

Students Grade Evaluation of Case Teaching using the Analytic Hierarchy Process

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Abstract — The paper analysis students' evaluation issues in case teaching mode. The evaluation indexes were selected by expert experience and fuzzy prioritization method. Thus the students' grade evaluation as a multidimensional index system of case teaching is established as a reasonable method based on Analytic Hierarchy Process, AHP. It can raise the equity of score and the enthusiasm of students from empirical comparison.

Keywords - case teaching; grade evaluation; fuzzy prioritization method; analytical hierarchy process; evaluation index

I. INTRODUCTION

With the rapid development of our higher education, the teaching quality has become a school crucial core elements, and to improve the quality of teaching is based on the University Teachers' teaching quality for scientific, objective, fair assessment. Teaching quality evaluation and analysis system was developed, effectively saves the university human resources, improve the level of teaching management, especially on the implementation of scientific management of universities plays a very important role, it is teaching information technology degree important milestone.

Therefore, how to establish a scientific evaluation system of teaching quality to better meet the needs of different periods of teaching quality evaluation requirements, it is urgent to solve the problem. The purpose of this paper, in the research of teaching quantify evaluation based on case, draw lessons from domestic and international experience of University Teachers' teaching quality evaluation, according to the different period of college teaching objectives and teaching task demand, based on user demand can modify the teaching quality evaluation index system evaluation model. The model uses the AHP method to get the teaching quality evaluation index system weight value, using the fuzzy operator two level fuzzy comprehensive operation, based on the fuzzy comprehensive evaluation of the maximum membership principle, evaluation to determine the level of maximum weight for the final evaluation grade. Especially in the teaching quality evaluation model customization, the qualitative description by fuzzy mathematics statistics method to the quantitative processing, make qualitative index and quantitative index of organic combination.

Student performance evaluation is the process of teaching inspection and supervision, assessment of teachers by master student's mastery of knowledge, understand teaching behavior and check the teaching effect, for continuous improvement in teaching to improve reference and reference value. Case teaching, the students into a realistic virtual environment, the combination of knowledge, ability, interest, each person's intelligence has a characteristic, does not exist in the traditional sense of the "difference", so the case

teaching of the course shall establish a diversified evaluation system, through various channels to evaluate students, truly to review and promote teaching.

At present, the case teaching student achievement evaluation exist the following problems:

A roll grades and evaluation content structure and single assessment subject. Student achievement evaluation 0, as the only judge by teachers, most schools students took, accounts for 70-90%, the proportion is too high, grades of 10-30%, evaluation content deviation, lead to some students cramming, studying and get good grades, some students at ordinary times active thinking, strong hands-on ability, but the overall result is not due to any question paper grades is not ideal, students reflect and ability does not match, increase some of the students' frustration, teaching contact unfair phenomenon, the serious deviation from the quality education and the cultivation of the innovative education.

Use a ruler to measure different students, has neglected the student personality. Popularizations of education, the individual differences are ignored. In the process of case teaching role plays, emotion, personality and psychological everybody is different, only suitable for not suitable for job roles, if use unified standard evaluation of students, make students be rejected, cause students to teachers' preferences, lead to personality are buried. For students to participate in the case of the situation, the learning process and learning effect is not enough attention, and students are less willing to attend the case teaching, is not conducive to the students.

Focus on results, ignoring the process. The students in the process of case teaching performance was not reflected in the overall performance, with summarize assessment is given priority to, is a kind of static evaluation, process couldn't reflect the students' growth.

The design of the fuzzy comprehensive evaluation system on quality of teaching is the use of a campus network development of teachers' teaching quality evaluation, online collection evaluation information, collected information on the basis of the fuzzy evaluation model of teaching quality automatic analysis, processing and instant feedback system. Evaluation of information collection and use the scientific method can be collected from students, teachers, teaching

management and Leadership Institute and other aspects of information. The ultimate purpose for teaching quality evaluation becomes more convenient, the evaluation result is more objective, accurate, feedback information is helpful to improve teaching quality and promote the development of teachers.

Through research and analysis, we design the AHP based fuzzy comprehensive evaluation method of teaching quality system. First of all, the research purpose, significance and the domestic and foreign research were analyzed, the concept and the related technology were summarized; secondly, according to the different roles from the system function demand and performance demand two respects undertook the system demand analysis; third, introduced with emphasis the system design, including the system design principle, overall architecture, function module and database design; fourth, introduces the key technology of this system and the implementation details, covering system technical architecture, development environment, function design, focusing on teaching quality evaluation model customization implementation details, and gives the flow chart of the system and the test run results; at the end of the essay were summarized, and the application of the system the research prospects.

