Construction of Evaluation Index System for Graduate Course

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Abstract

Abstract: Establishing the index system is the key to carry out the student assessment, evaluation of teaching quality largely depends on scientific index system. The related factors influencing the reliability and feasibility of teaching evaluation is analyzed in this article, and fair and scientific evaluation index system is established. Based on the summary of domestic and foreign existing evaluation index system, a set of new evaluation index system with a school teaching characteristics is established. The analytical hierarchy process is used to set up corresponding weights for each indicator, which makes the evaluation index system more complete and accurate.

Keywords: Curriculum evaluation; Indicator system; Analytic hierarchy process

1. Factors Affecting the Students' Evaluation of Teaching

The key which achieves the desired purpose of the assessment work lies in if the specific indexes can objectively and scientifically reflect the actual situation about the teaching work and teaching effect. Therefore, it is necessary to carefully study all the elements that may impact the fairness and scientificalness of evaluations before establishing high quality index system, such as the differences between students and teachers, individual and group, as well as the nature of courses, etc.

2. Principles in Establishing Scientific Index System

The following principles should be abided by when we build an index system: people-oriented, comprehensive, coordinated[1], scientific and feasible[2]. The following details combining with the specific teaching situation should also be noted:

i) Choose and establish indicators from the standpoint of students.
ii) Besides the quantitative questions, open questions should also be included in the evaluation index system.
iii) The indicators should be measurable so that we can get quantitative results.

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iv) Weight distribution should be reasonable and strong basis is needed[3].

3. Establishment of Reasonable and Scientific Evaluation Index System

The establishment of evaluation index system is to refine the teaching activity process and form different levels to reflect the real teaching process and teaching effect. Some evaluation indicators used by universities both at home and abroad are selected and all these indicators can reflect actual teaching situation and effect from some certain aspects, as shown in table 1.

Table1. Evaluation indicators used by universities both at home and abroad

The first level indicators	The secondary level indicators
Curriculum design	Explicit teaching goal
	Detailed teaching plan
Curriculum	Moderate difficulty
	Reasonable schedule
Inspection and test	Fair and justice
	Reasonable content
Teaching materials and supplementary materials	Teaching materials are easy to understand
	Supplementary materials are useful
Teaching	Express clearly and fluently, Full of passion
	Teachers can timely find problems and solve difficulties for students
	Explain new terms, concepts and principles clearly
Student feedback	Understand the main content of this course
	Develop an interest in this course

Based on the summary of domestic and foreign existing teaching evaluation index system, combined with the actual situation of the school for many years to carry out the assessment activities, we designed a new evaluation index system involved four primary indicators: teaching attitude, teaching contents, teaching methods and teaching effect, which are consistent with the method used by most universities. Specific indicators are shown in table 2.

Table2. Index system in teaching evaluation of our school

The first level indicators	The secondary level indicators
Teaching attitude	Serious and fully prepared
	Express clearly and fluently
Content of courses	Well organized, Highlight keys and difficulties
	Enrich content properly
Teaching method	Use multimedia correctly
	Clean and tidy blackboard writing
Teaching efficiency Teaching efficiency	Pay attention to the interaction with students, Inspire students' learning enthusiasm effectively
	Cultivate the ability of independent thinking
	Combine scientific research with production practice

4. Analytic Hierarchy Process (APH)

The analytic hierarchy process[4] (AHP) is a system analysis method put forward by Saaty (T.L.S Saaty), a professor at university of Pittsburgh, in the mid-1970s. In this way, the qualitative thinking process can be turned into a standard quantitative output which can be measured and also to keep the consistency of the thinking process and the decision making process.

4.1. *Concrete implementation steps of analytic hierarchy process*

4.1.1. *Establishment of the hierarchy relationships*

The top layer of hierarchical structure is the target, that is, the evaluation activities we want to carry out. The middle layer or criterion layer is the first level indicators. The bottom layer is the evaluation objects corresponded to the secondary level indicators.

4.1.2. *Construction of judgment matrix*

Given the influence degree to the target layer is different, we thus compare different indicators within the same level of N and the results of the comparison constitute the judgment matrix. Elements of judgment matrix represent the relatively importance degree related to the upper layer.

Table3. Assignment standard for the elements of judgment matrix

Assignment	Illustration
1	Indicators T_i and T_j are equally important
3	Indicator T_i is a little important than T_j
5	Indicator T_i is obviously important than T_j
7	Indicator T_i is more important than T_j
9	Indicator T_i is much more important than T_j
else	Between the above judgment value

T_i and T_j represent any two different evaluation indexes within the same level, a_{ij} and a_{ji} respectively represent the judgment value acquired from comparing T_i and T_j as well as T_j and T_i, we make the definition: $a_{ij} = 1/a_{ji}$.

Get the n-order judgment matrix as follows:

$$A = \begin{pmatrix} 1 & a_{12} & \cdots & a_{1n} \\ a_{21} & 1 & ... & a_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ a_{n1} & a_{n2} & ... & 1 \end{pmatrix} = \begin{pmatrix} 1 & a_{12} & \cdots & a_{1n} \\ \frac{1}{a_{12}} & 1 & ... & a_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ \frac{1}{a_{1n}} & \frac{1}{a_{2n}} & ... & 1 \end{pmatrix}$$

4.1.3. *Method of weight calculation*

There are many methods of weight calculation, such as eigenvalue method, least squares method, sum method etc. We use the way of sum one.

