A New Vocational Education Curriculum Evaluation Method Based on CIPP Model and Game Theory

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Abstract. To evaluate whether the teaching objectives of the course meet the expected requirements, this paper proposed a new vocational education curriculum evaluation method based on CIPP model and Game theory. Firstly, we used the Context, Input, Process, and Product Evaluation (CIPP) model to construct the evaluation index system of vocational education curriculum. Then the coefficient of variation method is applied to optimize the evaluation index system (OEIS). Secondly, the combined weighting method, based on game theory, is proposed to calculate the weight of the above evaluation index. Thirdly, the vocational education curriculum evaluation model is presented to evaluate the teaching objectives of the course. Finally, the effectiveness of the evaluation method was verified by evaluating the course of Mechanical Drawing. Simulation results show that the proposed method can give the result of course evaluation objectively and impartially.

Keywords: Vocational Education · course evaluation · CIPP model · coefficient of variation method · game theory

1 Introduction

With the rapid development of economy and society, vocational education is also developing at a high speed, which puts forward higher requirements for vocational education personnel training. In order to improve the teaching quality of vocational education, it is of great significance to construct a set of targeted, comprehensive and practical curriculum evaluation system to guide the curriculum reform of vocational education scientifically.

At present, the research on curriculum evaluation model mainly includes: the goal evaluation model proposed in [1], Educators Michael Scriven's article puts forward the goal of separation model [2]. The CIPP model was proposed in [3]. CSE model was proposed by the Educational Evaluation Center of UCLA [4]. In terms of the research on curriculum evaluation index system [5]. Focuses on analyzing the evaluation standards of applied curriculum construction issued by six national ministries and commissions

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[6]. Constructed the evaluation index system of physical education quality in schools based on CIPP model [7]. Constructed the evaluation index system of industry-education integration in higher vocational colleges based on CIPP model. In terms of the research on the establishment of the weight score of the curriculum evaluation index [8]. According to the analytic hierarchy process to determine the computer course evaluation index weight value [9]. Adopted the AHP method to establish the weight value of the evaluation index of the basic course of computer application in secondary vocational schools [10]. Adopted the AHP method to establish the weight value of the evaluation index of SPOC course.

Through the study of the above related literature, it is found that the curriculum evaluation index system is constructed based on the evaluation mode of combining evaluation purpose and evaluation guidance, and mainly adopts the methods of interview, literature review, consulting experts and so on, which is subjective to a certain extent. Using analytic hierarchy process to calculate the weight of course evaluation index is a simple method, but it is subjective. In order to objectively and justly evaluate the curriculum, to achieve the purpose of "promoting reform and promoting construction with evaluation". This paper proposes a curriculum evaluation method for vocational education based on CIPP model and game theory. First, using CIPP model to construct curriculum evaluation system. One method is to optimize the evaluation index, using the population method, the random sampling questionnaire method and the coefficient of variation method. One method uses the combination weighting method of game theory to determine the index weight. Finally, the curriculum evaluation model of vocational education is established. This model can reflect the current situation of curriculum construction more objectively, simply and accurately, and promote the curriculum reform and construction of vocational education.

2 Construction of Curriculum Evaluation System of Vocational Education Based on CIPP Model

According to the characteristics of vocational education and CIPP model, this paper puts forward a curriculum evaluation system based on CIPP model, which can comprehensively and flexibly evaluate all aspects of curriculum construction, and provide useful suggestions for curriculum development and practice reform.

2.1 CIPP Evaluation Model Principle Analysis

The CIPP evaluation mode consists of four parts: background evaluation (C), input evaluation (I), process evaluation (P) and outcome evaluation (P), as shown in Fig. 1.

The background evaluation mainly analyzes the basic background of curriculum construction, evaluates the actual demand, measures the feedback of target demand, and checks whether the curriculum construction unit meets the basic requirements of curriculum construction. INPUT evaluation is mainly to analyze and study the conditions, resources and different types of projects to achieve the goal, and to conduct a comprehensive evaluation. Process evaluation is to evaluate the process of construction,

