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College English Teaching Classroom Based on Fuzzy Mathematical Model



Abstract: - The use of English in daily communication is becoming more and more important. The degree of mastery of English is largely related to the quality of college English teaching. College English Teaching (CET) has always been the focus of college classroom teaching. The quality of CET directly affects the ability of college students to master English. The evaluation of College English Classroom Teaching (CECT) can reflect the quality of CECT, but the traditional CECT evaluation mainly adopts the average method to analyze, which leads to insufficient understanding of the teaching effect by teachers and low English learning efficiency of students. CET has a fuzzy boundary, and the fuzzy mathematical model can be used to analyze the evaluation indexes that affect the effect of CET and the relative weights of each index, so as to conduct a comprehensive evaluation of CET. A comparative analysis is made between the CET classroom based on fuzzy mathematical model and the traditional mean CET classroom. The experimental results show that the teaching efficiency of practical CET under the two CET evaluation methods is 63% and 75.7%, respectively, while the efficiency of professional CET is about 65.7% and 82.7%, respectively. It can be shown that analyzing CET through Fuzzy Comprehensive Evaluation (FCE) can improve the teaching efficiency of college English classrooms and promote the mastery of English.

Keywords: College English Teaching, Classroom Teaching Efficiency, Classroom Teaching Evaluation, Fuzzy Comprehensive Evaluation

Introduction

Under the influence of internationalization, college education attaches great importance to CET, and improves the English proficiency of college students through a sound teaching system and resource investment. However, the effect of improving the English proficiency of college students is not obvious, and the teachers do not know how to adjust the teaching direction in the CET classroom, which makes the overall CET effect very poor. Therefore, it is necessary to carry out accurate evaluation and analysis of CET, but the traditional college English classroom evaluation is mainly analyzed by scoring average. For example, in CET, the students' classroom enthusiasm, CET methods and teachers' teaching attitude are scored as 78, 84 and 72 respectively, and the comprehensive score is 78 according to the average method. The characteristics of CET evaluation are multiple indicators and fuzzy boundaries. Based on this, FCE can be used to systematically evaluate the quality of CET, and the comprehensive evaluation results can be obtained by analyzing the index weights. Using FCE to analyze CET can ensure the efficiency of CET, and improve students' English learning methods, so as to change

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English teachers' teaching methods in a targeted manner, thereby improving the quality of CET. Therefore, this paper has research significance.

CECT is the main method of CET, and relevant researchers evaluate and analyze the quality of CET. Among them, Jinyu W, through the evaluation of college English course teaching, analyzed that students' inattentiveness in English class is the main reason that affects the efficiency of CET [1]. Gu X conducted a weight analysis on the factors affecting the quality of university teaching, and the highest proportion of the influencing factors was the degree of multimedia CET [2]. Zhijie Z's research pointed out that the evaluation of teaching quality in college English classrooms can provide good feedback on CET information [3]. Zhang J's research showed that the evaluation of CET quality can find out the defects in the CET process, and adjust the CET plan in time according to the corresponding defects [4]. Haisheng C established a teaching evaluation model for CET. Through the analysis of the indicators, he proposed to strengthen the English interaction between teachers and students in the classroom [5]. A comprehensive evaluation of the quality of CET is helpful to analyze the factors that affect the efficiency of CET, but the method of comprehensive evaluation is not optimal.

FCE can quantitatively analyze qualitative problems, and many people use FCE to systematically analyze CET classrooms. Among them, Zhou R's research expressed the uncertainty of the FCE research system to accurately evaluate CET [6]. Liu Y combined FCE and grey analysis to evaluate the teaching quality of CET by determining the indicators [7]. Li X K used the fuzzy mathematical model to analyze that the students' oral English training in the classroom is the main factor affecting CET [8]. Li Q carried out fuzzy mathematical modeling of professional English courses in colleges and universities, and calculated the teaching quality of professional English courses in colleges and universities through a comprehensive analysis of the weights and values of each index [9]. FCE can effectively analyze the factors that affect the quality of CET and conduct a comprehensive analysis, but it lacks a comparison with the traditional evaluation of CET quality.

College English classroom is the main link of college English education, and the quality of CECT reflects the effect of CET [10]. The factors affecting the quality of CECT and the weights of each factor are comprehensively analyzed using FCE, so as to achieve a comprehensive analysis of the quality of CECT, compared with the traditional CET quality evaluation. Thus the teaching effect of college English can be improved by analyzing the quality of CET through FCE.

