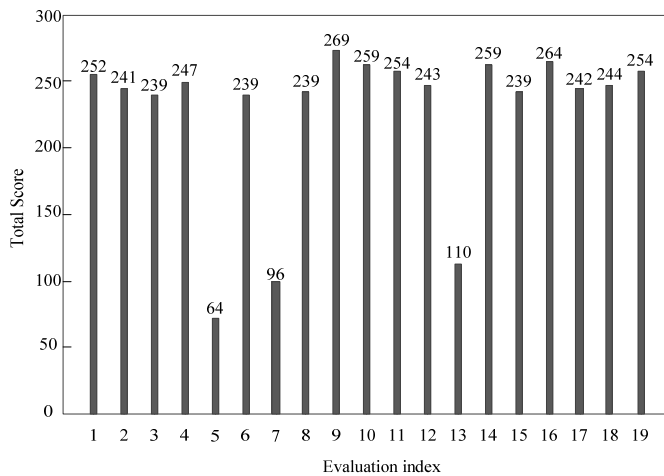
	Evaluation index	Total Score
Indicator 1	teaching plan	252
Indicator 2	Classroom teaching is scientific and reasonable	241
Indicator 3	Moderately adjust teaching techniques to ensure regular completion	239
Indicator 4	Teaching means	247
Indicator 5	Explain through multimedia teaching	64
Indicator 6	Help students expand their horizons in English classroom teaching	239
Indicator 7	Detailed teaching, many examples	96
Indicator 8	Focus on students' listening, speaking, reading and writing skills	239
Indicator 9	Teaching attitude	269
Indicator 10	Fully prepared for the course content	259
Indicator 11	Strict management of classroom discipline	254
Indicator 12	Timely feedback to students' questions	243
Indicator 13	Reasonable scheduling of class time	110
Indicator 14	Classroom performance	259
Indicator 15	Spoken English clarity	239
Indicator 16	Spoken Chinese should be the ratio	264
Indicator 17	Proportion of new words in spoken language	242
Indicator 18	Students answer questions positively	244
Indicator 19	Student oral English ratio when answering questions	254

Judge the expert members to score the evaluation indicators in the pre-set system of expert evaluation indicators. The scoring standard is a four-degree scale: mark the extremely non critical indicators as 0 point; mark the extremely critical indicators as 3 points; mark the non-critical indicators as 1 point; mark the critical indicators as 2 points, and select the expert evaluation indicators by means of questionnaire (Liu et al., 2016; Morgan et al., 2016).

One hundred questionnaires were issued, and expert evaluation indicators were obtained according to the results of the questionnaire survey. Ninety questionnaires were collected in total, and there were ten invalid questionnaires, including four abstention questionnaires and six ineffective ones. The results of the questionnaire survey are shown in Figure 2.

According to the data in Figure 2, draw the score column chart corresponding to each student's English classroom performance evaluation indicator.

Figure 3 Expert evaluation indicator score

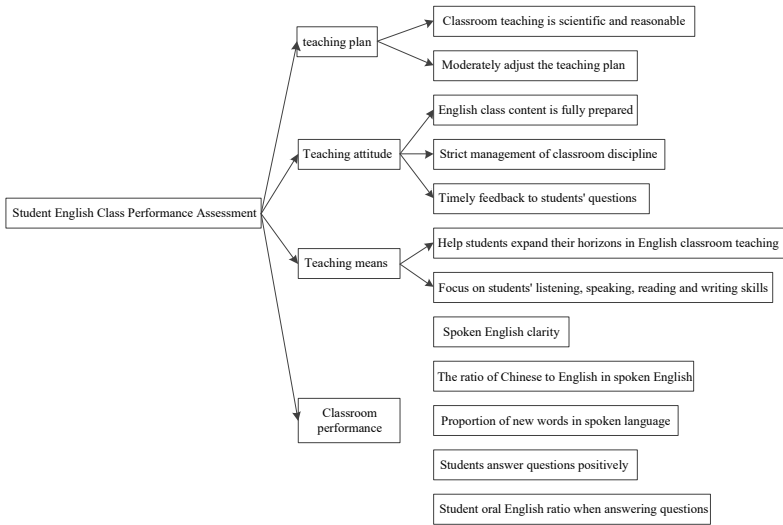


The abscissa in Figure 3 describes the assessment indicators of students' English classroom performance, and the ordinate describes the total scores corresponding to the assessment indicators. It can be seen from Figure 3 that the total scores of most students' English classroom performance evaluation indicators are more than 230, but there are some students whose scores of English classroom performance evaluation indicators are relatively low. Students whose scores more than 230 are selected as the reserved indicators.

