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The Quality of College English Teaching Determined by Fuzzy Comprehensive Evaluation

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The evaluation of teaching quality plays an essential role in improving teaching and learning outcomes. In this study, the quality of English teaching in the School of Foreign Languages of Jimei University was evaluated. An index system was designed and scored by ten experts. Then the weights were obtained by the bat algorithm, and the evaluation results were obtained using the fuzzy comprehensive evaluation method. Generally speaking, the quality of English teaching at the college was good. The results show that the fuzzy comprehensive evaluation method was effective and also provides some guidelines for improving the quality of English teaching in the college.

Keywords: fuzzy comprehensive evaluation, English teaching, teaching quality, evaluation index, bat algorithm

1. INTRODUCTION

In order to address problems associated with the teaching of English at the college, the quality of the teaching must be evaluated. Teaching and teacher evaluations are important, especially in higher education (Villanueva et al., 2017). A comprehensive evaluation can help to determine the quality of the curriculum, teachers' skills, classroom management, and learning outcomes, and is the first step to addressing any problems and improving the overall quality of the students' learning experience (Wang et al., 2017). Most of the current teaching evaluation methods contain few abstract evaluation indexes and has low operability and weak objectivity, and the evaluation of the teaching quality related to an individual subject is seldom seen. Based on heterogeneous language information, Zhang et al. (2017) evaluated the classroom teaching quality at four levels, using a simulation case to verify the effectiveness of the method. The researchers evaluated the teaching quality based on Massive Open Online Courses (MOOC), designed an evaluation model based on a fuzzy comprehensive evaluation, and verified the effectiveness of the method through experiments, as a means of improving students' learning efficiency. Hu (2017) evaluated the quality of teaching in a physical education unit, carried out weight optimization using an artificial neural network method and a genetic algorithm, established an evaluation system, and found through the experiment that the scheme was feasible. Pang et al. (2017) conducted an evaluation of the teaching quality of part-time teachers. They carried out a quantitative evaluation by applying the analytic hierarchy process (AHP) method, synthesized the evaluation results of all courses based on the fuzzy comprehensive evaluation method and fuzzy matrix computation, and verified the applicability of the method. This current study analyzed the quality of English teaching in the School of Foreign Languages in Jimei University, established the evaluation index system by means of fuzzy comprehensive evaluation in order to determine the quality of English teaching at the college. Several suggestions are offered that can assist to improve the quality of foreign language teaching in general.

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2. FUZZY COMPREHENSIVE EVALUATION

2.1 Fuzzy Comprehensive Evaluation Method

A fuzzy comprehensive evaluation is based on fuzzy mathematics (Jiao et al., 2016). It has a clear, systematic structure and performs well when used to evaluate problems which are difficult to quantify (Wei et al., 2015; Han et al., 2015). The specific steps are as follows.

(1) The evaluation factors are determined. It is assumed that $H = \{h_1, h_2, \cdots, h_m\}$, representing m factors of the evaluated object, i.e., evaluation indexes.

(2) The evaluation level is determined. It is assumed that $L = \{l_1, l_2, \cdots, l_n\}$, representing n kinds of determination of every evaluation index, i.e., evaluation grade;

(3) A fuzzy relationship matrix is established. Factor h_i is evaluated, and an evaluation set $r_i = (r_{i1}, r_{i2,\cdots,} r_{im})$ is obtained. For m factors, the overall evaluation matrix can be obtained, i.e., fuzzy relationship matrix $R = (r_{ij})m \times n$, where r_{ij} refers to the membership of the i-th factor at the j-th evaluation grade.

(4) Weight vector $Z = (z_1, z_2, \ldots, z_m)$ of the evaluation factor is introduced;

(5) The fuzzy composition is performed. Fuzzy transformation is performed on Z and R. Then $B = (b_1, b_2, \ldots, b_n)$ is obtained, i.e., $B = Z \cdot R$;

(6) The results of the fuzzy evaluation are analyzed.

Since the weights of evaluation factors have a great impact on the evaluation results, and their values are mostly determined by experience and lack of reliable basis, this study selected the bat algorithm (Premkumar and Manikandan, 2015) to determine the weights.

