Quality Evaluation of College English Classroom Teaching Based on Fuzzy Comprehensive Evaluation

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Abstract: English teaching aim and teaching principle are the basis and starting point of English classroom teaching quality evaluation. Feasible evaluation technology supports the English classroom teaching process and effects. According to the features of classroom teaching, this paper establishes a hierarchical teaching quality evaluation index model and gives a comprehensive evaluation to college English classroom teaching quality with the method of fuzzy comprehensive evaluation. The application shows that this method reduces the interference of fuzzy factors in evaluation and makes the result more reasonable.

Introduction
Scientific classroom teaching quality evaluation is an important issue in educational evaluation. In order to improve classroom teaching quality, higher institutions lay down an evaluation system of classroom teaching quality, which rates teaching of teachers according to the evaluation indexes by their students [1-3]. Dean’s office organizes this evaluation at the end of semester, collects data from students and rates teachers’ classroom teaching performances in this semester. A scientific evaluation system guides evaluators to work towards a specific goal, provides feedbacks to teachers, understands their own teaching on time and adjusts teaching plans and methods according to the feedbacks [4].

English teaching has its own features, while the quality evaluation of English classroom teaching is of great importance in English teaching evaluation. English teaching aim and teaching principle are basis and starting point of English classroom teaching quality evaluation [5]. Feasible evaluation technology supports the English classroom teaching process and effects, which undoubtedly has an important functional evaluation and guiding value [6, 7]. However, there are some problems in the evaluation of college English classroom teaching in China, (1) the evaluation results are influenced by some personal factors. Because the teachers’ performance in teaching process are different from the personal preferences of evaluators, which has a bad influence on the evaluation results. (2)In evaluation system, indexes are described by natural language and understood by evaluators with their own understandings. Moreover, the choices of different evaluation indexes are shown by grades, so that the result with such a strong fuzziness will produce a great deviation in the quantification process. (3) The evaluation results are generally calculated by weighted average method which divides related indexes rigidly and differs with the actual results. Fuzzy comprehensive evaluation method is a common method processing multi-indexes and fuzzy problems. In order to offer a new idea of English classroom teaching evaluation method and find an easy and accessible method, this paper applies fuzzy comprehensive evaluation to college English classroom teaching quality evaluation, which can solve the problems in evaluation to some extent.

Fuzzy Comprehensive Evaluation Method
The fuzzy comprehensive evaluation is an effective multi-factor comprehensive evaluation decision method, it can make the comprehensive evaluation for the things affected by many factors, so the fuzzy comprehensive evaluation is also named as fuzzy comprehensive decision or fuzzy multi-factor decision. The main steps of fuzzy comprehensive evaluation are as follows:
1. Determine the evaluation indicator set: \( U=\{u_1, u_2, \ldots, u_m\} \), \( u_i \) (\( i=1, 2, \ldots, m \)) is the evaluation
indicators at the same level. The evaluation indicators can be divided into multi-level, the level of indicators is determined by the complexity of the problem.

2. Determine the evaluation result set: \( V = \{v_1, v_2, \ldots, v_n\} \), \( v_j, j=1,2,\ldots,n \) is the evaluation result, \( n \) is the number of element. The set defines the selection range of evaluation results of some evaluation factor, and the elements in the result set can be qualitative or quantitative.

3. Determine the weight vector: \( W=(w_1, w_2, \ldots, w_m) \), \( w_i \) (i =1,2,….m) is the weight of \( u_i \), which meet \( \sum_{i=1}^{m} w_i = 1 \).

4. Determine the membership matrix: suppose makes an evaluation for the ith evaluation indicator \( u_i \) and obtains a module vector \( R_i = (r_{i1}, r_{i2}, \ldots, r_{im}) \) for comment set \( V \), \( r_{ij} \) is the degree of indicator \( u_i \) has \( v_j \), \( 0 \leq r_{ij} \leq 1 \). If \( m \) indexes are made comprehensive evaluation, the result is a matrix \( R \) which has \( m \) rows and \( n \) columns, it is named as membership matrix. Each row in the matrix is the evaluation result of each index, and the whole matrix contains all the information obtained by the evaluation of the evaluation index set \( U \) according to the evaluation result set \( V \).

5. Fuzzy evaluation
Fuzzy synthesis of weight vector and membership matrix can obtain the result of fuzzy evaluation, such as

\[
B = W \ast R = [w_1, w_2, \ldots, w_m] \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{bmatrix} = (b_1, b_2, \ldots, b_n).
\]

If the index is multi-level, the steps 3-5 are repeated.