II. A COMPREHENSIVE EVALUATION INDEX SYSTEM DESIGN

Nowadays, our society has been increasingly reliant on information technology, the total amount of knowledge has doubled about every five years, the renewing cycle of knowledge has become shorter and shorter, thus, how to learn is also one necessary part in our everyday life. It has become the calling of the times how to enable the future citizens to love learning, be good at learning and how to carry out the idea of education for all-around development and lifelong learning. The learning assessment is not only the summing up and appraising of the learner's past learning process, learning status and learning performance, but also a re-adjusting and a re-optimizing aiming at the full utilizing of learning objectives, learning strategies and learning resources with an eye for the future. Its basic goal is to serve the decision-making in learning, and its essence is to improve continuously. DECD, one of internationally famous institutions of policy research and analysis, which was founded in 1961, has been putting helping its member countries to promote their economy, employment and living standard. She first held its Program for International Student Assessment in 2000 to find out how 15-year-old students who will finish compulsory education have mastered necessary knowledge and skills in order to participate in social affairs in future. The assessing content is no longer limited to textbooks. Its emphases are laid on problem-solving abilities by applying what they have learned to everyday life and jobs flexibly. Its assessing methods are written test based on Item Response Theory as well as questionnaire which is used to gather information in learning context. The assessing idea is forward-looking, the method is advanced, and the process is well-organized, thus, the assessing mode has won acceptance and participation around

more and more countries and regions. Shanghai is the first participating region in Chinese mainland, which participated in 2009 and 2012. Although universally acknowledged achievements have been obtained, some deficiencies have also been found in the meantime. The outcomes pose great challenges to our three-dimensional assessing system that is always hesitating at the crossroad in the learning evaluation of our basic education. How should we refer to and digest the assessing idea and advanced assessing method in AHP to serve our basic education and learners' lifelong development? For this purpose, the author put up the assessment of learning literacy.

A. Introduction of Analytic Hierarchy Process (AHP)

AHP method is derived from the operational research, is a combination of quantitative and qualitative methods of decision analysis. It wills policy makers decision thinking process for complex systems modelling and quantification. Using this method, decision makers and factors of a complex problem into several levels, the pair wise comparison between various factors and calculation, get different weights; provide the basis for the selection of the optimal scheme [1]. Through AHP method with ladder structure objectives, principles, constraint conditions, such as part of the evaluation scheme, construction of judgment matrix, and then the judgment matrix characteristic root corresponds to the largest eigenvectors as corresponding coefficient, and finally the weights of comprehensive give a solution. [2, 3]

B. Evaluation Index Hierarchy Construction

Firstly, how the learning mechanism is formed on macro-level is examined from the perspective of interdisciplinary in the aspect of behavioral mechanism of learning. It includes neuron as physical basis of learning and its biochemical activities, the function and features of plasticity of synapse in the forming of memory trace. Then, informational representation and its acquired characteristics of narrowly defined knowledge and skills, strategies in general and specific domain are analyzed respectively. After this, problem and problem-solving in learning are defined and classified, the common process of problem-solving, how to form the strategies in general and specific domain, creativity and its role in problem-solving, and the concise analysis of Complicated Problem-Solving (CPS) in real-life are involved in order. Furthermore, the five earlier theories of transfer such as formal discipline, identical elements and contemporary theories of transfer as Ausubel's transfer of cognitive structure, transfer of production, meta-cognition and the forth are orderly discussed in order to know if students can apply what they have learned to unfamiliar situations flexibly. In addition, the essence of transfer and the advantageous requirements in learning are explored. In the part of situated learning and social construction, ecological systems theory and educational multiculturalism are introduced from the point of social culture, and interpersonal interaction is analyzed. Finally, feeling, emotion, interests and attitude are studied as key points in human nature on the basis of comparing and analyzing such the mainstream motivations to learn as humanism at the

same time, the Keller's rote learn and interaction between individual and environment model of motivation to are also introduced and explored. As a summing up of how the above six factors influence learning, the author proposed one model of restrictive relations among learning mechanisms.