2.2 Weight Optimization by Bat Algorithm

The bat algorithm is a population intelligence algorithm (Xue et al., 2015) that simulates the echolocation behavior of bats (Wang et al., 2015), with high convergence speed and strong optimization ability. It is assumed that the population scale of the bat is n, then in the D-dimensional space, the update formula for the speed and position of bat i can be written as:

$$f_i = f_{\min} + (f_{\max} - f_{\min})\sigma,$$
$$v_t^t = v_i^{t-1} + (x_i^{t-1} - x')\, f_i,$$
$$x_i^t = x_i^{t-1} + v_i^t,$$

where $[f_{\min}, f_{\max}]$ stand for the pulse frequency range, σ is a random number in [0, 1], and x' is the current global optimal position.

In the local search, a solution is selected from the set of optimal sets to update the bat position: $x_{new} = x_{old} + \eta A^t$, where x_{old} refers to the solution randomly selected from the optimal solution set, η is a random number in $[-1, 1]$, and A^t is the average loudness of all bats at time t.

During the search, pulse loudness A_i and frequency P_i of bat will change, and the updating formula can be written as:

$$A_i^{t+1} = \gamma A_i^t,$$
$$P_i^{t+1} = P_i^0 \left[1 - e^{-\lambda t}\right]$$

where γ is the pulse loudness increase coefficient and λ is the attenuation coefficient of pulse frequency.

For a fuzzy comprehensive evaluation, the mathematical model of its weight can be written as:

$$fitness(w_i -) = \min \sum_{i=1}^{m} \sum_{j=1}^{m} (y_{ij} - w_{ij} x_{ij}),$$

$$s.t. \sum_{i=1}^{n} = 1,\ w_i \geq 0,\ i = 1, 2, \ldots, m,$$

where x_{ij} refers to the scores of different evaluation indexes, w_{ij} refers to the weight of different indicators, and y_{ij} refers to the score of the evaluation grade. w_{ij} is optimized by the bat algorithm to obtain the optimal weight.

3. CASE STUDY

3.1 Evaluation Index

In order to verify the reliability of fuzzy comprehensive evaluation, teachers and students from the School of Foreign Languages of Jimei University were chosen as the research subjects. The specific index system is shown in Table 1.

Classroom management, for example, could be written as $H_1 = \{H_{11}, H_{12}\}$. The evaluation grade of every indicator included "excellent", "good", "passed", "failed", and "poor", written as $L = \{l_1, l_2, l_3, l_4, l_5\}$. The membership function is shown in Table 2.

3.2 Experimental Data

Ten front-line English teachers scored the teaching quality, and the membership of different indicators was obtained, as shown in Table 3.

3.3 Weight Calculation

The weight was calculated using the bat algorithm. The population size was set at 10, the maximum number of iterations was set as 100, the value of $[f_{\min}, f_{\max}]$ was set as [0, 2], the pulse loudness was set at 0.25, the frequency was set at 0.5, the pulse loudness enhancement coefficient was set at 0.05, and the pulse loudness attenuation coefficient was set at 0.9. After optimization by the bat algorithm, the weight was obtained:

Table 1 Evaluation index system.

