Construction and Application of Comprehensive Evaluation Model of “Golden Classroom”

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Abstract. The survey shows that the intensity of learners’ interest in courses is the strong positive energy for the construction of "Golden Lessons", and the optimization of classroom teaching is the primary factor among many factors in the construction of "Golden Lessons". The director who constructs the "golden lesson" is the teacher, the main body is the student, and the measurement of the "golden content" is the classroom teaching. Therefore, the continuous "Golden Classroom" is an inevitable move to build a "Golden Lesson", it is imperative to find the evaluation standard of "Golden Classroom" scientifically and reasonably. Based on this, through the combination of qualitative and quantitative, using the principle of fuzzy mathematics, a comprehensive evaluation model of "Golden Classroom" is constructed, and the standard score of the final evaluation result is used to give the threshold of "Golden Classroom". For the objective determination of "Golden Classroom", building "Golden Lessons" has certain theoretical enlightenment and application value.

1. Introduction
At the "New Era National Undergraduate Education Work Conference for Higher Education Institutions" held in June 2018, Minister Chen Baosheng of the Ministry of Education first proposed the concept of "Golden Lessons", and the "Golden Lesson" was subsequently written into the Ministry of Education documents. What is "Golden Lesson"? Director Wu Yan of the Department of Higher Education of the Ministry of Education put forward the standard of Golden Lessons: high-level, innovative, and challenging. Obviously, based on the connotation of the "golden course", the creation of a gold course requires high-quality textbooks, teachers and students must devote themselves, besides, teachers and relevant functional departments must have efficient management mechanisms and countermeasures [1]. In short, "Gold Teaching Material", "Gold Investment" and "Gold Management"[2].

Regarding the construction of the "Golden Lesson", we recently conducted a large-scale survey at a certain normal university. The subjects of the survey were 740 college students and 100 college teachers. The survey adopted a combination of questionnaires and interviews. Among the students, there were 500 current students and 240 college students who had just graduated in the past three years. Both teachers and students were divided in liberal arts and sciences. The survey results show that 91.2% of students and 96% of teachers believe that the positive energy formed by the strong interest of learners in the curriculum is a necessary and sufficient condition for the construction of a "Golden Lesson". The
general orientation gave us a strong interest, we also selected 50 fresh graduates who had graduated more than three years and were admitted to graduate school. We conducted further in-depth interviews with them. And it is very important to choose the future direction of further study and employment. Although the curriculum is the concretization, operability, and targetization of the basic standards of "Morality Education", most of the surveyed believe that the content of teaching materials as an important part of it depends on the reconstruction of teachers to a great extent [3]. At the same time, it is believed that the intensity and benefit of "Gold management" are also closely related to the "interest" of students.

By arranging the survey data, many results are gathered: the director who constructs the "golden lesson" is the teacher, the main body is the student, and the measurement of the "golden content" is the classroom teaching. Because only the consecutive "golden classes" can be combined into a veritable "golden Lesson". Therefore, a comprehensive, fair and just evaluation of the gold content of classroom teaching is the most important thing in constructing and promoting the "golden Lesson". Based on this, it is imperative to find the evaluation standard of "Golden Classroom" scientifically and reasonably.

2. Comprehensive evaluation model of "Golden Classroom"

2.1. Determine the "Golden Classroom" evaluation index system and corresponding evaluation weights

Macroscopically speaking, any course is an orderly arrangement and combination of system theory, knowledge, methods, etc. Regardless of the order in which the classroom is presented, it shows cold beauty, therefore, only courses that students have felt and experienced and can enlighten students are real courses [4]. Based on this concept, the following indicator system can be selected for comprehensive evaluation of the "gold content" of classroom teaching [5]. As shown in Table 1.

