A study on the application of hierarchical analysis in the analysis of factors influencing the quality of English teaching

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Abstract. At this stage, along with the continuous development of China's Internet information technology, the field of education and teaching has gradually penetrated computer technology to assist teaching, and the traditional teaching mode and evaluation mode have also undergone significant changes.This paper proposes an analysis method of English teaching quality influencing factors by combining intelligent algorithms, using hierarchical analysis to analyze relevant influencing factors, combining with the comprehensive evaluation of convenience rights, studying English teaching effect evaluation, building a diversified evaluation system, and completing the calculation and evaluation of teaching data. In the complex English teaching evaluation environment, in order to improve the accuracy and rationality of the evaluation model, the relevant personnel need to constantly adjust the English assessment objectives, so as to provide corresponding reference for the subsequent innovation and application of the teaching evaluation model.

Keywords: hierarchical analysis; English teaching; teaching quality; influencing factors.

1. Introduction

English language teaching is a basic type of course for students. The English course helps colleges to expand students' knowledge, improve students' quality education and cultivate comprehensive composite talents useful to society. English teaching plays an important role in the whole college education system, so the effect of English teaching in colleges directly affects the comprehensive cultivation of relevant talents in colleges[1-3]. To build a reasonable and effective evaluation system of English teaching effect in colleges is the key research goal of all colleges at present. In the existing studies, data are analyzed by questionnaires, index systems are constructed, and quantitative analysis methods are used to evaluate these index systems and set a standard for evaluating teachers' teaching effectiveness, which is of great practical significance. Some studies have shown that the effectiveness of English teaching is improved by improving the learners' overall cognitive ability. In summary, the use of variable weight ideas to improve the fixed-weight hierarchical analysis method overcomes the problem of the possibility of failure of the traditional hierarchical analysis method. In this paper, the hierarchical analysis method is used as a basis to analyze the evaluation of English teaching effectiveness in colleges, combined with variable-weight comprehensive assessment.

2. Evaluation of English teaching effectiveness in colleges based on variable-weight hierarchical analysis

2.1 Establishing index system

Taking students as the center and highlighting their central position of evaluation, the index system of English teaching effectiveness evaluation in colleges is constructed from the students' perspective[4-6]. According to the characteristics of English teaching in colleges, the structure of teaching effectiveness evaluation index system is shown in Table 1.

Table 1. System structure of teaching effect evaluation index

Target layer	Level 1 index layer	Secondary index layer
English teaching effect	teaching attitude A_1	teaching responsibility A_{11}
		reserve position A_{12}
		impart knowledge and educate A_{13}
	teaching level A_2	oral proficiency A_{21}
		education content A_{22}
		teaching language A_{23}
	teaching method A_3	teaching method A_{31}
		teaching approach A_{32}
		interactivity A_{33}

2.2 Establishing comparative judgment matrix

After the index system is established, experts need to judge and compare the factors of the first level index layer and the second level index layer, and use them as the basis to build the judgment matrix. For the first-level indicators, the evaluation range is determined by the level, and the actual evaluation results are determined by the students as the teaching subjects; for the second-level indicators, the evaluation needs to be implemented according to the actual teaching effect, which can be divided into 5 evaluation categories according to the teaching effect[7-8].

Category A: The evaluation status is excellent, and all indicators of teaching effectiveness are met, with a score of 80-100.

Category B: The evaluation status is good, only some indicators are not satisfied, and the score is 60-80.

Category C: The evaluation status is good, able to meet most of the evaluation indexes, with a rating of 40-60.

Class D: The evaluation status is qualified, only a very small number of evaluation indicators can be met, the rating result is 20-40 points

Category E: the evaluation status is unqualified, basically unable to meet the evaluation indexes, with a score of 0-20.

Since students are the center of the evaluation of English teaching effectiveness in colleges, this paper invites 10 college students to score the index system in pairs according to the 1-9 scale method. 1-9 scale method has the following meanings: when the scale is 1, it means that the two factors are equally important; when the scale is 3, it means that one factor is slightly more important than the other; when the scale is 3, it means that the two factors are more important than the other[9-11].