Index selection whether appropriate, directly affect the final evaluation result is objective and fair. Index selection is too little, examines student achievement is not comprehensive, index lack of representative, the coverage is not complete, can't reflect students' comprehensive strength, produce partial; Index selection is too much, may reduce proportion of key test project, increase the difficulty of examination, the point is not prominent [4, 5]. So according to the characteristics of case teaching, on the basis of recycling questionnaire, consulting experts, using the experience of domestic case teaching course assessment of student achievement, adhere to a comprehensive, conciseness, clarity, independence, feasibility principle, from the case to participate in the process, case reports, grades and comprehensive examination four aspects comprehensive assessment of students' comprehensive performance, the highest level known as the goal layer, middle layer called the rule layer, the lowest layer called scheme, measures from belong to criterion layer or to influence rule layer, as shown in table 1.

TABLE I EXPERT EVALUATION RESULTS

grouping	1	3	5	7	9	total	Optimization coefficient
C6/C7	3	7				24	0.24
C6/C8			3	4	3	70	0.70
C6/C9	3	2	5			34	0.34
C7/C8			2	2	6	78	0.78
C7/C9		2	7	1		48	0.48
C8/C9	3	6	1			26	0.26

C. The Evaluation Index System Optimization

Will separate index of upper index importance sorting, remove will not be important indicators, using fuzzy prioritization method in n alternatives to establish a fuzzy preference relation, preferential selection index of high importance.

$$① O_{ij} + O_{ji} = 1;$$

$$② 0 \leq O_{ij} \leq 1 (i \neq j; i, j = 1, 2, \dots, n).$$

From table 1 to establish fuzzy matrix of optimization:

$$O = \begin{Bmatrix} 0.5 & 0.24 & 0.70 & 0.34 \\ 0.76 & 0.5 & 0.78 & 0.48 \\ 0.30 & 0.22 & 0.5 & 0.26 \\ 0.66 & 0.52 & 0.74 & 0.5 \end{Bmatrix}$$

$\alpha \in [0, 1]$, and satisfy the following conditions:

$$\text{When } O_i \geq \alpha, O_{ij}^\alpha = 1; \text{ when } 0 \leq O_i \leq \alpha, O_{ij}^\alpha = 0$$

For example, when $\alpha = 0.48$, then:

$$O_{0.48} = \begin{Bmatrix} 0.5 & 0 & 1 & 0 \\ 1 & 0.5 & 1 & 1 \\ 0 & 0 & 0.5 & 0 \\ 1 & 0 & 1 & 0.5 \end{Bmatrix}$$

Line 2 element numerical value maximum, so the C7 is advantageous factors for first, remove the C7 in rows and columns, a new fuzzy matrix of optimization:

$$O' = \begin{Bmatrix} 0.5 & 0.70 & 0.34 \\ 0.30 & 0.5 & 0.26 \\ 0.66 & 0.74 & 0.5 \end{Bmatrix}$$

When $\alpha = 0.5$, then:

$$O_{0.5} = \begin{Bmatrix} 0.5 & 1 & 0 \\ 0 & 0.5 & 0 \\ 1 & 1 & 0.5 \end{Bmatrix}$$

The largest third row element, so C9 is superior for the second factor. Repeat the above steps, we get four indexes of fuzzy precedence for the C7 and C9, C6 and C8.

Membership function: If domain known theory of upper belonging to the order of indicators, membership is available under type calculation [5].

$$A(u_i) = \frac{\ln[m - r(u_i)]}{\ln(m - 1)}$$

Then

$$r(C8) = 4, A(C8) = \frac{\ln[4 + 2 - 4]}{\ln(4 + 2 - 1)} = 0.43$$

The same we can obtain:

$$A(C6) = 0.68, A(C7) = 1, A(C9) = 0.86$$

D. Construct Judgment Matrix

Remember the target layer element to A, criterion layer elements for B1, B2, B3, B4, criterion layer element dominated the next layer of elements for C1, C2, ..., Cn (n = 12). For rules, decision makers to compare the two elements of Ci and Cj which one is more important, how important is, according to the results of the questionnaire and to supervise, expert evaluation, reference Satty 9 scaling method, defined according to the proportion of scale to the assignment of importance degree, USES the geometric average to average scale values given by the correction, so as to construct

various indicators to judge matrix $B = (a_{ij})_{n \times n}$.