Table 1. "Golden Lesson" classroom teaching quality evaluation index system

| First-level index | Second-level index |
|-------------------|--------------------|
| Classroom design  | Introduction design |
|                   | Content organization |
|                   | Method selection    |
| Classroom performance | Teacher-student interaction |
|                   | Advancing speed     |
|                   | Expanding space     |
| Classroom effect  | Ideological and political penetration |
|                   | Knowledge standard  |
|                   | Hands-on ability    |

In summary, it can be seen that comprehensive observation and analysis of classroom design, classroom performance and classroom effects are sufficient to describe the gold content of classroom teaching. Therefore, to evaluate whether a classroom teaching is a "golden classroom", you can choose a set of factors:

\[ U = \{U_1, U_2, U_3\} = \{\text{Class design, class performance, class effect}\} \]  

Among them \[ U_1 = \{u_{11}, u_{12}, u_{13}\} = \{\text{Introduction design, content organization, method selection}\} \]  

\[ U_2 = \{u_{21}, u_{22}, u_{23}\} = \{\text{Teacher-student interaction, advance speed, expand space}\} \]  

\[ U_3 = \{u_{31}, u_{32}, u_{33}\} = \{\text{Ideological and political penetration, knowledge up to standard, practical ability}\} \]  

According to modern teaching concepts and the importance of each link in the classroom teaching process, the weights of the first-level indicators are:

\[ A = (a_1, a_2, a_3), \]

The weights of the secondary indicators are:
Among them, the selection of the weights of the first-level indicators and the second-level indicators, we usually consider using expert evaluation to directly determine, considering, however, that different experts have different emphasis on the elements of the optional factors, therefore this study introduces the idea of set-value statistics to determine the weights of the primary and secondary indicators[6].

According to the principles and methods of set-value statistics, first let every expert give the estimated interval of the index based on his own knowledge, experience, and intuition. For example, for the first-level indicator, suppose the estimated interval of the evaluation of the first expert on the first factor is:

Calculate the eigenvalue of the factor according to the set value statistical formula, and set the eigenvalue of the $i$-th factor

$$a^*_i = \frac{1}{2} \sum_{l=1}^{k} (t_{2l}^{(i)} - t_{1l}^{(i)})^2$$

Then the weight of the $i$-th factor is:

$$a_i = \frac{a^*_i}{a_1 + a_2 + a_3}, i = 1, 2, 3$$

Suppose that the weights determined by the above calculation method are as follows:

$$A_1 = (0.30, 0.45, 0.25); A_2 = (0.10, 0.60, 0.30); A_3 = (0.30, 0.40, 0.40)$$

2.2. Determine the evaluation level and build the evaluation matrix

Humans are not good at a particular sensory area: we do not have the sharp vision of eagles, the hearing of bats, and the smell of rodents. However, human sensory mechanisms allow us to process a wide range of complex sensory inputs[7]. The main body of teaching is students, and the standard of "Golden Classroom" should be based on the satisfaction of students through the senses. Because getting strong satisfaction through feeling can generate re-demand, and further re-demand can gather positive energy. Such a virtuous circle can effectively promote the harmonious interaction between teachers and students and ensure the formation of an efficient and veritable "golden classroom". Based on this, the evaluation level of each factor is set as:

$$V = \{v_1, v_2, v_3, v_4, v_5\} = \{\text{strongly satisfied, satisfied, not sure, dissatisfied, strongly dissatisfied}\}$$

We can make a comprehensive judgment on the $U_1, U_2, U_3$ stratification respectively.

$$U_1 = \{u_{11}, u_{12}, u_{13}\} \quad U_2 = \{u_{21}, u_{22}, u_{23}\} \quad U_3 = \{u_{31}, u_{32}, u_{33}\}$$

Single-factor fuzzy evaluation is the key to comprehensive evaluation, which is usually carried out through survey statistics or fuzzy statistics [8]. If the evaluation object is evaluated according to the $j, (j=1,2,3)$ factor $u_j$ in the factor set $U_j$, and the membership degree of $v_k, (k=1,2,...,5)$ in the evaluation set is set as $r_{jk}$, so the evaluation result according to $U_i$ can be expressed by a fuzzy set:

$$R = \begin{pmatrix}
    r_{11} & r_{12} & r_{13} & r_{14} & r_{15} \\
    r_{21} & r_{22} & r_{23} & r_{24} & r_{25} \\
    r_{31} & r_{32} & r_{33} & r_{34} & r_{35}
\end{pmatrix} i = 1, 2, 3$$

Among them, $r_{jk}$ can be determined by the students' teaching evaluation materials, can also be determined by expert on-site evaluation, or can be weighted by the results of student evaluation and professional on-site evaluation, etc.