A scale of 5 means that one is significantly more important than the other; a scale of 7 means that one is strongly more important than the other; a scale of 9 means that one is extremely important than the other; a scale of 2, 4, 6, 8 means the middle value of adjacent scales; the inverse of the scale means that if factor x and factor y are compared to get a_{xy}, then factor y is compared to factor x to get $1/a_{xy}$. The judgment matrix is obtained by comparing two evaluation indexes, as in equation (1)-equation (4).

$$G_1 = \begin{bmatrix} \dfrac{A_1}{A_1} & \dfrac{A_2}{A_1} & \dfrac{A_3}{A_1} \\ \dfrac{A_1}{A_2} & \dfrac{A_2}{A_2} & \dfrac{A_3}{A_2} \\ \dfrac{A_1}{A_3} & \dfrac{A_2}{A_3} & \dfrac{A_3}{A_3} \end{bmatrix} \quad (1)$$

$$G_2 = \begin{bmatrix} \dfrac{A_{11}}{A_{11}} & \dfrac{A_{12}}{A_{11}} & \dfrac{A_{13}}{A_{11}} \\ \dfrac{A_{11}}{A_{12}} & \dfrac{A_{12}}{A_{12}} & \dfrac{A_{13}}{A_{12}} \\ \dfrac{A_{11}}{A_{13}} & \dfrac{A_{12}}{A_{13}} & \dfrac{A_{13}}{A_{13}} \end{bmatrix} \quad (2)$$

$$G_3 = \begin{bmatrix} \dfrac{A_{21}}{A_{21}} & \dfrac{A_{22}}{A_{21}} & \dfrac{A_{23}}{A_{21}} \\ \dfrac{A_{21}}{A_{22}} & \dfrac{A_{22}}{A_{22}} & \dfrac{A_{23}}{A_{22}} \\ \dfrac{A_{21}}{A_{23}} & \dfrac{A_{22}}{A_{23}} & \dfrac{A_{23}}{A_{23}} \end{bmatrix} \quad (3)$$

$$G_4 = \begin{bmatrix} \dfrac{A_{31}}{A_{31}} & \dfrac{A_{32}}{A_{31}} & \dfrac{A_{33}}{A_{31}} \\ \dfrac{A_{31}}{A_{32}} & \dfrac{A_{32}}{A_{32}} & \dfrac{A_{33}}{A_{32}} \\ \dfrac{A_{31}}{A_{33}} & \dfrac{A_{32}}{A_{33}} & \dfrac{A_{33}}{A_{33}} \end{bmatrix} \quad (4)$$

Where, G represents the weight of each judgment matrix after calculation.

2.3 Consistency test

U is the eigenvector, which generally corresponds to the maximum characteristic root μ_{max} in the judgment matrix, and the consistency test of the judgment matrix is based on the following steps.

（a）The consistency index CI is calculated as equation (5).

$$CI = \frac{\mu_{max} - m}{m - 1} \quad (5)$$

Where m denotes the number of columns or rows of the judgment matrix.

(b) The average random consistency index RI is found, i.e., the average random consistency index RI is obtained by repeatedly calculating 1,000 times according to the positive and negative matrices of order 1 to 10.

(c) Calculate the consistency ratio CR as in equation (6).

$$CR = \frac{CI}{RI} \quad （6）$$

To determine the consistency of the matrix is reasonable and acceptable, it is necessary to ensure that the consistency ratio value is less than 0.1, and only then can the eigenvector be treated as a factor to weight the vector. Each index at the same level is divided into different levels according to the degree of importance or goodness, and the quantitative value is assigned to it to determine whether the constructed judgment matrix meets the condition of full consistency.

2.4 Variable-weight comprehensive assessment

Usually, in order to reflect the real situation of English teaching effect in colleges, the weight of evaluation indexes is adjusted appropriately by the variable-weight synthesis method, and the variable-weight synthesis model is equation (7).

$$\begin{cases} W(a1,a2,a3,...,am) = \dfrac{\sum\limits_{j=1}^{m} \lambda_j^{(0)} a_j^{\gamma}}{\sum\limits_{k=1}^{m} \lambda_k^{(0)} a_k^{\gamma-1}} \\ 0 < \gamma \leq 1 \end{cases} \quad (7)$$

In the formula, λ_j and a_j denote the weight and evaluation value of the j th index respectively; γ denotes the parameter. If the evaluator (student) is conservative in evaluating the effectiveness of English teaching, in this case, the influence of each indicator will be considered too much, and $\gamma < 1/2$; if the evaluator (student) is more open-minded and can tolerate some teaching defects, then $\gamma > 1/2$; if $\gamma = 1/2$, then the evaluation index weights are the same as the constant weight synthesis model, as in equation (8).

