Evaluation of Classroom Teaching Quality of College Teachers from the Perspective of Educational Psychology

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Abstract: The evaluation of teaching quality is an important part of the management and an important factor affecting the development of colleges and universities, and an effective means to cultivate teachers' teaching ability. In this paper, various factors affecting teaching were studied from the perspective of educational psychology, and then the dimensions and indicators of teaching quality evaluation were determined. Next, the whole process of quantitative analysis of qualitative problems was realized by using rigorous mathematical methods to objectively and comprehensively evaluate the classroom teaching quality of college teachers. It is a new breakthrough and attempt to apply the teaching quality evaluation model in educational psychology, which effectively broadens the horizon of evaluation, renews the evaluation concept, and promotes the realization of teaching effect. At the same time, this new concept and model is of great significance to the research of educational psychology.

1. Research Background and Significance

Guided by the Ministry of Education's "Undergraduate Teaching Quality and Teaching Reform Project in Colleges and Universities", the main breakthrough is to comprehensively improve the undergraduate teaching quality in colleges and universities. At present, the evaluation of teaching quality in colleges and universities mainly follows past experiences and practices, with more inheritance and less reform and innovation. Educational psychology mainly focuses on the psychological laws of teaching and education, which involves studying the psychological mechanism that affects the teaching process, exploring the formation of cognitive process, and studying the teacher-student and student-student relationships.

Course teaching is the main way of talent training in Colleges and universities. The level and quality of course teaching will affect the professional ability of college students. Therefore, most colleges and universities establish a student evaluation system to reflect and track the teaching quality of courses [1].Student evaluation of teaching embodies the educational concept of "student-centered". It is an important way for colleges and universities at home and abroad to evaluate the quality of classroom teaching, and it is the fundamental system to ensure the teaching quality of colleges and universities in China [2].Students' teaching evaluation is an important part of teaching quality monitoring, and the in-depth analysis of teaching evaluation data is the key process of students' teaching evaluation [3].

At present, colleges and universities generally use the method of students' evaluation of teaching to assess teachers' teaching ability. In view of the incompatibility of the evaluation results, the research aims to put forward a more scientific and reasonable evaluation method of teachers' teaching ability on the basis of not changing the existing institutional arrangements [4]. The classification theory of educational objectives of bloom, an American educational psychologist, provides a theoretical basis for the evaluation of teaching in Colleges and universities. The evaluation model based on this theory can not only ensure the objectivity, authenticity and impartiality of the evaluation of teaching to a great extent, but also improve the style of study and teaching in Colleges and universities, and improve the quality of teaching in Colleges and universities at the same time [5].

The development of teaching quality evaluation and analysis system has effectively saved the human resources and improved the teaching management level, and especially played a very important role in the implementation of scientific management in colleges and universities, so it is an important milestone in the informatization degree of teaching in colleges and universities. The objective and fair conclusion of teaching quality evaluation can be realized by depending on the guiding ideology of modern education evaluation, using scientific indicator system and evaluation standards, and closely focusing on the professional training objectives [6].

In view of the above understanding, it is of great practical significance to develop a "teaching quality evaluation and analysis system based on educational psychology" under the guidance of new teaching concepts and innovative systems from the perspective of educational psychology.

2. Concept Definition

Teaching quality evaluation refers to the value judgment made by using the theory and technology of educational evaluation on whether the teaching process and its results meet certain quality requirements. It is not only a theoretical problem, but also a practical problem [7].

Teaching quality evaluation is to judge the distance between the present teaching situation and the predetermined goal, so as to effectively promote the evaluated object to approach the predetermined goal and achieve the goal of continuously improving teaching, educational environment and teaching quality [8].