Since $A_i (i = 1, 2, 3)$ has been given, the fuzzy comprehensive evaluation of each sub-factor set obtains:
2.3. Comprehensive evaluation

Based on the above calculation results, a comprehensive evaluation of all factors can be obtained as:

\[ B = A \circ R = A \circ B_2 \circ R_3 \]

(14)

The final judgment result can be obtained through "normalization" and "assignment".

3. Application of the comprehensive evaluation model of "Golden Classroom"

"Degree" is to maintain the range, scope and limit of the "quantity" of things. Only by knowing the "degree" of things can we accurately understand the quality of things. How to choose the "degree" to portray the "Golden Classroom"? We can give this "degree" in the sense of "quantity" through comprehensive evaluation results.

According to the evaluation index system and corresponding evaluation weights of the "Golden Classroom" determined above, the fuzzy comprehensive judgment matrix of each sub-factor set can be determined according to the information feedback (frequency) of the classmates on the teaching results.

Table 2. Feedback form for students’ classroom listening information

| First-level indicator | Second-level indicator | Strongly satisfied | Satisfied | Not sure | Dissatisfied | Strongly dissatisfied |
|-----------------------|------------------------|--------------------|-----------|----------|--------------|----------------------|
| Classroom design      | Introduction design    | 0.70               | 0.20      | 0.05     | 0.05         | 0.00                 |
|                       | Content organization   | 0.55               | 0.20      | 0.15     | 0.05         | 0.05                 |
|                       | Method selection       | 0.50               | 0.30      | 0.10     | 0.05         | 0.05                 |
| Classroom performance | Teacher-student interaction | 0.55         | 0.30      | 0.10     | 0.05         | 0.00                 |
|                       | Advancing speed        | 0.45               | 0.20      | 0.20     | 0.10         | 0.05                 |
|                       | Expanding space        | 0.42               | 0.30      | 0.16     | 0.08         | 0.04                 |
| Classroom effect      | Ideological and political penetration | 0.41       | 0.40      | 0.12     | 0.07         | 0.00                 |
|                       | Knowledge standard     | 0.50               | 0.30      | 0.10     | 0.08         | 0.02                 |
|                       | Hands-on ability       | 0.46               | 0.24      | 0.2      | 0.09         | 0.01                 |

Available from Table 2:

\[ B_1 = A_1 \circ R_1 = (0.10,0.60,0.30) \circ \begin{pmatrix} 0.70 & 0.20 & 0.05 & 0.05 & 0.00 \\ 0.55 & 0.20 & 0.15 & 0.05 & 0.05 \\ 0.50 & 0.30 & 0.10 & 0.05 & 0.05 \end{pmatrix} = (0.55,0.23,0.13,0.05,0.05) \]

(15)

\[ B_2 = A_2 \circ R_2 = (0.30,0.40,0.30) \circ \begin{pmatrix} 0.55 & 0.30 & 0.10 & 0.05 & 0.00 \\ 0.45 & 0.20 & 0.20 & 0.10 & 0.05 \\ 0.42 & 0.30 & 0.16 & 0.08 & 0.04 \end{pmatrix} = (0.47,0.26,0.16,0.08,0.03) \]

(16)

\[ B_3 = A_3 \circ R_3 = (0.20,0.40,0.40) \circ \begin{pmatrix} 0.41 & 0.40 & 0.12 & 0.07 & 0.00 \\ 0.50 & 0.30 & 0.10 & 0.08 & 0.02 \\ 0.46 & 0.24 & 0.20 & 0.09 & 0.01 \end{pmatrix} = (0.47,0.30,0.14,0.08,0.01) \]

(17)

Thereby
According to the principle of maximum degree of membership, the teaching evaluation of the course is considered very satisfactory.