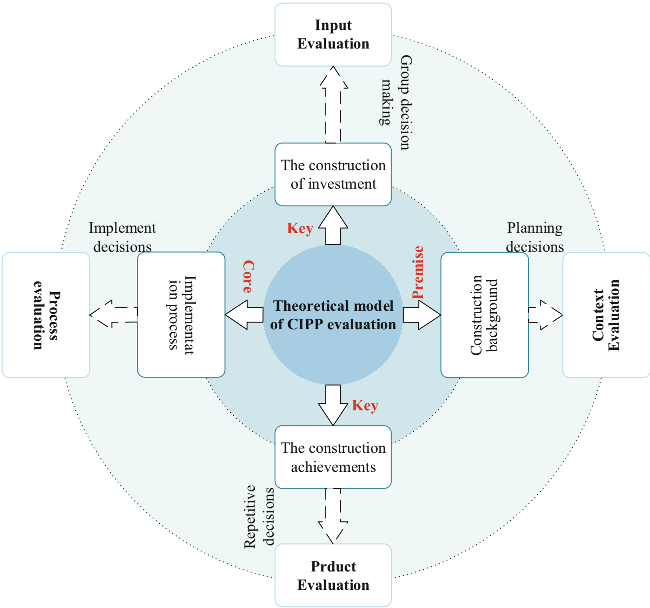

Fig. 1. CIPP evaluation model

and feedback the effective evaluation information to the course managers and constructors, so that they can fully grasp the course construction. The result evaluation mainly evaluates and analyzes the final effect of the curriculum reform.

2.2 Construction of Evaluation Index System of Vocational Education Curriculum Based on CIPP Model

According to the evaluation content of CIPP's four dimensions and the evaluation standard of applied curriculum construction issued by six ministries, through interviews, literature review, consulting experts, etc. the Evaluation Index System of vocational education curriculum based on CIPP model is preliminarily established, as shown in Fig. 2.

2.3 Optimization of the Evaluation Index System of Vocational Education Curriculum Based on the Coefficient of Variation Method

Cluster sampling and random sampling were used to sample all teachers of vocational education major in a department of a university, and several other teachers were randomly selected as expert members. In order to ensure the rationality of the index system, the expert members conducted a questionnaire survey. The Open five-point questionnaire

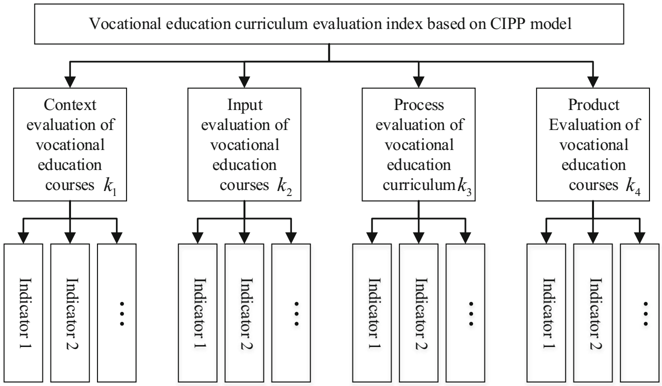

Fig. 2. Curriculum evaluation index system of vocational education based on CIPP model

was used to consult the index system, and the evaluation set in the questionnaire is

$$V = \{ \underset{1}{\text{very unreasonable}}, \underset{2}{\text{unreasonable}}, \underset{3}{\text{general}}, \underset{4}{\text{reasonable}}, \underset{5}{\text{very reasonable}} \}$$

After the questionnaire is collected, the questionnaire with missing items and non-standard answers is removed. Set up the score set according to the data of the valid items of the statistical questionnaire, the score set is $\boldsymbol{X}_{m*n}$.

$$\boldsymbol{X} = \begin{matrix} & \begin{matrix} 1 & 2 & \cdots n \end{matrix} \\ \begin{matrix} 1 \\ 2 \\ \vdots \\ m \end{matrix} & \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix} \end{matrix} \tag{1}$$

where, m is the valid total number of participants, n is the index number.

According to formula (1), the mean score of the indicators i is:

$$A_i = \frac{1}{m}\sum_{kk=1}^{m} x_{kki} \tag{2}$$

where, $kk = 1, 2, \cdots, m$; $i = 1, 2, \cdots, n$; x_{kki} is the score of i by the questioner of kk.