The Analytic Hierarchy Process (AHP), put forward in the early 1970s by T.L.Satty, a famous American operational scientist, is a qualitative and quantitative decision-making analysis method, which models and quantifies the decision-making thinking process of complex systems [9].By applying this method, the decision-makers can get the weights of different schemes by decomposing complex problems into several levels and factors (as shown in Figure 1) and simply comparing and calculating the factors, thus providing the basis for the selection of the best scheme. Weber et al. proposed to use AHP algorithm to evaluate and select suppliers.
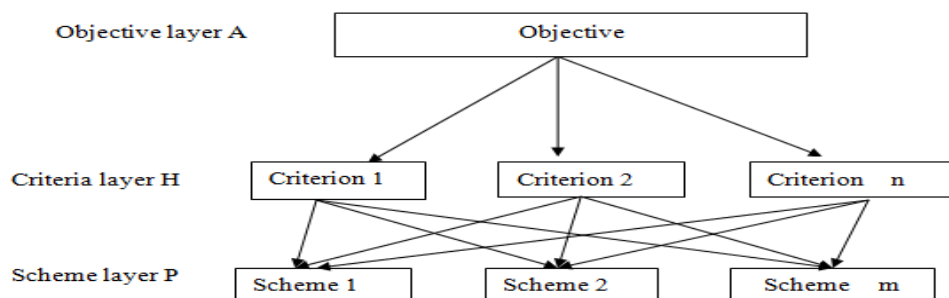

Figure 1: Structure of AHP

Basic principle of AHP is to evaluate schemes according to objectives, sub-objectives (criteria), constraints and departments with hierarchical structure. The judgment matrix is determined by pairwise comparison, and then the eigenvector component corresponding to the maximum eigenvalue of the judgment matrix is taken as the corresponding coefficient. Finally, the weight of each scheme is given comprehensively.

On the basis of fuzzy mathematics, the fuzzy set is formed by using the basic characteristics and influencing factors of the inspected object, and the appropriate membership function is constructed. By using the transformation operation in fuzzy set theory, the inspected object is quantitatively analyzed, and the basic method of comprehensive evaluation is finally made. Because many evaluation criteria involved in teaching quality evaluation are fuzzy, i.e. there is no very clear affirmation or negation, only by means of fuzzy operation can the subjective opinions of each non-linear evaluation be comprehensively summarized to get comparable quantitative results. Obviously, the fuzzy comprehensive evaluation method for teaching quality will reflect the advantages and disadvantages of the evaluated objects more scientifically, and the analysis results will be closer to the actual situation [10].

3. Construction of Fuzzy Comprehensive Evaluation System for Teaching Quality

The comprehensive evaluation system is mainly divided into two parts: AHP model of teaching quality evaluation system and multilevel model of fuzzy comprehensive evaluation [10]. AHP model is the basic frame of the whole evaluation system and provides strong data support for the later fuzzy evaluation. Fuzzy comprehensive evaluation is to use the basic transformation method of fuzzy mathematics to comprehensively process the weight data and fuzzy set information after the previous quantization so as to obtain the final evaluation result.

In view of this, the basic steps of comprehensive evaluation are as follows: determining the evaluation indexes, determining the weights of indexes, calculating the weight coefficients of each evaluation indicator by AHP, constructing a fuzzy comprehensive evaluation multilevel model, analyzing and calculating the comprehensive evaluation values, and finally making an evaluation.

3.1 The construction of AHP model of teaching quality

3.1.1 The establishment of evaluation objectives and the construction of evaluation indicators

Comprehensive evaluation	Leaders	Teaching attitude
		Teaching methods
		Teaching contents
		Teaching effect
		Professional qualification
		Basic teaching skills
	Colleagues	Teaching attitude
		Teaching methods
		Teaching contents
		Teaching objectives
		Basic teaching skills
	Students	Teaching attitude
		Teaching methods
		Teaching contents
		Teaching effect

Figure 2: Structure of teaching quality evaluation indicators

From the perspective of educational anthropology, the key factors affecting the teaching quality of colleges and universities are the management concept of managers, teachers' teaching willingness and students' learning motivation and achievement motivation. In view of this, find out the key factors affecting teachers' teaching quality [11]. Four grades of excellent, good, qualified and unqualified evaluations are made according to different indicators from the three levels of students, colleagues and leaders, focusing on the evaluation contents of teaching attitude, teaching content, teaching methods, teaching effect and comprehensive professional ability.