Construct Teaching Quality Evaluation Index Model

The indexes of classroom teaching evaluation include teaching content, teaching method, teaching ability and teaching effect, etc.

1)Teaching content: teaching content is a basic index of teaching evaluation. When organizing and arranging teaching content, teachers should focus on teaching objectives and show the unification of knowledge teaching and ability development in teaching process. The specific index and content include the correctness of knowledge, the comprehensiveness of knowledge, the definition of objectives and the close integration with reality.

2)Teaching method: reasonable and effective teaching method is beneficial to achieve teaching objectives and smooth implementation of teaching content. It is also helpful to cultivate students’ various abilities and good personal quality and inspire students to think the way of learning. The specific index is the diversity of teaching means and the flexibility of teaching method.

3)Teaching ability: the concept of teaching ability is very wide, but from the perspective of classroom teaching, it includes teaching basic skills of teacher, method of motivating students and ability of organization and random strain in teaching.

4)Teaching effect: Teaching effect can be evaluated by the achievement of teaching objectives and completion of teaching process and embodied by the progress of students and classroom atmosphere.

According to the evaluation object, evaluator can create indexes. Because of various evaluation factors, indexes can be categorized and combined to a hierarchical structure. After analyzing classroom teaching quality evaluation, the hierarchical structure of evaluation index system and evaluation object can be established. Grade I indexes of the evaluation in classroom teaching quality include teaching attitude, teaching content, teaching method and teaching effect, etc. Every grade I index contains various grade II indexes. Table 1 is the evaluation indexes system of classroom teaching quality from students. Index es in the table show comprehensive integrity and relative independence, then \( C_2 = C_{21} + C_{22} + C_{23} + C_{24} \), \( C_{2i} \cap C_{2j}(i \neq j) = \emptyset \), grade I index is \( C_2 = \{C_{2i1}, C_{2i2}, \ldots, C_{2i4}\} \).
Table 1. Evaluation indexes system.

| Evaluation Content                                      | Grade I index                                                                 | Grade II index                                                                 |
|---------------------------------------------------------|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| Students’ Evaluation                                    |                                                                               |                                                                               |
| C2                                                      | Evaluation Content                                                           | Evaluation Content                                                           |
| C21                                                     | Rich content, correct viewpoint(C211)                                         | Emphasize highlight, reasonably detailed, moderate difficulty(C212)          |
| C22                                                     | Specific teaching plan, full preparation(C221)                                | Serious teaching, strict requirement(C222)                                    |
| C23                                                     | Diversification of means(C231)                                                | Teach students according to their aptitude(C232)                              |
| C24                                                     | Improve the interest in learning(C241)                                        | Promote self-study, inspire students(C242)                                   |
| Students’ Evaluation                                    | Rich content, correct viewpoint(C211)                                         | Emphasize highlight, reasonably detailed, moderate difficulty(C212)          |
| C2                                                      | Evaluation Content                                                           | Evaluation Content                                                           |
| C21                                                     | Specific teaching plan, full preparation(C221)                                | Serious teaching, strict requirement(C222)                                    |
| C22                                                     | Specific teaching plan, full preparation(C221)                                | Serious teaching, strict requirement(C222)                                    |
| C23                                                     | Diversification of means(C231)                                                | Teach students according to their aptitude(C232)                              |
| C24                                                     | Improve the interest in learning(C241)                                        | Promote self-study, inspire students(C242)                                   |

Comprehensive Fuzzy Evaluation of Classroom Teaching

Construct the Evaluation Factor Set, the Comment Set, the Numerical Set and the Weight Set

1. Construct the evaluation factor set of indicators
   \( C_{21} = \{ C_{211}, C_{212}, C_{213}, C_{214} \} \), \( C_{22} = \{ C_{221}, C_{222}, C_{223}, C_{224} \} \), \( C_{23} = \{ C_{231}, C_{232}, C_{233}, C_{234} \} \), \( C_{24} = \{ C_{241}, C_{242}, C_{243}, C_{244} \} \);

2. Construct the comment set:
   \( V = \{ V_1, V_2, V_3, V_4, V_5 \} = \{ \text{very excellent, excellent, good, medium, need to be strengthened} \} \), The numerical set which is corresponding to the comment set is \( N = \{ N_1, N_2, N_3, N_4, N_5 \} \).