Methods of Classroom Quality Analysis in CET

CECT evaluation can effectively reflect the quality of teaching and is an important indicator to measure the level of classroom teaching [11]. Teachers can gain a deeper grasp of classroom instruction by using scientific and objective evaluation techniques that help them better comprehend the benefits and drawbacks of their own teaching. Students can also gain a more comprehensive understanding of their own learning situation, and the evaluation of CECT can raise the level of CET. The structure of CECT evaluation is shown in Figure 1.

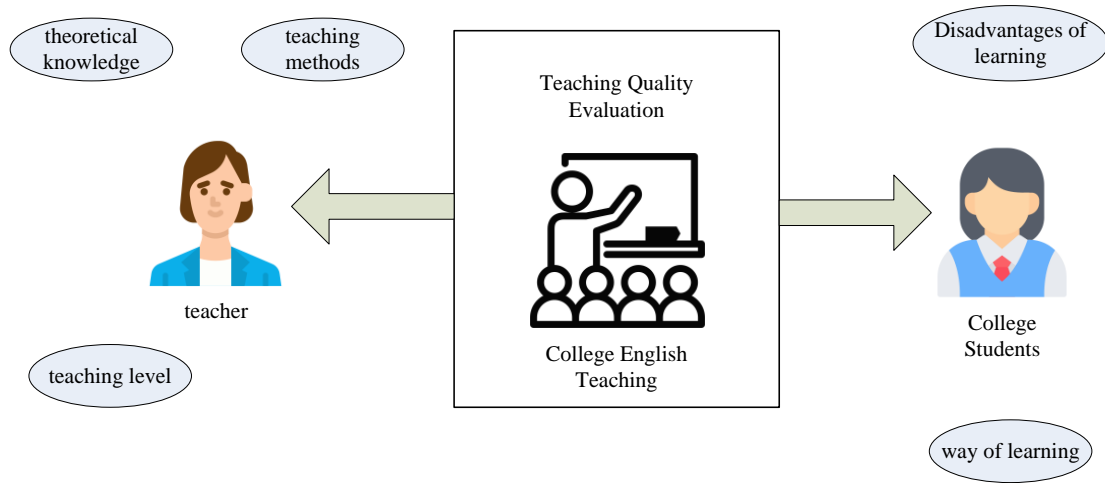


Figure 1. Structure diagram of CECT evaluation

In Figure 1, the teaching quality evaluation of CET can promote college English teachers to improve their CET level, and help college students understand their learning shortcomings, thus improving the efficiency of CET [12].

Questionnaire Method

When evaluating the quality of CET, it is necessary to determine the indicators that affect the quality of CET. To this end, it is necessary to collect the relevant CET evaluation data. The questionnaire method is a social investigation method. Generally, data is collected from the close relatives of the research objects through mail or paper forms. The general structure of the questionnaire method is shown in Figure 2.

