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PAPER

Multi-Dimensional Evaluation of Teachers' Leading Role in Art-Training Courses

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ABSTRACT

Art-training courses are an important form of practical education, with cultivating students' innovative thinking and practical skills as their primary objective. In classroom teaching, teachers have a vital influence on students' learning results. However, conventional methods for evaluating teachers of art-training courses generally have few dimensions and thus are unable to comprehensively and accurately reflect teachers' leading role in art-training courses. To fill in this blank, this study created a multi-dimensional evaluation index system (EIS) for assessing teachers' leading role in art-training courses and built a multi-dimensional model based on a satisfaction function and using a cobweb chart. The proposed model can be used to evaluate the overall performance of teachers and analyze the relationship and balance between each evaluation index. The model can output more equitable evaluation results, increasing the trust of evaluation objects for the evaluation process. Lastly, validity of the model was verified by empirical analysis.

KEYWORDS

training course, teacher's leading role, multi-dimensional evaluation, cobweb chart

1 INTRODUCTION

As educational reform has continued to progress in the 21st century, practical education has gradually become an important part of the education system [1–10]. Training courses develop students' ability to solve real-world problems by simulating actual working scenarios [11–19]. Art-training courses are an important form of practical education, with cultivating students' innovative thinking and practical skills as their primary objective [20–23], during which the art-training teachers play a leading role in the classroom and exert a significant influence on students' learning results.

However, conventional methods for evaluating teachers of art-training courses generally have few dimensions and thus are unable to comprehensively and accurately reflect teacher's leading role in art-training courses, and the subjective

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component in the evaluation of teachers might hurt the fairness of the evaluation results, thereby affecting the career development of the teachers. Thus, it's of both theoretical and practical values to give multi-dimensional evaluation of teachers' leading role in art-training courses.

Multi-dimensional evaluation judges teachers' leading role from different angles and dimensions and gives all-around evaluations of teacher performance in art-training courses, thereby offering detailed data for educational institutions and departments. It also eliminates subjectivity in evaluation and creates a fairer competitive environment and paves a better career path for teachers.

Currently available multi-dimensional evaluation methods generally fail to fully cover the various roles and responsibilities of teachers in practical training courses, such as instructing students to carry out practical activities, organizing course resources, and promoting students to cooperate and communicate with each other. If the selection of evaluation indexes are not all-inclusive, the attained evaluation results may not be able to accurately reflect the leading role of teachers. Teachers may also differ significantly in teaching style, teaching method, and personality, and current methods have not fully considered these individual differences, resulting in evaluation results not being able to precisely indicate the actual performance of teachers. To solve these issues, this study attempts to discuss a multi-dimensional method for evaluating teachers' leading role in art-training courses, in the hope of providing a new research perspective and method for the education evaluation field. Through a review of related literature, the pros and cons of existing evaluation methods were analyzed, and a multi-dimensional model was constructed based on a satisfaction function and a cobweb chart; the later part was verified to valid by empirical analysis. Research conclusions attained in this study can be used for providing comprehensive information about teachers' leading role in art-training courses for educational institutions and departments, instructing teachers to improve teaching methods and strategies, and enhancing the teaching quality of art-training courses.

2 MULTI-DIMENSIONAL EVALUATION BASED ON A SATISFACTION FUNCTION

To solve the satisfaction problem of evaluation objects in the multi-dimensional evaluation of teachers' leading role in art-training courses, this study proposed a novel one-time evaluation score conversion function, which converts the initial scores of each index of evaluation objects, so as to make the evaluation more pertinent. This study also introduced a satisfaction function to balance the satisfaction degree between evaluation objects to avoid significant differences in the satisfaction degree of evaluation objects caused by the unfairness of evaluation method, thereby giving more equitable evaluation results and increasing the trust of evaluation objects for the evaluation process.

For the multi-dimensional evaluation task (teachers' leading role in art-training courses) in this study, five first-level indexes were created, as follows:

1. Index of teaching content and method: This index measures the teaching content and methods adopted by teachers in training courses, including aspects of the innovation and practicality of teaching content, and the diversity and adaptability of teaching method. Teachers should have the ability to guide students to explore and practice in art-training courses and to use effective strategies to promote the development of students' artistic skills and aesthetic judgment.

2. Index of course organization and management: Art-training courses usually involve a variety of resources and activities, so teachers need to have a good ability to organize and manage the course. This index describes teachers' performance in course planning, resource allocation, time management, and class discipline to ensure smooth progress of the course.

3. Index of student interaction and communication: Art-training courses often emphasize students' participation and interaction. Teachers should have the ability to communicate effectively with students. This index evaluates teachers' performance in guiding students to discuss, encouraging them to ask questions, replying their questions, and paying attention to students' individual differences and provide personalized guidance.