The retention indicators obtained include oral English rate, teaching plan, students' enthusiasm for answering questions, scientific and reasonable classroom teaching, proportion of new words in oral English, appropriate adjustment of teaching plan, proportion of Chinese and English in oral English, oral English clarity, teaching attitude, classroom performance, and English classroom teaching content to be fully prepared and strict. Manage classroom discipline, classroom performance, timely feedback students' questions, pay attention to students' listening, speaking, reading and writing ability, teaching methods, and expand classroom teaching vision.

Evaluate the classroom performance, teaching attitude and teaching plan. Based on the evaluation factors, experts select the evaluation indicators of students' English classroom performance (Ma and Wang, 2018; Li et al., 2018) through the experimental results to obtain the expert evaluation indicator system, as shown in Figure 4.

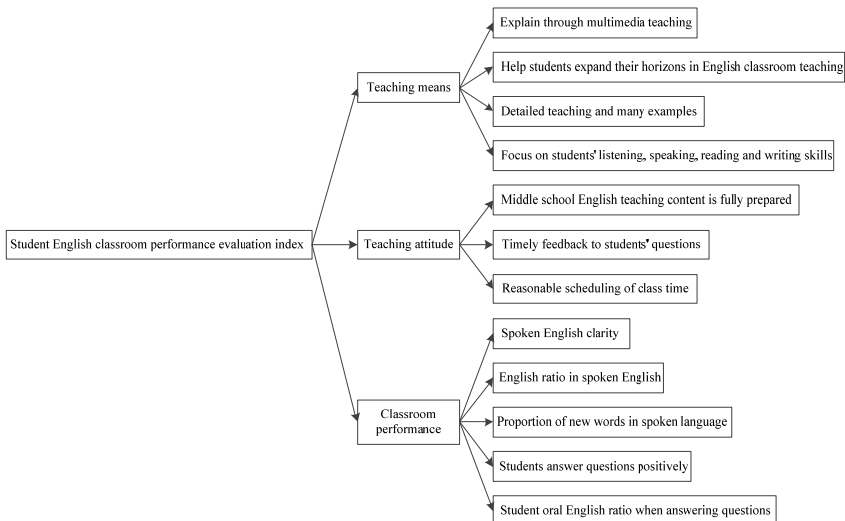
Figure 4 Expert evaluation indicator system



2.2.2 Student assessment indicators

On the basis of expert evaluation indicators, the evaluation indicators of students' performance in English teaching classroom are preliminarily selected through the relevant materials of English classroom performance evaluation, as shown in Figure 5.

Figure 5 Student evaluation indicator preset system

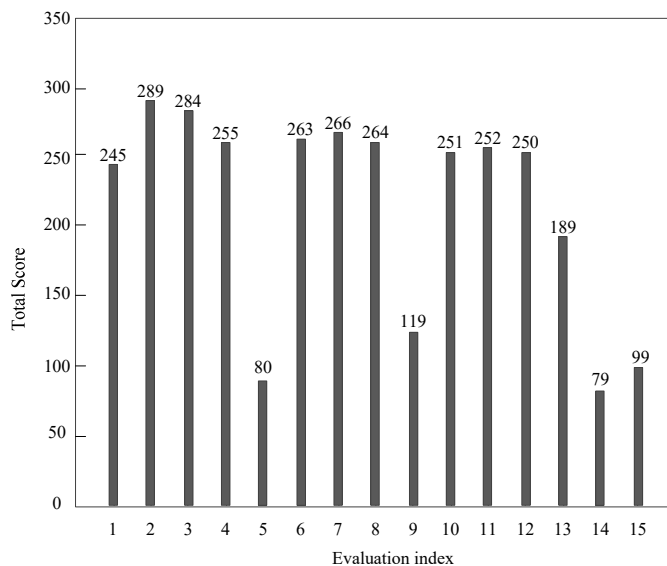


It is determined that the student group will score the evaluation indicators of the students' English classroom performance. The scoring standard is a four-degree scale: the extremely non-critical indicators will be scored 0; the extremely critical indicators will be scored 3; the non-critical indicators will be scored 1; the critical indicators will be scored 2, and the evaluation indicators of the students will be selected by the way of questionnaire (Lu, 2018; Yu, 2016).