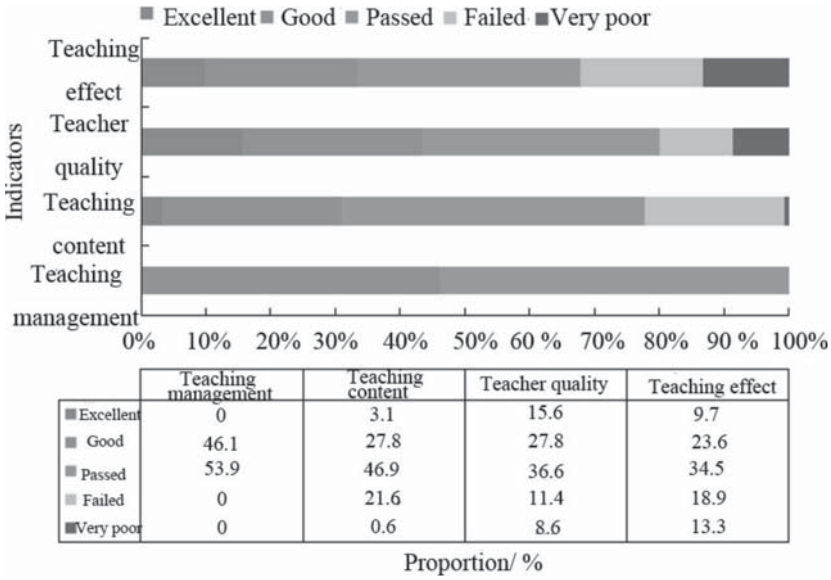
Primary indicators	Secondary indicators
Teaching management H_1	Classroom discipline H_{11}
	Student attitude H_{12}
Teaching content H_2	Clear teaching objectives H_{21}
	Comprehensive teaching content H_{22}
	Rich teaching language H_{23}
	Suitable teaching amount H_{24}
	Teaching of key and difficult points H_{25}
	Considering personality differences H_{26}
Teacher quality H_3	Teaching instrument H_{31}
	Attitude towards lesson preparation H_{32}
	Patience H_{33}
	Professional ethics H_{34}
Teaching effect H_4	Students' English listening and speaking ability H_{41}
	Students' English reading ability H_{42}
	Students' English writing ability H_{43}

Table 2 Membership function.

l_1	$\frac{1}{10}(x-90)$	$90 \le x \le 100$
	0	$x < 90$
l_2	$\frac{1}{10}(100-x)$	$90 \le x \le 100$
	$\frac{1}{10}(x-80)$	$80 \le x \le 90$
	0	$x < 80$
l_3	0	$x \ge 80$
	$\frac{1}{10}(80-x)$	$70 \le x \le 70$
	$\frac{1}{10}(x-60)$	$60 \le x \le 70$
	0	$x < 60$
l_4	0	$x \ge 70$
	$\frac{1}{10}(70-x)$	$60 \le x \le 70$
	$\frac{1}{20}(x-40)$	$40 \le x \le 60$
l_5	0	$x \ge 60$
	$\frac{1}{20}(60-x)$	$40 \le x < 60$
	1	$0 \le x < 40$

Table 3 The membership matrix.

	V_1	V_2	V_3	V_4	V_5
H_{11}	0.2	0.6	0.1	0.1	0
H_{12}	0.4	0.4	0.2	0	0
H_{21}	0.1	0.7	0.2	0	0
H_{22}	0.1	0.8	0.1	0	0
H_{23}	0.1	0.6	0.2	0.1	0
H_{24}	0.1	0.4	0.5	0	0
H_{25}	0.2	0.6	0.2	0	0
H_{26}	0.2	0.2	0.6	0	0
H_{31}	0.3	0.6	0.1	0	0
H_{32}	0.2	0.6	0.2	0	0
H_{33}	0.1	0.7	0.1	0.1	0
H_{34}	0.3	0.5	0.2	0	0
H_{41}	0.1	0.6	0.2	0.1	0
H_{42}	0.1	0.5	0.4	0	0
H_{43}	0.1	0.4	0.4	0.1	0



	Teaching management	Teaching content	Teacher quality	Teaching effect
Excellent	0	3.1	15.6	9.7
Good	46.1	27.8	27.8	23.6
Passed	53.9	46.9	36.6	34.5
Failed	0	21.6	11.4	18.9
Very poor	0	0.6	8.6	13.3

Figure 1 The evaluation results of different indicators.

$$Z_1 = (0.476, 0.524),$$
$$Z_2 = (0.166, 0.234, 0.152, 0.146, 0.221, 0.081),$$
$$Z_3 = (0.351, 0.189, 0.109, 0.351),$$
$$Z_4 = (0.333, 0.333, 0.333)$$

It was found that the weight of student attitude towards classroom management was high, (0.524); in the teaching content, the weight of comprehensive teaching content was the highest, (0.234); for teacher quality, the weight of teaching instruments and professional ethics was high, (0.351); for teaching outcomes, the weight of students' listening, speaking, reading and writing skills was consistent.