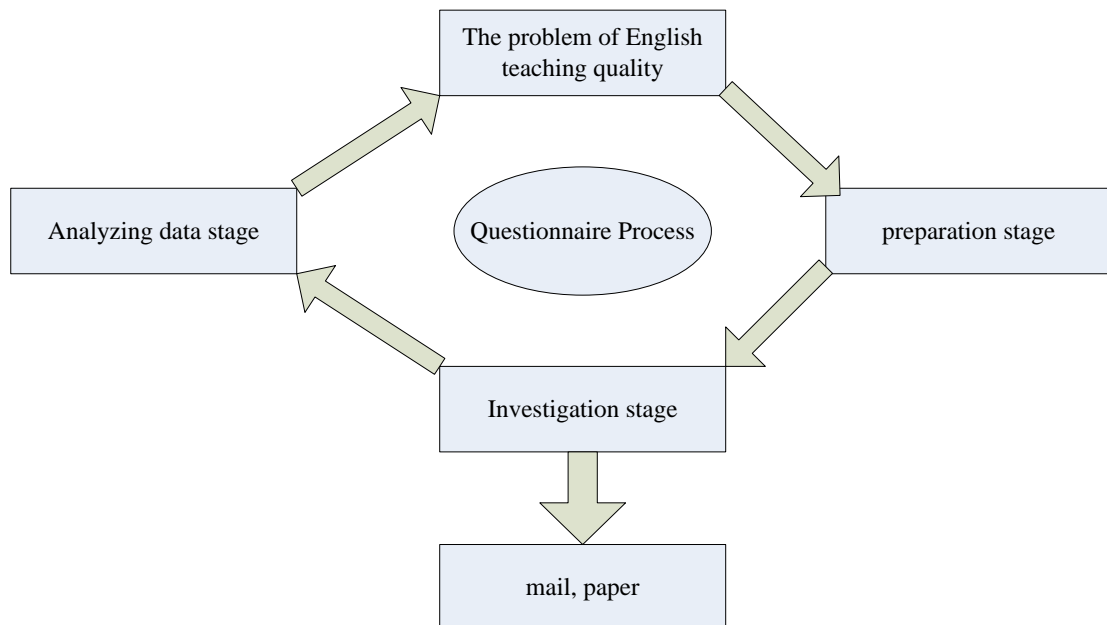


Figure 2. Structure diagram of the questionnaire method

In Figure 2, the structure of the questionnaire method is explained. First, it is necessary to determine the research question, that is, the elements influencing the quality of college English education in this paper. Then the object of the study is determined by finding relevant information, and a questionnaire is issued for data investigation. Questionnaire method is an extremely simple, low-cost and detailed survey method.

In the process of CET, the main participants are college English teachers and college students. Therefore, a questionnaire survey was conducted for college English teachers and students [13-14]. In order to make the data of the questionnaire survey more credible, a random survey was conducted on all students in the university, and teachers with more than 3 years of teaching experience were selected for English teachers.

A total of 95 college students and 5 English teachers were surveyed in this questionnaire, with a total of 100 questionnaire results, of which 80 were valid questionnaires. The questionnaire was displayed in the form of a scoring design, and the factors that affect the quality of CET were scored 0, 1, 2, and 3 respectively indicating the main degree of the influencing factors. For example, "0" means no effect. The results of the questionnaire survey are shown in Table 1.

Table 1. Results of the questionnaire

Influencing factors	High impact (people)	Moderate impact (person)	Low impact (people)	No impact (people)
English teaching plan	68	6	6	0
Rationality of teaching	62	9	9	0
Teaching means	1	1	32	46
Degree of classroom interaction	40	20	20	0
Students' classroom motivation	42	8	20	10
Students' speaking level	38	12	20	10
Discipline in the English classroom	10	20	10	40
Teacher's teaching level	58	12	7	3
Student attendance	5	15	24	36

In Table 1, the score of each influencing factor by the investigators was described. A total of 9 influencing factors were counted, among which the index of CET plan had the largest number of high influential people.

The findings of the questionnaire survey were subjected to data analysis, and all of the contributing factors' scores were summed up. Table 2 displays the results of the questionnaire survey scores.

Table 2. Scores of questionnaire survey results

Serial number	Index	Total score (points)
1	English teaching plan	222
2	Rationality of teaching	213
3	Teaching means	37
4	Degree of classroom interaction	180
5	Students' classroom motivation	162
6	Students' speaking level	158
7	Discipline in the English classroom	80
8	Teacher's teaching level	205
9	Student attendance	69

In Table 2, the total score of each influencing factor was counted, among which the influencing factor with the highest score was the English teaching plan, with a total score of 222 [15]. Among the influencing factors, there were six indicators with more than 100 points, while the indicators with less than 100 points were teaching means, English classroom discipline and student attendance. Therefore, the three indicators with lower scores were not analyzed.

FCE

When a questionnaire is used to examine the elements influencing CET quality, there is subjective deviation, which makes the analysis process of the influencing factors vague [16]. FCE can be used to make a fuzzy analysis of CEET. The structure of FCE is shown in Figure 3.