Figure 6 Student assessment indicators

Evaluation index		Total Score
Indicator 1	Teaching means	245
Indicator 2	Explain through multimedia teaching	289
Indicator 3	Help students expand their horizons in English classroom teaching	284
Indicator 4	Detailed teaching, many examples	255
Indicator 5	Focus on students' listening, speaking, reading and writing skills	80
Indicator 6	Teaching attitude	263
Indicator 7	Middle school English teaching content is fully prepared	266
Indicator 8	Timely feedback to students' questions	264
Indicator 9	Reasonable scheduling of class time	119
Indicator 10	Classroom performance	251
Indicator 11	Spoken English clarity	252
Indicator 12	Spoken English and English ratio	250
Indicator 13	Proportion of new words in spoken language	189
Indicator 14	Students answer questions positively	79
Indicator 15	Student oral English ratio when answering questions	99

Figure 7 Student evaluation indicator scores



One hundred questionnaires were sent out. According to the results of the questionnaire, the evaluation indicators of students were obtained. The total scores of the evaluation indicators were as Figure 6.

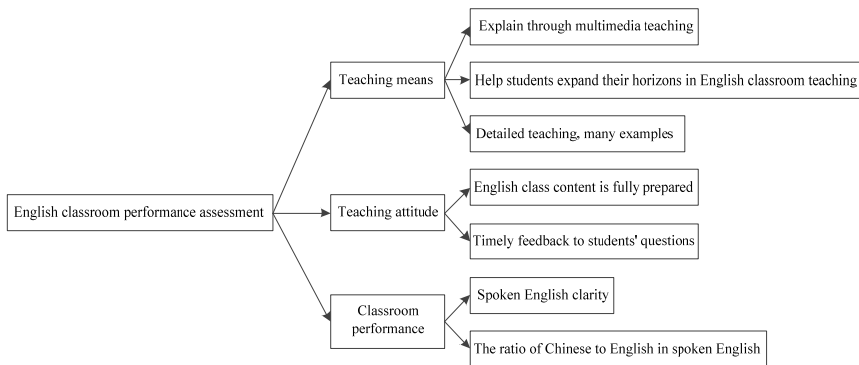
According to the data in Figure 6, draw the score column chart corresponding to the student evaluation indicator.

The abscissa in Figure 7 describes the evaluation indicators of students' English classroom performance, and the ordinate describes the total scores corresponding to the evaluation indicators of students' English classroom performance. It can be seen from Figure 7 that the scores of most students' English classroom performance evaluation indicators are relatively high, and the scores are all above 230, but there are some students' English classroom performance evaluation indicators whose scores are lower than 120. The indicators whose scores are above 230 are taken as the reserved indicators of students' English classroom performance evaluation indicators.

The reserved indicators include the proportion of Chinese and English in oral English, teaching methods, oral English clarity, multimedia teaching and explanation, classroom performance, helping students to expand their vision of English classroom teaching, timely feedback of students' questions, full preparation of English classroom teaching content, meticulous teaching, and many examples.

According to the scores corresponding to the student evaluation indicators, the classroom performance, teaching attitude and teaching methods are evaluated. Through the above evaluation indicators and the experimental results, the student evaluation indicator system is obtained, as shown in Figure 8.

Figure 8 Student evaluation indicator system



3 Assessment methods of students' English classroom performance

3.1 Calculation of evaluation indicator weight

In order to make the assessment method more reasonable and the assessment results more accurate, the experts and students of the questionnaire statistics on the basis of retained assessment index data. On the basis of the differences of each evaluation indicator of students' English classroom performance, information entropy is used as the carrier to calculate the corresponding weight of the evaluation indicator of students' English classroom performance, so as to provide the basis for the evaluation of students' English

classroom performance (Liu et al., 2017; Wei and Wang, 2016). The specific process is as follows:

Let n represent the total number of options available, all of which can be used to measure the quality of students' English classroom performance evaluation indicators. On the basis of big data analysis, the original decision matrix of m rows and n columns is established, and its expression is as follows:

$$X = \begin{pmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{pmatrix} \quad (1)$$