4. Index of practical guidance and feedback: In art-training courses, teachers need to give instructions and help students master relevant skills. This index focuses on teachers' performance in providing students with targeted skill guidance, practical advice, and timely and effective feedback.

5. Index of student achievement and growth: The ultimate goal of the task is to promote students to grow and gain achievement in art-training courses. This index aims to evaluate students' performance in aspects of course work quality, skills improvement, and creativity development, and the contribution of teaching to these outcomes.

Assuming: $T_u(z)$ represents the sum of converted values of evaluation indexes of the $u(1 \le u \le o)$-th evaluation object, then:

$$T_u(z) = \sum_{k=1}^{w} t_{uk} = \sum_{k=1}^{w} \left(\frac{s_{uk}}{f_k} \right)^2 z_k \tag{1}$$

The following formula calculates the sum of converted values of evaluation indexes of all evaluation objects $T(z)$:

$$T(z) = \sum_{u=1}^{o} \sum_{k=1}^{w} t_{uk} = \sum_{u=1}^{o} \sum_{k=1}^{w} \left(\frac{s_u}{f_k} \right)^2 z_k \tag{2}$$

The evaluation proportion D_u of the u-th evaluation object can be calculated by the following formula:

$$D_u = \frac{T_u(z)}{T(z)} = \frac{\sum_{k=1}^{w} \left(\frac{s_{uk}}{f_k} \right)^2 z_k}{\sum_{u'=1}^{o} \sum_{k=1}^{w} \left(\frac{s'_{uk}}{f_k} \right)^2 z_k} \tag{3}$$

According to above analysis, if the value of D_u is too small, then the attained value of $z_k (1 \le k \le w)$ is least favorable for it; conversely, if the value of D_u is too large, then the attained value of $z_k (1 \le k \le w)$ is most favorable for it. In order to get an ideal satisfaction function, the values of $z_k (1 \le k \le w)$ that are the most and least favorable for the $u(1 \le u \le o)$-th evaluation object were solved, and the formula below gives the expression of model (O_1) and model (O_2) constructed in this study for describing the optimal performance proportion of the $u(1 \le u \le o)$-th evaluation object:

$$(O_1)\begin{cases} MAX \dfrac{\sum_{k=1}^{w}\left(\dfrac{s_{uk}}{f_k}\right)^2 z_k}{\sum_{u'=1}^{o}\sum_{k=1}^{w}\left(\dfrac{s'_{uk}}{f_k}\right)^2 z_k}, \\ s.t \quad z_k \in [\sigma,\lambda](1 \le k \le w). \end{cases} \tag{4}$$

$$(O_2)\begin{cases} MIN \dfrac{\sum_{k=1}^{w}\left(\dfrac{s_{uk}}{f_k}\right)^2 z_k}{\sum_{u'=1}^{o}\sum_{k=1}^{w}\left(\dfrac{s'_{uk}}{f_k}\right)^2 z_k}, \\ s.t \quad z_k \in [\sigma,\lambda](1 \le k \le w). \end{cases} \tag{5}$$

For each evaluation object, the satisfaction degree increases with the proportion. Assuming D'_u and D''_u represent the most and least favorable proportion for the $u(1 \le u \le o)$-th evaluation object, then the newly built satisfaction function can be written as:

$$d_u(D_u) = \left(\frac{D_u - D''_u}{D'_u - D''_u}\right)^{\frac{1}{3}} = \left(\frac{\sum_{k-1}^{w}\left(\dfrac{s_{uk}}{f_k}\right)^2 z_k}{\dfrac{\sum_{u'=1}^{o}\sum_{k=1}^{w}\left(\dfrac{s_{uk}}{f_k}\right)^2 z_k}{D'_u - D''_u}}\right) \tag{6}$$

According to above formula, the maximum satisfaction of evaluation objects is 1, in which case $D_u = D_u'$; the minimum satisfaction of evaluation objects is 0, in which case $D_u = D_u''$.

Based on score conversion function and satisfaction function, the following multi-dimensional evaluation model (*LPO*) can be constructed for the evaluation task of this study, and the evaluation objective of this model is to get the minimal difference of individual satisfaction between different evaluation subjects:

$$\begin{aligned} &(LPO)MAX(d_1(D_1), d_2(D_2), ..., d_o(D_o), d_{o+1}), \\ &s.t. \quad z_k \in [\sigma,\lambda](1 \le k \le w). \end{aligned} \tag{7}$$

where

$$d_{o+1} = -\sum_{1 \le u \le u' \le o} [d_u(D_u) - d_{u'}(D_{u'})]^2. \tag{8}$$

