Application of AHP in the "Excellent Lesson Excellent Pay" Course Selection in College

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Abstract. Teaching quality affects the level of teaching and educational standards in the school. Conducting objective, impartial and scientific evaluation for curriculum teaching quality is an important task of teaching reform. According to the construction of teaching quality evaluation model based on AHP, this paper uses evaluation methods of students teaching evaluation, peer teaching evaluation, supervision teaching evaluation, using AHP to make relevant quantitative indicators of teaching quality and comprehensively evaluate teaching quality so as to objectively and effectively reflect the actual teaching effectiveness, so that it will provide decision-making reference for "excellent lesson excellent pay" course selection. The results show that the Teaching Quality Evaluation System Based on AHP Applies to "excellent lesson excellent pay" course selection, which is an effective evaluation method.

Introduction

Teaching quality is directly related to the quality of personnel training as well as educational quality and standards in the school. In order to improve the overall standard of teaching schools and teaching quality, promote the continuous development of the school teaching, some colleges and universities implement the "excellent lesson excellent pay". That is, according to the relevant management measures, the teachers of teaching curriculum which is rated high quality, will be rewarded to encourage and stimulate the teachers through a variety of methods to enhance the quality of teaching and improve the quality of personnel training, to improve the overall quality of teaching school.

Principle and overview of AHP

Analytic Hierarchy Process (shortly called AHP) is a multi-objective decision analysis method for quantitative and qualitative combination operations research that T.L.Saaty proposed in the 1970s.

The implementation steps of Analytic Hierarchy Process are as follows:

1. Build the hierarchical structure model, use analytic hierarchy method to classify factors involved in issues, and according to affiliation, dominance relationship to form group, building reasonable and orderly hierarchical structure model from the top to the lowest, tnen constructing evaluation indicator system.

2. Construct judgment matrix, expert advice method is used to quantify the relative importance of each factor of each layer in a "1-9" scale Saaty determined (Table 1) and then build judgment matrix.

Table 1 Scale approach and meaning

Scale	Meaning（Comparison of A_i and A_j）

1	It represents two factors are equally important
3	It represents a factor is slightly more important than the other factor
5	It represents a factor is obviously more important than the other factor
7	It represents a factor is strongly more important than the other factor
9	It represents a factor is extremely more important than the other factor
2, 4, 6, 8	The intermediate value of above adjacent judgment
Reciprocal value of the above	If the ratio of factor i to factor j is a_{ij}, then the ratio of factor j to factor i is $a_{ji=1/a_{ij}}$

3. Single-level sort, calculating the weight, and making consistency checking. Use the judgment matrix to calculate the relative weight factor, because the judgment matrix cannot have complete consistency, the results will lead to the feature vector deviation of judgment matrix (single-level sort). In order to ensure the rational results obtained by the AHP method, the consistency of judgment matrix need to be examined to decide whether to accept it.

The method of calculating consistency CI is: $CI=(\lambda_{max}-n)/(n-1)$; the method of calculating consistency ratio CR is: $CR=CI/RI$. The average random consistency index value RI is shown by the Table 2look-up.

