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Study on a Quality Evaluation Method for College English Classroom Teaching

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Abstract: A quality evaluation method is an important means and the main basis on which to evaluate the college English classroom teaching quality of teachers. To overcome the one-sided subjectivity and resulting imprecision of the traditional classroom teaching quality evaluation method, a scientific and reasonable quality evaluation index system for college English classroom teaching is constructed. The fuzzy comprehensive evaluation method and the analytic hierarchy process method are combined to propose an improved multi-level fuzzy comprehensive evaluation model for obtaining a new college English classroom teaching quality evaluation method. In the proposed method, according to the fuzzy characteristics of a college English classroom teaching quality evaluation, the fuzzy comprehensive evaluation method is used to transform the qualitative evaluation indexes into limited quantitative evaluation indexes, then a judgment matrix is constructed to determine the weights among different levels by using the analytic hierarchy process method. Additionally, the college English classroom teaching quality is evaluated in detail. Finally, an actual case of college English classroom teaching is used to verify the effectiveness of the college English classroom teaching quality evaluation method. The results show that the proposed college English classroom teaching method can overcome the subjectivity and randomness shortcomings of the traditional classroom teaching quality evaluation methods, and improve the reliability, accuracy, and objectivity of fuzzy comprehensive evaluation. It is an effective method to evaluate college English classroom teaching quality.

Keywords: college English; fuzzy comprehensive evaluation method; analytic hierarchy process; classroom teaching quality; evaluation indexes

1. Introduction

With the acceleration of the popularization of higher education and the increasing number of college students year by year in China, the scale of higher education has become larger and larger. On one hand, the expansion of school scale has widened the development space for colleges and universities. On the other hand, it also brings a lot of problems, among which the quality of teaching is particularly prominent. Classroom teaching is the key link of the whole school's teaching work, and is also the core of the work of teachers. Classroom teaching quality is directly related to a school's teaching quality. College English is regarded as one of the most important basic courses in colleges and universities, which bears the important task of improving English ability and cultivating comprehensive accomplishment for students [1]. Classroom teaching is regarded as the central link in college English teaching, and it has decisive significance for improving the overall quality of the course. A scientific and reasonable classroom evaluation system and its operating mechanism are not only an organic part of classroom teaching, but also an important means to improve classroom teaching quality. Therefore, from the perspective of education value, a complex dynamic system of

college English classroom teaching is comprehensively, reasonably, and effectively evaluated by using education science methods in order to give guidance, encouragement, and identification functions, and to construct an evaluation index system. It has positive significance to promote the teaching level of teachers and the teaching quality of schools.

Abroad, college classroom teaching evaluation has been around for a hundred years, and the evaluation theory and methods are relatively perfect. Our country started classroom teaching evaluation in the middle of the 1980s. At present, there is abundant literature on classroom teaching evaluation. Sui [2] proposed a strategic study for the classroom monitoring of English language teaching. Li [3] utilized an uncertain linguistic weighted averaging operator to aggregate the uncertain linguistic information corresponding to each alternative and derive the overall value of the alternatives, which are ranked by using the formula of the degree of possibility for the comparison between two uncertain linguistic variables. Wu [4] defines a relative correlation degree to determine the ranking order of all alternatives by calculating the degree of grey correlation to both the positive-ideal solution and negative-ideal solution simultaneously. Zhu [5] proposed a quality evaluation system and evaluation methods for the teaching quality of college English. Pei [6] elaborated on some aspects of the instructional communication process and suggested ways in which teachers can establish and nurture both effective and affective communication relationships that maximize their students' opportunity to achieve the optimum of success under a multimedia environment. Luo [7] applied a comprehensive model of AHP (Analytic Hierarchy Process)-DEA (Data Envelopment Analysis)-FCE (Fuzzy Comprehensive Evaluation) to evaluate college English teaching quality by using 15 indicators as the exemplified analysis. Sun [8] applied Moodle-based blended learning to college English teaching and conducted an experimental study of 90 non-English majors within one semester in order to explore the effectiveness of Moodle-based blended learning. Sun [9] proposed modern educational technology to aide college English teaching design. Hu [10] applied principal component analysis to determine the factors affecting the quality of English teaching, and then established a comprehensive evaluation system. Yu [11] proposed an English teachers' classroom teaching ability system based on expert systems and the natural language recognition technology of artificial intelligence. Hu [12] proposed an ELM (Extreme Learning Machine) English writing competence evaluation model to conduct the comprehensive evaluation of its users' writing competence. Ma and Shi [13] adopted the visual interactive concept map method in order to solve the problem of students' poor thinking in English writing. Hu [14] proposed a new teaching model for the improvement of students' autonomous learning ability by research and a survey on a teaching model of college English in the environment of computer networks. Wang [15] proposed a method for computer-aided college English translation teaching. Ma [16] proposed a complete English teaching system based on visual simulation technology to solve the problem of the low utilization efficiency of English teaching resources and students' learning quality. Zhang [17] explored the advantages and disadvantages of the college English teaching pattern based on the state quo and problems of Chinese college English teaching from the view of inter-cultural communications. Zhao et al. [18] designed and practiced college English teaching based on cross-cultural foreign language education theory, systemic education theory, and multimedia-assisted English teaching theory. Wang et al. [19] proposed a quality evaluation index system for the classroom teaching of English as a foreign language.