3. Construct the weight indicators at all levels for the student evaluation by using the AHP method as following:
   \( W_{21} = \{ 0.57, 0.11, 0.25, 0.07 \} \), \( W_{22} = \{ 0.45, 0.11, 0.28, 0.16 \} \), \( W_{23} = \{ 0.56, 0.27, 0.09, 0.08 \} \),
   \( W_{24} = \{ 0.14, 0.23, 0.49, 0.14 \} \), \( W_{2} = \{ 0.38, 0.38, 0.12, 0.12 \} \);

Construct the Membership Matrix

The membership matrix is \( R = \{ r_{ij} \} \), \( R_i \) is the membership for \( v_1, v_2, \ldots, v_m \) which are in the comment set corresponding to \( i^{th} \) index in the evaluation factor, so \( r_{ij} = \frac{\text{the number of person whose the } j^{th} \text{ indicator choose } v_i \text{ level}}{\text{the total number of person who participate in the evaluation}} \), where \( j = (1, 2, \ldots, m) \). We use the form of questionnaire, and invite 400 students in our college to make evaluation for some teacher’s teaching quality, the evaluation results are shown as table 2, the numerical in the table means the number of person who choose the corresponding option.

The subordinate subset of teaching content can be firstly constructed from table 2:
$R_{211} = \{0.5,0.3,0.1,0.075,0.025\}$, $R_{212} = \{0.45,0.25,0.2,0.1,0\}$, $R_{213} = \{0.6,0.3,0.1,0,0\}$, $R_{214} = \{0.375,0.525,0.1,0,0\}$

So the membership matrix of teaching content in student evaluation is obtained:

$$R_{21} = \begin{bmatrix}
0.5 & 0.3 & 0.1 & 0.075 & 0.025 \\
0.45 & 0.25 & 0.2 & 0.1 & 0 \\
0.6 & 0.3 & 0.1 & 0 & 0 \\
0.375 & 0.525 & 0.1 & 0 & 0
\end{bmatrix}$$

Table 2. Evaluation results.

| Students’ Evaluation $C_2$ | Evaluation Content | $V_1$ | $V_2$ | $V_3$ | $V_4$ | $V_5$ |
|--------------------------|--------------------|-------|-------|-------|-------|-------|
| grade I index            | grade II index     |       |       |       |       |       |
| Teaching Content($C_{21}$) | Rich content, correct viewpoint($C_{211}$) | 200   | 12    | 40    | 30    | 10    |
|                          | Emphasize highlight, reasonably detailed, moderate difficulty($C_{212}$) | 180   | 10    | 80    | 40    | 0     |
|                          | Link theory with practice, teach methods of study and research($C_{213}$) | 240   | 12    | 40    | 0     | 0     |
|                          | Combine the development of discipline, introduce the latest achievement($C_{214}$) | 150   | 21    | 40    | 0     | 0     |
| Teaching Attitude($C_{22}$) | Specific teaching plan, full preparation($C_{221}$) | 130   | 21    | 50    | 5     | 5     |
|                          | Serious teaching, strict requirement($C_{222}$) | 100   | 23    | 70    | 0     | 0     |
|                          | Class suspension involuntarily($C_{223}$) | 120   | 21    | 45    | 20    | 5     |
|                          | Fair and appropriate evaluation to students($C_{224}$) | 150   | 20    | 30    | 15    | 5     |
| Teaching Method($C_{23}$) | Diversification of means($C_{231}$) | 110   | 24    | 20    | 30    | 0     |
|                          | Teaching students according to their aptitude($C_{232}$) | 200   | 10    | 60    | 25    | 15    |
|                          | Moderate course progress($C_{233}$) | 180   | 16    | 40    | 20    | 0     |
|                          | Encourage interaction between teachers and students($C_{234}$) | 160   | 16    | 80    | 0     | 0     |
| Teaching Effect($C_{24}$) | Improve the interest in learning($C_{241}$) | 170   | 18    | 50    | 0     | 0     |
|                          | Promote self-study, inspire students($C_{242}$) | 180   | 17    | 40    | 5     | 0     |
|                          | Students get valuable knowledge ($C_{243}$) | 150   | 20    | 45    | 5     | 0     |
|                          | Improve ability of solving problems($C_{244}$) | 130   | 21    | 50    | 5     | 5     |
**Calculate the Fuzzy Evaluation Vector**