Using the coefficient of variation CV_n to measure questionnaire coordination:

$$\mathrm{CV}_i = \frac{S_i}{A_i} \tag{3}$$

where

$$S_i = \sqrt{\frac{1}{m}\sum_{kk=1}^{m}(x_{kki} - A_i)^2}$$

If the i index is satisfied the follow inequality

$$\begin{cases} A_i < \varepsilon_1 \\ \mathrm{CV}_i > \varepsilon_2 \end{cases} \tag{4}$$

We delete the i index. The ε_1 and ε_2 shall be set by the expert group.
Using (4) to optimize the index in (1), we obtain

$$\boldsymbol{X}^* = \begin{matrix} \\ 1 \\ 2 \\ \vdots \\ m \end{matrix} \begin{matrix} 1 & 2 & \cdots & n^* \\ \left[\begin{matrix} x_{11} & x_{12} & \cdots & x_{1n^*} \\ x_{21} & x_{22} & \cdots & x_{2n^*} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn^*} \end{matrix}\right] \end{matrix} \tag{5}$$

After optimizing the curriculum evaluation index system. In the following section, the combination weighting method is proposed to calculate the weight of the index system.

3 The Combination Weighting Method Based on the Game Theory

To calculate the weight of indicators in course evaluation, we proposed both the subjective weight method of FAHP and the objective weighting method of entropy. Furthermore, the combination weighting, using the game theory, is presented to make full use of the advantages of subjective and objective weight methods.

3.1 Subjective Weighting of Curriculum Evaluation Indexes of Vocational Education Based on FAHP Method

To solve the problem that the consistency test of AHP is not easy to pass [11], proposed the fuzzy analytic hierarchy process (FAHP) was based on the fuzzy set theory. FAHP can be carried out in the following four steps: to establish a multi-level hierarchical index model; to compare two indexes of the same level, to establish a fuzzy complementary judgment matrix; consistency test of fuzzy complementary judgment matrix; single ranking and total ranking.

1) Establishment of Fuzzy Complementary Judgment Matrix.

Invite a panel of external experts p to evaluate the course. The experts first discussed the course together. The expert group first conducted a group discussion to compare the indicators at the same level in Formula (5) in pairs, to determine the importance of each index r_{ij}, get the fuzzy complementary judgment matrix $\boldsymbol{A} = (r_{ij})_{n^* \times n^*}$.

$$\boldsymbol{A} = \begin{matrix} \\ k_1 \\ k_2 \\ \vdots \\ k_{n^*} \end{matrix} \begin{matrix} k_1 & k_2 & \cdots & k_{n^*} \\ \left[\begin{matrix} r_{11} & r_{12} & \cdots & r_{1n^*} \\ r_{21} & r_{22} & \cdots & r_{2n^*} \\ \vdots & \vdots & \ddots & \vdots \\ r_{n^*1} & r_{n^*2} & \cdots & r_{n^* \times n^*} \end{matrix}\right] \end{matrix} \tag{6}$$

Table 1. the meaning of r_{ij} in fuzzy complementary judgment matrix.

scale r_{ij}	meaning
0.5	$k_i = k_j$
0.6	the former k_i is slightly more important than the latter k_j
0.7	the former k_i is obviously more important than the latter k_j
0.8	the former k_i is more important than the latter k_j
0.9	the former k_i is more important than the latter k_j.
0.1,0.2,0.3,0.4 (complementary)	According to the properties. $r_{ij} + r_{ji} = 1(i, j = 1, 2, \ldots, n)$, The complementary value is obtained.

The value of r_{ij} is shown in Table 1.

Meanwhile, the fuzzy complementary judgment matrix $\boldsymbol{A} = (r_{ij})_{n^* \times n^*}$ has the following properties:

$$r_{ii} = 0.5 \qquad (i = 1, 2, \cdots, n^*) \tag{7}$$

$$r_{ij} + r_{ji} = 1 \qquad (i, j = 1, 2, \cdots, n^*) \tag{8}$$

$$r_{11} - r_{z1} = a, r_{12} - r_{z2} = a, \cdots, r_{1j} - r_{zj} = a \tag{9}$$

where, a is constant; z= $2, 3, \cdots, n^*$; j= $1, 2, 3, \cdots, n^*$; z $\neq j$.

2) Consistency Test of Fuzzy Complementary Judgment Matrix.

This paper adopts the formula method to carry out consistency test, and the test formula is as follows:

$$r^*_{ij} = \frac{\sum\limits_{m=1}^{n^*} r_{im} - \sum\limits_{m=1}^{n^*} r_{jm}}{2(n^* - 1)} + 0.5 \tag{10}$$

where $i, j = 1, 2, \cdots$ n*.