The fuzzy comprehensive evaluation method is a comprehensive evaluation method based on fuzzy mathematics. This method transforms qualitative evaluation into quantitative evaluation according to the membership degree theory of fuzzy mathematics. It has the characteristics of clear results and strong systematicness, and can solve fuzzy and difficult-to-quantify problems. Additionally, it is suitable for solving various non-determining problems. Xu et al. [20] developed a comprehensive evaluating method based on integrating the Delphi approach, the analytic hierarchy process (AHP), the gray interconnect degree, and fuzzy evaluation to evaluate accurately complex systems. Ma et al. [21] proposed a fuzzy comprehensive evaluation method to quantify trust along with a trust quantification algorithm. Li et al. [22] established a fuzzy comprehensive evaluation

model for the energy-saving of public buildings, which is based on the basic principle of fuzzy mathematics from the viewpoint of a total life cycle. Zhu et al. [23] proposed an AHP-fuzzy comprehensive evaluation method based on a fuzzy comprehensive evaluation algorithm, combining a hierarchy analysis method for an optimal route choice model under an emergency. Wang et al. [24] proposed an AHP-FUZZY model by weight sets and a fuzzy evaluation matrix to evaluate enterprises' logistics outsourcing risks, including financial risk, information risk, market risk, and management risk. Fang et al. [25] proposed multi-hierarchy fuzzy comprehensive evaluation as a means to resolve city traffic problems. Shao et al. [26] proposed an improved entropy fuzzy comprehensive evaluation method for a management conflict innovation ideal solution. Chen et al. [27] proposed a fuzzy-ANP comprehensive evaluation model to construct an index system for food safety supervision information transparency.

As is known from the literature, these classroom teaching quality evaluation systems and methods can better evaluate classroom teaching quality. But there still exist some shortcomings in the actual applications. The evaluation system lacks discipline pertinence, the evaluation objective is not enough, and the evaluation methods are relatively simple. At the same time, in these methods there exists a complex calculation time or difficult determination weights. College English classroom teaching quality evaluation is a comprehensive concept, and is composed of many factors. These factors have their own properties, and are complicated and uncertain. They consist of a fuzzy set. A college English classroom teaching quality evaluation is a multi-level and multi-attribute decision problem for a complex system under a class of fuzzy environment. The fuzzy comprehensive evaluation method is a commonly used fuzzy multi-objective and multi-level evaluation method. It can comprehensively summarize the opinions of the evaluation factors, and comprehensively reflect the pros and cons of the respondents. The analytic hierarchy process method is a simple, flexible, and practical multi-level decision-making method. It takes on a high logicality, systematicness, conciseness, and practicability. In the comprehensive evaluation of college English classroom teaching quality, there is involved a great deal of complex phenomena and the interaction of many factors, and there are a lot of fuzzy phenomena and fuzzy concepts. Therefore, according to the characteristics of college English teaching, the fuzzy comprehensive evaluation method and analytic hierarchy process method are used to establish a multi-level fuzzy comprehensive evaluation model of a college English teaching evaluation system, which is further improved in order to improve its solving performance. The improved multi-level fuzzy comprehensive evaluation model can effectively avoid the difficultly of determining the problem of weights to a certain extent, and improve the calculated performance. The college English classroom teaching quality evaluation method based on an improved multi-level fuzzy comprehensive evaluation model provides a scientific evaluation method for evaluating the classroom teaching quality in colleges and universities.

The remainder of the paper is organized as follows. The analytic hierarchy process and fuzzy comprehensive evaluation method are introduced in Section 2. In Section 3, the improved multi-level fuzzy comprehensive evaluation method is described in detail. Section 4 establishes the evaluation index system of college English classroom teaching quality. In Section 5, an example of college English classroom teaching quality evaluation is introduced in detail. Finally, conclusions are offered and future research directions are discussed in Section 6.

2. Analytic Hierarchy Process and Fuzzy Comprehensive Evaluation Methods

2.1. Analytic Hierarchy Process Method

Analytic hierarchy process (AHP) is a simple and flexible method proposed by Professor Satty, an American operations research expert, in the early 1970s [28,29]. The advantage of AHP is that it combines qualitative evaluation and quantitative evaluation. It takes on a high logicality, systematicness, conciseness, and practicability. This method is an effective method for multi-level and multi-objective decision-making problems. According to the nature of the problem and the

achieved goal, the component factors of the problem are decomposed, and the hierarchical structure model is formed according to the relationship among the factors. Then, according to the hierarchy process, the important weights of the total goal are obtained. This method is used to determine the final comprehensive weights by comparing two by two, which can yield more objective and accurate results.