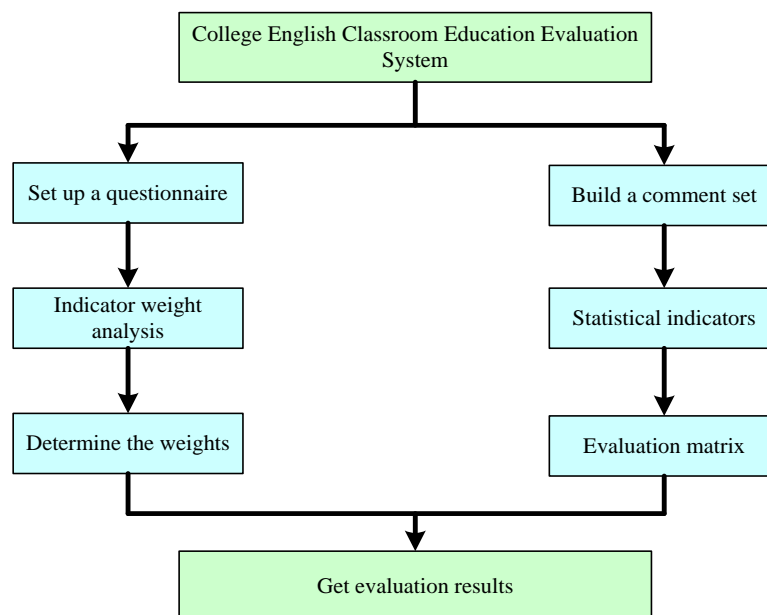


Figure 3

In Figure 3, the evaluation process of CECT includes the establishment of comment set, the analysis of indicators, the determination of evaluation matrix and the calculation of the weight of each indicator.

The comment set is a collection of evaluations made by evaluators on CECT. Assuming that there are n comments in the comment set, then the comment set is expressed as Formula 1:

$$A = \{a_1, a_2, \dots, a_n\} \quad (1)$$

In Formula 1, a_n represents the n -th comment.

The indicator data of the questionnaire survey is counted, and if there are m indicators, the indicator set can be expressed as Formula 2:

$$S = \{s_1, s_2, \dots, s_m\} \quad (2)$$

Membership analysis is performed on the comment set and the index set. Assuming that s_i is the i -th index, and the membership degree between s_i and the j -th comment set is h_{ij} , then the evaluation set of index s_i is expressed as Formula 3:

$$h_i = (h_{i1}, h_{i2}, \dots, h_{in}) \quad (3)$$

An evaluation matrix is constructed for the analyzed indicators.

$$H = \begin{bmatrix} h_1 \\ h_2 \\ \dots \\ h_m \end{bmatrix} = \begin{bmatrix} h_{11} & h_{12} & \dots & h_{1n} \\ h_{21} & h_{22} & \dots & h_{2n} \\ \dots & \dots & \dots & \dots \\ h_{m1} & h_{m2} & \dots & h_{mn} \end{bmatrix} \quad (4)$$

In Formula 4, any row of the evaluation matrix represents an index evaluation set.

The weights of the indicators are analyzed. Assuming that the weight of the indicator is W , then Formula 5 can be obtained:

$$W = \{w_1, w_2, \dots, w_m\} \quad (5)$$

For the indicator weight, there is the following relationship:

$$\sum_{j=1}^m w_j = 1 \quad (6)$$

In Formula 6, w_j represents the weight of the j -th indicator, and $w_j \geq 0$.

The fuzzy comprehensive analysis is carried out on all the indicators through the index weight and the evaluation matrix. The formula of the FCE is expressed as Formula 7:

$$G = W \cdot H \quad (7)$$

Experiments and Results of College English Classroom Teaching Quality

Data Sources for English Teaching in College

In order to obtain the evaluation indicators of CET, the experiment needed to analyze the close contacts in the process of CET, and asked three groups of college English teachers, college students and college English experts to complete a questionnaire. Among them, there were 40 college English teachers and 200 college students. The evaluation indicators that they thought can evaluate the quality of CET were investigated.

Fuzzy comprehensive analysis was used to analyze the weight of the statistical evaluation index

$W = \{w_1, w_2, \dots, w_m\}$, and the evaluation matrix $H = \begin{bmatrix} h_1 \\ h_2 \\ \dots \\ h_m \end{bmatrix} = \begin{bmatrix} h_{11} & h_{12} & \dots & h_{1n} \\ h_{21} & h_{22} & \dots & h_{2n} \\ \dots & \dots & \dots & \dots \\ h_{m1} & h_{m2} & \dots & h_{mn} \end{bmatrix}$ was constructed. The

weight analysis results of the evaluation indicators of CET are shown in Table 3.