The hierarchy of evaluation system is shown in Figure 2, in which the objective layer is at the top, the middle part is the criteria layer, and the scheme layer is at the bottom. Depending on the complexity of the research problem, when there are many factors for indicator design, both the criteria layer and the scheme layer can be further divided into several sub-layers to form a multi-layer indicator system.

Table 1: Basic evaluation contents of the evaluation system

Primary indicators	Secondary indicators	Primary indicators	Secondary indicators
Teaching attitude	Teaching and educating with rigorous scholarship; Teaching by personal example as well as verbal instruction; teachers and students valuing each other; Being modest and prudent, diligent and progressive; Adequate preparation of lessons and earnest teaching	Teaching effect	Meeting the requirements of the syllabus; Teaching efficiently; Fully arousing students' learning enthusiasm; Gradually improving students' learning ability.
Teaching methods	Diversified and flexible choice of teaching methods Teaching students in accordance with their aptitude and pay attention to ability training. Application of modern educational technology and methods Appropriate proportion of practical teaching	Basic teaching skills	Standard and beautiful blackboard writing with reasonable design; Standard, well-worded Mandarin; Reasonable allocation of teaching time; Mastery of modern educational technology
Teaching focuses	Rich content and correct knowledge points; Highlighting the key points and breaking through the difficulties thoroughly; Large amount of information, linking the frontiers of disciplines; Attaching importance to the training of thinking methods.	Professional qualification	Making bold innovations in teaching reform; Outstanding contribution to curriculum construction; Having certain scientific research ability; Driving discipline development

The secondary evaluation indicators of this evaluation system were established integrating various factors that can reflect the teaching quality in educational psychology in combination with the teaching quality evaluation rules generally carried out in colleges and universities in recent years, as shown in Table 1. The specific evaluation content is not static, and the perspectives of leaders, colleagues and students on the same issue will be slightly different. Due to the limited space, the evaluation content will be unified and simplified (Table 1).

3.1.2 Determining Indicator Weight set by AHP

Weight set is a set that reflects the important relationship between indicator factors and has a strong guiding role. It is exported depending on the objective and scientific comparison of index factors, so as to preliminarily realize the quantification of data. The specific steps are as follows:

(1) According to the indicator content, a judgment matrix C was constructed, which is a

comprehensive data table obtained by pairwise comparison according to 1-9 scaling theory according to the specific content of each factor in this level, considering its influence on the indicator factors of the upper level with the characteristics of. $a_{ij} = \frac{1}{a_{ij}}, a_{ij} > 0. a_{ij} = 1$ For example, $a_{ij} = 7$ in the judgment matrix indicates that ai is obviously more important than aj, and $a_{ij} = 3$ indicates that ai is slightly more important than aj.

(2) Sorting weights hierarchically and exporting weight sets.

Normalizing the columns for n-order decision matrix C:

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

(3) Consistency test of judgment matrix. Any judgment error in the comparison of evaluation factors may lead to the appearance of unreasonable ordering, and the judgment matrix at this time is not completely consistent. The consistency ratio CR is introduced. If CR<0.1, the judgment matrix has satisfactory consistency; otherwise, the judgment matrix needs to be modified.

$$CR = \frac{CI}{RI}, where(CI = \lambda_{\frac{max}{n-1}}, \lambda_{max} = \frac{1}{n}\sum_{i=1}^{n} \frac{\sum_{i=1}^{n} c_{ij}w_j}{w_j}) \tag{2}$$

And RI is the average random consistency indicator.

3.2 Fuzzy evaluation multi-level model

Based on the hierarchical structure diagram of evaluation indicators constructed above, each evaluation subsystem has secondary evaluation indicators. Therefore, the secondary indicators decomposed by each primary indicator should be comprehensively evaluated at first, and then fuzzy transformation should be carried out in combination with the weight of each primary indicator, and finally the secondary fuzzy evaluation results of each subsystem can be obtained. The specific steps of this process are as follows:

(1) The evaluation factor (indicator) set C={C1, C2, ... Cn } of the evaluation object was determined, i.e., the evaluation target was regarded as a fuzzy set C composed of a plurality of factors, a comment set V={V1, V2, ... Vn} for the evaluation factor evaluation level and a value set N={N1, N2, …Nm} for quantifying the evaluation result were set.