E. Calculating Relative Weight And Consistency Check

1) The judgment matrix is used to calculate each index and relative weight coefficient matrix characteristic root, as follows:

$$(1) M_i = \prod_{j=1}^n a_{ij}, i=1, 2, \dots, n;$$

$$(2) \bar{W}_i = \sqrt[n]{M_i};$$

$$(3) (\bar{W}_1, \bar{W}_2, \dots, \bar{W}_n)^T; \quad w_i = \frac{\bar{W}_i}{\sum_{j=1}^n \bar{W}_j};$$

$$(4) \lambda_{\max} = \sum_{i=1}^n \frac{(BW)_i}{nW_i}$$

2) The Level of Single Sorting and Consistency Check

The structure of judgment matrix is appropriate? For consistency check, the method is:

First level: single sort consistency index:

$$C.I = \frac{\lambda_{\max} - n}{n - 1};$$

Then calculating random consistency

index: $C.R = \frac{C.I}{R.I}$. If $C.R \leq 0.1$ that the consistency of judgement matrix can be accepted, the mean random consistency index R.I values according to table 2.

TABLE II R.I MEAN RANDOM CONSISTENCY INDEX

dimension	1	2	3	4	5	6	7	8
R.I	0.00	0.00	0.58	0.96	1.12	1.24	1.32	1.41

Listed below according to the above calculation steps, relative to the overall goal of the relative importance of each criterion layer between the comparison, is the judgment matrix A, B, and under the rule of A single factor of relative weight and consistency check calculation, as shown in table 3 to table 7

TABLE III A-B

A	B1	B2	B3	B4	W _i	index
B1	1	3	5	3	0.517	$\lambda_{\max}=4.104$ C.I=0.035 R.I=0.96 C.R=0.036<0.1
B2	1/3	1	3	1/2	0.168	
B3	1/5	1/3	1	1/3	0.077	
B4	1/3	2	3	1	0.238	

TABLE IV B1-C

B1	C1	C2	C3	C4	W _i	index
C1	1	1/2	3	3	0.284	$\lambda_{\max}=4.003$ C.I=0.001 R.I=0.96 C.R=0.001<0.1
C2	2	1	5	6	0.518	
C3	1/3	1/5	1	1	0.099	
C4	1/3	1/5	1	1	0.099	

TABLE V B2-C

B2	C5	C6	C7	W _i	index
C5	1	2	1	0.4	$\lambda_{\max}=3$ C.I=0 R.I=0.58 C.R=0<0.1
C6	1/2	1	1/2	0.2	
C7	1	2	1	0.4	

TABLE VI B3-C

B3	C8	C9	C10	W _i	index
C8	1	1	2	0.4	$\lambda_{\max}=3$ C.I=0 R.I=0.58 C.R=0<0.1
C9	1	1	2	0.4	
C10	1/2	1/2	1	0.2	

TABLE VII B4-C

B4	C11	C12	W _i	index
C11	1	3	0.75	$\lambda_{\max}=2$ C.I=0 R.I=0 C.R=0<0.1
C12	1/3	1	0.25	

When $\lambda_{\max} = n$, C.R = 0 is completely consistent. C.R value, the greater the consistency of judgment matrix, as a result of the judgment matrix C.R values are less than 0.1, you can believe they are a satisfactory consistency.

Should pay attention to in practical application, a hierarchy model of the factors in each layer number and the factors of both two paired comparison of the values is not immutable, but according to the requirements of the school orientation and subject characteristics, such as the specific circumstances, decided by the rich experience, good sense of experts.

3) Calculate combination weights of each layer

Calculate each layer of the combination of the right to see table 8, and consistency check.

TABLE VIII LEVEL C TOTAL SORTS CALCULATION TABLE

C	B1	B2	B3	B4	weight
C1	0.284				0.147
C2	0.518				0.268
C3	0.099				0.051
C4	0.099				0.051
C5		0.4			0.067
C6		0.2			0.034
C7		0.4			0.067
C8			0.4		0.031
C9			0.4		0.031
C10			0.2		0.015
C11				0.75	0.179
C12				0.25	0.060

$$C.I = \sum_{i=1}^n W_i^B (C.I)^T = (0.517, 0.168, 0.077, 0.238)(0.001, 0, 0, 0)^T = 0.0005$$

$$R.I = \sum_{i=1}^n W_i^B (R.I)^T = (0.517, 0.168, 0.077, 0.238)(0.96, 0.58, 0.58, 0)^T = 0.638$$

$$C.R = \frac{C.I}{R.I} = 0.0008 < 0.1, \text{ that satisfies the requirement}$$

of consistency.