The model was subjected to scalarization processing:

$$\begin{aligned} &(APO)MAX\ \gamma, \\ &s.t. \quad \begin{cases} d_u(D_u) \ge \gamma (1 \le u \le o), \\ -\sum_{1 \le u \le u' \le o} [d_u(D_u) - d_{u'}(D_{u'})]^2 \ge \gamma, \\ z_k \in [\sigma,\lambda](1 \le k \le w). \end{cases} \end{aligned} \tag{9}$$

3 MULTI-DIMENSIONAL EVALUATION BASED ON A COBWEB CHART

Geometric graphics can clearly show the relationship and balance between different evaluation indexes, which can help interpret and understand the evaluation process, thereby reducing model complexity. In this study, a multi-dimensional and multi-objective integrated evaluation model was built based on geometric graphics for solving the target evaluation task, the proposed method attempts to make use of the intuitive feature of geometric graphics and convert the integrated problem with multiple objectives and indexes into a geometric problem to attain better flexibility when dealing with such problems. By adjusting the shapes and parameters of geometric graphics, the proposed model can adapt to different evaluation scenarios and requirements with higher universality.

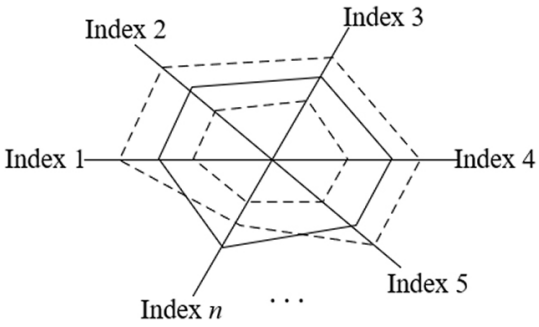

Fig. 1. Multi-dimensional evaluation model based on a cobweb chart

The cobweb chart (also called a radar chart) is a common method to visualize multi-dimensional evaluation problems. It uses polygons to show the scores of each evaluation index, thereby displaying the evaluation results of multi-dimensional indexes as geometric graphics and making the valuation process and results more intuitive and easier to understand, which is conducive to improving the acceptance and participation of the evaluation process. The method is applicable to multi-dimensional evaluation scenarios and can flexibly cope with the multi-dimensional evaluation requirements of the target evaluation task. It can be applied to overall teacher performance evaluation and index relationship analysis. Figure 1 shows the cobweb chart of the multi-dimensional evaluation model for the target evaluation task.

The multi-dimensional evaluation model built for the target evaluation task was defined based on mathematical formulas and a cobweb chart. Assuming that b axial lines radiating from a point in the model can divide the plane into b equal pieces with an equal angle of $2\pi/b$; and that axis $X_u(1 \le u \le b)$ represents the multi-dimensional evaluation index u of the target evaluation task, Z represents the area of the cobweb, A represents the area of the polygon enclosed by a given boundary, and T represents the multi-dimensional evaluation value of the target evaluation task, then the cobweb area A can be calculated using the following formula:

$$A = \frac{1}{2} \times \left(\sin \frac{2\tau}{b} \right) \times (X_1 \times X_2 + X_2 \times X_3 + \cdots + X_{b-1} \times X_b + X_b \times X_1) \tag{10}$$

The relationship between Z and T is given by the following formula:

$$T = \sqrt{\frac{z}{a}} = \frac{1}{\sqrt{a}} z^{\frac{1}{2}} \tag{11}$$

Also, if $1/(a)^{1/2} = J$, then $T = JZ^{1/2}$, A and J are both constants.

The principle of using the cobweb chart to conduct multi-dimensional evaluation is given below:

1. Draw several axes in a plane, each of which represents an evaluation index. The coordinate scale range of axes is 0–1, and the closer the index value is to 1, the better the aspect indicated by the evaluation index is completed.
2. For the target evaluation task (teacher's leading role in art-training course) at a certain time, analyze the scores of each evaluation index and map the scores to the scales of corresponding axes.
3. Connect scale points on each axis to form a closed polygon—namely, the cobweb.
4. Through analysis of the shape and area of the cobweb, the evaluation task can be comprehensively evaluated. Generally speaking, the larger the cobweb area, the better the leading role of a teacher in the art-training course, and vice versa.

This method visualizes the scores of each evaluation index using the cobweb chart, making it easier to analyze and compare; also, the cobweb area visualizes the overall level of teachers' leading role in art-training courses. The formula for calculating the evaluation value is:

$$A = \sqrt{\frac{Cobweb\ area}{Area\ of\ \ the\ equilateral\ polygon\ with\ b\ edges}} \tag{12}$$

For the ectopic reversed-order phenomenon of indexes in the cobweb gray target decision-making model, this study adopted the minimum-area sorting method for calculation, which makes the shape of the cobweb more compact and reduces the mutual influence between indexes, thereby improving the stability of evaluation results; moreover, this method reduces the uncertainty caused by positional changes of indexes and simplifies the analysis and interpretation process of evaluation results.