Table 3. Weight analysis of college English teaching evaluation indicators

Serial number	Evaluation indicators	Weights
1	Accuracy of classroom assessment	26%
2	Efficiency of college English classroom teaching	21%
3	Students' interest in learning	23%
4	Teacher teaching level	22%
5	Teacher's teaching attitude	4%
6	Students' classroom performance	4%

In Table 3, the weights of CET evaluation indicators were analyzed, and the highest weight was the accuracy of classroom evaluation, accounting for 26%. The indicators with the least weight were teachers' teaching attitude and students' classroom performance each accounting for 4%. Since the weight of the first four indicators was more than 20%, it was far more than the latter two indicators. Therefore, the latter two evaluation indicators were not considered when evaluating indicators.

Experiment Design of CECT

This paper evaluated the teaching quality of CECT, mainly by setting up a control group and an experimental group. Among them, the control group used the traditional evaluation method of average value. The influence of two evaluation methods on the quality of CECT was compared.

The first four indicators in Table 3 were selected as the evaluation standards for the two types of English teaching quality. The experiment was set up for half a year, and the teaching situation under the two evaluation methods was counted every month. In the process of CECT, different types of English courses bring different teaching effects. The most common CECT is practical CET and professional CET, and it is necessary to carry out experimental analysis on the two CET methods.

Accuracy of Classroom Assessment: The purpose of teaching effectiveness assessment of CECT is to conduct a comprehensive analysis of CET, and the accuracy of CET evaluation can directly lead to the accuracy of the analysis of English classroom teaching. A higher evaluation of CET quality is conducive to discovering problems in the process of CET. Comparing the accuracy of classroom evaluation of the two methods of CET quality evaluation, Figure 4 displays the comparing findings for the accuracy of classroom assessment.

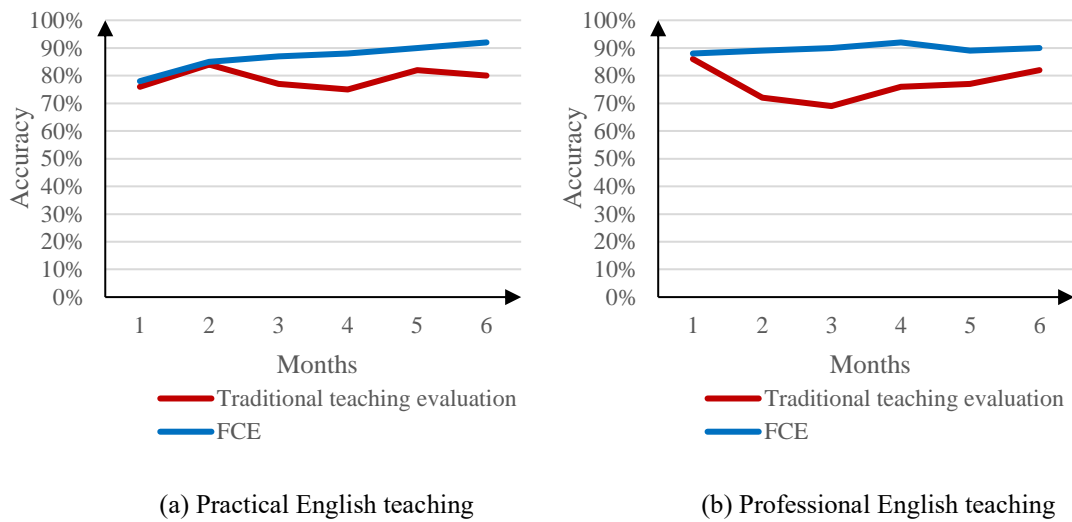


Figure 4. Results of the accuracy comparison of classroom assessments

In Figure 4(a), it is a comparison of the accuracy of two kinds of teaching quality evaluations for practical English teaching. Among them, the accuracy of English teaching evaluation under traditional teaching evaluation fluctuated within 6 months. Its accuracy was highest at the second month, when the assessment accuracy was 84%, and lowest at the fourth month. The accuracy of CET evaluation based on FCE was constantly improving, reaching the highest in the sixth month of the experiment, and the accuracy of CET evaluation in the sixth month was 92%. In Figure 4(b), the evaluation accuracy of professional CET was analyzed. Among them, the accuracy of CET evaluation under traditional teaching evaluation first decreased and then increased, and the accuracy of professional CET evaluation was 69% at the lowest and 86% at the highest. The data of CET evaluation based on FCE was relatively stable during the six-month experimental period, and

the average evaluation accuracy of professional CET was about 90%. Therefore, the use of fuzzy mathematical models can improve the accuracy of CECT evaluation.