Assume that there is a certain planning decision objective u, and that the influencing factors are $V_i(i = 1, 2, 3, \cdots, n)$. Additionally, the important weights of the planning decision objectives for V_i are $w_i(i = 1, 2, 3, \cdots, n)$, respectively. There are $u = w_1V_1 + w_2V_2 + \cdots + w_nV_n$. Because the weights of the influencing factors V_i are different, the influence degrees of the factors V_i for the objective u are compared by using a two by two method, and all comparison results can be represented by one matrix A.

$$A = \begin{bmatrix} w_1/w_1 & w_1/w_2 & \cdots & w_1/w_n \\ w_2/w_1 & w_2/w_2 & \cdots & w_2/w_n \\ \cdots & \cdots & \cdots & \cdots \\ w_n/w_1 & w_n/w_2 & \cdots & w_n/w_n \end{bmatrix} \quad (1)$$

A is called the judgment matrix. If the judgment matrix A meets the consistency condition, the weights of the influencing factors $V_1, V_2, \cdots, V_n$ of the objective u are obtained by normalizing the obtained $w = (w_1, w_2, \cdots, w_n)^T$ on the eigenvalue problem $Aw = nw$.

The steps of the analytic hierarchy process method are described as follows [30].

(1) The AHP method is used to divide the indexes in the evaluation system to form an orderly hierarchical structure according to the dominant relation and subordinate relation in order to establish the index system framework and determine the component factors.

(2) Construct the comparison judgment matrix. The expert consultation method is used to determine the relative importance of all factors in the same level according to the 1–9 scale method in order to construct the judgment matrix.

(3) Calculate the relative weights of the comparison factors by using the judgment matrix.

$$W = (w_1, w_2, \cdots, w_n) \quad (2)$$

Then, the consistency test of the judgment matrix is executed, and the consistency index is calculated.

(4) Obtain the comprehensive score of each level according to the relative weights and the score of each factor. Then, the evaluation is executed according to the comprehensive score.

2.2. Fuzzy Comprehensive Evaluation Method

The fuzzy comprehensive evaluation method is used to construct the fuzzy judgment matrix based on the rank standards and weights of the determined evaluation factors by using the principles of the fuzzy linear transform and the maximum membership degree [31,32]. This method uses a multi-level compound operation to ultimately determine the grade of the evaluation object. Because college English classroom teaching is a complicated process of information exchange between teachers and students, it takes on the characteristics of many factors, including fuzzy type, delay, and dynamics. Therefore, the fuzzy comprehensive evaluation method is selected to study college English classroom teaching quality. The fuzzy comprehensive evaluation method has two models: a single-level model and a multi-level model of fuzzy comprehensive evaluation.

2.2.1. Single-Level Fuzzy Comprehensive Evaluation Model

The fuzzy comprehensive evaluation model is composed of the index set U, the evaluation set V, and the judgment matrix R. The steps of the single-level model of comprehensive evaluation are described as follows.

(1) Determine the evaluation index set

$$U = \{u_1, u_2, \cdots, u_m\}. \tag{3}$$

Here, $u_i (i = 1, 2, 3, \cdots, m)$ is the evaluation index of the same level.

(2) Determine the evaluation results set

$$V = \{v_1, v_2, \cdots, v_n\}. \tag{4}$$

Here, $v_j (j = 1, 2, 3, \cdots, n)$ is the evaluation result, and n is the number ofgrades. This set specifies the selection range of the evaluation results for one evaluation factor. The grades of the result set can be a qualitative value or a quantifiable value.

(3) Determine the weight vector

$$W = (w_1, w_2, \cdots, w_n). \tag{5}$$

Here, $w_i (i = 1, 2, 3, \cdots, n)$ indicates the importance degree of index u_i. It is the weight which meets $\sum_{i=1}^{n} w_i = 1$ $(0 \leq w_i \leq 1)$.

(4) Determine the membership matrix

Assume that the evaluation index u_i is evaluated in order to obtain a fuzzy vector $R_i = (r_{i1}, r_{i2}, \cdots, r_{im}\}$ for the relative evaluation set V. r_{ij} is the degree of v_j for the index u_i, and $0 \leq r_{ij} \leq 1$. If the number of the indexes(n) is evaluated, then the matrix R with m rows and n columns is obtained, which is called the membership matrix. In this matrix, each row is an evaluation result for each index, and the whole matrix contains all the information obtained by the evaluation result set V for the evaluation index set U.

(5) Fuzzy comprehensive evaluation

The fuzzy composition of the weight vector and the membership matrix is used to obtain the fuzzy evaluation result.

$$B = W \circ R = [w_1, w_2, \cdots, w_m] \circ \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{bmatrix} = (b_1, b_2, \cdots, b_m) \tag{6}$$

where $\circ$ in the expression is the generalized fuzzy composition operator.

$$b_j = \sum_{i=1}^{n} w_i r_{ij} (j = 1, 2, 3 \cdots, m) \tag{7}$$

Therefore, the general process of the single-level model of fuzzy comprehensive evaluation is shown in Figure 1.