(2) The fuzzy evaluation relation matrix (membership matrix) was established:

$$R = \begin{pmatrix} r_{11} & r_{12} & r_{13} \\ r_{21} & r_{22} & r_{23} \\ \dots & \dots & \dots \\ r_{n1} & r_{n2} & r_{n3} \end{pmatrix} \tag{3}$$

Where, rij = the number of people who choose vj level in the i-th indicator/the total number of people who participate in the evaluation, which indicates the degree of membership of the evaluated object to the evaluation level vj from the perspective of indicator factor ci.

(3) The indicator weight set W derived from AHP and the membership matrix R were combined for fuzzy transformation operation, and the comprehensive evaluation result matrix S was obtained.

$$S = WR$$

$$= (w_1 w_2 ... w_n) \begin{pmatrix} r_{11} & r_{12} & r_{13} \\ r_{21} & r_{22} & r_{23} \\ & & ... \\ r_{n1} & r_{n2} & r_{n3} \end{pmatrix} \quad (4)$$

$$= (S_1 S_2 ... S_n)$$

Where, SI represents the membership degree of the evaluated object to the Vi evaluation level as a whole.

The fuzzy evaluation matrix and numerical set were used to derive the final evaluation result.

$$F = SN = \left(S_1, S_2, S_3, \cdots S_m \right)\left(N_1, N_2, N_3, \cdots N_m \right)^T \quad (5)$$

3.3 An example of comprehensive evaluation calculation

For example, for the student evaluation subsystem, the fuzzy comprehensive evaluation process was gradually completed by combining the evaluation contents of this subsystem (as shown in Table 2).

Table 2: Secondary evaluation indicators of student evaluation subsystem

	Evaluation contents			
	Primary indicators	Secondary indicators	Primary indicators	Secondary indicators
Student evaluation C_3	Teaching attitude C_{31}	Teaching and educating with rigorous scholarship C_{311}	Teaching contents C_{33}	Rich content and correct knowledge points C_{331}
		Teaching by personal example as well as verbal instruction; teachers and students valuing each other C_{312}		Highlighting the key points and breaking through the difficulties thoroughly C_{332}
		Being modest and prudent, diligent and progressive C_{313}		Large amount of information, linking the frontiers of disciplines C_{333}
		Adequate preparation of lessons and earnest teaching C_{314}		Attaching importance to the training of thinking methods C_{334}
	Teaching methods C_{32}	Diversified and flexible choice of teaching methods C_{321},	Teaching effect C_{34}	Meeting the requirements of the syllabus C_{341}
		Teaching students in accordance with their aptitude and pay attention to ability training C_{322}		Teaching efficiently C_{342}
		Application of modern educational technology and methods C_{323}		Fully arousing students' learning enthusiasm C_{343}
		Appropriate poportion of practical teaching C_{324}		Gradually improving students' learning ability C_{344}

(1) According to Table 2, the evaluation index judgment matrix was constructed, the weight coefficient was determined, and the consistency test was made. The "teaching attitude" in students' evaluation, for example, is determined by experts to judge the matrix:

$$F = GN = (0.4048 \quad 0.4367 \quad 0.1422) \begin{pmatrix} 90 \\ 80 \\ 70 \\ 60 \end{pmatrix} \quad (6)$$

After normalization:
$$C_{31} = \begin{pmatrix} 0.5966 & 0.5357 & 0.4375 & 0.6618 \\ 0.1193 & 0.1071 & 0.1875 & 0.0735 \\ 0.0852 & 0.0357 & 0.0625 & 0.0441 \\ 0.1989 & 0.3214 & 0.3125 & 0.2206 \end{pmatrix} \tag{7}$$

After normalization, the weight vector of each secondary index relative to the primary index was obtained

$$w_{31} = (0.5579, 0.1218, 0.0569, 0.2634)^{\text{T}} \tag{8}$$

Then

$$\lambda_{max} = \frac{1}{4} = \sum_{i=1}^{4} \frac{\sum_{i=1}^{4} c_{ij} w_j}{w_j} = 4.0975 \tag{9}$$

When n=4, RI=0.9, so CR=CI/RI=0.0325/0.9=0.0361<0.1, indicating that the judgment matrix and weight set are reasonable.