Only when CR <0.1, it is considered that judgment matrix has satisfactory consistency, single-level sort result is credible, or it need to correct the value of judgment matrix until it has satisfactory consistency.
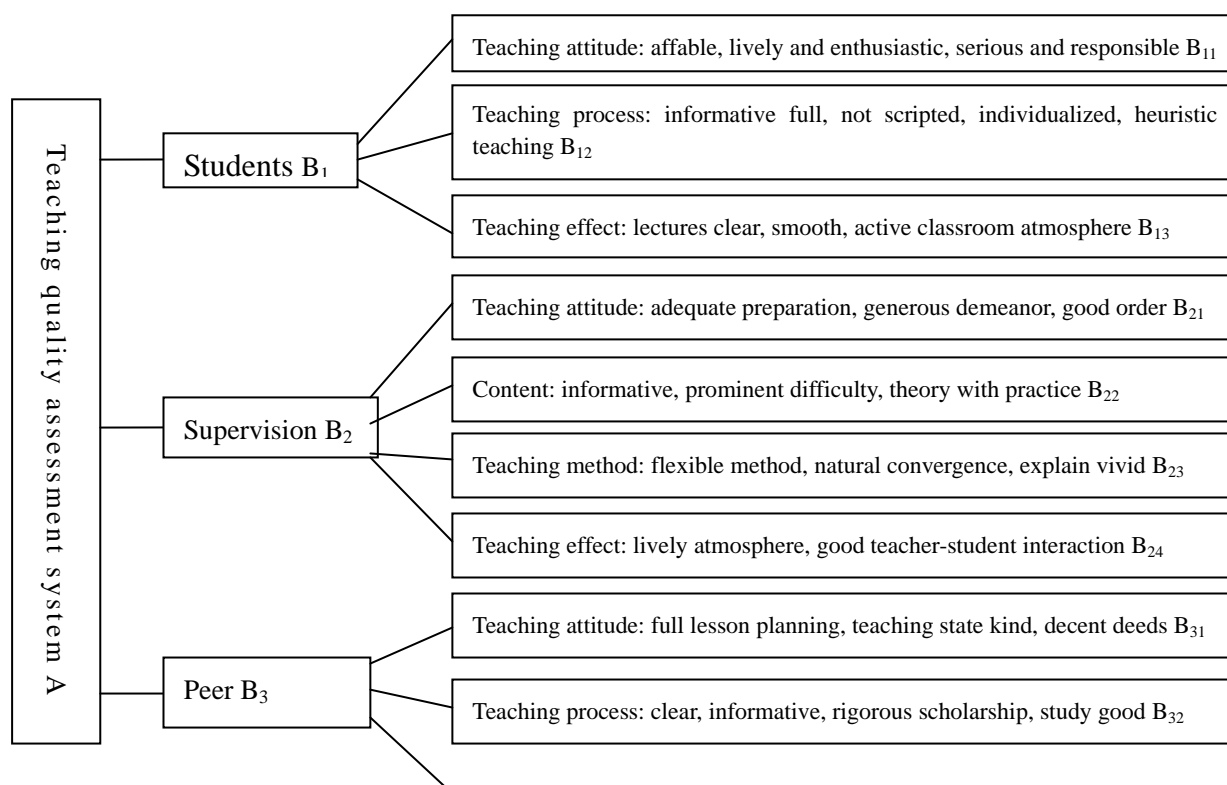
Table 2 the average random consistency index values (*RI*)

Order(n)	1	2	3	4	5	6	7	8
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41

4. Total level sorting and consistency check, and conclude. By the weight factor to obtain the total level sorting, after consistency tests have been passed, and each factor weight is ultimately determined. Combine the score of each factor to calculate comprehensive evaluation score of each layer, and thus the overall evaluation based on comprehensive evaluation score is obtained.

Teaching Quality Assessment Model construction of pay "excellent lesson excellent pay"

The structure of teaching quality assessment system is shown in fig. 1.

Teaching effect: classroom reflect the good, lively atmosphere, students' ability to absorb, achieve the purpose of teaching B_{33}

Fig. 1 the structure of teaching quality assessment system

"Excellent lesson excellent pay" teaching quality assessment can be evaluated by students teaching evaluation, peer teaching evaluation, supervision teaching evaluation to comprehensively evaluate teaching quality.

Students teaching evaluation are mainly from three aspects, including teaching attitude, teaching process and results. Evaluation of the teaching attitude mainly examines whether teachers attitude amiable with students, whether lectures vivid enthusiasm, serious and responsible, whether serve as role models. The main teaching process evaluation examines whether the teachers have substantial amount and information is moderate, not scripted in lecture course, whether choose individualized treatment to students, in teaching stage, whether use modern teaching philosophy to make heuristic teaching, so that students' attention is highly concentrated, attracted to classroom teaching. Evaluation of teaching effectiveness mainly depends on whether the teachers organize clear, smooth, prominent focus and difficulty, whether classroom atmosphere is active and so on.

Supervision teaching evaluation is mainly from four aspects, including teaching attitude, teaching content, teaching methods and teaching effectiveness. The teaching attitude mainly examines the adequacy of teacher preparation, whether content is up to date, whether generous demeanor, whether classroom teaching order is good. The teaching content mainly examines whether teacher lectures are substantial, whether the difficulty is prominent and theory is combined with actual situation. Teaching methods mainly sees whether the method of teacher lectures is flexible, whether teaching is natural convergence, whether explain vivid, sound loud, and language smooth. Classroom teaching effect mainly depends on the active atmosphere, whether good teacher-student interaction, whether students' mastering knowledge and acceptance ability is good.