Note: When the conclusion cannot be drawn directly according to the principle of maximum membership, we can consider the elements in $B$ to compromise and re-determine the threshold corresponding to each evaluation level.

There is indeed a vague area in the determination of the "Golden Classroom". It is difficult to give a precise definition whether it is a student attending the class or an expert who is in person to judge. However, if you assign a value to the result of the fuzzy comprehensive evaluation, you can determine a relatively easy-to-operate principle from the perspective of "quantity", which is based on the standard score. For example, strongly satisfied, satisfied, not sure, dissatisfied and strongly dissatisfied, respectively assign 95 points, 90 points, 80 points, 60 points, and 40 points. Thus the final score (i.e. standard score) is

$$\text{B} = (95, 90, 80, 60, 40) = (95 90 80 60 40)(0.49 0.26 0.15 0.07 0.03)T = 87.35\text{(points)} \quad (19)$$

The standard score formed by the combination of qualitative and quantitative can be used as a quantitative standard for judging the "Golden Classroom". If the results of continuous judgment or multiple sampling are all "Golden Classroom", then this course can be regarded as a "Golden Class". In addition, using this model, we can also perform factor analysis on each first-level indicator, analyze the gap with the satisfaction of each corresponding second-level indicator, and then take corresponding adjustments and optimizations to keep it more reasonable and scientific, and maximize the contribution rate to the high standard score.

4 Basic principles of comprehensive evaluation of "Golden Classroom"

4.1 Scientific selection of evaluation factor indicators and their corresponding evaluation proportions

The reason why we adopt fuzzy comprehensive evaluation of "Golden Classroom" is because there are some fuzzy areas in its evaluation. It is necessary to quantify some factors with unclear boundaries and difficult to quantify, and comprehensively evaluate the status of the affiliation level of the evaluated object from multiple factors. Based on this, we must choose the substantive (qualitative) indicators that can truly reflect the quality of classroom teaching as the evaluation factor set, and give the corresponding evaluation weights scientifically, and this is the key to evaluating whether the model is valuable. It is recommended to follow the concept of modern education when choosing courses, invite a number of experts to brainstorm ideas based on the characteristics of the discipline, and further improve and adjust the course practice.

4.2 Using multiple methods to improve the fairness and reliability of the evaluation matrix

Since each element of the evaluation matrix is subjectively determined, and generally speaking, subjective or qualitative indicators have a certain degree of ambiguity, and the division of index values is generally rough, therefore, it is very important to improve the authenticity and rigor of the evaluation matrix. For example, when using the frequency method, on the one hand, it is necessary to increase the number of evaluators as much as possible. On the other hand, it is necessary to pay attention to the professional quality of the participants to reduce the "untrue" of the information obtained as much as possible. In order to improve accuracy, highly respected experts should be invited to participate in the collection of information, and the original information should be "Delete both ends and keep the middle". In order to improve accuracy, highly respected experts should be invited to participate in the collection
of information, and the original information should be "Delete both ends and keep the middle", to ensure the fairness and reliability of the evaluation results to a large extent [9].

4.3 Ensure the rigor of the "Golden Classroom" threshold

According to the assumption of this article, use standard scores to describe the gold content of the course, and even determine the quantitative standard of "golden classroom". As a threshold, how should it be determined to make the evaluation more objective and rigorous? We believe that, first of all, we must grasp "consistency" and have a high standard score for continuous comprehensive evaluation of classroom teaching. Secondly, it must be "discriminatory" and stand up to comparison. This standard score must be higher than the comprehensive evaluation standard scores of most classroom teaching. When necessary, random sampling surveys can be used to prove significant differences with other classroom teaching with a two-sample statistical hypothesis test. At this time, this standard score can be used as the minimum score to define "Golden Classroom", that is, the threshold of "Golden Classroom".

In short, only when a true "Golden Classroom" is constructed can there be a veritable "Golden Class". Therefore, only through in-depth discussion on overcoming the influence of human factors to the greatest extent, and then giving a more accurate standard for evaluating "Golden Class", can we provide more reliable basis and measures for the identification and construction of "Golden Class".

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