A Model of Teaching Evaluation System based on Fuzzy Interval

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Abstract
Teaching evaluation is the main purpose of value judgment of teaching development and the development of a university, the only evaluation standard, teaching evaluation is to improve the quality of teaching in Colleges and universities, teachers and students meet the demand that teaching evaluation system is the college education quality concept and education, classroom teaching evaluation is the main work the classroom teaching quality monitoring and teaching value, function evaluation, feedback, reflection, criticism and other, the main purpose of teaching evaluation is to promote the overall development of teachers and students. This paper uses the fuzzy interval method to construct a student oriented teaching evaluation system. The results show that the method proposed in this paper constructed the teaching system to promote teachers, change their teaching ideas, implement the teaching method of "student oriented", and promote the improvement of classroom teaching quality, which must give full play to their initiative in the construction of teaching evaluation system.

Key words: Teaching Evaluation System, Fuzzy Interval, Membership Degree, Fuzzy Sets

1. INTRODUCTION
The key period of the education system of our country is changing, the higher education in our country is at the popularization and internationalization of the direction of development, the higher education of our country into one of the connotative development when today's most urgent task. The quality of teaching in Colleges and universities is directly related to the students' knowledge level and comprehensive ability level.

Our current society is toward the popularization of higher education, internationalization of higher education in the direction of development, in order to guarantee the teaching quality of colleges and universities, colleges and universities must ensure that teaching is student-centered. According to the survey, as early as the mid twentieth Century, many experts and scholars have found the students' learning results play a decisive role, the academic circles have three main educational psychology, the school has admitted that in the process of teaching must be student-centered, and must emphasize the importance of constructivism, active learners the discovery and study of knowledge process is critical, and we called the study is actually thinking that the learners actively construct knowledge system, the knowledge system is based on the textbook or other sources of the original scenario based. Teachers are the guides of learners' learning process, and play a role of supervision and assistance to students' learning. Therefore, teachers should realize that their role in learning and life is not only the disseminator of students' knowledge content. Teachers should pay more attention to their teaching methods in classroom teaching, mainly to guide students to think actively, create a positive learning atmosphere, and know the students in group cooperation, participate in the whole learning process, need to establish the incentive mechanism to some extent, let the students have interest in learning of learning content, students can make positive incentive thinking, active learning, with a sense of curiosity, construct their own knowledge system by using my knowledge.

Take the student as this is not only the teaching principle and should be the value orientation of teachers, at the same time, this theory is also a method from the perspective of philosophy, from a personal perspective, I think the construction of university teaching evaluation system of China's current (also called reconstruction), need for teachers to return to modern education the idea, let the teachers realize the importance of quality concept. That is, through interactive teaching to the teaching process, to control quality of teaching activities, and promote the learners' progress, improve their level of knowledge, teaching evaluation system and to promote the development of good comprehensive level, education industry to a certain extent, improve teachers. Therefore, the construction of university education evaluation system needs to carry out the "student oriented" concept, and the idea as the starting point and final destination of the construction of teaching evaluation system in Colleges and universities, to achieve the two consent. Personally think that China's higher education evaluation system (student-centered evaluation system) should be composed of the following aspects: first, in the teaching process need to always implement the "student oriented" concept of education, from the organization of teaching content, teaching methods, teaching organization form to determine the following aspects, earnestly implement the philosophy of education. University teaching evaluation method of time must respect the students' subjective consciousness; secondly, because active learning is directly related to the quality
of teaching, teachers should fundamentally realize active learning, guide students to active learning, stimulate students' interest, ask questions about the study of students in the classroom, understand the learning situation of students, answering questions for students, improve their learning enthusiasm and learning ability. Finally, teachers should clear teaching evaluation system of students' rights and obligations, students in the system is the system of the subject, they is the stakeholder evaluation system, it should be possible to make the "truth", express their demands to the teachers and schools, teachers and Schools should also meet the students' reasonable demands and improve their teaching quality as much as possible.

