

## Analytic Hierarchy Process Evaluation of English Teaching Quality in Application-Oriented Universities

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**Abstract** - Teaching quality is the lifeblood of college survival and development, and improving the teaching quality is the eternal theme of teaching management. To establish teaching quality monitoring system is an important measure to guarantee improvement of the teaching quality. And the teaching quality evaluation is an effective way to improve the teaching quality. By reasonable teaching evaluation, the teaching management department can scientifically and comprehensively learn teachers' teaching situation. So that teachers can identify gaps and take measures to further facilitate the teaching. The method proposed in this paper is the evaluation of the teaching quality based on the dynamic Analytic Hierarchy Process sets. According to dynamic and Analytic Hierarchy Process (AHP) teaching quality evaluation factors, this paper clarifies how to create dynamic AHP sets and analyze the dynamic AHP evaluation results. Meanwhile it also plays a valuable role in exploring better teaching quality evaluation methods.

**Keyword** - Teaching quality; Analytic Hierarchy Process; Evaluation.

### I. INTRODUCTION

With the rapid development of language technology and improvement of a student's language literacy, a university student's ability is increasingly demanded in terms of language knowledge, skill and application in the information-based society. Colleges and universities across China have carried out reforms to the teaching of English language courses for college students in non-language majors in accordance with the guidance of ...*To Further Enhance the Opinion of language Basic Teaching in Colleges and Universities and Basic Requirements on language Basic Teaching* (White Paper) proposed by the Steering Committee for language Course Teaching of Non-language Majors in Higher Institutions of the Ministry of Education in China and the *Requirements on language Teaching of Colleges* (6th Edition - 2011 Version) (Blue Paper) written by the Steering Committee of English language Course of Universities of the Ministry of Education in China [1][2]. Among these reforms, AHP evaluation is being implemented in some colleges and universities.

#### *A Analysis of the Necessity of AHP Evaluation*

Because of the popularity of language education in recent years, English language courses are no longer limited to universities and colleges, but have begun to be applied in primary and middle schools. The economic condition of different regions, however, has led to an imbalance in language literacy.

The language knowledge level of students coming from developed regions or large and medium-sized cities has almost conformed to the teaching requirement of Englishes of languages, while a lot of students coming from remote areas or underdeveloped regions are unable to receive

systematic language knowledge even though some of them have used languages before. Based on this condition, where the student's language operating level is unbalanced when they are enrolled at a university or college, it is imperative to implement AHP evaluation of English language course there [3].

AHP evaluation or teaching according to different levels, is a teaching method based on the theory of pedagogy and psychology. In AHP evaluation, students are divided into different levels according to their practical situation. By taking the national teaching syllabus as a basic target, teaching targets of different levels are formulated according to the specific situation, and are improved step-by-step.

Students are divided according to their levels and grades, and also according to their current levels of competence, so that a hierarchy of student and teaching objectives will be formed. In addition, according to their learning status, the system of upgrading and downgrading will be implemented as this is a highlight of AHP evaluation. For instance, Englishes of language is an obligatory course for all students.

If AHP evaluation is implemented, students will be required to take an examination in language operating skills at the beginning of their university/college life. Based on the academic performance in this examination, students will be divided into two grades (or levels) - an exempt programme or a compulsory programme, and students of each grade will be taught according to different teaching objectives in an effort to meet the requirements of application-oriented talent cultivation.

AHP evaluation, in fact, is affected by various factors, such as the characteristics of students, development and update of teaching methods, means and facilities, effective intervention of network teaching, etc. Drawing from successful experience of other universities and colleges,

and in order to avoid the defects of over grading, the author has carried out reforms and practice on the AHP evaluation of the English of language course based on the application-oriented guideline.

In addition, the author has also found effective solutions for the phenomenon where students with a good foundation cannot acquire enough knowledge and where students with a poor foundation fail to keep up with the teaching schedule. To further implement this teaching reform, the teaching of the English language course should be application-oriented and should focus on students of different levels.