The specific steps are:

1. When the number of evaluation indexes is $2b$, they are arranged in ascending order according to evaluation values. Then a series is attained as $s_1, s_2, \ldots, s_{2b}$:

$$A = \sqrt{\frac{s_1 + (s_{2b} + s_{2b-1}) + \sum_{u=2}^{b-1} s_u (s_{2b-i} + s_{2b+2-u}) + s_b (s_{b+1} + s_{b+2})}{2b}} \tag{13}$$

2. When the number of evaluation indexes is $2b + 1$, they are arranged in ascending order according to evaluation values. Then a series is attained as $s_1, s_2, \ldots, s_{2b+1}$:

$$A = \sqrt{\frac{s_1 + (s_{2b} + s_{2b+1}) + \sum_{u=2}^{b} s_u (s_{2b+1-u} + s_{2b+3-u}) + s_b (s_{b+1} + s_{b+2})}{2(b+1)}} \tag{14}$$

The three steps of multi-dimensional evaluation of 5 first-level indexes are:

1. **Quantify indexes:**
   The first step was to clarify indexes of the target evaluation task. For the quantification of the five first-level indexes mentioned above, specific quantitative evaluation criteria should be set for each index; through data and information collection, the performance of teachers in terms of these indexes was converted into values between 0 and 1; the closer the value is to 1, the better the performance of the evaluation object in the aspect represented by the index.
2. **Draw the cobweb chart:**
   Then an axis was assigned to each first-level index quantified in the above step, all axes were evenly distributed in the plane. The scale range of axes was 0–1, and scores of each first-level index were mapped to scale points on corresponding axes. After that, the scale points on axes were connected in sequence to form a closed polygon—namely, the cobweb. To eliminate ectopic reversed-order phenomenon of indexes, the minimum-area sorting method was adopted to minimize the area of the cobweb.
3. **Give integrated evaluation of first-level indexes based on the cobweb chart:**
   By calculating cobweb area, the integrated evaluation of five first-level indexes could be attained. On the whole, a larger cobweb area indicates that a teacher plays a better leading role in the art-training course, and vice versa. By comparing the cobweb of a teacher with that of other teachers or other training courses, the strengths and weaknesses of the teacher in the art-training process can be revealed, thereby promoting teaching reform and the mutual learning between teachers. The formula for calculating the value of integrated evaluation is:

$$A = \sqrt{\frac{S_1 + (S_4 + S_5) + S_2(S_3 + S_5) + S_2(S_3 + S_3)}{2(2+1)}} \tag{15}$$

Fuzzy AHP was adopted to calculate the evaluation indexes, and the calculation process is shown in Figure 2. In the method, assuming $I = \{i_1, i_2, ..., i_b\}$ represents the multi-dimensional evaluation indexes of the target evaluation task, n represents the number of evaluation indexes. For the complex multi-dimensional evaluation problem of the target evaluation task (teachers' leading role in art-training courses), the final comprehensive evaluation results consist of each evaluation index and their proportions, assuming $S = \{s_1, s_2, ..., s_b\}$ represents a fuzzy vector on I, s_u represents the weight of the u-th factor, and it satisfies $\sum_1^b s_u = 1$.

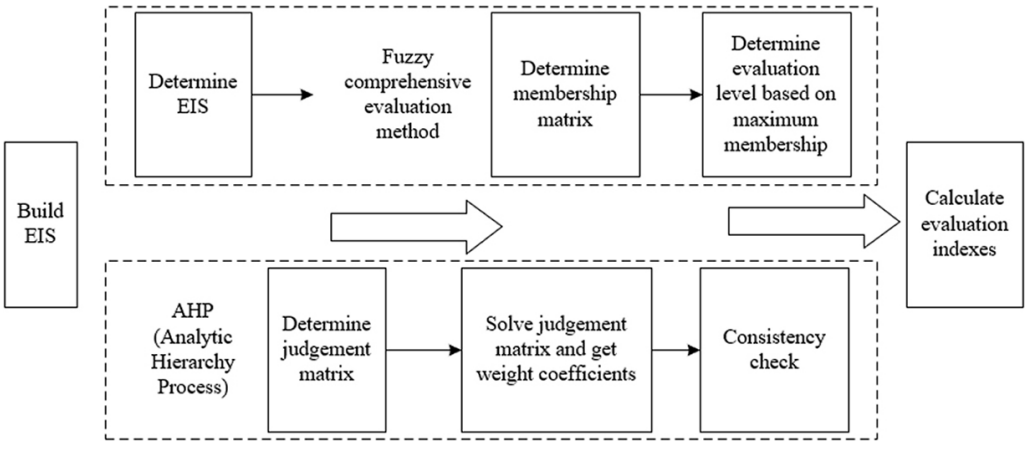

Fig. 2. Calculation process of evaluation indexes

For factor i_u, based on the membership degree e_{uk} of comment set $C=\{C_1,C_2,...,C_l\}$, the single factor judgment set of i_u can be attained as $E_u=\{e_{u1},e_{u2},...,e_{ul}\}$; that is:

$$e_{uk}=\frac{Number\ of\ evaluators\ who\ evaluated\ the\ object\ as\ level\ k}{Total\ number\ of\ evaluators} \quad (u=1,2,...,b;k=1,2,...,l) \tag{16}$$