2. COMPOSITION OF TEACHING EVALUATION SYSTEM

University teaching evaluation system for students of the importance have been widely concerned, therefore the "student-centered" should be took as the basis and the basic idea, and improve the students' comprehensive quality as the objective of teaching evaluation system in the construction of teaching evaluation system. Although the evaluation criteria can be different, the evaluation system needs to meet the standards of its own development, the evaluation criteria must take students "learning" as the center, focus on building a teaching evaluation system to promote the development of students, and improve students' learning achievement and comprehensive ability. Teachers should also actively guide students to improve their learning methods in the course of teaching, avoid students doing useless work, and improve students' self-learning ability and self-control ability. The results of the assessment system can in turn produce certain effect on teachers, improve teaching concept to a certain extent, guide teachers to "student-centered" as their teaching philosophy, and ultimately promote the development of teachers' profession and improve current classroom teaching situation. Through investigation and study, college teaching evaluation system should include academic evaluation, interactive evaluation, growth evaluation, evaluation of difference, oriented evaluation, testability evaluation aspects.

2.1. Academic Evaluation

Academic evaluation should be the focus of classroom teaching, the academic is the human exploration of the objective world of ideas, thoughts, ideas and methods, which are produced through the exchange, has a certain theoretical and scientific. As everyone knows, the higher education and occupation education the biggest difference is that the purpose of higher education is not simply a professor knowledge and experience, but let students pay more attention to the academic content of classroom teaching, teachers, schools can also let the academic development of the cultural environment has its own characteristics and traditional culture. Teachers in the process of classroom teaching, not only need the textbook to teach students to exchange with students of the discipline in recent years of development, as well as the latest knowledge of experts and scholars, some novel theories, and arouse students' learning interest and enthusiasm for scientific exploration, to guide the students get into the habit of critical thinking and dialectical thinking in the process of learning inertia. At the same time, the high standard of narrative teaching can inspire the teachers to improve their professional level and teaching level.

2.2. Interactive Evaluation

As everyone knows the classroom teaching is an interactive process, only the "teaching" and "learning" to combine is a complete teaching system, students explore and promote students and teachers on students' knowledge to the teaching evaluation system, students can bold hypothesis and careful argumentation, dare to criticize, encourage students to produce active interest in learning. Teachers should guide the students to express their views and ideas in the classroom, teachers should teach students in the classroom "to err is human" point of view, allowing students to dare to question the teacher's teaching contents. The teacher should allow students to teach methods and lecture comments, and humbly accept the reasonable opinions, and unreasonable opinions or misunderstanding, teachers should select the appropriate time to the students to explain, let the students evaluate their lectures whether regulations, whether to facilitate understanding, classroom interaction etc. a content, improve their level of knowledge and ability.

2.3. Growth Evaluation

Teachers should pay attention to students' growth, according to the survey, most of our universities currently have student achievement to measure students' learning level, learning quality, and the teaching level of teachers is the average score of students to measure, this is a big trend of teaching evaluation, this evaluation method is lack of continue to focus on improving the ability of students and the self value of the. This result will only lead to elite education become a microcosm of the examination oriented education, all requirements of college students should have a certain critical spirit of exploration, self thinking ability and innovation ability, but in the current higher education system, students' ability has not been improved, at the same time in order to ensure the graduation rate, much higher college teachers have "water", this part of the teachers and students of
the social echo is more intense, which greatly affected the health of China's higher education sustainable development. We are trying to build the student teaching evaluation of the system, need to pay attention to the growth of students, improve the students in the learning process of self-thinking ability and self-control ability, the ability of innovation and practice.

2.4. Oriented Evaluation
In the construction of the evaluation system of university teaching. Teacher evaluation is usually their experience, therefore, the competent authorities should organize the school qualified and experienced teachers, so that they can construct the teaching experience and the domestic and foreign universities teaching evaluation system of their own experience to choose, and finally determine the corresponding to their school the evaluation system in the method should be mainly adopts the method of qualitative analysis, and the use of quantitative analysis combined with the quantitative analysis must be based on a survey of students as the basis, to ensure the reliability of quantitative analysis. Each index that can evaluate the quality of classroom instruction can instruct teachers and improve their teaching level.

2.5. Testability Evaluation
In the design of college teaching evaluation system should have certain pertinence, according to different evaluation subjects design different evaluation system, the evaluation of classroom teaching activities for students, should as far as possible to ensure the evaluation index clearly, students need to make objective and fair evaluation according to the evaluation indexes and their feelings in the classroom. In order to improve the operability of evaluation, testability should be determined around the subjects and students.