Peer teaching evaluation are from three aspects, including teaching attitude, teaching process and effect. The teaching attitude mainly examine the adequacy of teacher preparation, affable teaching state, decent words and deeds, attention of a teacher. The teaching process mainly relates to clear thinking, substantial content, rigorous scholarship, and good learning atmosphere. The teaching effect are mainly from classroom reflect the good, lively atmosphere, students' ability to absorb, achieve the purpose of teaching.

The index weight determination

Based on the relationship of each level and each factor in "excellent lesson excellent pay" Teaching Quality Evaluation System to construct the judgment matrix, the add and product method is used to obtain the characteristic value matrix (Wi) and the biggest feature root (λ_{max}) of judgement matrix of index layer and factor layer, and consistency test is made (Table 3-6).

Table 3 Judgment indicators matrix in criterion layer

A	B_1	B_2	B_3	W_i	λ_{max}	CI	CR
B_1	1.0000	2.0000	3.0000	0.5390			
B_2	0.5000	1.0000	2.0000	0.2973	3.0092	0.0046	0.0079
B_3	0.3333	0.5000	1.0000	0.1638			

The calculation shows that CR is equal to 0.0079 and less than 0.1, the results show that the judgment matrix has satisfactory consistency.

Table 4 Judgment matrix of students teaching evaluation index

B_1	B_{11}	B_{12}	B_{13}	W_i	λ_{max}	CI	CR
B_{11}	1.0000	0.1667	0.5000	0.1033			
B_{12}	5.9988	1.0000	5.0000	0.7225	3.0293	0.0146	0.0252
B_{13}	2.0000	0.2000	1.0000	0.1741			

The calculation shows that CR is equal to 0.0252 and less than 0.1, the results show that the judgment matrix has satisfactory consistency.

Table 5 Judgment matrix of supervision teaching evaluation index

B_2	B_{21}	B_{22}	B_{23}	B_{24}	W_i	λ_{max}	CI	CR
B_{21}	1.0000	0.2500	0.3333	0.5000	0.0960			
B_{22}	4.0000	1.0000	2.0000	3.0000	0.4658	4.0310	0.0103	0.0115
B_{23}	3.0003	0.5000	1.0000	2.0000	0.2771			

The calculation shows that CR is equal to 0.0115 and less than 0.1, the results show that the judgment matrix has satisfactory consistency.

Table 6 Judgment matrix of peer teaching evaluation index

B_3	B_{31}	B_{32}	B_{33}	W_i	λ_{max}	CI	CR
B_{31}	1.0000	0.1429	0.5000	0.0919			
B_{32}	6.9979	1.0000	6.0000	0.7545	3.0327	0.0163	0.0282
B_{33}	2.0000	0.1667	1.0000	0.1535			

The calculation shows that CR is equal to 0.0282 and less than 0.1, the results show that the judgment matrix has satisfactory consistency.

From the secondary and tertiary index weight (single-level sort weight) of Table 3-6, the total level of available sort weights is shown in Table 7.

Table 7 Total level sort of "excellent lesson excellent pay" Teaching Quality Evaluation factor

Target layer	Index layer	Weight	Factor layer	Single-level sort weight	Total-level sort weight
"Excellent lesson excellent pay" teaching quality assessment system A	Students teaching evaluation B_1	0.5390	Teaching attitude: affable, lively and enthusiastic, serious and responsible B_{11}	0.1033	0.0557
			Teaching process: informative full, not scripted, individualized, heuristic teaching B_{12}	0.7225	0.3894
			Teaching effect: lectures clear, smooth, active classroom atmosphere B_{13}	0.1741	0.0938
	Supervision teaching evaluation B_2	0.2973	Teaching attitude: adequate preparation, generous demeanor, good order B_{21}	0.0960	0.0285
			Content: informative, prominent difficulty, theory with practice B_{22}	0.4658	0.1385
			Teaching method: flexible method, natural convergence, explain vivid B_{23}	0.2771	0.0824
			Teaching effect: lively atmosphere, good	0.1611	0.0479