We firstly make the complex operation of fuzzy matrix:

\[
S_{21} = W_{21} \cdot R_{21} = (0.57, 0.11, 0.25, 0.07) \\
\begin{bmatrix}
0.5 & 0.3 & 0.1 & 0.075 & 0.025 \\
0.45 & 0.25 & 0.2 & 0.1 & 0 \\
0.6 & 0.3 & 0.1 & 0 & 0 \\
0.375 & 0.525 & 0.1 & 0 & 0
\end{bmatrix}
\]

\[
= (0.5117, 0.3093, 0.1110, 0.0537, 0.0142)
\]

Therefore, the evaluation value of teaching content which is presented by membership is

\[
S_{21} = (0.512, 0.309, 0.111, 0.054, 0.014);
\]

Similarly, other secondary indicators are calculated as follows:

\[
S_{22} = (0.318, 0.527, 0.120, 0.025, 0.011); S_{23} = (0.361, 0.473, 0.093, 0.064, 0.0101); S_{24} = (0.393, 0.479, 0.113, 0.014, 0.002);
\]

Construct the grade I fuzzy matrix of student evaluation:

\[
S_{2} = \begin{bmatrix}
S_{21} \\
S_{22} \\
S_{23} \\
S_{24}
\end{bmatrix} = \begin{bmatrix}
0.512 & 0.309 & 0.111 & 0.054 & 0.014 \\
0.318 & 0.527 & 0.120 & 0.025 & 0.011 \\
0.361 & 0.473 & 0.093 & 0.064 & 0.010 \\
0.393 & 0.479 & 0.113 & 0.014 & 0.002
\end{bmatrix}
\]

make the complex operation of fuzzy matrix: \(W_{2} = (0.38, 0.38, 0.12, 0.12)\)

\[
Y_{2} = W_{2} \cdot S_{2} = (0.38, 0.38, 0.12, 0.12) \begin{bmatrix}
0.512 & 0.309 & 0.111 & 0.054 & 0.014 \\
0.318 & 0.527 & 0.120 & 0.025 & 0.011 \\
0.361 & 0.473 & 0.093 & 0.064 & 0.011 \\
0.393 & 0.479 & 0.113 & 0.014 & 0.002
\end{bmatrix}
\]

\[= (0.405, 0.431, 0.112, 0.041, 0.011)\]

We get the secondary fuzzy comprehensive evaluation vector: \(Y_{2} = (0.405, 0.431, 0.112, 0.041, 0.011)\).

**Summary**

Fuzzy comprehensive evaluation method is a common method processing multi-indexes and fuzzy problems. This paper applies fuzzy comprehensive evaluation to English classroom teaching quality evaluation, which has a very strong practical significance. Firstly, this method minimizes the influences of external and internal interference factors on the evaluation results. It not only solves comprehensive evaluation problem of multi-index, but also considers the relation of individual factors and personal influences. Secondly, compared with the traditional method, the application of fuzzy comprehensive evaluation not only evaluates the classroom teaching quality into excellent, good, average and poor level objectively, but also avoids the consequences of large fuzziness and subjectivity. To a certain extent, it alleviates the interferences of fuzzy factors in evaluation and produces a more scientific and reasonable result.

**References**

[1] Yuankun Yao, Marilyn L. Grady, How Do Faculty Make Formative Use of Student Evaluation Feedback: A Multiple Case Study, Journal of Personnel Evaluation in Education. 7(2014) 61-63.

[2] Trudy W. Banta, Quality and Accountability in Higher Education: Improving Policy, Enhancing Performance, Journal of Higher Education. 11(2011) 83-85.

[3] Helena Worthen, Joe Berry, Bargaining for "Quality" in Higher Education: A Case Study from the City Colleges of Chicago, Labor Studies Journal. 16(2014) 27-28.
[4] Yoon, K. S., Duncan, T., & Shapley, K., Reviewing the Evidence on How Teacher Professional Development Affects Student Achievement, Journal of Higher Education. 9(2015) 45-47.

[5] Numan, D, Pursuing Professional Development: The Self as Source, Journal of Academy of Educational Leadership. 8(2012) 21-23.

[6] Beycioglu, K., Ozer, N. & Ugurlu, C. T, Teachers’ Views on Educational Research, Journal of Teaching and Teacher Education, 26(2013) 1088-1093.

[7] Bucklowc, Clark P, The Role of the Institute for Learning &Teaching in Supporting Professional Development in Higher Education, Journal of Teacher Development, 4(2010) 3-8.