Efficiency of CECT: The purpose of CECT evaluation is to improve the efficiency of teaching and make English teaching more efficient. To compare the teaching efficiency of the two evaluation methods of CECT, the experiment was carried out for 6 months, which mainly judged the teaching efficiency of college English classrooms by testing the English scores and English learning of college students after English teaching evaluation. The comparison results of CECT efficiency are shown in Figure 5.

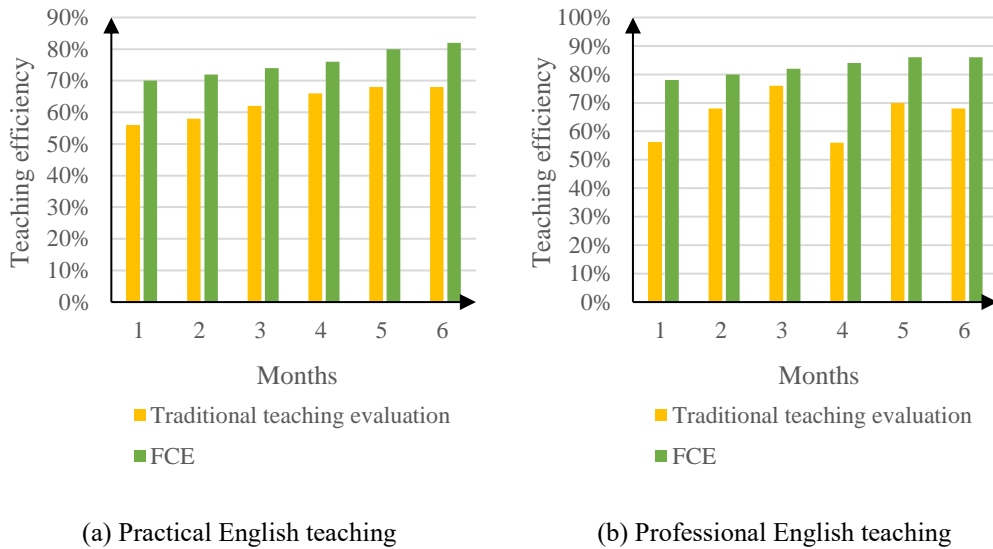
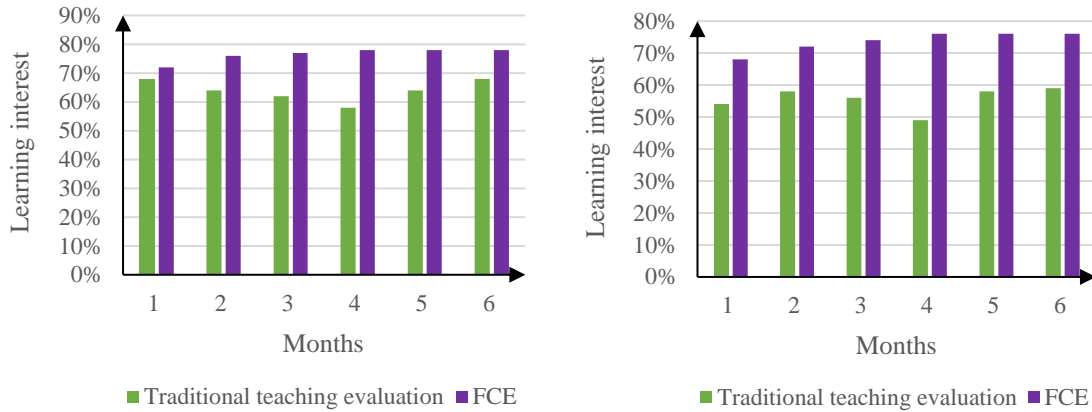


Figure 5. Results of English classroom teaching efficiency comparison

In Figure 5(a), the teaching efficiency of practical CET under two CET evaluation methods is described. The efficiency of CET under the traditional CET evaluation and the CET evaluation based on FCE was constantly improving. However, the CET efficiency under the CET evaluation based on FCE was obviously higher than that of the traditional model. The average teaching efficiency of the two English teaching evaluation methods was 63% and 75.7% respectively. In Figure 5(b), the teaching efficiency of professional English was compared. The teaching efficiency under the traditional English teaching evaluation fluctuated up and down during the experimental period, and the average English teaching efficiency was about 65.7%, while the CET efficiency based on FCE had been improving, reaching convergence in the fifth month, and the average English teaching efficiency was about 82.7%. Therefore, the teaching evaluation method based on FCE can effectively improve the efficiency of English classroom teaching.