## II. THE DETERMINATION METHOD OF SUBJECTIVE WEIGHT COEFFICIENT

Using AHP to determine the subjective weights of evaluation indexes, the main steps are as follows:

Constructing judgment matrix, scaling method for evaluation of each factor to carry on the assignment, the importance of the judgment matrix of structure are as follows:

The sheer level and a consistency check of judgment matrix. as the largest of judgment matrix eigenvalue and eigenvector, and carries on the satisfaction degree of validation. The calculation steps are following:

Calculated judgment matrix product of all the elements:

$$m_i = \prod_{i=1}^n b_{ij} i = 1, 2, \dots, n$$

The Nth root:

$$\varpi_i = \sqrt[n]{m_i} (i = 1, 2, \dots, n)$$

On vector normalization processing

$$\varpi = (\varpi_1, \varpi_2, \dots, \varpi_n)^T$$

That is, to the desires of feature vector:

$$\omega_i = \frac{\varpi_i}{\sum_{j=1}^n \varpi_j} i = 1, 2, \dots, n$$

Calculate the maximum characteristic root matrix:

$$\lambda_{\max}: \lambda_{\max} = \frac{1}{n} \sum_{i=1}^n \frac{(A\omega)_i}{\omega_i}$$

Consistency check of judgment matrix, namely  $CR = CI/RI$ , Among them,  $CI = \frac{\lambda_{\max} - n}{n - 1}$ ,

When  $CR < 0.10$ , the judgment matrix is satisfied consistency, otherwise we need readjust the element values.

Hierarchy total ordering. That needs to compute synthetic weight of each factor on the system 's overall goal, to

determine the relative importance that all the factors of A-layer have for the system overall goal-A layer. This process has been run from the top layer to the bottom layer.

The method of determining the coefficients of objective weight. Entropy weight is a kind of objective method of endow with weight, namely to determine the index weight according to relative degree of change about the index's influence on the overall system, greater degree of relative change means larger weights of indicators[8-9]. The main steps of using Entropy weight to give weight are as follows:

The original matrix. Index of comprehensive evaluation of a sample about  $m$ , a problem about  $n$  index, the formation of the original matrix are formatted as follows:

$$X = \{X_{ij}\}_{m \times n} (0 \leq i \leq m, 0 \leq j \leq n)$$

Index normalized processing. Since the dimension and the order of the magnitude of each indicator has certain differences, we have to eliminate the influences of different dimensions on the evaluation result, so it is necessary to standardize various indicators.

$$X'_{ij} = \begin{cases} \frac{X_j - X_{\min}}{X_{\max} - X_{\min}} - A \\ \frac{X_{\max} - X_j}{X_{\max} - X_{\min}} - B \end{cases}$$

Index after normalization treatment, the matrix proportion is as follows:

$$Y = \left\{ \frac{X'_{ij}}{\sum_{i=1}^m X'_{ij}} \right\} (0 \leq i \leq m, 0 \leq j \leq n)$$

Calculation index information entropy and information utility value. The first item index  $j$  of information entropy value is:

$$e_j = -k \sum_{i=1}^m y_{ij} \ln y_{ij} (k = 1/\ln m)$$

Information utility value depends on the difference in value between 1 and the index of information entropy  $e_j$ . Its computation formula is:

$$dj = 1 - e_j$$

Calculation entropy of index. The entropy value of the  $j$  item parameter values is defined as weight:

$$\omega_j = \frac{d_j}{\sum_{i=1}^m d_j}$$

First of all, Dividing factor set  $U = \{u_1, u_2, \dots, u_m\}$ ,  $i=1, 2, \dots, m$  into subset  $U_i = \{S_{i1}, S_{i2}, \dots, S_{in}\}$ ,  $i=1, 2, \dots, S$  according to some properties so as to meet the conditions:

$$\sum_{i=1}^s U_i = S; \bigcup_{i=1}^s U_i; U_i \cap U_j = \phi, (i \neq j)$$

Then making a comprehensive evaluation on each factor set. If the evaluation result set  $V = \{v_1, v_2, \dots, v_n\}$ ,  $j=1, 2, \dots, n$ ,  $i=1, 2, \dots$ , Then, the distribution of the weight of  $n$  is:

$$W = \{w_{i1}, w_{i2}, \dots, w_{in}\}, i=1, 2, \dots, n$$

Among them  $\sum_{i=1}^s W_{in} = 1, 0 \leq W_{in} \leq 1$ . If  $R_i$  is the single factor evaluation matrix, then we will get a vector:

$$B_i = W_i R_i = (b_{i1}, b_{i2}, \dots, b_{im}), i=1, 2, \dots, s$$

Then taking each  $U_i$  as a factor,  $\mu = \Delta\{U_1, U_2, \dots, U_n\}$ , Thus,  $\mu$  is a set of factor, the single factor evaluation matrix of  $\mu$  is:

$$R_j = \begin{bmatrix} B_1 \\ B_2 \\ \dots \\ B_s \end{bmatrix} = \begin{bmatrix} B_{11} & B_{12} & \dots & B_{1m} \\ B_{21} & B_{22} & \dots & B_{2m} \\ \dots & \dots & \dots & \dots \\ B_{s1} & B_{s2} & \dots & B_{sm} \end{bmatrix}$$

Each  $U_i$  is a part of  $U$ , which can reflect an attribute of  $U$ , it can be assigned according to the importance of the weight of  $W_j = \{w_{j1}, w_{j2}, \dots, w_{jn}\}$ ,  $j=1, 2, \dots, m$ , therefore, we can get two grade evaluation vector:

$$B_j = W_j \circ R_j = (B_{j1}, B_{j2}, \dots, B_{jn})$$

Calculation of index weight of degree of integration of tourism industry

For weight calculation, it is mainly to invite experts to pairwise compare importance of various factors in each-level evaluation and the results are used to establish the judgment matrix of AHP weight distribution [10]. By consulting experts, this paper reaches A~An judgment matrix and An~B judgment matrix of degree of integration of tourism industry in Hainan. Due to space limitations, this paper only describes A~An judgment matrix.

TABLE 1. A~AN JUDGMENT MATRIX

A	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>4</sub>	A <sub>5</sub>
A <sub>1</sub>	1.00	0.20	0.20	0.14	0.33
A <sub>2</sub>	5.00	1.00	3.00	1.00	1.00
A <sub>3</sub>	5.00	0.33	1.00	1.00	1.00
A <sub>4</sub>	7.00	1.00	1.00	1.00	3.00
A <sub>5</sub>	3.00	1.00	1.00	0.33	1.00

It is to calculate the feature vector of each judgment matrix as the weight of each criterion layer to goal level and to check consistency, the results are as follows: the weights of An criterion layer to goal layer A are (0.05, 0.29, 0.19, 0.31, 0.17); the weights of B1~B5 criterion layer to goal layer A2 are (0.36, 0.36, 0.16, 0.08, 0.04); the weights of B6~B9 criterion layer to goal layer A2 are (0.09, 0.09, 0.21, 0.61); the weights of B10~B14 criterion layer to goal layer A3 are (0.09, 0.05, 0.37, 0.07, 0.42); the weights of B15~B20 criterion layer to goal layer A4 are (0.21, 0.04, 0.44, 0.21, 0.04, 0.06); the weights of B21~B27 criterion layer to goal layer A5 are (0.03, 0.03, 0.31, 0.07, 0.07, 0.22, 0.27).

TABLE 2. RESULTS OF CONSISTENCY CHECK AMONG INDEXES

Matrix	$\lambda_{max}$	C.I.	R.I.	C.R.	Whether it passed or not
A-A <sub>n</sub>	5.28	0.07	1.12	0.06 < 0.1	Yes
A <sub>1</sub> -B <sub>5</sub>	5.14	0.03	1.12	0.03 < 0.1	Yes
A <sub>2</sub> -B <sub>9</sub>	4.15	0.05	0.89	0.06 < 0.1	Yes
A <sub>3</sub> -B <sub>14</sub>	5.14	0.03	1.12	0.03 < 0.1	Yes
A <sub>4</sub> -B <sub>20</sub>	6.48	0.10	1.26	0.08 < 0.1	Yes
A <sub>5</sub> -B <sub>27</sub>	7.43	0.07	1.36	0.05 < 0.1	Yes