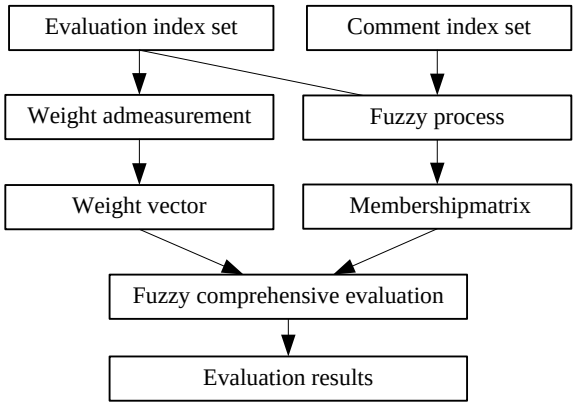

Figure 1. The general process of the single-level model of fuzzy comprehensive evaluation.

2.2.2. Multi-Level Fuzzy Comprehensive Evaluation Model

The multi-level fuzzy comprehensive evaluation model is appropriate if a complex system evaluation must consider many factors, and each factor also often includes a number of levels. That is to say, these factors often are determined by several factors. The fuzzy comprehensive evaluation method is a commonly used fuzzy multi-objective and multi-level evaluation method. It can comprehensively summarize the opinions of the evaluation factors, and comprehensively reflect the pros and cons of the respondents. The analytic hierarchy process method is a simple, flexible, and practical multi-level decision-making method. It takes on a high logicality, systematicness, conciseness, and practicability. Therefore, the fuzzy comprehensive evaluation method and analytic hierarchy process method are combined to construct a multi-level fuzzy comprehensive evaluation model in this paper. For the comprehensive evaluation method of a multi-factor and multi-level system, firstly, all factors of the lowest level are comprehensively evaluated, then all factors of the above level are comprehensively evaluated. The method then turns to the next level to be comprehensively evaluated until the highest level in order to obtain the total comprehensive evaluation result. This process is called the multi-level model of fuzzy comprehensive evaluation. The steps of multi-level model of comprehensive evaluation are described as follows.

(1) According to the single-level comprehensive evaluation model, the comprehensive evaluation result of the objective B_{ij} is obtained. i indicates the i level, and j indicates the j sub-objective in the same level.

(2) Construct new fuzzy matrix R_i

$$R_i = \begin{bmatrix} B_{i1} \\ B_{i2} \\ \cdots \\ B_{il} \end{bmatrix} = \begin{bmatrix} b_{i11} & b_{i12} & \cdots & b_{i1m} \\ b_{i21} & b_{i22} & \cdots & b_{i2m} \\ \cdots & \cdots & \cdots & \cdots \\ b_{il1} & b_{il2} & \cdots & b_{ilm} \end{bmatrix} \tag{8}$$

where l indicates the number of sub-objectives in the i level.

(3) Single-level comprehensive evaluation

The weight set of the sub-objective in the i level is given as follows.

$$W_i = (w_{i1}, w_{i2}, \cdots, w_{il}) \tag{9}$$

(4) Fuzzy comprehensive evaluation

The fuzzy composition of the weight vector and the membership matrix are used to obtain the fuzzy evaluation result.

$$B_i = W_i \circ R_i = [w_{i1}, w_{i2}, \cdots, w_{im}] \circ \begin{bmatrix} b_{i11} & b_{i12} & \cdots & b_{i1m} \\ b_{i21} & b_{i22} & \cdots & b_{i2m} \\ \cdots & \cdots & \cdots & \cdots \\ b_{il1} & b_{il2} & \cdots & b_{ilm} \end{bmatrix} = (b_{i,1}, b_{i,2}, \cdots, b_{i,m}) \quad (10)$$

(5) Fuzzy comprehensive evaluation of the objective

The evaluation is executed from the lower level to the next level in order to obtain the fuzzy comprehensive evaluation result of the objective.

$$B_i = (b_{0,1}, b_{0,2}, \cdots, b_{0,m}) \quad (11)$$

3. An Improved Multi-Level Fuzzy Comprehensive Evaluation Method

In the multi-level fuzzy comprehensive evaluation model, on the one hand, when the experts determine the weights $W = (w_1, w_2, \cdots, w_n)$, they always have personal preferences, expectations, and other information. In addition, the difficulty degree in determining the weight of each index is different. In addition, if the composition operation selection is not appropriate for the expression (6), the evaluation result will fail or be inaccurate. So, the idea of the weighted mean deviation method of the maximum membership degree is used to improve the multi-level fuzzy comprehensive evaluation model in order to improve its solving performance and obtain the improved multi-level fuzzy comprehensive evaluation model. The evaluation steps of the proposed model are described as follows.