$$W_0 = \sum_{j=1}^{m} \lambda_j^{(0)} a_j \quad (8)$$

The use of constant-weight composite evaluation cannot clearly show whether an evaluation index is "qualified" or "unqualified", and it is easy to overlook some details in the evaluation of English teaching effectiveness, resulting in inaccurate evaluation results[12-13]. Through continuous practical analysis, if the parameter γ is 0.2, it can be generally applied to the evaluation of English teaching effectiveness. Compared with the comprehensive evaluation method of hierarchical analysis combined with variable-weighted evaluation method, the method of hierarchical analysis combined with constant-weighted evaluation method can better reflect the impact on the overall evaluation results caused by the changes of individual indicators.

2.5 Comprehensive evaluation by variable weight hierarchical analysis

The calculation of the effect of English teaching in colleges is calculated gradually from the level of secondary indicators to the target level, using the weights multiplied with the rating values to get the calculation results of secondary indicators, and using the variable-weight synthesis model to get the assessment results of the effect of English teaching in colleges[14-16]. After determining the weights of each secondary index for the target layer, it is also necessary to obtain the scores of each index to calculate the overall score of English teaching effectiveness, and evaluate the merits of teaching effectiveness by the high or low scores, as in equation (9).

$$F = \sum_{i=1}^{9} R_i G_i \quad (9)$$

In this equation, F denotes the overall score of teaching effectiveness; G_i denotes the relative weight of the i th indicator affecting teaching effectiveness; R_i denotes the evaluation score of the i th indicator. In order to make the evaluation results more objective, we should obtain the evaluation results from various aspects, and we can use questionnaires and other forms to obtain R_i values.

3. Analysis of the results of the application of hierarchical analysis method in the analysis of the influence factors of English teaching quality

3.1 Results of the simulation experiment

This article is based on the teaching characteristics of a college English course in Hangzhou, Zhejiang Province, the hierarchical analysis method is used to establish the analysis model, and the analysis results are shown in the following table[17-18]. Based on the weight distribution characteristics of each index layer, it can be concluded that:

①the main factors affecting the results of the impact factors of English teaching quality in the college are teachers' classroom teaching and students' acceptability.

② teachers' classroom teaching methods have an important influence on teachers' classroom teaching.

③students' acceptability is mainly affected by students' knowledge structure, see Table 2.

Table 2. Analysis table of factors influencing English teaching quality

Factor layer	Teacher classroom teaching 0.6369	Student acceptance 0.2582	Interaction between teachers and students 0.1047	combination weight
instructional objectives	0.1396			0.0889
content of courses	0.3325			0.2118
teaching method	0.5278			0.3362
Psychological characteristics of students		0.0719		0.0185
Cognitive characteristics of adolescent students		0.2789		0.1720
knowledge structure		0.6491		0.1676
student and teacher relationship			0.75	0.0785
Teachers guide their students' interest			0.25	0.0261

3.2 Conclusion

This paper takes the quality of English teaching in the college in Hangzhou, Zhejiang Province as the background of the study, mainly from the three perspectives of English classroom teaching, students' receptiveness and interaction between teachers and students, and draws the following conclusions.

(1) English teaching methods in the college are mostly in the form of board books, and multimedia teaching is used less. This is mainly due to the poor foundation of local English teaching. In addition, the school teachers are older and the teaching style has not developed with science and technology. During adolescence, students' logical thinking ability grows rapidly while their mental cognitive level is relatively slow[19-21]. For the characteristics of adolescents' growth, English teaching methods should adopt more situational education methods to help students improve their English.

(2) The daily teaching content focuses on grammar, not on semantics, and ignores the humanistic aspects of English to explain the supplement, in addition to the unreasonable arrangement of

teaching content, unscientific division of teaching tasks, and unclear division of teaching difficulties, which are also important factors affecting the quality of English teaching.

(3) In the actual survey, it was found that the school's students' English acceptance ability is weak, mainly because the student population of the college is mainly surrounding rural students. Students have poor English foundation and little practice in spoken English. English has a strong humanistic character, and the students' narrow knowledge and less understanding of foreign countries cause some degree of difficulty in learning English.

(4) English is an instrumental language, and the focus of English exams is more on English application skills due to social development. As a professional English teacher, we should adjust our teaching plan in time to strengthen students' English application ability.