In this way, an overall evaluation matrix E can be attained based on the judgement of b evaluation indexes; then, the fuzzy relationship matrix of each evaluation object from I to C can be determined:

$$E=\begin{bmatrix} e_{11} & e_{12} & \cdots & e_{1l} \\ e_{21} & e_{22} & \cdots & e_{2l} \\ \vdots & & & \\ e_{b1} & e_{b2} & \cdots & e_{bl} \end{bmatrix} \tag{17}$$

If there is a fuzzy relationship $E=(e_{uk})_{b\times l}$ from I to C, then a fuzzy transformation $YE:D(C)\rightarrow D(C)$ can be attained based on E, and the final comprehensive evaluation results can be attained based on this transformation.

$$N=S\cdot E \tag{18}$$

where

$$n_k=\sum_{u=1}^{b}(s_u\cdot e_{uk})(k=1,2,...,l) \tag{19}$$

After n_k was attained through calculation, if $\sum n_k\neq 1$, then normalization processing was required further; that is:

$$n_k'=\frac{n_k}{\sum_{k=1}^{l}n_k} \tag{20}$$

At last, the evaluation results were converted into specific scores using the following formula:

$$L=C\cdot N^Y \tag{21}$$

4 EXPERIMENTAL RESULTS AND ANALYSIS

Figure 3 compares the satisfaction degree of evaluation objects based on data given in Table 1, and analysis shows that the overall satisfaction of evaluation objects was 0.7604: the performance was good. However, among the 76 serial numbers, only 31.58% of them had a satisfaction degree higher than 0.8, indicating certain fluctuations in the performance of evaluation objects in different aspects and that further improvements could be made. In the meantime, the satisfaction degree of serial number 61 was the highest, reaching 0.9341: the performance was good; the satisfaction degree of serial numbers 3 and 11 was the lowest, 0.6142, so attention is required for solving problems and making improvements in these aspects.