- 1 The original decision matrix is normalised by the vector normalisation method, and the corresponding normalised decision matrix is obtained. Its expression is as follows:

$$Y = \begin{pmatrix} y_{11} & y_{12} & \dots & y_{1n} \\ y_{21} & y_{22} & \dots & y_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ y_{m1} & y_{m2} & \dots & y_{mn} \end{pmatrix} \quad (2)$$

where the expression of element y_{ij} is as follows:

$$y_{ij} = \frac{x_{ij}}{\sum_{i=1}^m x_{ij}} \quad (3)$$

- 2 Calculate the entropy value corresponding to the j -item student's English classroom performance evaluation indicator:

$$b_j = \frac{1}{\ln m} \sum_{i=1}^m (y_{ij} \ln y_{ij}) \quad (4)$$

- 3 Calculate the corresponding weight according to the entropy value of the evaluation indicator of students' English classroom performance:

$$\omega_j = \frac{1 - b_j}{\sum_{j=1}^n (1 - b_j)} \quad (5)$$

3.2 Assessment method

In the fuzzy environment, $A = \{A_1, A_2, \dots, A_m\}$ is the scheme set, $G = \{G_1, G_2, \dots, G_m\}$ is the indicator set, $D = \{D_1, D_2, \dots, D_t\}$ is the evaluation expert set.

The evaluation indicator G_j in the expert D_k measure scheme A_i forms the evaluation matrix $R^{(k)}$, whose expression is as follows:

$$R^{(k)} = [a_{ij}^{(k)}]_{m \times n} \quad (6)$$

Among them, $a_{ij}^{(k)}$ represents intuitionistic fuzzy number, and its expression is as follows:

$$a_{ij}^{(k)} = (\mu_{ij}^{(k)}, \nu_{ij}^{(k)}, \pi_{ij}^{(k)}) \tag{7}$$

Based on the IFPOWA operator, the assessment method of students' English classroom performance based on big data analysis is evaluated. The specific steps are as follows:

- 1 For the individual evaluation matrix $R^{(k)} = [a_{ij}^{(k)}]_{m \times n}$, the elements $a_{ij}^{(k)}$ ($i = 1, \dots, m; j = 1, \dots, n$) are aggregated by IFPOWA operator. For the evaluation indicator G_j , the intuitionistic fuzzy value a_{ij} corresponding to the comprehensive evaluation value A_i is obtained. Based on the intuitionistic fuzzy value a_{ij} of the comprehensive evaluation value, the group evaluation matrix composed of k experts is obtained (Hu et al., 2018; Zhang, 2018):

$$R = (a_{ij})_{m \times n} \tag{8}$$

$$\text{IFPOWA}(a_{ij}^1, a_{ij}^2, \dots, a_{ij}^k) = a_{ij} \tag{9}$$

- 2 Let C describe the cost-effective indicator set; B describe the benefit indicator set, standardise the evaluation indicators of students' English classroom performance, and obtain the corresponding evaluation matrix β after the standardisation treatment.

$$\beta = (\beta_{ij})_{m \times n} \tag{9}$$

where the expression of β_{ij} is as follows:

$$\beta_{ij} = \begin{cases} a_{ij}, & j \in B \\ \text{Neg}(a_{ij}), & j \in C \end{cases} \tag{10}$$

- 3 The comprehensive evaluation value of the evaluation indicator corresponding to the scheme in the evaluation matrix β is weighted and integrated by the ratio system analysis method to obtain the comprehensive evaluation value y_i corresponding to the scheme A_i .

$$y_i = \sum_{j=1}^n \beta_{ij} \tag{11}$$

Through the analysis formula (11), it can be seen that the larger the comprehensive evaluation value y_i is, the better the scheme is. Therefore, the scheme can be sorted according to the size of the evaluation value y_i .

- 4 By determining the minimum element corresponding to cost-effective attribute or the maximum element corresponding to benefit attribute, the reference point method solves the uncertainty problems such as the calculation of corresponding distance measure and the solution of positive and negative ideal method in TOPSIS method (Liu, 2018), that is, the following formula exists:

$$\beta_j = (\mu_{\beta_j}, \nu_{\beta_j}, \pi_{\beta_j}) = \begin{cases} \max_i \beta_{ij}, & j \in \beta \\ \min_i \beta_{ij}, & j \in C \end{cases} \quad (12)$$

The distance measure between the corresponding evaluation value β_{ij} and intuitionistic fuzzy value $\beta_j = (\mu_{\beta_j}, \nu_{\beta_j}, \pi_{\beta_j})$ of the reference point in each scheme is $d(\beta_{ij}, \beta_j)$, and its calculation formula is as follows:

$$d(\beta_{ij}, \beta_j) = \frac{1}{2} (|\mu_{\beta_{ij}} - \mu_{\beta_j}| + |\nu_{\beta_{ij}} - \nu_{\beta_j}| + |\pi_{\beta_{ij}} - \pi_{\beta_j}|) \quad (13)$$

On the basis of the maximum distance between the evaluation value β_{ij} and the intuitionistic fuzzy value β_j , the scheme that is closer to the miserable reference point is better.