(1) Determine the index set of evaluation objective $U = \{u_1, u_2, \cdots, u_m\}$.
(2) Determine the evaluation results set $V = \{v_1, v_2, \cdots, v_n\}$.
(3) Construct the evaluation matrix of single-level index on the next level R_i

$$R_i = \begin{bmatrix} r_{i11} & r_{i12} & \cdots & r_{i1p} \\ r_{i21} & r_{i22} & \cdots & r_{i2p} \\ \cdots & \cdots & \cdots & \cdots \\ r_{im1} & r_{im2} & \cdots & r_{imp} \end{bmatrix}. \quad (12)$$

(4) Construct the weight set

The following expression is used to obtained the weights.

$$W_i = (w_{i1}, w_{i2}, \cdots, w_{im}), \sum_{i=1}^{m} w_i = 1 (w_i \geq 0) \quad (13)$$

The determination of the weight sets is difficult in different situations. For the weights that are difficult to determine, how to obtain a more objective and accurate weight set is very critical and important. Therefore, the weighted mean deviation method of the maximum membership degree is used to solve the unknown index weights. The weights of all factors are computed by using the following expression [33].

$$w_{ij} = \sum_{k=1}^{n} (g_{ij} - r_{ijk}) / \sum_{i=1}^{m} \sum_{k=1}^{n} (g_{ij} - r_{ijk}) \quad (14)$$

where, $g_{ij} = r_{ij1} \vee r_{ij2} \vee \cdots \vee r_{ijp}, i = 1, 2, \cdots, m, \vee$ indicates the fuzzy union operator.

(5) Fuzzy comprehensive evaluation of the sub-level

$$B_i = W_i \circ R_i = [w_{i1}, w_{i2}, \cdots, w_{im}] \circ \begin{bmatrix} b_{i11} & b_{i12} & \cdots & b_{i1p} \\ b_{i21} & b_{i22} & \cdots & b_{i2p} \\ \cdots & \cdots & \cdots & \cdots \\ b_{im1} & b_{im2} & \cdots & b_{imp} \end{bmatrix} = (b_{i1}, b_{i2}, \cdots, b_{ip}). \quad (15)$$

(6) Fuzzy comprehensive evaluation of the level

According to the fuzzy comprehensive evaluation result of the sub-objective, the fuzzy matrix of the upper level is constructed as follows:

$$R = \begin{bmatrix} B_1 \\ B_2 \\ \cdots \\ B_n \end{bmatrix}. \quad (16)$$

(7) Obtain fuzzy comprehensive evaluation value

The double weight method is used to transform the fuzzy comprehensive evaluation result into the corresponding fuzzy comprehensive evaluation value. The j evaluation is composed of the new weight c_j in order to obtain a new weight set $C = (c_1, c_2, \cdots, c_p)$. The fuzzy comprehensive evaluation value is obtained by using the following expression:

$$S = C \circ BT = \sum_{j=1}^{p} c_j b_j. \quad (17)$$

4. The Evaluation Index System of College English Classroom Teaching Quality

The college English classroom teaching quality evaluation indexes are to evaluate the classroom teaching ability, process and effect of teachers, so as to guide teachers to improve classroom teaching work and the classroom teaching quality. In the college English classroom teaching, it involves a great deal of complex phenomena and interaction of many factors, and there are a lot of fuzzy phenomena and fuzzy concepts. Therefore, the evaluation index system of college English classroom teaching quality is directly related to the development of college English teaching evaluation. A reasonable and effective college English classroom teaching quality evaluation index system is only developed, in order to truly make an overall analysis of college English classroom teaching level and teaching effect, which has the certain difficulty and challenge.

4.1.Evaluation Index Construction Principle of College English Classroom Teaching Quality

The evaluation indexes of college English classroom teaching quality are constructed according to the following principles:

(1) Scientific principle

Science refers to the correct and standard degree of knowledge in college English classroom teaching. The degree of mastering and confirming knowledge mainly depends on the degree of imparting and explaining knowledge in college English classroom teaching. Therefore, teachers should adhere to the scientific attitude of seeking truth from facts. In addition, the taught knowledge should be scientific and standard knowledge in order to ensure that the taught knowledge accepted by students is objective and standard knowledge.

(2) Technical principle

Technique refers to the teaching skill to creatively accomplish teaching tasks based on combining students with the actual classroom situation in the teaching process. The specific contents of the technology include language expression ability, organization and management ability, keen observation ability, and the flexible handling of unexpected events.

(3) Effectiveness principle

Effectiveness refers to the mastering degree of the taught contents for students in the teaching process. It directly reflects the acceptance and internalization degree of the teaching content for students. It includes the mastering degree of knowledge and skills, and a relevant knowledge application ability.

(4) Creativity principle

Creativity refers to creatively teaching the teaching content, duly teaching the learning actuality of the teaching content, and introducing or guiding their research. Creativity requires novelty and the integrity of the teaching content. At the same time, it should pay attention to whether the teaching method is suitable for the characteristics of the students, and whether it will help the students to cultivate their creative ability.