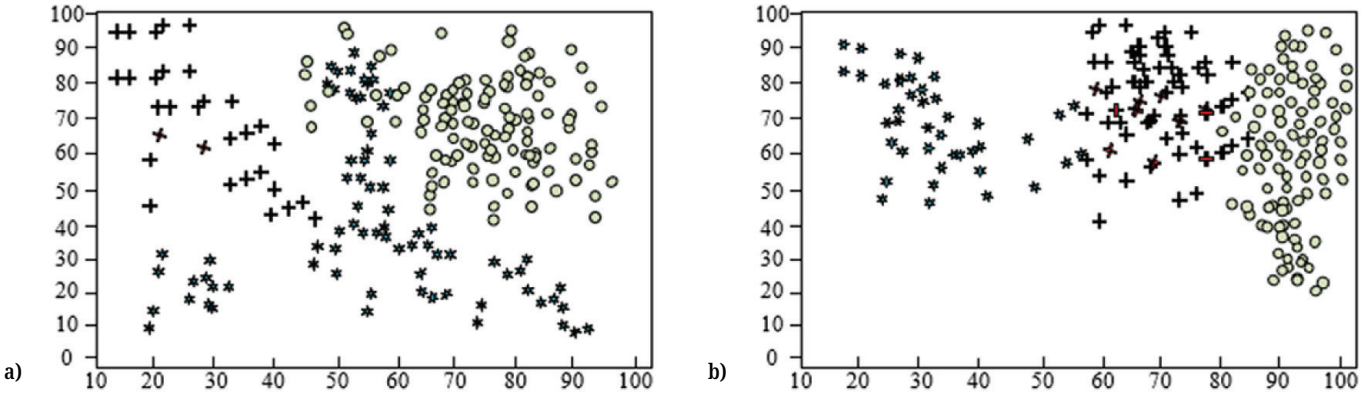

Fig. 3. Comparison of evaluation objects' satisfaction

The evaluation index system (EIS) created was analyzed based on the data of the fuzzy comprehensive evaluation matrix given in Table 2, and the attained analysis results were: the teaching content was mostly evaluated as excellent (0.3) and good (0.31), and the proportion of qualified (0.26) and unqualified (0.2) teaching content was lower. The teaching method was mostly evaluated as qualified (0.2), and the proportion of teaching method evaluated as excellent (0.1), good (0.1), and unqualified (0.1) was relatively low. Course planning was mostly evaluated as excellent (0.5), and the proportion of course planning evaluated as good (0.2), qualified (0.4), and unqualified (0.2) was relatively low. Resource allocation was mostly evaluated as excellent (0.6), followed by good (0.46), qualified (0.16), and unqualified (0.2). Time management was mostly evaluated as excellent (0.7), followed by good (0.8), qualified (0.3), and unqualified (0.1). The index of "Instruct students to discuss" was mostly evaluated as good (0.41) or qualified (0.5), and the proportion of that evaluated as excellent (0.39) and unqualified (0.1) was relatively low. The index of "Encourage students to ask questions" was mostly evaluated as good (0.43), followed by excellent (0.31), qualified (0.3), and unqualified (0.1). The index of "Reply to students' questions" was mostly evaluated as qualified (0.4), followed by excellent (0.2), good (0.3), and unqualified (0.1). The index of "Targeted skill guidance" was mostly evaluated as good (0.5), followed by excellent (0.41), qualified (0.1), and unqualified (0.2). The index of "Practice advice" was mostly evaluated as good (0.48), followed by excellent (0.37), qualified (0.02), and unqualified (0.1). The index of "Timely and effective feedback" was mostly evaluated as good (0.6), followed by excellent (0.39), qualified (0.3), and unqualified (0.2). The index of "Skill improvement and creativity development" was mostly evaluated as excellent (0.47), followed by good (0.44), qualified (0.4), and unqualified (0.1).

Table 1. Satisfaction of evaluation objects

Serial Number	Satisfaction	Serial Number	Satisfaction	Serial Number	Satisfaction
1	0.8142	7	0.8625	13	0.8352
2	0.7625	8	0.8142	14	0.7412
3	0.6142	9	0.8362	15	0.7625
4	0.8362	10	0.8251	16	0.7154
5	0.7915	11	0.6142	17	0.8256
6	0.7362	12	0.9025	18	0.7265

(Continued)

Table 1. Satisfaction of evaluation objects *(Continued)*

Serial Number	Satisfaction	Serial Number	Satisfaction	Serial Number	Satisfaction
19	0.7514	39	0.7625	59	0.6472
20	0.6352	40	0.8625	60	0.6152
21	0.7615	41	0.7619	61	0.9341
22	0.8529	42	0.8352	62	0.8265
23	0.6352	43	0.6415	63	0.8362
24	0.7418	44	0.7625	64	0.7471
25	0.7629	45	0.8352	65	0.6415
26	0.7052	46	0.8062	66	0.8615
27	0.7469	47	0.7413	67	0.8143
28	0.8417	48	0.8269	68	0.7485
29	0.6392	49	0.8352	69	0.8269
30	0.7158	50	0.6417	70	0.7351
31	0.8362	51	0.6385	71	0.7047
32	0.6417	52	0.6291	72	0.7485
33	0.7416	53	0.8362	73	0.8362
34	0.7362	54	0.8147	74	0.7615
35	0.8159	55	0.7362	75	0.8152
36	0.8625	56	0.7594	76	0.6749
37	0.7062	57	0.8152		
38	0.7481	58	0.8362		

Table 2. Fuzzy evaluation matrix

	First-Level Indexes	Second-Level Indexes	Fuzzy Comprehensive Evaluation Matrix			
			Excellent	Good	Pass	Not Pass
EIS	Teaching content and method (Index 1)	Teaching content	0.3	0.31	0.26	0.2
		Teaching method	0.1	0.1	0.2	0.1
	Course organization and management (Index 2)	Course planning	0.5	0.2	0.4	0.2
		Resource allocation	0.6	0.46	0.16	0.2
		Time management	0.7	0.8	0.3	0.2
	Student interaction and communication (Index 3)	Instruct students to discuss	0.39	0.41	0.5	0.1
		Encourage students to ask questions	0.31	0.43	0.3	0.1
		Reply to students' questions	0.2	0.3	0.4	0.1
	Practice guidance and feedback (Index 4)	Targeted skill guidance	0.41	0.5	0.1	0.2
		Practice advice	0.37	0.48	0.02	0.1
		Timely and effective feedback	0.39	0.6	0.3	0.2
	Student achievement and growth (Index 5)	Skill improvement and creativity development	0.47	0.44	0.4	0.1

Then, the above data was subjected to comprehensive analysis to get these conclusions: the proportion of Index 2 (Course organization and management) rated as excellent or good was relatively high, so the performance was good. The proportion of Index 3 (Student interaction and communication) and Index 4 (Practice guidance and feedback) rated as good was high, which indicates room for much improvement since the proportion rated as excellent was slightly insufficient. The performance of Index 1 (Teaching content and method) and Index 5 (Student achievement and growth) was just average, so attention is required on problems in all aspects to seek improvement.