4. Optimization strategies of English teaching quality based on hierarchical analysis

4.1 School education dimension

Schools need to clarify their own positioning and promote the development and implementation of reform measures for English teaching[22-24]. First, improve the professionalism of English teachers. Schools need to pay attention to the improvement of English teachers' teaching level and build a team of English teachers with excellent overall quality and professionalism. First of all, we should control the threshold of teachers' entry in recruitment, set up a strict selection system for teachers, pay attention to the all-round investigation of teachers' education, professionalism, oral expression ability and social cognitive ability, and control the teaching level of teachers from the root. Secondly, we need to strengthen English teachers' theoretical training and practical training, hire professional professors to come to schools to give talks and teaching guidance to English teachers, and provide targeted guidance to teachers' teaching concepts and teaching methods, so as to provide basic support for the improvement of English teachers' teaching level. Secondly, it is necessary to build an exchange platform and organize English teachers to communicate and exchange with teachers from other famous schools, so as to promote the effective improvement of their teaching ability in the exchange of experience and exchange teaching. In addition, the school should assess teachers' professional mastery and teaching ability, set up and implement a reward and punishment system, and reward or punish them according to the teaching effect and popularity of students, so as to tap the subjective initiative of English teachers, promote them to enrich their English knowledge structure and improve their English professional ability, and thus realize the overall improvement of the English teachers' team's comprehensive strength[25].

Second, strengthen the professionalism of the curriculum. Schools need to closely integrate "learning" and "use" to fully reflect the effect of "learning to use" in English teaching. Therefore, we need to promote the implementation of reform measures in curriculum setting, firstly, we need to refine the curriculum content, take the market and enterprise's demand for talent training as the basis, focus on students' intended industry and employment direction, combine professional knowledge, enhance the professionalism of the curriculum content, and provide professional orientation training for students, thus making English teaching conform to the plan of application-oriented talent training, on the other hand, we can use this to build the school On the other hand, it can be used to build the school's characteristics and strengthen the close cooperation between the school and enterprises.

4.2 Teachers' Teaching Dimension

As the direct transmitter of English teaching, English teachers' own quality and teaching methods determine the effectiveness of English teaching in schools. Teachers need to clarify the difficult task they are responsible for, improve their own quality and teaching methods, so as to promote the realization of the function of nurturing people in English teaching. First of all, they should pay

attention to the improvement of their teaching level. English teachers need to clearly position themselves, raise the standard of their teaching quality, and closely combine their sense of mission with the quality of teaching. Therefore, English teachers need to enrich their English knowledge structure for English majors so that their theoretical level can be competent for the requirements of English teaching. At the same time, English teachers need to fully learn from the teaching methods of teachers in famous schools, apply them to the actual teaching in a localized way, and abandon the old teaching concepts and teaching methods, so as to promote the improvement of their own teaching ability[26]. In addition, it is an important task for English teachers to combine the actual teaching of English with the needs of society for students. Therefore, teachers should integrate the requirements of the market and enterprises for the comprehensive level of higher vocational students in all aspects, such as teaching materials, organizing activities and arranging examinations, so as to strengthen the realistic meaning of English teaching. Secondly, diversify the teaching methods. In the teaching of "listening" and "speaking", multimedia equipment should be used as a carrier to mobilize students' visual and auditory senses and to implement the comprehensive use of multimodal forms, so that Students' ability to coordinate the application of English can be exercised. At the same time, English teachers need to abandon the traditional teacher form, recognize and enhance students' subjectivity, apply inquiry, experiential and cooperative teaching methods in teaching practice, create a good classroom atmosphere, stimulate students' interest in learning, subconsciously improve students' learning motivation, and make students take the initiative in the English teaching classroom. In addition, English teachers should organize students to participate in various English learning and communication activities, such as English speech contests and English role-playing, in which students' English knowledge is enriched and their comprehensive English application skills are fully exercised, and this implicit teaching method can achieve a "silent" effect and is easily accepted and welcomed by students. It is easy to be accepted and welcomed by students.

5. Conclusion

The application of hierarchical analysis in the analysis of factors influencing English teaching quality can minimize data calculation errors in the evaluation process, improve the overall evaluation rate, expand the scope of English teaching evaluation, gradually build a stable and safe teaching evaluation system, continuously build diversified evaluation levels, better reflect the actual effect of English teaching, promote a more systematic and complete teaching evaluation structure, and It is of strong practical significance to narrow the assessment differences.

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