The first step: Normalize the column elements of A, we get the matrix $\bar{A} = (\bar{a}_{ij})$

$$\bar{a}_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}}$$

The second step：Add up the row elements of $\bar{A}$, we get matrix $\bar{W} = [\bar{w}_{ij}, \bar{w}_{ij}, ..., \bar{w}_{ij}]^T$

$$\bar{w}_i = \sum_{i=1}^{n} \bar{a}_{ij}$$

The third step：Normalize the matrix $\bar{W}$, we can get matrix

$$W = [w_{ij}, w_{ij}, ..., w_{ij}]^T$$

$$w_i = \frac{\bar{w}_i}{\sum_{i=1}^{n} \bar{w}_i}$$

4.2. *The application* of *analytic hierarchy process－－Take a certain university as an example*

4.2.1. *Construction of judgment matrix* A

According to the relative importance among nine indicators provided by the graduate school, we get the judgment matrix A

$$A = \begin{pmatrix} 1 & 5 & 1 & 3 & 7 & 7 & 3 & 3 & 5 \\ 1/5 & 1 & 1/5 & 1/3 & 3 & 3 & 1/3 & 1/3 & 1 \\ 1 & 5 & 1 & 3 & 7 & 7 & 3 & 3 & 5 \\ 1/3 & 3 & 1/3 & 1 & 5 & 5 & 1 & 1 & 3 \\ 1/7 & 1/3 & 1/7 & 1/5 & 1 & 1 & 1/5 & 1/5 & 1/3 \\ 1/7 & 1/3 & 1/7 & 1/5 & 1 & 1 & 1/5 & 1/5 & 1/3 \\ 1/3 & 3 & 1/3 & 1 & 5 & 5 & 1 & 1 & 3 \\ 1/3 & 3 & 1/3 & 1 & 5 & 5 & 1 & 1 & 3 \\ 1/5 & 1 & 1/5 & 1/3 & 3 & 3 & 1/3 & 1/3 & 1 \end{pmatrix}$$

4.2.2. *The sum method is used to get the matrix* $\bar{A}$

$$\bar{A}=\begin{pmatrix} 0.2713 & 0.2308 & 0.2713 & 0.2908 & 0.1892 & 0.1892 & 0.2908 & 0.2908 & 0.2308 \\ 0.0543 & 0.0462 & 0.0543 & 0.0331 & 0.0811 & 0.0811 & 0.0331 & 0.0331 & 0.0462 \\ 0.2713 & 0.2308 & 0.2713 & 0.2908 & 0.1892 & 0.1892 & 0.2908 & 0.2908 & 0.2308 \\ 0.0904 & 0.1385 & 0.0904 & 0.0993 & 0.1351 & 0.1351 & 0.0993 & 0.0993 & 0.1385 \\ 0.0388 & 0.0154 & 0.0388 & 0.0199 & 0.0270 & 0.0270 & 0.0199 & 0.0199 & 0.0154 \\ 0.0388 & 0.0154 & 0.0388 & 0.0199 & 0.0270 & 0.0270 & 0.0199 & 0.0199 & 0.0154 \\ 0.0904 & 0.1385 & 0.0904 & 0.0993 & 0.1351 & 0.1351 & 0.0993 & 0.0993 & 0.1385 \\ 0.0904 & 0.1385 & 0.0904 & 0.0993 & 0.1351 & 0.1351 & 0.0993 & 0.0993 & 0.1385 \\ 0.0543 & 0.0462 & 0.0543 & 0.0331 & 0.0811 & 0.0811 & 0.0331 & 0.0331 & 0.0462 \end{pmatrix}$$

4.2.3. *Add up the row elements of* $\bar{A}$

$$\bar{W}=\begin{pmatrix} 2.2550 & 0.4625 & 2.2550 & 1.0259 & 0.2221 & 0.2221 & 1.0259 & 1.0259 & 0.4625 \end{pmatrix}^{T}$$

4.2.4. *Normalize the matrix* $\bar{W}$

$$W=\begin{pmatrix} 0.2518 & 0.0516 & 0.2518 & 0.1145 & 0.0248 & 0.0248 & 0.1145 & 0.1145 & 0.0516 \end{pmatrix}^{T}$$

Table4. Evaluation index system with the weight

Evaluation indicators	Weight
Serious and fully prepared	0.2518
Express clearly and fluently	0.0516
Well organized, Highlight keys and difficulties	0.2518
Enrich content properly	0.1145
Use multimedia correctly	0.0248
Clean and tidy blackboard writing	0.0248
Pay attention to the interaction with students, Inspire students' learning enthusiasm effectively	0.1145
Cultivate the ability of independent thinking	0.1145
Combine scientific research with production practice	0.0516

5. Conclusions

With the development of Chinese higher education, differences exist in colleges and universities in aspects like the level of academic, quality of faculties and students, etc. In the process of designing index system, we did not solely comply with the index system of others, instead, a number of additional factors such as the actual teaching situation, students' learning style and the school culture were all taken into consideration. A set of new evaluation index system was established so that teachers can be more freely to play their own unique teaching style, at the same time students can focus fully on the evaluation to reduce factors affecting the authenticity and credibility of assessment process.

However, the evaluation index system is not able to adapt to different course categories and we only consider for students, the corresponding teacher mutual evaluations and expert assessments were ignored.

As for evaluation questionnaire itself, there are also some inevitable defects. It is difficult to get comprehensive and detailed information because of the limitation of indicator quantity. It's not enough to persuade us purely by evaluation scores, other effective ways must be combined with, for instance, communications and symposiums[5].

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