3.4 Evaluation Results

The result was calculated with the fuzzy comprehensive evaluation method. The results of the evaluation of the various indicators were:

$$H_1 = (0, 0.461, 0.539, 0, 0),$$
$$H_2 = (0.031, 0.278, 0.469, 0.216, 0.006),$$
$$H_3 = (0.156, 0.278, 0.366, 0.114, 0.086),$$
$$H_4 = (0.097, 0.236, 0.345, 0.189, 0.133).$$

The overall evaluation result of English teaching quality is:

$$H = (0.081, 0.472, 0.436, 0.011, 0)$$

The results showed that 8.1% was "excellent", 47.2% was "good", 43.6% was "passed", and 1.1% was "failed" in evaluating English teaching quality in the School of Foreign Languages. Generally speaking, the quality of English teaching is considered "good". The next step is the analysis based on different indicators.

Figure 1 shows that, for classroom management, 46.1% achieved "good", and 53.9% "passed". This indicates that the level of classroom management was not high, classroom discipline was poor, and students' learning attitude was relatively average. For the teaching content, 3.1% was "excellent", 27.8% was "good", 46.9% "passed", 21.6% "failed", and 0.6% was very poor. During the lesson, students were asked to repeat words, phrases and sentence patterns, and were required to complete numerous exercises in order to learn English. The teaching method is relatively straightforward and is aimed at preparing students for exams. However, the teachers are paying little attention to the practical application of the language learning. In terms of of teacher quality, 15.6% was "excellent", 23.6% was "good", 36.6% "passed", 11.4% "failed", and 8.6% was "very poor". For the teaching and learning outcomes, 9.7% were "excellent", 23.6% were "good", 34.5% "passed", 18.9% "failed", and 13.3% were "very poor". Compared with other indicators, "very poor" teaching had the highest impact. This indicated that the outcomes of English teaching in the School of Foreign Languages were very average as were the students' listening, speaking, reading and writing skills. The curriculum and the classroom teaching practices focused more on ensuring that students passed their examination, and less on the practical application of a newly-acquired language.

4. DISCUSSION

This research on the quality of English teaching in the School of Foreign Languages found that the result was "good", following a fuzzy comprehensive evaluation, although there were some shortcomings in classroom management and teaching content. To improve the quality of English teaching, the following measures should be taken.

(1) Improve classroom management. When teaching, teachers should be able to manage classroom discipline, ensure that students concentrate on the task at hand instead of doing things unrelated to the lesson, take steps to ensure student engagement with their learning, foster

students' interest in English learning, and ensure that students have a positive attitude towards their learning.

(2) Innovate teaching methods and enrich teaching content. Teachers should enrich the curriculum and its delivery by ensuring their own professional development, and combining information technology with multimedia resources (Wang, 2016). Educators should adopt modern teaching methods, foster students' interest in learning by engaging them in games, group activities, oral presentations, student-teacher interactions, and discussions. In these ways, classroom teaching becomes student-oriented, signaling a shift away from traditional teacher-oriented practice.

(3) Strengthen the faculty and improve the quality of teachers. The school could employ skilled and experienced teachers, and improve the skills of their current teaching staff by providing adequate training (Ome et al., 2017; Diego Troncoso et al., 2017) and encouraging a culture of excellence. Teachers themselves should take every opportunity for professional development and strive to improve their teaching practices and professional ethics.

(4) Combine theory with practice to improve the teaching and learning outcomes. In the teaching of English teaching, schools and teachers should strike a balance between theory and practice, rather than giving priority to examinations. Students should master theoretical knowledge and apply their knowledge of English in practice through their communications in order to ensure effective and long-term learning outcomes.

5. CONCLUSION

Based on the fuzzy comprehensive evaluation and bat algorithm, this study analyzed the quality of English teaching in the School of Foreign Languages. The results showed that:

(1) the classroom management level of the college had a 53.9% likelihood of being "passed";

(2) the teaching content of the college was general, with a 46.9% probability of being "passed";

(3) the quality of teachers in the college was not high, with a 36.6% probability of being "passed";

(4) the teaching outcomes of the college were not good, with a 34.5% probability of "passed";

((5) generally speaking, the quality of English teaching was "good".

The quality of English teaching in the School of Foreign Languages is inadequate. If this is to improve, classroom management and the quality of the curriculum and the teaching staff must be improved.

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