Students' Interest in Learning: The evaluation of CET is conducive to analyzing the state of college students in English education and learning, in order to achieve timely adjustment to students' learning situation. The learning interests of college students in practical English and professional English were different and needed to be discussed separately. The comparison results of students' learning interests under the two English teaching evaluation modes are shown in Figure 6.



(a) Practical English teaching

(b) Professional English teaching

Figure 6. Results of students' learning interest comparison

In Figure 6(a), the comparison results of students' learning interest under practical English teaching are depicted. Among them, the students' learning interest under the traditional English teaching evaluation first decreased and then increased, reaching the lowest level in the fourth month. At this time, the students' learning interest was 58%, and the students' learning interest was the highest at 68%. Students' interest in learning under the teaching evaluation based on FCE had been improving, reaching convergence in the fourth month, and the students' interest in learning at this time was 78%. In Figure 6(b), it is a comparison of students' interest in professional English teaching. Among them, the students' interest in learning in the sixth month under the evaluation of traditional CET was 59%, while the the students' interest in learning under the teaching evaluation based on FCE was the lowest 68%, and the students' interest in learning in the sixth month was 76%. Therefore, FCE of different types of English teaching can improve students' interest to learn English.

Teacher's Teaching Level: The primary factor influencing CET effectiveness is teachers' proficiency in instructing. The evaluation of CET quality in CECT is helpful to analyze the teaching characteristics and deficiencies of English teachers. The teaching level of English teachers can be raised by studying the CET evaluation. The comparison results of the English teachers' teaching level under the two English teaching evaluations are shown in Figure 7.

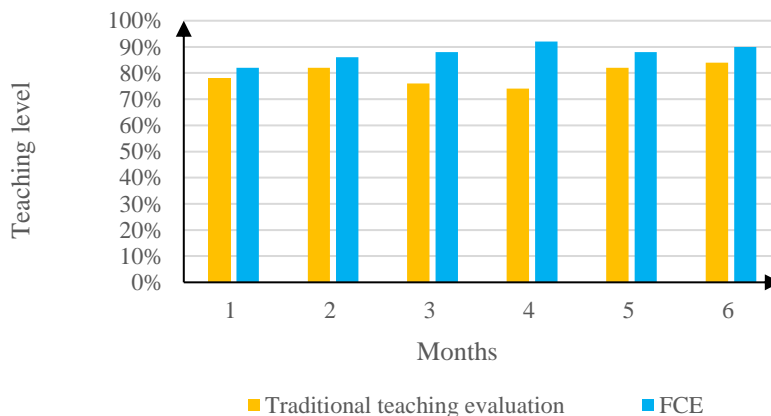


Figure 7. Results of the comparison of the teaching level of English teachers

In Figure 7, the teaching levels of English teachers under two English teaching evaluations are described. Among them, the teaching level of English teachers under the evaluation of traditional CET reached the lowest level in the fourth month, when the teaching level was 74%, and reached the highest level in the sixth month, with the highest teaching level being 84%. Under the teaching evaluation based on FCE, English teachers had a higher teaching level. During the six-month of the experimental period, the average teaching level of English teachers was about 87.7%. Therefore, by using the FCE to assess the quality of English classroom instruction for college students, English teachers can raise their teaching levels.

Conclusion

With the increasing popularity of English, people pay more and more attention to CET, but the teaching efficiency of college English is not very high. Through the teaching evaluation of CET, the problems existing in the teaching process can be analyzed. In this paper, the quality of CET was analyzed by means of FCE, and the evaluation indicators of CET were calculated through questionnaires, and the weights of the evaluation indicators were analyzed. This paper compared and analyzed the teaching evaluation of college English courses based on FCE and the traditional CET evaluation. The experimental results showed that the teaching evaluation of college English courses based on FCE can improve the accuracy of CET evaluation, and the English learning interest of college students and the CET level of teachers, thus improving the teaching efficiency of college English classroom. This paper analyzed CET by means of teaching evaluation, and fundamentally solved the problem of low efficiency of CET. However, in the selection of evaluation indicators in this paper, the number of people investigated was too small, and the data obtained for evaluation indicators were not accurate enough.

Data Availability

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

Conflicts of Interest

The authors declare no conflicts of interest.

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