Likewise, other indicator weight sets can be calculated as follows:

$$C_{31}W_{32} = \begin{pmatrix} 1 & 1/3 & 4 & 2 & 0.2532 \\ 3 & 1 & 5 & 3 & 0.5064 \\ 1/4 & 1/5 & 1 & \frac{1}{3} & 0.0723 \\ 1/2 & 1/3 & 3 & 1 & 0.1682 \end{pmatrix} \tag{10}$$

$$C_{33}W_{33} = \begin{pmatrix} 1 & 2 & 7 & 5 & 0.5411 \\ 1/2 & 1 & 4 & 2 & 0.2648 \\ 1/7 & 1/4 & 1 & \frac{1}{2} & 0.0686 \\ 1/5 & 1/2 & 2 & 1 & 0.1256 \end{pmatrix} \tag{11}$$

$$C_{34}W_{34} = \begin{pmatrix} 1 & \frac{1}{5} & 2 & \frac{1}{6} & 0.0911 \\ 5 & 1 & 5 & \frac{1}{2} & 0.3259 \\ 1/2 & 1/5 & 1 & \frac{1}{7} & 0.0611 \\ 6 & 2 & 7 & 1 & 0.5219 \end{pmatrix} \tag{12}$$

The weights of the factors evaluated by the first-level students were calculated:

$$(C_3 W_3) = \begin{pmatrix} 1 & \frac{1}{3} & \frac{1}{2} & \frac{1}{5} & 0.0847 \\ 3 & 1 & 2 & \frac{1}{3} & 0.2333 \\ 2 & 1/2 & 1 & \frac{1}{4} & 0.1397 \\ 5 & 3 & 4 & 1 & 0.5423 \end{pmatrix} \tag{13}$$

(2) The comment set, the numerical value set, the evaluation factor set, and the weight set were determined, the membership matrix was constructed, and the fuzzy comprehensive evaluation was performed using fuzzy transformation.

Comment set: V={V1, V2, V3, V4}={excellent, good, qualified, unqualified};

Numerical value set: N={N1, N2, N3, N4}={90, 80, 70, 60}.

Now it is proposed to conduct comprehensive evaluation with 100 students combined with

student evaluation indicators at all levels. The results are shown in Table 3.

Table 3: Results of comprehensive evaluation of teachers' teaching quality by 100 students

	Contents		Excellentv1	Good v2	Qualified v3	Unqualified v4
	Primary indicators	Secondary indicators				
Students opinions C3	Teaching attitude C31	C311	70	30	0	0
		C312	80	10	10	0
		C313	60	20	20	0
		C314	80	20	0	0
	Teaching methods C32	C321	60	30	10	0
		C322	40	50	10	0
		C323	40	40	10	10
		C324	50	40	10	0
	Teaching contents C33	C331	80	20	10	0
		C332	60	40	0	0
		C333	60	30	0	0
		C334	50	30	10	10
	Teaching effect C34	C341	90	10	0	0
		C342	80	20	0	0
		C343	40	50	10	0
		C344	30	60	10	0

The membership matrix of student evaluation on each evaluation criterion can be obtained from Table 3 as follows:

$$(R_{31} R_{32} R_{33} R_{34}) =$$
$$\begin{pmatrix} 0.7 & 0.3 & 0 & 0 & 0.6 & 0.3 & 0.1 & 0 & 0.8 & 0.2 & 0 & 0 & 0.9 & 0.1 & 0 & 0 \\ 0.8 & 0.1 & 0.1 & 0 & 0.4 & 0.5 & 0.1 & 0 & 0.6 & 0.4 & 0 & 0 & 0.8 & 0.2 & 0 & 0 \\ 0.6 & 0.2 & 0.2 & 0.4 & 0.4 & 0.1 & 0.1 & 0.6 & 0.3 & 0.1 & 0 & 0.4 & 0.5 & 0.1 & 0 \\ 0.8 & 0.2 & 0 & 0.5 & 0.4 & 0.1 & 0 & 0.5 & 0.3 & 0.1 & 0.1 & 0.3 & 0.6 & 0.1 & 0 \end{pmatrix}$$ (14)

Fuzzy transformation was carried out on the secondary indicators under each primary indicator by combining their respective weights and membership degrees. After normalization, the fuzzy evaluation matrix of secondary indicator was derived.