- 5 In the total multiplication model, the evaluation matrix corresponding to each scheme is aggregated by the product operator, and the comprehensive evaluation value corresponding to scheme A_i is obtained.

$$U_i = \prod_{j=1}^n \beta_{ij} \quad (14)$$

- 6 Combined with the evaluation results of ratio system analysis, reference point method and total multiplication model, the evaluation of students' English classroom performance is realised.

4 Experiments and discussion

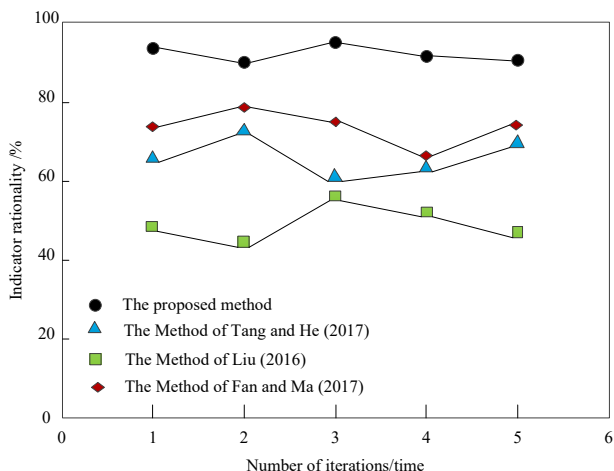
In order to verify the overall effectiveness of the assessment method of students' English classroom performance based on big data analysis, it is necessary to test the assessment method of students' English classroom performance based on big data analysis. The operating system of this test is windows, the experimental software is MyEclipse 8.6, and the CPU is 2.90 GHz. Taking the real data of an English class in a college as the experimental sample, the experimental indicators are rationality, significance and accuracy of different methods. Among them, the rationality of indicators can reflect the practical application value of the evaluation method, the significance of indicators can reflect the evaluation effect, and the evaluation accuracy can directly reflect the performance of the evaluation method. Therefore, the above three indicators are selected as the test indicators of this paper. This paper takes the method of evaluating students' English classroom performance based on big data analysis as the experimental group, and takes the methods of the method of Fan and Ma (2017), the method of Tang and He (2017) and the method of Liu (2016) as the experimental group to test.

4.1 Indicator rationality experiment

The index reasonableness was taken as the test index to verify the effectiveness of the assessment method, Fan and Ma (2017) method, Tang and He (2017) method and Liu (2016) method of students' English classroom performance based on big data analysis.

The higher the index significance value, the higher the reliability of the evaluation method. The test results of the four different methods are as Figure 9.

Figure 9 Indicator rationality of four different methods (see online version for colours)



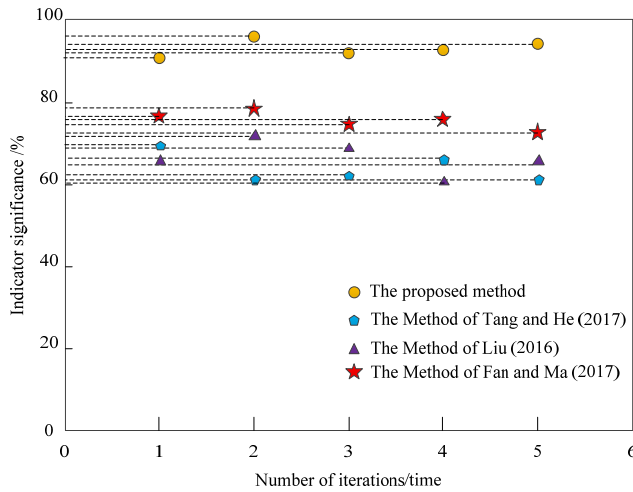
First of all, Figure 9 shows that the rationality of the indicators obtained by the big data analysis-based assessment method for students' English classroom performance in multiple iterations is more than 90%, while the rationality of the indicators obtained by the Fan and Ma (2017) method in multiple iterations fluctuates around 80%; Figure 9 shows that the rationality of the indicators obtained by the Tang and He (2017) method and the Liu (2016) method in multiple iterations is 70%, respectively. The higher the reasonable indicator value is, the better the evaluation effect of the method is. Comparing the results of the above four different methods, we can see that the rationality of the indicators of the evaluation method of students' English classroom performance based on big data analysis is higher than that of other methods, because the evaluation method of students' English classroom performance based on big data analysis determines the evaluation indicators of students' English classroom performance through questionnaire survey, which improves the rationality of the evaluation method based on big data analysis.