On the basis of scrutinizing several common English words concerning evaluation from perspective of etymology, its classical definition are introduced, the influences of connotation of knowledge and two different outlooks of knowledge are analyzed, the main features of evaluation in

four different times are carefully examined, the reconstructing of evaluating mode in present circumstances is inquired into subsequently. In view of the fact that evaluation correlate with measurement and test, thus, measurement as a quantitative form and its resultant measuring target, rules, scales and indicators are discussed successively. Lastly, the relations between evaluation and measurement and test are concluded.

Seeing that measuring theory for learning is still Classical Test Theory (CTT) in our standardization examination, therefore, basic assumptions, mathematical model, reliability and its computation are analyzed first. In comparison with it, the other two measuring theories for learning which rose in 90s of the last century successively, they are Generalizability Theory (GT) and Item Response Theory (IRT), are discussed in the mean time. In GT, basic principles and their conceptions are explained first, and several common methods in random facet design are discussed. Then, applying situations and relative short comings are also pointed out. In IRT, its main characteristics are studied first, and the four assumptions are analyzed later. The selected model and its parameters are discussed in the end.

4) Comprehensive evaluation

On student performance evaluation process, to all students in the teaching course evaluation, the combined weight can be calculated according to the above; by the assessment team scores of students, to calculate each student's comprehensive evaluation value, can calculate each student's overall performance.

Among the four hot spot issues of testing scores, engagement in learning, transfer of knowledge and reflection & innovation, the order of ranking superiority are: testing scores> reflection & innovation> in learning>transfer of knowledge and reflection & innovation, and students have less degree of engagement in learning widely.

III. CASE ANALYSIS

A. Instance Profile

To our level 2009 automobile service engineering \"auto insurance and claims\" case teaching student performance evaluation as an example, the 1091 class by AHP method, comprehensive evaluation result, scoring 1092 class according to the traditional examination way, with the aid of SPSS and EXCEL statistical software student scores. Case teaching student performance appraisal according to the principle of index, complete and with clear grading index by the assessment team to grade 0 item of each student. Scores of score multiplied by the calculated weight shown in table 10, is a student practical score values of the case teaching course. As shown in table 9.

TABLE IX A STUDENTS' COMPREHENSIVE PERFORMANCE CALCULATION

C	WEIGHT		Score
C1	0.147	75	11.025
C2	0.268	80	21.44
C3	0.051	88	4.488
C4	0.051	60	3.06
C5	0.067	90	6.03
C6	0.034	72	2.448
C7	0.067	76	2.584
C8	0.031	84	2.604
C9	0.031	86	2.666
C10	0.015	100	1.5
C11	0.179	87	15.573
C12	0.060	80	4.8

B. Comparative Analyses

From tables 10 and 11 you can see that the students' overall performance in 70-85 separation of normal distribution, in accordance with law. Only in my teaching effect comparison: before using the AHP method to comprehensive assessment of student achievement pass rate was 82.3%, the average score of 72.5, using AHP method for comprehensive evaluation of performance, after pass rate rose to 97%, the average score of 80.2, students overall improvement, use AHP method to assess the academic record, students improve the interest in learning this course.

TABLE X 1091 STUDENT PERFORMANCE STATISTICS

Score	Score scale	90-100	80-89	70-79	60-69	0-59
	number	4	12	14	2	1
	mean	80.2	max	92	min	55

TABLE XI 1092 STUDENT PERFORMANCE STATISTICS

Score	Score scale	90-100	80-89	70-79	60-69	0-59
	number	2	8	12	6	6
	mean	72.5	max	90	min	42

IV. CONCLUSION

AHP method is applied in this paper, on the case teaching method of the course grade is used for quantitative analysis, to reduce the influence of subjective factors, makes the learning objective, fair and scientific performance evaluation, the following conclusions:

(1) analyzed the characteristics and existing problems of case teaching course, summarizes the factors affecting student performance case teaching course, using the method of expert experience and the fuzzy optimization method for early evaluation index for screening, using the AHP method and the comprehensive evaluation, the assessment of student achievement more fully reflect the students' comprehensive quality.

(2) in our hospital in automobile service engineering case teaching as an example, analysis the comprehensive evaluation of the course of \"auto insurance and claims, students overall achievement normally distributed, in line with the law, that index weight is reasonable, the statistical results show that the students' learning effect is improved

obviously, and illustrate the examination way to a certain extent, inspired the students' interest in learning.

This article is not for the construction of the comprehensive evaluation index of correlation analysis, the rationality of the design of indicators to be further research.

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