After normalization: S31 = (0.7328, 0.2436, 0.0236).

Similarly: S32 = (0.4673, 0.4255, 0.1, 0.0072)

S33 = (0.6956, 0.2724, 0.0194, 0.0126), S34 = (0.5237, 0.418, 0.0583).

Fuzzy comprehensive operation was performed on the weight of the primary indicators of student evaluation and the first-level fuzzy matrix;

The fuzzy comprehensive evaluation vector of student evaluation subsystem was obtained by normalizing Y: Y3 = (0.5523, 0.3846, 0.0597, 0.0034)

(3) Fuzzy comprehensive analysis of evaluation results of each subsystem. The final evaluation vectors of the two subsystems of leaders and colleagues can be similarly exported according to the export process of the fuzzy comprehensive evaluation results of the above-mentioned student evaluation system.

According to the general evaluation of colleges and universities, the proportion of leaders, colleagues and students is 3: 3: 4, that is, the weight vector W = (0.3, 0.3, 0.4). The comprehensive evaluation matrix obtained by each evaluation subsystem is R = (Y1 Y2 Y3), and the final fuzzy comprehensive evaluation matrix is:

Y1 = (0.2783, 0.4536, 0.2563, 0.0118), Y2 = (0.3345, 0.4893, 0.1381, 0.0381) G = WR =

$$(0.3 \quad 0.3 \quad 0.4) \begin{pmatrix} 0.2783 & 0.4536 & 0.2563 & 0.0118 \\ 0.3345 & 0.4893 & 0.1318 & 0.0381 \\ 0.5523 & 0.3846 & 0.0597 & 0.0034 \end{pmatrix} =$$

$$(0.4048, 0.4367, 0.1422) \qquad (15)$$

The final score of this teacher is: $F = GN = (0.4048, 0.4367, 0.1422) \begin{pmatrix} 90 \\ 80 \\ 70 \\ 60 \end{pmatrix} \qquad (16)$

As a result, the score of fuzzy comprehensive evaluation based on AHP is 82.3, and the teaching quality of this teacher is between excellent and good, which needs to be improved.

3.4 Result

Similarly, the teacher's teaching evaluation score of the colleague and leader was calculated to get the total score. Based on the fuzzy comprehensive evaluation of educational psychology, the objectivity and fairness of the evaluation are realized by grading, dividing indicators and then quantifying. Finally, it comes to the conclusion that the main factors of higher scores in teaching evaluation are strong teaching responsibility, emphasis on inspiration, emphasis on the cultivation of students' ability, correct viewpoint, clear concept, prominent emphasis, rigorous research and being a teacher by example. Moreover, different types of teachers have different correlations with various indicators, which also points out a clear direction for different types of teachers to further improve classroom teaching quality in the future.

4. Conclusion

It is easy to find that the evaluation methods used in teaching quality evaluation reflect the theoretical achievements of educational psychology in many aspects by combining educational psychology with teaching quality evaluation system from a comprehensive point of view, such as determining the factors that affect teaching quality, namely, teachers' teaching ability, teaching attitude, teaching means and knowledge reserve. In turn, from the perspective of teaching evaluation, educational psychology can fully adjust the relationship between teachers and students, colleagues, leaders, etc. in a variety of evaluation methods, make full use of psychological principles to teach students in accordance with their aptitude, teach students in accordance with their classes, and improve the teaching quality evaluation system from various angles.

To sum up, from the perspective of educational psychology, under the guidance of new teaching concepts and innovative systems, the evaluation of teaching quality has greatly improved students' initiative and activity in learning, and the comprehensiveness and diversity of teachers' education.

To sum up, based on teaching in evaluation, evaluation in teaching and starting from people, educational psychology should be used to reform teaching evaluation.

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