4.2 Scale significance test

The effectiveness of the four methods is further verified by using the indicator significance as the test indicator. The higher the indicator significance value is, the higher the reliability of the evaluation method is. The test results of four different methods are as Figure 10.

Analysis of Figure 10 shows that in many iterations, the significance of the indicators obtained by the big data analysis-based method for assessing students' English classroom performance is higher than 90%, while the significance of other methods is lower than 78%, which proves that the reliability of this method is higher. This is because the evaluation method of students' English classroom performance based on big data analysis can improve the significance of the evaluation method of students' English classroom performance based on big data analysis.

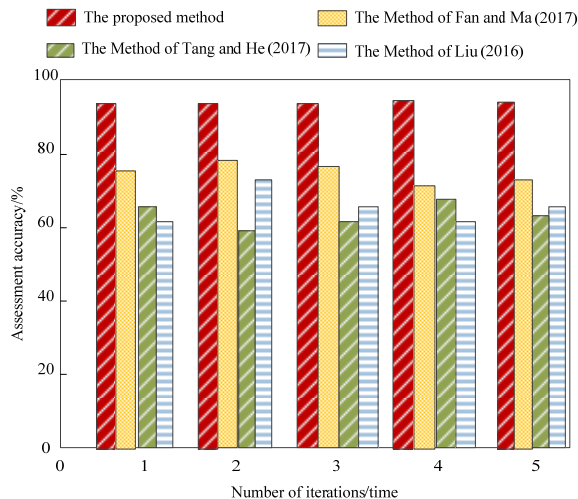
Figure 10 Indicator significance of four different methods (see online version for colours)



4.3 Evaluation accuracy experiment

Based on the analysis of big data, the methods of assessment of students' English classroom performance, Fan and Ma (2017), Tang and He (2017) and Liu (2016) are used to test the accuracy of the four methods. The higher the accuracy of assessment, the better the performance of the methods. The test results are as Figure 11.

Figure 11 Evaluation accuracy of four different methods (see online version for colours)



It can be seen from Figure 11 that in many iterations, the accuracy rate of the assessment method of students' English classroom performance based on big data analysis is always higher than 93%, while the accuracy rate of other three methods is lower than 80%, which is obviously lower than the method in this paper, which can prove that the

performance of the proposed method is better. Because the assessment method of students' English classroom performance based on big data analysis uses IFPOWA among experts. Based on the corresponding support degree of assessment information, we can gather the individual information of assessment experts, and then get the corresponding assessment opinions of the group, which can improve the assessment accuracy of the assessment method of students' English classroom performance based on big data analysis.

5 Conclusions

- 1 China has put forward higher requirements for higher education in the new stage of socialist modernisation construction. Teaching is the core task of higher education. Improving the effect of students' classroom performance is the key to promoting the development and reform of the university, and making the evaluation method of students' English classroom performance become the current research hotspot. It is helpful to solve the problems existing in the current methods and improve the teaching quality to complete the evaluation of students' English classroom performance accurately through the evaluation indicators with high rationality and significance.
- 2 Aiming at the problems of low rationality, low significance and low accuracy of the current evaluation methods of students' English classroom performance, this paper puts forward the evaluation method of students' English classroom performance based on big data analysis.
- 3 Based on the principles of directionality, objectivity, comprehensiveness, feasibility and motivation, the expert evaluation indicator and student evaluation indicator are obtained by consulting relevant literature and combining with questionnaire survey. Using information entropy to calculate the weight of students' English classroom performance evaluation indicators. The product operator is used to aggregate the evaluation matrix to complete the evaluation of students' English classroom performance.
- 4 The experimental results show that the rationality of the proposed method is above 90%, the significance of the indicators is higher than 90%, the accuracy of evaluation is always higher than 93%, and the applicability is good.
- 5 In the experimental process, due to the setting of experimental environment parameters, there are certain differences between the experimental environment and the real environment, the experimental results and the actual results have certain deviation, but it does not affect the experimental conclusions. In order to get more accurate experimental results, it is necessary to optimise and study the evaluation methods of students' English classroom performance based on big data analysis.

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