The four principles restrict each other and together affect teaching quality. If the classroom teaching quality can be objectively evaluated, the four principles must be evaluated. Advantages and disadvantages are put forward in the evaluation process in order to more effectively avoid weaknesses, release early and iterate, and quickly improve teaching ability. The goal is to ensure the high reliability and efficiency of a college English teaching quality evaluation.

4.1. Quality Evaluation Index System of College English Classroom Teaching

College English is regarded as a tool subject, which has obvious practical and applied characteristics. The overall goal of college English education is to train a comprehensive language ability in students, and the students' learning and mastering conditions are the basic starting point and the ultimate goal of evaluating classroom teaching. Moreover, the key of college English classroom teaching evaluation is whether the teachers pay attention to the development of subjectivity, warm up the enthusiasm of language learning, and inspire thinking and learning interest for students in the classroom. Therefore, a college English classroom teaching evaluation should fully reflect its disciplinary characteristics. Based on the existing references for quality evaluation indexes of college English classroom teaching [34–36], according to the actual teaching purposes, training objectives, and the opinions of students in Dalian Jiaotong University, teachers and experts are integrated in order to propose a quality evaluation index system of college English classroom teaching in Table 1.

Table 1. The quality evaluation index system of college English classroom teaching.

Content	First-Level Index	Second-Level Index
The evaluation index system of college English classroom teaching quality (U)	Teaching attitudes (u_1)	Clear course teaching plan, fully prepared lessons (u_{11}) Strict teaching and requirements (u_{12}) Finish class on time and never adjust (stop) class (u_{13}) Earnestly and promptly correct homework (u_{14}) Often tutor and communicate with students (u_{15})
	Teaching contents (u_2)	Rich teaching content and the right viewpoint (u_{21}) Mastering books, exact concepts, and clear principles (u_{22}) Highlight key points, in appropriate detail, and at the proper difficulty (u_{23}) Absorb new ideas, new achievements, and new techniques to update teaching contents (u_{24}) Integrating theory with practice, communication learning, and research methods (u_{25})

Table 1. *Cont.*

Content	First-Level Index	Second-Level Index
The evaluation index system of college English classroom teaching quality (U)	Teaching methods (u_3)	Strictly organize teaching, and pay attention to teaching students in accordance with their aptitude (u_{31}) Diversified teaching methods and means (u_{32}) Moderate teaching schedule, reasonable classroom time (u_{33}) Organize teaching in English, accurate and vivid oral English teaching, fluent reading (u_{34}) Encourage students to ask questions and personal views and discuss these with them (u_{35}) Clear and vivid language, neat writing on the blackboard (u_{36})
	Teaching effectiveness (u_4)	Accurately master the basic theoretical knowledge of the course (u_{41}) Improve the pronunciation and intonation standards (u_{42}) Improve the ability of understanding and solving related problems (u_{43}) Promote positive thinking and inspiration to students (u_{44})

5. An Example of a College English Classroom Teaching Quality Evaluation

The college English classroom teaching case in Dalian Jiaotong University is selected as study objective in order to verify the effectiveness of the proposed college English classroom teaching quality evaluation method. A detailed description is given as follows.

5.1. Determine the Evaluation Index Set

As shown in Table 1, the first-level evaluation indexes are $U = \{u_1, u_2, u_3, u_4\}$ = {Teaching attitude, Teaching content, Teaching method, Teaching effectiveness}. The second-level evaluation indexes are $U_i = \{u_{i1}, u_{i2}, u_{i3}, u_{i4}\}$.

5.2. Establish Evaluation Sets

The evaluation set is used to directly describe the evaluation results of college English classroom teaching quality for teachers. In general, the evaluation results can be divided into five grades, as $V = \{v_1, v_2, u_3, v_4, v_5\}$ = {Excellent, Good, Medium, Pass, Fail}. According to the college English classroom teaching condition, 20 experts from Dalian Jiaotong University are hired to comprehensively evaluate the college English classroom teaching quality for teachers in order to establish the college English classroom teaching quality evaluation set. These experts include 10 provincial master teachers, 5professors with oriented teaching, and 5teaching leaderships of institutes. The evaluation results for each grade percentage are shown Table 2.

5.3. Establish Evaluation Matrix

The second-level indexes of teaching attitudes (u_1) are selected as an example in order to study and establish the evaluation matrix.

$$R_1 = \begin{bmatrix} 0.6 & 0.2 & 0.1 & 0.1 & 0 \\ 0.7 & 0.1 & 0.1 & 0.1 & 0 \\ 0.5 & 0.1 & 0.2 & 0.1 & 0.1 \\ 0.4 & 0.3 & 0.3 & 0 & 0 \\ 0.6 & 0.3 & 0 & 0.1 & 0 \end{bmatrix}$$

Table 2. The evaluation results for each grade percentage.