### III. REFORM IDEAS OF AHP EVALUATION

According to the investigation, it was found that many universities and colleges are confronted with such a problem in the teaching of English language courses - to teach students who have a good foundation in language with more related knowledge and skills and to help students who have a poor foundation to reach the objectives of teaching of the English language course in the university/college. The AHP evaluation of the English language course, which is set either for university or for the cultivation of application-oriented talent, can be divided into four parts:

- Students can be divided into two grades and be taught accordingly, after taking the language operating level grade examination. Students with a good foundation can be exempted from the basic language course, but are required to take the examination. Meanwhile, they can take any language course as an elective course. As to the remaining students, AHP evaluation will be

adopted according to the previous requirements (they are required to take Englishes of language before taking other language courses).

- The course hours are reduced from 68 credit hours or 56 credit hours to 45 credit hours, but the teaching quality remains the same.
- The integration of *classroom teaching*, *experiment teaching* and *network teaching* is realised in the language classroom (language laboratory). Students' autonomous learning is realised in the laboratory room via network with teaching after class.
- The assessment of students should be based on the final examination and the Jilin Province college student language office automation examination, so that the assessment will be more objective.

In AHP evaluation, students with a good foundation cannot only reach the highest level of the curriculum requirement, but can also take an extra language course. Students with a poor foundation, however, can follow the teaching schedule and reach the basic requirement of the course. Students between both sides cannot only learn well, but can enjoy the learning process from the after-class type and improvement type cases. In this way, students will learn both in the class and after class, and will move from passive to positive learning. From appropriate case teaching, students' learning interest will be readjusted, and their internal driving force will be enhanced by network teaching platform and related cases.

#### *A. Students of the Exemption Programme Learn the Teaching Mode Autonomously*

Students in the exemption programme can be exempted from taking a language course, but are required to take part in the examination. Some teachers have carried out a follow-up investigation on these students and found that these students have almost realised the autonomous learning pattern under the guidance of teachers. A student's autonomous learning process is designed scientifically. A student's part is composed of autonomous learning, submitting case designs, questions and discussions, a testing phase and a comprehensive test. The teacher's part is composed of establishing a teaching resource library, guidance, correcting homework, providing feedback, a testing phase and follow-up supervision.

First, the tutor will divide the teaching content into six modules according to the teaching requirements of Englishes of languages, and design basic case examples and comprehensive cases by combining the modules of each

chapter. The tutor will guide the students to learn step-by-step and focus on the cultivation of student's operating ability and self-study ability.

Second, with a network teaching integration platform, students will be provided with *Englishes of languages Exemption* network course resource, which will be the resource for the autonomous learning after class. Further, the tutor will lead students to take a selective course related to language applications according to their interests or major, such as graphic design, Web page design, multi-media courseware making and access database technology or lead them to participate in language-related associations and other competitions.

#### *B. Teaching Mode Integrated With Classroom Teaching, Experiment Teaching, Network*

##### *B1. Teaching for Students in the Compulsory Programme*

This teaching mode aims to understand a student's mastery of the teaching content from the analysis of a student's examination and a questionnaire survey. In the meantime, the teacher will also carry out teaching activity according to the student's level. Group teaching and language guiding will be integrated into one teaching mode, which is the combination of teaching theory and practice. Each student has one language; when the teacher explains to the students, they operate the language and do exercises, with the teacher distributing teaching documents, handing in homework, Q&A with the help of LAN, and ensuring the teaching results of the course.

Monitoring a student's status of hearing a class and understanding a student's mastery of knowledge, improving a student's efficiency in classroom learning, and realising LAN teaching and multi-media teaching in the language laboratory are enhanced by making use of multi-media teaching software.