2.6. Difference Evaluation
Different class, different subjects have different teaching contents and teaching characteristics, so in every aspect of teaching, evaluation of teaching quality should also have certain differences, to avoid the evaluation of different types of courses using the same evaluation standard, this fair is on the surface of such activities on the diagnostic evaluation guidance and evaluation. In the evaluation of classroom teaching content, it is necessary to design different teaching content organization, teaching style and teaching interaction evaluation standards, but also need to evaluate different teachers and students in different disciplines.

3. INTERVAL VALUED FUZZY EVALUATION METHOD
The interval valued fuzzy average method is to evaluate the teaching evaluation system by replacing the traditional evaluation scheme with the effective interval score.

The arithmetic of interval number can be show by the following formula

$$[R] = \left\{ [a^-, a^+] : a^- \leq a^+, a^- \in R \right\}$$

where \([R]\) is the set of all closed intervals formed on the real number set \(R\).

\[\forall [a^-, a^+], [b^-, b^+] \in [R], a^- > 0, b^- > 0, \forall k \in Q,\]

\[[a^-, a^+] + [b^-, b^+] = [a^- + b^-, a^+ + b^+]\]

\[k[a^-, a^+] = [ka^-, ka^+]\]

\[\forall k_i \in Q, [a_i^-, a_i^+] \in [R], \text{then}\]

\[
\begin{pmatrix}
[a_1^-, a_1^+] \\
[\cdots] \\
[a_n^-, a_n^+]
\end{pmatrix} = k_1[a_1^-, a_1^+] + \cdots + k_n[a_n^-, a_n^+] \tag{4}
\]

when \([a, b], [c, d] \in [R], \text{then}\)

\([a, b] < [c, d], b < c\)

\[
[a, b] < [c, d], \frac{a + b}{2} < \frac{c + d}{2}, b \geq c \]

\([a, b] = [c, d], a = c, b = d\)
\[ [a,b] \approx [c,d], \ a \neq c, \ \frac{a+b}{2} = \frac{c+d}{2} \]

The calculation steps of interval valued fuzzy evaluation method are as follows.

Step 1. The evaluation results are divided into four grades: Excellent\([80,100]\), Good\([70,79]\), Medium\([60,69]\), Poor\([45,59]\). The indexes of the evaluation table were scored, and the frequency \(p_i\) of each index was calculated, and the score of the effective interval was calculated
\[
[a^{-}, a^{+}] = \sum_{i=1}^{4} p_i [a_i^-, a_i^+] 
\]

Because most of the time interval effective score calculated not necessarily falls in a certain level range, can not determine the evaluation level directly, which requires the calculation of the effective range of the level of membership of each grade interval is determined. The maximum level of membership (average of two points) is on interval \([45,100]\). \(y_1(t), y_2(t), y_3(t), y_4(t)\) are the subordinate functions of the corresponding difference, middle, good and excellent respectively
\[
y_1(t) = \begin{cases} 1 , & t \in [45,60] \\ \frac{70-t}{10} , & t \in [60,70] \\ 0 , & t \in [70,100] \end{cases} 
\]

\[
y_2(t) = \begin{cases} \frac{t-45}{15} , & t \in [45,60] \\ 1 , & t \in [60,70] \\ \frac{80-t}{10} , & t \in [70,80] \\ 0 , & t \in [80,100] \end{cases} 
\]

\[
y_3(t) = \begin{cases} \frac{t-60}{10} , & t \in [60,70] \\ 1 , & t \in [70,80] \\ \frac{100-t}{20} , & t \in [80,100] \end{cases} 
\]

\[
y_4(t) = \begin{cases} 0 , & t \in [45,70] \\ \frac{80-t}{10} , & t \in [70,80] \\ 1 , & t \in [80,100] \end{cases} 
\]

The obtained effective intervals are substituted into the four functions respectively, and the degree of membership in each grade interval is determined. The maximum level of membership (average of two points) is the final rating. Suppose \(U = (u_1, \cdots, u_n)\) is the collection of primary evaluation indexes in the evaluation table of influencing factors in teaching evaluation system, and \(U_i\) is first grade evaluation index; \(Q = (q_1, \cdots, q_n)\) is the weight of the corresponding first level index; \(U = [u_{i1}, \cdots, u_{in}]\) is a collection of two levels of evaluation, \(U_{ij}\) is a two level index under the first level index \(u_i\), \(Q_i = (q_{i1}, \cdots, q_{in})\) is the weights of the corresponding two level indexes; \(U_{ijk} = [u_{ijk}, \cdots, u_{ijn}]\) is the collection of three level evaluation indexes, \(U_{ijk}\) is three level evaluation index of two level evaluation index \(U_{ij}\), \(Q_{ij} = (q_{ij1}, \cdots, q_{ijn})\) is the weights of the corresponding three level indexes.