First-Level Index	Second-Level Index	The Evaluation Results				
		Excellent	**Good**	**Medium**	**Pass**	**Fail**
Teaching attitudes (u_1)	u_{11}	0.6	0.2	0.1	0.1	0
	u_{12}	0.7	0.1	0.1	0.1	0
	u_{13}	0.5	0.1	0.2	0.1	0.10
	u_{14}	0.4	0.3	0.3	0	0
	u_{15}	0.6	0.3	0	0.1	0
Teaching contents (u_2)	u_{21}	0.6	0.1	0.1	0	0.2
	u_{22}	0.2	0.5	0.2	0.1	0
	u_{23}	0.2	0.6	0.1	0	0.1
	u_{24}	0.2	0.4	0.1	0.2	0.1
	u_{25}	0.6	0.1	0.1	0.1	0.1
Teaching methods (u_3)	u_{31}	0.4	0.4	0	0.1	0.1
	u_{32}	0.6	0.3	0.1	0	0
	u_{33}	0.6	0.1	0.1	0.1	0.1
	u_{34}	0.7	0.1	0.1	0.1	0
	u_{35}	0.8	0.1	0.1	0	0
	u_{36}	0.7	0.1	0	0.1	0.1
Teaching effectiveness (u_4)	u_{41}	0.4	0.2	0.2	0.2	0
	u_{42}	0.4	0.3	0.1	0.1	0.1
	u_{43}	0.5	0.2	0.1	0.1	0.1
	u_{44}	0.6	0.2	0.2	0.2	0

5.4. Comprehensively Evaluate the College English Classroom Teaching Quality

(1) Calculate the weights

According to the important degree of each factor in each level, the corresponding weights are assigned and calculated. In the fuzzy comprehensive evaluation method, the weight is very important, and it directly affects the comprehensive evaluation results. There are many methods to determine the weights, such as the Delphi (expert evaluation method), the expert survey method, the comparison matrix method, the fuzzy consistent judgment matrix method, the fuzzy priority matrix method, and so on. In the college English classroom teaching quality evaluation, the fuzzy consistent judgment matrix method is selected to determine the weights of the factors, which can eliminate the influence of subjective factors to the greatest extent. The obtained weights are more objective, and more coincident with the actual situation. So, the weighted mean deviation method of the maximum membership degree (expression (14)) is used to obtain the corresponding weights of teaching attitudes (u_1).

$$A_1 = (0.2222\ 0.2778\ 0.1667\ 0.1111\ 0.2222)$$

(2) The expression (15) is used to obtain the corresponding evaluation results, as follows.

$$B_1 = (0.5889\ 0.1889\ 0.1167\ 0.0889\ 0.0167)$$

The corresponding evaluation results of teaching content (u_2), teaching methods, and teaching effectiveness are obtained as follows.

$$B_2 = (0.3882\ 0.3235\ 0.1176\ 0.0647\ 0.1059)$$

$$B_3 = (0.6692\ 0.1538\ 0.0731\ 0.0615\ 0.0423)$$

$$B_4 = (0.5000\ 0.2182\ 0.1545\ 0.0818\ 0.0455)$$

(3) According to the obtained comprehensive evaluation results of the sub-objectives, the first-level fuzzy matrix is constructed.

$$R = \begin{bmatrix} B_1 \\ B_2 \\ B_3 \\ B_4 \end{bmatrix} = \begin{bmatrix} 0.5889 & 0.1889 & 0.1167 & 0.0889 & 0.0167 \\ 0.3882 & 0.3235 & 0.1176 & 0.0647 & 0.1059 \\ 0.6692 & 0.1538 & 0.0731 & 0.0615 & 0.0423 \\ 0.5000 & 0.2182 & 0.1545 & 0.0818 & 0.0455 \end{bmatrix}$$

(4) The final evaluation result of college English classroom teaching quality can be obtained as follows.

$$B = (0.5690\ 0.2020\ 0.1101\ 0.0744\ 0.0445)$$

(5) The comprehensive evaluation value is obtained by using the double weight method.

In order to make full use of the comprehensive evaluation information, a percentage system is used to give each evaluation grade. According to the opinions of the experts, the following values are given. $V_1(\text{Excellent}) - 90 \sim 100$, $V_2(\text{Good}) - 80 \sim 89$, $V_3(\text{Medium}) - 70 \sim 79$, $V_4(\text{Pass}) - 60 \sim 69$, $V_5(\text{Fail}) - 0 \sim 59$.

The percentages of 95, 85, 75, 65, and 30% are selected respectively to represent Excellent, Good, Medium, Pass, and Fail. So, the comprehensive scores of college English classroom teaching quality for a teacher are calculated and obtained as follows.

$$S = (95\ 85\ 75\ 65\ 30) \begin{pmatrix} 0.5690 \\ 0.2020 \\ 0.1101 \\ 0.0744 \\ 0.0445 \end{pmatrix} = 85.65$$

The comprehensive score is 85.65, which is in the range of the grade V_2. So the college English classroom teaching quality of the teacher is evaluated as Good.