Table 3. Evaluation indexes

	Phase I	Phase II	Phase III
Index 1	1.302	0.936	0.914
Index 2	1.528	1.485	0.962
Index 3	1.369	0.926	0.935
Index 4	1.204	0.913	0.814
Index 5	0.768	0.627	0.862

Evaluation indexes in each phase were analyzed based on data given in Table 3, and these are the conclusions attained from the data: The value of Index 1 in the first phase was 1.302, indicating a good performance; then the value grew to 0.936 in the second phase, showing a slight decline, but the performance was still not bad; after that, the value of Index 1 changed to 0.914 in the third phase, maintaining a relatively good level. The value of Index 2 in the first phase was 1.528, indicating an excellent performance; then the value of dropped slightly to 1.485, but the performance was still good; then the value of the index continued to fall to 0.962 in the third phase, showing an obvious decline compared with the first two phases, indicating that attention might be needed for improvements in this aspect. The value of Index 3 in the first phase was 1.369, also suggesting a good performance; then the value decreased a bit to 0.926, but the performance was still not bad; in the third phase, the value grew slightly back to 0.935, which was not much different from the second stage, and then it was maintained at a good level. The value of Index 4 in the first phase was 1.204, indicating a good performance; then the value dropped to 0.913 in the second phase, but the performance was still not bad; after that, the value of the index continued to decline to 0.814, exhibiting a significant decrease compared with the first two phases, so attention might be required for improvements in this aspect. The value of Index 5 in the first phase was 0.768, indicating an average performance; then the value decreased to 0.627 in the second phase, showing a slight decrement, as the performance got worse; after that, the value grew back to 0.862 in the third phase, showing significant improvement compared with the previous two phases, and the performance was good.

Conclusions can be drawn from the above data analysis: in the three phases, Index 2 (Course organization and management) performed excellently, but the performance declined in the third phase, suggesting attention might be required for improvement. Index 1 (Teaching content and method) and Index 3 (Student interaction and communication) performed stably in the three phases and stayed at a good level. Index 4 (Practice guidance and feedback) showed a decline in the third phase compared with the first two phases, so attention might be needed for

improvement in this aspect. Index 5 (Student achievement and growth) showed an obvious improvement in the third phase; the performance was good.

Table 4. Deviation analysis

	Evaluation Result	Deviation Analysis
Phase I	Index 1=0.958	The difference between the actual teaching content and the planned teaching content is reduced; obvious improvement could be observed in terms of teaching content control compared with the previous phase
	Index 2=0.946	The course planning in this phase got slower compared with that in the previous two phases, but the overall difference was not much
	Index 3=0.935	The completed student guidance and response was slightly different from the plan
	Index 4=0.857	The level of completed practical guidance and feedback was slightly decreased compared with the previous two phases
	Index 5=0.816	There was a gap between the completed effect of student growth and the plan
	A=0.942	The evaluation result was good
Phase II	Index 1=0.925	The completed teaching content was quite different from the planned teaching content
	Index 2=1.629	The completed course planning was significantly ahead of schedule
	Index 3=0.952	The completed student guidance and response basically met the requirement of the plan
	Index 4=0.947	The level of completed practical guidance and feedback was almost the same as the plan
	Index 5=0.635	The completed effect of student growth did not reach the planned value
	A=1.241	The evaluation result was good, which was better than the first phase; other target values were smaller, and the target value of course planning was larger
Phase III	Index 1=1.526	The completed teaching content was close to the planned teaching content
	Index 2=1.347	The completed course planning was slightly ahead of schedule and was basically consistent with the plan
	Index 3=1.629	The completed student guidance and response had basically met the requirement of the plan
	Index 4=1.541	The level of completed practical guidance and feedback had basically met the requirement of the plan
	Index 5=0.769	There was a gap between the completed effect of student growth and the requirement of the plan
	A=1.352	The evaluation result was good, indicating that the teacher had planned the objective well before teaching