Establish the judgment matrix about fuzzy consistency through consistency test.

$$\boldsymbol{R} = \begin{matrix} & \begin{matrix} k_1 & k_2 & \cdots & k_{n^*} \end{matrix} \\ \begin{matrix} k_1 \\ k_2 \\ \vdots \\ k_{n^*} \end{matrix} & \begin{bmatrix} r^*_{11} & r^*_{12} & \cdots & r^*_{1n^*} \\ r^*_{21} & r^*_{22} & \cdots & r^*_{2n^*} \\ \vdots & \vdots & \ddots & \vdots \\ r^*_{n^*1} & r^*_{n^*2} & \cdots & r^*_{n^* \times n^*} \end{bmatrix} \end{matrix} \tag{11}$$

$$\boldsymbol{R} = (r^*_{ij})_{n^* * n^*} \tag{12}$$

3) The Subjective Weight of Vocational Education Curriculum Evaluation Index Was Calculated Based on FAHP Method.

The formula of fuzzy analytic hierarchy process to calculate the weight value is:

$$\omega_i = \frac{\sum_{j=1}^{n^*} r_{ij}^* + \frac{n^*}{2} - 1}{n^*(n^* - 1)} \tag{13}$$

According to (12) and (13), the subjective weight value of the index can be calculated. Similarly, the subjective weight $\boldsymbol{W}_{\text{FAHP}} = \{\omega_1, \omega_2, \cdots, \omega_n.\}$ of all indicators.

To sum up, this method is simple to operate, but the weight calculated is subjective to some extent. Therefore, we propose a method to calculate the weight of curriculum evaluation index of vocational education based on entropy weight.

3.2 Objective Weight Calculation of Vocational Education Curriculum Evaluation Index Based on Entropy Weight Method

Information entropy is an extended concept of thermodynamics. The higher the information entropy is, the lower the information utilization rate will be. Otherwise, the higher the information utilization rate will be. The entropy weight method calculates the weight of the index through the change of the entropy value of the index. Generally, FAHP can be carried out in the following four steps: to establish the evaluation set matrix; normalizes the index evaluation matrix; to calculate the weight of the indicator.

1) Establish the Evaluation Set Matrix.

In order to ensure the objectivity of the evaluation, the expert group evaluated and scored the course construction according to the index content respectively, and established the matrix $\boldsymbol{C}(c_{hi})_{p\times n^*}$ for the scoring data.

$$\boldsymbol{C} = \begin{array}{c} \\ 1 \\ 2 \\ \vdots \\ p \end{array} \begin{array}{c} \begin{array}{cccc} 1 & 2 & \cdots & n^* \end{array} \\ \begin{bmatrix} c_{11} & c_{12} & \cdots & c_{1n^*} \\ c_{21} & c_{22} & \cdots & c_{2n^*} \\ \vdots & \vdots & \ddots & \vdots \\ c_{p1} & c_{p2} & \cdots & c_{p\times n^*} \end{bmatrix} \end{array} \tag{14}$$

where, c_{hi} is the score value of the i index by the h expert; $h = 1, 2, \cdots, p$; $i = 1, 2, \cdots, n^*$.

2) Data Normalization Processing.

Index normalized processing. If i is the Positive indicators:

$$c_{hi}^* = \frac{c_{hi} - \min\{c_{hi}\}_{h=1}^p}{\max\{c_{hi}\}_{h=1}^p - \min\{c_{hi}\}_{h=1}^p} \tag{15}$$

If i is the negative indicators.

$$c_{hi}^{*} = \frac{\max\{c_{hi}\}_{h=1}^{p} - c_{hi}}{\max\{c_{hi}\}_{h=1}^{p} - \min\{c_{hi}\}_{h=1}^{p}} \tag{16}$$

where, $\max\{\boldsymbol{C}_{hi}\}$ and $\min\{\boldsymbol{C}_{hi}\}$ are the maximum and minimum values of the index respectively.