In order to further understand the evaluation information of each factor in the first-level index, the evaluation results are shown in Table 3 according to the above calculation results.

Table 3. Result of appraisal.

First-Level Index	Score	Grade	First-Level Index	Score	Grade
Teaching attitude	87.03	Good	Teaching method	87.44	Good
Teaching content	80.57	Good	Teaching effectiveness	84.32	Good

As can be seen from the Table 3, the evaluation grades of teaching attitude, teaching content, teaching methods, and teaching effectiveness of college English classroom teaching for the teacher are Good. The results show that the teacher is balanced in all aspects of classroom teaching attitude, teaching content, teaching methods, and teaching effectiveness. In addition, the evaluation information of each factor in the first-level index can more accurately evaluate the college English classroom teaching level. At the same time, the teacher can also evaluate and analyze his (her) teaching behaviors so as to improve themselves and promote self-improvement.

5.5. Performance Comparison and Analysis

In order to demonstrate the effectiveness of the improved multi-level fuzzy comprehensive evaluation method, the multi-level fuzzy comprehensive evaluation method, the fuzzy comprehensive evaluation method, and the analytic hierarchy process are selected for the evaluation of college English

classroom teaching quality in this paper. The first-level index score, comprehensive score, and running time are selected as performance comparison and analysis indexes. The calculation and comparison results are shown in Table 4.

Table 4. The calculation and comparison results.

Methods	First-Level Index Score	Comprehensive Score	Running Time (s)
The fuzzy comprehensive evaluation method	89.14 78.45 88.29 81.07	84.15	23.238
The analytic hierarchy process method	88.23 77.37 88.04 81.53	84.87	21.439
The multi-level fuzzy comprehensive evaluation method	87.59 79.82 88.03 84.15	85.31	17.512
The improved multi-level fuzzy comprehensive evaluation method	87.03 80.57 87.44 84.32	85.65	15.047

As can be seen from the Table 4, the comprehensive scores of the improved multi-level fuzzy comprehensive evaluation method, the multi-level fuzzy comprehensive evaluation method, the fuzzy comprehensive evaluation method, and the analytic hierarchy process method are 85.65, 85.31, 84.15, and 84.47,respectively. The running times of the improved multi-level fuzzy comprehensive evaluation method, the multi-level fuzzy comprehensive evaluation method, the fuzzy comprehensive evaluation method, and the analytic hierarchy process are 15.047s, 17.512s, 23.238s, and 21.439s, respectively. The results show that the running time of the improved multi-level fuzzy comprehensive evaluation method (15.047s) is less than the running times of the multi-level fuzzy comprehensive evaluation method, the fuzzy comprehensive evaluation method, and the analytic hierarchy process method. That is to say, the computational efficiency of the improved multi-level fuzzy comprehensive evaluation method is the highest. The variance of the first-level index score of the improved multi-level fuzzy comprehensive evaluation method is least among the four methods. It shows that the first-level indexes of the improved multi-level fuzzy comprehensive evaluation method are more stable. By the performance comparison and analysis, the improved multi-level fuzzy comprehensive evaluation method is a better method for evaluating college English classroom teaching quality. It takes on a higher computational efficiency and better stability.

6. Conclusions

The college English classroom teaching quality evaluation is based on college English teaching's purpose and its teaching principles, and uses feasible technology to evaluate the college English classroom teaching process and determine the effect on the value, which undoubtedly takes on an important function for evaluation and guidance in college English teaching. The fuzzy comprehensive evaluation method is a commonly used method for dealing with multi-index and fuzzy problems. The analytic hierarchy process method is a simple, flexible, and practical multi-level decision-making method. It takes on a high logicality, systematicness, conciseness, and practicability. Therefore, the fuzzy comprehensive evaluation method and the analytic hierarchy process method were applied to college English classroom teaching quality evaluation, which has very strong practical significance. In this paper, a scientific and reasonable quality evaluation index system of college English classroom

teaching is constructed for compensating for the one-sided subjectivity and resulting imprecision of the traditional classroom teaching quality evaluation method. Additionally, an improved multi-level fuzzy comprehensive evaluation model based on making full use of the fuzzy comprehensive evaluation method and the analytic hierarchy process method is proposed to obtain a new college English classroom teaching quality evaluation method. Finally, an actual case of college English classroom teaching in Dalian Jiaotong University is used to verify the effectiveness of the improved multi-level fuzzy comprehensive evaluation model and the college English classroom teaching quality evaluation method. The results show that the proposed method can overcome the subjectivity and randomness shortcomings of the traditional classroom teaching quality evaluation methods, avoid the subjectivity and unilateralism in the traditional evaluation, and improve the reliability, accuracy, and objectivity of a fuzzy comprehensive evaluation. It provides an effective method for evaluating college English classroom teaching quality.

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