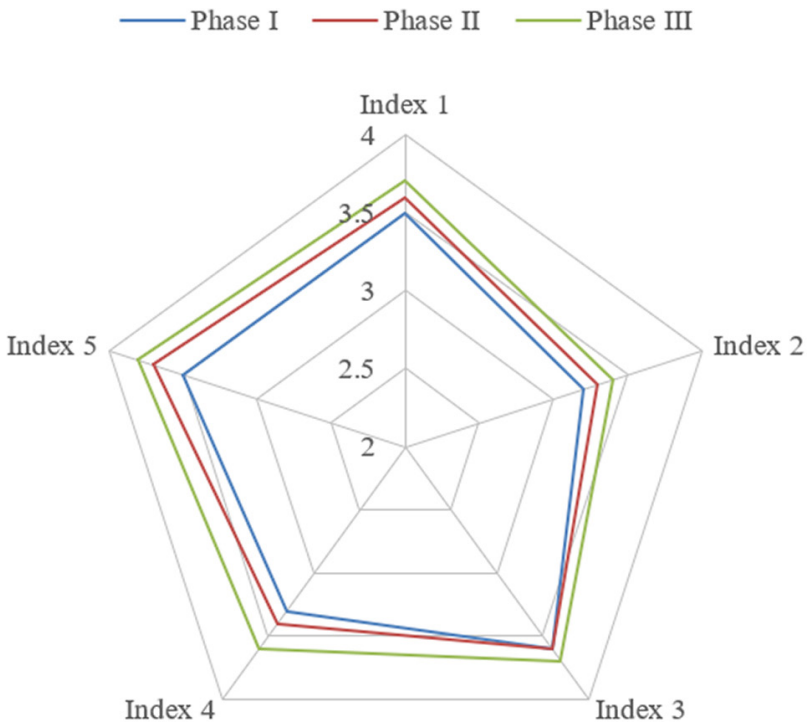

Fig. 4. Example of cobweb chart

Table 4 gives the bias analysis results, based on which the following conclusions can be drawn: the teacher had planned the objective well before teaching. The evaluation results of the first and second phases were good, but in terms of Index 5 (Student achievement and growth), there is still room for improvement. The evaluation result of the third phase was good—the various indexes performed well—but attention is required on Index 1 (Teaching content and method), Index 2 (Course organization and management), and Index 5 (Student achievement and growth) to ensure that the teaching quality and students' learning effect is be improved continually.

Figure 4 shows an example of the cobweb chart. According to the data given in the figure, the evaluation indexes of each phase can be analyzed. In the first phase, the performance of Index 3 (Student interaction and communication) was the best, with a score of 3.6. Index 2 (Course organization and management) performed poorly, with a score of 3.2, while other indexes (Index 1-Teaching content and method, Index 4-Practice guidance and feedback, and Index 5-Student achievement and growth) performed well, and their scores were all 3.5. Compared with the first phase, the performance of all indexes improved to some extent in the second phase. The performance of Index 5 (Student achievement and growth) was the best, with a score of 3.7. Index 2 (Course organization and management) was still a weak link, with a score of 3.3. The scores of other indexes (Index 1-Teaching content and method, Index 3-Student interaction and communication, and Index 4-Practice guidance and feedback) were all between 3.6 and 3.4, and their performance was good. Compared with the first two phases, the performance of all indexes improved to some extent in the third phase. The performance of Index 5 (Student achievement and growth) was the best, with a score of 3.8; the score of Index 2 (Course organization and management) increased to 3.4, but it is still the weak link; the scores of other indexes (Index 1-Teaching content and method, Index 3-Student interaction

and communication, and Index 4-Practice guidance and feedback) were all between 3.6 and 3.7, indicating good performance in these aspects.

Based on the above analysis, the following conclusions can be drawn: from the first phase to the third phase, the scores of indexes increased to some extent, indicating that the teaching process was improving. During the three phases, the performance of Index 5 (Student achievement and growth) was the best, indicating that students' learning effect was enhanced constantly during each phase. Index 2 (Course organization and management) was a weak link during all three phases, so more attentions might be required to improve the effect of course organization and management. The performance of the other indexes (Index 1-Teaching content and method, Index 3-Student interaction and communication, and Index 4-Practice guidance and feedback) was good for each phase, but there is still room for further improvement.

5 CONCLUSION

In this study, an EIS was created for the multi-dimensional evaluation of teachers' leading role in art-training courses, and a multi-dimensional evaluation model was constructed based on satisfaction function, and a cobweb chart and was used to analyze the relationship and balance between various evaluation indexes. The proposed method can give more equitable evaluation results and increase the trust of evaluation objects for the evaluation process. Applying the method to actual cases, the satisfaction degree of evaluation objects was compared and analyzed; the data of a fuzzy comprehensive evaluation matrix was given, the situations of five evaluation indicators in each phase were analyzed combining with actual cases, and the findings suggest that the performance in teaching content and method and student achievement and growth was just average, so problems in these two aspects need more attention and improvements should be made accordingly; bias analysis suggests that in the three phases, teachers had well planned the teaching objectives, but there are still room for further improvement in terms of student achievement and growth; at last, the evaluation values and trends in each phase were analyzed as well, and the results suggest that teachers need to pay attention to the changes of each indicator and adopt targeted measures to improve their teaching quality.

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