Equation (15) and (16) normalize Eq. (14) and obtain:

$$\boldsymbol{C}^{*} = \begin{matrix} & \begin{matrix} 1 & 2 & \cdots & n^{*} \end{matrix} \\ \begin{matrix} 1 \\ 2 \\ \vdots \\ p \end{matrix} & \begin{bmatrix} c_{11}^{*} & c_{12}^{*} & \cdots & c_{1n^{*}}^{*} \\ c_{21}^{*} & c_{22}^{*} & \cdots & c_{2n^{*}}^{*} \\ \vdots & \vdots & \ddots & \vdots \\ c_{p1}^{*} & c_{p2}^{*} & \cdots & c_{p\times n^{*}}^{*} \end{bmatrix} \end{matrix} \tag{17}$$

3) The Weight of Vocational Education Course Evaluation Index is Calculated Based on Entropy Weight Method.

First, calculate the proportion B_{hi} of the index in Eq. (17).

$$B_{hi} = \frac{c_{hi}^{*}}{\sum_{h=1}^{p} c_{hi}^{*}} \qquad (i = 1, 2, \cdots, \text{n}^{*}) \tag{18}$$

Secondly, the entropy value of the index is calculated.

$$e_i = -t\sum_{h=1}^{p} B_{hi} \ln B_{hi} \qquad (i = 1, 2, \cdots, \text{n}^{*}) \tag{19}$$

where, $t=\frac{1}{ln^{,}}$; If $B_{hi} = 0$, $B_{hi}lnB_{hi} = 0$.

Then, the information entropy redundancy d_i is calculated.

$$d_i = 1 - e_i \tag{20}$$

Finally, the weight value of the index is calculated

$$\beta_i = \frac{d_i}{\sum_{h=1}^{p} d_i} \tag{21}$$

The above method calculates the objective weight value $\boldsymbol{W}_{\text{EWM}} = \{\beta_1, \beta_2, \cdots, \beta_i\}$.

3.3 Combining Game Theory to Calculate the Comprehensive Weight of Vocational Education Curriculum Evaluation Index

First, we construct the base weight vector set W.

According to section III-A and section III-B, Set of base weight vectors $\boldsymbol{W} = [\boldsymbol{W}_{\text{FAHP}}, \boldsymbol{W}_{\text{EWM}}]^{T}$.

Construct a linear combination of weight vectors W_{zong}. The linear combination of the above two vectors is:

$$\boldsymbol{W}_{\text{zong}} = a_1 \boldsymbol{W}_{\text{FAHP}}^T + a_2 \boldsymbol{W}_{\text{EWM}}^T \tag{22}$$

where the coefficients a_1 and a_2 are linear combination coefficients, respectively.

The multi-objective game ensemble model is used to optimize two linear combination coefficients $\boldsymbol{a} = [a_1, a_2]$, so as to minimize the deviation between $\boldsymbol{W}_{\text{zong}}$ and a_1 and a_2, namely:

$$\min\left\{\left\|a_1 \boldsymbol{W}_{\text{FAHP}}^T - \boldsymbol{W}_{\text{zong}}^T\right\| + \left\|a_2 \boldsymbol{W}_{\text{EWM}}^T - \boldsymbol{W}_{\text{zong}}^T\right\|\right\} \tag{23}$$

Take the first derivative of the above equation, the equivalent of a system of linear equations:

$$\begin{bmatrix} \boldsymbol{W}_{\text{FAHP}} \cdot \boldsymbol{W}_{\text{FAHP}}^T & \boldsymbol{W}_{\text{FAHP}} \cdot \boldsymbol{W}_{\text{EWM}}^T \\ \boldsymbol{W}_{\text{EWM}} \cdot \boldsymbol{W}_{\text{FAHP}}^T & \boldsymbol{W}_{\text{EWM}} \cdot \boldsymbol{W}_{\text{EWM}}^T \end{bmatrix} \begin{bmatrix} a_1 \\ a_2 \end{bmatrix} = \begin{bmatrix} \boldsymbol{W}_{\text{FAHP}} \cdot \boldsymbol{W}_{\text{FAHP}}^T \\ \boldsymbol{W}_{\text{EWM}} \cdot \boldsymbol{W}_{\text{EWM}}^T \end{bmatrix} \tag{24}$$

The above formula calculates the combination coefficient. $\boldsymbol{a} = [a_1, a_2]$. To normalize the combination coefficient:

$$a_k^* = |a_k| \Big/ \sum_{k=1}^{2} |a_k| \qquad (k = 1, 2) \tag{25}$$

Available, $\boldsymbol{a}^* = \left[a_1^*, a_2^*\right]$.