Peer teaching evaluation B_3	0.1638	teacher-student interaction B_{24} Teaching attitude: full lesson planning, teaching state kind, decent deeds B_{31}	0.0919	0.0151
		Teaching process: clear, informative, rigorous scholarship, study good B_{32}	0.7545	0.1236
		Teaching effect: classroom reflect the good, lively atmosphere, students' ability to absorb, achieve the purpose of teaching B_{33}	0.1535	0.0251

According to the relevant theoretical and computational data, we need to test the consistency of the overall ranking, for $CI=\sum_{i=1}^{n} a_i(CI)_i=0.0136$, $RI=\sum_{i=1}^{n} a_i(RI)_i=0.6752$, then we get $CR=\dfrac{CI}{RI}=\dfrac{0.0136}{0.6752}=0.0201<0.1$. The value of CR is 0.0201, therefore, the total level sort weights are reasonable, which can be used as a reference for "excellent lesson excellent pay" Teaching Quality Evaluation System.

Application of Teaching Quality Evaluation System in practice

The "excellent lesson excellent pay" Teaching Quality Evaluation form is shown in Table 8.

Table8 the "excellent lesson excellent pay" Teaching Quality Evaluation form

Evaluation target	Evaluation index	Weight	Evaluation factor	Weight	Evaluation standard Excellent(8.5-10) Good(7.5-8.4) Moderate(6.0-7.4) Poor(5.9 and below)
"Excellent lesson excellent pay" teaching quality assessment system	Students teaching evaluation	0.5390	Teaching attitude: affable, lively and enthusiastic, serious and responsible B_{11}	0.0557	
			Teaching process: informative full, not scripted, individualized, heuristic teaching B_{12}	0.3894	
			Teaching effect: lectures clear, smooth, active classroom atmosphere B_{13}	0.0938	
	Supervision teaching evaluation	0.2973	Teaching attitude: adequate preparation, generous demeanor, good order B_{21}	0.0285	
			Content: informative, prominent difficulty, theory with practice B_{22}	0.1385	
			Teaching method: flexible method, natural convergence, explain vivid B_{23}	0.0824	
			Teaching effect: lively atmosphere, good teacher-student	0.0479	

		interaction B$_{24}$		
Peer teaching evaluation	0.1638	Teaching attitude: full lesson planning, teaching state kind, decent deeds B$_{31}$	0.0151	
		Teaching process: clear, informative, rigorous scholarship, study good B$_{32}$	0.1236	
		Teaching effect: classroom reflect the good, lively atmosphere, students' ability to absorb, achieve the purpose of teaching B$_{33}$	0.0251	

The "excellent lesson excellent pay" Teaching Quality Evaluation form in universities is completed by constructing students teaching evaluation, supervision teaching evaluation and peer teaching evaluation, after the index weight calculation and consistency check, the university has formed "excellent lesson excellent pay" Teaching Quality Evaluation form. In order to make the Teaching Quality Evaluation form more operational, it is divided into four levels: excellent (8.5-10), good (7.5-8.4), moderate (6.0-7.4) and poor (5.9 and below), based on the evaluation quantization form, the evaluators give object scores, and thus the quality of teaching evaluation object gets an objective and rational evaluation.

As can be seen from the quality of teaching evaluation form, in the secondary indicator, the weight of students teaching evaluation is the largest, nearly 54 percent; followed by supervision teaching evaluation, nearly 30%; and peer teaching evaluation has minimum weight, about 16%. In the third indicator, of the students teaching evaluation, the teaching process weight is the largest, followed by the teaching effect, teaching attitude has minimum weight. Of the supervision teaching evaluation, the weight descending sort is teaching content, teaching methods, teaching effect, teaching attitude. Of the peer teaching evaluation, the teaching process weight is the largest, followed by the teaching effect, teaching attitude has minimum weight. The teaching process weight in students teaching evaluation and peer teaching evaluation and the teaching content weight in supervision teaching evaluation account for 65%, which is also consistent with the actual selection situation of "excellent lesson excellent pay" Teaching Quality Evaluation form in universities.

This is a simplified and easy to operate ""excellent lesson excellent pay" Teaching Quality Evaluation system, which is suitable for "excellent lesson excellent pay" course selection, and also in line with the demands of students and teachers. This paper uses AHP to weight evaluation index with the actual teaching evaluation scores, which is more conducive to the accuracy and validity of teaching evaluation results.

Acknowledgement

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