The teacher teaches students by readjusting various resources on-line and making full use of network resources after class. The *network teaching platform* has provided students with an ideal digital learning environment. With the case learning mode and cooperation learning mode, it helps students to cultivate innovation ability and promotes their individual development, providing a sound environment for a student's automatic learning and project development. Teachers will also strive to create sound conditions, launch diversified extracurricular activities for students, carry out language skills competitions, organise language-related associations, and improve students' interest and enthusiasm in learning.

IV. ADOPTATION OF AHP EVALUATION WITH CASES

AHP evaluation with cases is adopted for students of both the exempt and compulsory programmes. Professional teaching cases are divided into the *basic type*, *after-class type*, *improvement type* and *comprehensive type*; and students of the exempt programme are required to complete the cases according to their preference, whereas students of the compulsory programme are required to select *compulsory case* and *selective case* according to the student's foundation.

Students with a sound foundation must be guaranteed that they have something to do in the class, while students with a poor foundation must be assured that they can follow the learning schedule. Automatic design should be added in both the *improvement type* and the *comprehensive type* to set additional points for students and to improve a student's learning initiative. In the meantime, cases or knowledge of important chapters will be recorded as *micro-courses*, so that students can review them after class.

A. The Introduction of The Language Office Automation Examination As Part Of The Course Assessment

The introduction of the Jilin Province college student language office automation examination is regarded as an integral part of course assessment. For the assessment of

this course in the past, classroom performance accounted for 30%, and the final examination accounted for 70%.

The Jilin Province college student language office automation examination (Jilin Region) was introduced after the introduction of the educational reform, in which the original way of assessment accounts for 50% and the Level-II examination also accounts for 50%.

Students will be regarded as fully *qualified* in the examination when their academic performance of the two examinations is greater than or equal to 60 points. Students' learning results can be objectively checked from the Jilin Province college student language office automation examination or can be compared with the other universities of Jilin Province. From the overall condition of students who participated in Level-II examination over the past two sessions, sound achievements are yielded.

As shown in the analytical statement and Tables 3-4, which report on academic performance, one can see that the language knowledge and operating ability that the students master before university are not as good as expected. To guarantee a satisfactory teaching result, only a few students can be exempted from taking the language courses. Most of the students obtained less than 30 points in the graded examination.

A sound performance was made in level-II examination with the average points of 84.6, with an excellent rate of 57.6% and an overall pass rate of almost 100%. Due to the fact that the difficulty was greater in the final examination, the students only obtained the average score of 76.9, the excellent rate of 31.6%, the pass rate of 91.6%.

TABLE 3.COMPARATIVE ANALYSIS OF SCORES SECTION OF GRADE 2014 LANGUAGE OPERATING LEVEL TEST.

Data item	Entrance examination	Level-II examination	Final examination
90-100 points	0	765	275
80-90 points	0	903	771
70-80 points	2	428	659
60-70 points	15	156	411
Below 60 points	2303	10	194

TABLE 4.CPARATIVE ANALYSIS OF SINGLE ITEM SCORES OF GRADE 2014 LANGUAGE OPERATING LEVEL TEST

Data item	Entrance examination	Level-II examination	Final examination
Average Point	24.5	84.6	76.9
Highest Point	72.9	99	99.2
Lowest Point	2.1	19.3	13.5

TABLE 5.COMPARATIVE ANALYSIS OF THE PASS RATE OF GRADE 2014 LANGUAGE OPERATING LEVEL TEST.

Data item	Entrance examination	Level-II examination	Final examination
Excellence rate	0%	57.60%	31.60%
Pass rate	0.73%	99.60%	91.60%

## V. CONCLUSIONS

After two years of experimenting with this system, the system that is divided into selective and compulsory courses, it has been found that AHP evaluation with cases is an effective teaching method. It has fully embodied the modern teaching philosophy that may vary from person to person, and that they should be taught accordingly. AHP evaluation also focuses on the demand of specialty, and should be combined with application-oriented and student-based individual development. As shown in the analysis of academic performance, the course teaching effect has been good and students have achieved a high level in language operation. Furthermore, the conduct of this research and the experimental results may provide a useful reference for the curriculum reform in similar universities and colleges.

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