The index combination weight is:

$$\boldsymbol{W}_{\text{zong}} = a_1^* \boldsymbol{W}_{\text{FAHP}}^T + a_2^* \boldsymbol{W}_{\text{EWM}}^T \tag{26}$$

4 Vocational Education Curriculum Evaluation Process Based on CIPP Model and Game Theory Combination Empowerment

4.1 Evaluation Value Calculation of Vocational Education Curriculum Based on CIPP Model and Game Theory

According to Eqs. (14) and (26), the evaluation value of the course can be obtained by multiplying the average set $\overline{\boldsymbol{c}_p}$ of each indicator and the combined weight $\boldsymbol{W}_{\text{zong}}$ of the indicators.

$$\boldsymbol{Z} = \boldsymbol{W}_{\text{zong}} \overline{\boldsymbol{c}_p} \tag{27}$$

4.2 Flowchart of Vocational Education Course Evaluation Based on CIPP Model and Game Theory

Vocational education curriculum Evaluation Process based on CIPP model and game theory, as shown in Fig. 3.

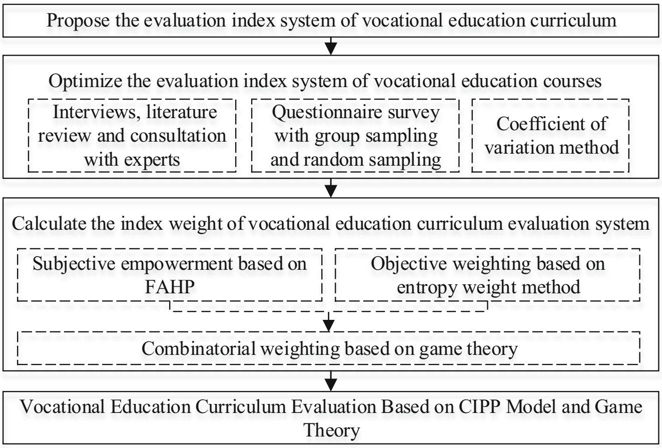

Fig. 3. Flowchart of curriculum evaluation system in vocational education

5 Example Verification

This study applies the above vocational education course evaluation method based on CIPP model and game theory combination empowerment to evaluate the course of Mechanical Drawing.

5.1 To Construct the Evaluation Index System of Mechanical Drawing Course Based on CIPP Model

According to section II-A, the evaluation index of Mechanical Drawing course based on CIPP model is established, as shown in Fig. 4.

where $y_1, y_2, \cdots, y_{19}$ are curriculum construction planning, objectives of curriculum construction, course specialization construction, course content organization, construction of teaching material, teaching supporting resources construction, cultivation of teaching staff, teaching archive management, teaching mode, the main interaction, course education, arouse the potential of teaching subject, process management and feedback, meet the individual needs of students, course assessment and evaluation, student achievement assessment, completion of course objectives, improvement and Effectiveness, innovation and application value, respectively.

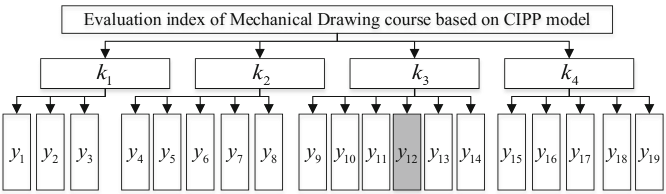

Fig. 4. Evaluation index system of Mechanical Drawing course based on CIPP model

All the experts of a vocational school and other vocational schools were selected randomly, 11 in total. As an expert group, they conducted a questionnaire survey on the index system. One of the questionnaires was incomplete, and there were 10 valid questionnaires.

According to (2) and (3), the mean value n and the coefficient of variation CV_n of each indicator after statistics were calculated. Let $\varepsilon_1 = 3$, $\varepsilon_2 = 0.3$. Except for A_{12}, the average score of each index is more than 3.2 and the coefficient of variation is less than 0.3, indicating that each index is relatively reasonable. $A_{12} < 3$. This shows that the content of "potential incentive of teaching subject" is unreasonable. Delete this index. The evaluation index system of mechanical drawing course based on CIPP model is established.

5.2 Weight Calculation of Evaluation Index of "Mechanical Drawing" Course Based on Combination Weighting of Game Theory

1) Subjective Weighting of Evaluation Index of Mechanical Drawing Course Based on FAHP Method.