First, the score of the three indicators of teaching evaluation system is evaluated by the evaluation of the main, statistical frequency of each level falls in the distribution, which can get the A in the original score interval using the formula of effective interval score
$$F_y = \left\{ \begin{array}{c} [f_{y_1}, f_{y_1}^+] \\ \vdots \\ [f_{y_m}, f_{y_m}^+] \end{array} \right\}$$

Where $m$ is the number of three level indexes under the two level index $u_y$. The weight can be calculated as:

$$R_y = [r_y^-, r_y^+] = q_y \times F_y = \sum_{k=1}^{m} q_{yk} [f_{yk}^-, f_{yk}^+] = [\sum_{k=1}^{m} q_{yk} f_{yk}^-, \sum_{k=1}^{m} q_{yk} f_{yk}^+]$$

$R_y$ is the number of two level indexes under the first level index $u_y$.

In the same way, the effective interval score of the first level index can be obtained as:

$$R_i = [r_i^-, r_i^+] = [\sum_{j=1}^{m} q_{ij} r_j^-, \sum_{j=1}^{m} q_{ij} r_j^+]$$

where $m$ is the number of two level indexes under the first level index $u_i$.

Effective interval score is

$$R = [r^-, r^+] = [\sum_{i=1}^{m} q_i r_i^-, \sum_{i=1}^{m} q_i r_i^+]$$

where $m$ is the number of primary indicators in the evaluation system.

The effective interval scores of the four evaluation subjects are as follows:

$$Z = [z^-, z^+] = [\sum_{i=1}^{4} W_i z_i^-, \sum_{i=1}^{4} W_i z_i^+]$$

where $[z_i^-, z_i^+]$ is the last valid interval of the $i$ evaluation subject, that is, $W_i$ is the weight of the $i$ evaluation subject in the comprehensive scoring system. Then $[z^-, z^+]$ is substituted into the rank membership function $y_i(t) = y_i(t)$ in turn and determine its level. The ranking of design factors in comprehensive evaluation can be obtained by ranking the maximum membership degree in the same grade.

Confirm the fraction interval for the reference of evaluation results as shown in Table 1.

<table>
<thead>
<tr>
<th>Evaluation method</th>
<th>Fraction interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>0-40</td>
</tr>
<tr>
<td></td>
<td>40-60</td>
</tr>
<tr>
<td></td>
<td>60-80</td>
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<tr>
<td></td>
<td>80-90</td>
</tr>
<tr>
<td></td>
<td>90-100</td>
</tr>
<tr>
<td>Good</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>0.95</td>
</tr>
<tr>
<td>Ordinary</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Poor</td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>0</td>
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<tr>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

The evaluation result obtained from the above processes is:

$$K'_{11} = (0.23, 0.21, 0.25, 0.19, 0.32)$$

By using the above method, we can obtain the evaluation set of the other three sub-sets, which are

$$K'_{12} = (0.31, 0.28, 0.15, 0.08, 0.11)$$
$$K'_{13} = (0.20, 0.15, 0.37, 0.21, 0.06)$$
$$K'_{14} = (0.16, 0.22, 0.38, 0.13, 0.28)$$

Through the above formula, we can obtain the single factor evaluation matrix corresponding to $W_i$, which is shown as follows, $K'_{11}$.
4. CONCLUSION

University teaching evaluation system is a more complex evaluation system needs the relevant departments to develop school teaching quality management system related to the collection of teaching information from different perspectives, but also need to ensure the accuracy and credibility of the information collected, should fully mobilize the enthusiasm of all the teachers and students to construct the evaluation system, the importance of students and teachers are able to understand the teaching evaluation, improve teaching quality.

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