Six external experts, enterprise leaders and experts from our university formed a course evaluation team to evaluate the course of Mechanical Drawing and promote the course construction.

The method of section III-A to calculate the subjective weight $\boldsymbol{W}_{\mathrm{FAHP}}$ of the index.

$$\begin{aligned}\boldsymbol{W}_{\mathrm{FAHP}} = \{&0.053, 0.059, 0.062, 0.051, 0.056, 0.048,\\ &0.053, 0.041, 0.04, 0.063, 0.044, 0.051, 0.054,\\ &0.059, 0.051, 0.079, 0.057, 0.079\}.\end{aligned}$$

2) Objective Weight Calculation of Evaluation Index of Mechanical Drawing Course Based on Entropy Weight Method.

The members of the expert group will evaluate and score the construction of the course according to the 100 percent system against the index content, and make statistics.

MATLAB software is used to calculate the above scoring values according to (14)–(21), and the objective weight value of each evaluation index can be obtained.

$$\begin{aligned}\boldsymbol{W}_{\mathrm{EWM}} = \{&0.061, 0.042, 0.065, 0.079, 0.084, 0.074,\\ &0.067, 0.057, 0.048, 0.047, 0.034, 0.043, 0.086,\\ &0.034, 0.05, 0.034, 0.046, 0.049\}.\end{aligned}$$

3) Combining Game Theory to Calculate the Comprehensive Weight of Vocational Education Curriculum Evaluation Index.

Through Eqs. (22)–(24), the combination coefficient $\boldsymbol{a} = [0.342, 0.690]$ of subjective weight obtained by fuzzy analytic hierarchy process and objective weight obtained by entropy weight method is obtained. $\boldsymbol{a}^* = [0.331, 0.669]$ is normalized by Formula

(27), and the combined weight of each indicator can be obtained by Formula (26).

$$\boldsymbol{W}_{\text{zong}} = \{0.058, 0.048, 0.064, 0.07, 0.075, 0.065, 0.062, 0.052, 0.045, 0.052, 0.037, 0.046, 0.075, 0.042, 0.05, 0.049, 0.05, 0.059\}.$$

5.3 Evaluation of the Course of Mechanical Drawing

According to (27), the final score value of Mechanical Drawing course is 80.426.

In this survey, the average weight of the evaluation index system of mechanical drawing courses was 0.056, and 9 items were higher than the average weight. The top three scores in terms of weight were textbook construction, meeting students' individual needs, curriculum ideology and politics and curriculum content organization, accounting for 0.07, 0.069 and 0.065 respectively. The teaching material construction of mechanical drawing course, which meets the individual needs of students, the ideological and political theory of the course and the content organization of the course, plays an important role in the overall construction of the course. These should cause the course builder to attach great importance.

In the expert project index score, the average score was 80.3, with 7 indicators below the score. Among them, the scores of teaching model, process management and feedback, improvement and effectiveness are the lowest, indicating that the course construction of Mechanical Drawing is relatively weak in these three aspects, which are the main influencing factors restricting the course construction. From the analysis of the discrete situation of expert scores, the scores of learning support, course evaluation and evaluation, and course goal completion are relatively different, which indicates that the construction of this evaluation index is not reasonable, and it is necessary to optimize.

6 Conclusions

The main contribution of this paper is that a new vocational education curriculum evaluation method, based on CIPP model and Game theory, was proposed to evaluate whether the teaching objectives of the course meet the expected requirements.

Firstly, construct a curriculum evaluation index system of vocational education based on CIPP model from four aspects: curriculum background evaluation, curriculum input evaluation, curriculum construction evaluation and curriculum outcome evaluation. Furthermore, the variation coefficient method is proposed to optimize the above curriculum evaluation index system.

Secondly, both the subjective weight of FAHP method and the objective weight of entropy method were presented to calculate the weight of the curriculum evaluation index system. Furthermore, the combined weighting method which can give weight more objectively, based on the Nash equilibrium theory in game theory, was proposed to make full use of the advantages of the subjective weight of FAHP method and the objective weight of entropy method.

Thirdly, the vocational education curriculum evaluation model was presented to evaluate the teaching objectives of the course. Simulation results show that the proposed method can give the result of course evaluation objectively and impartially.

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