Research on the Ideological and Political Evaluation System of Computer Courses Based on CIPP Model

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Abstract. In view of the current problem of poor ideological and political performance of professional courses, and considering the advantages of CIPP model in terms of process orientation and decision-making improvement, this paper constructs a curriculum ideological and political evaluation index system based on CIPP model, and uses analytic hierarchy process to allocate the index weights in the evaluation system. Using the questionnaire data and principal component analysis method, the internal correlation of the secondary indicators is mined, and the evaluation indicators are dimensioned down. According to the load coefficient of the principal component, the weight of the secondary indicators is redistributed. The weight distribution of the indicators obtained from the two analyses is basically consistent, verifying the scientificity and reliability of the evaluation index system. This system can effectively evaluate the quality of ideological and political teaching in computer courses, thereby promoting the improvement of ideological and political teaching effectiveness.

Keywords: CIPP model · Curriculum ideological and political · Evaluation index system

1 Introduction

In recent years, the construction of curriculum ideology and politics is an important part of teaching reform. The author's college has also introduced curriculum ideology and politics into the teaching of professional courses, but there are still problems such as rigid teaching, single form, and fuzzy evaluation. In the face of the poor effectiveness of curriculum ideological and political education, establishing a scientific comprehensive evaluation index system for curriculum ideological and political education is an urgent matter and a powerful guarantee for improving the effectiveness of curriculum ideological and political education. Xu Xiangyun and other teachers constructed a universal curriculum ideological and political evaluation framework for university courses based on the comprehensive evaluation of ideological and political issues in university courses [1]. Zhang Wen embedded the CIPP model in the ideological and political education evaluation system, and constructed an ideological and political education evaluation system with "background input process results" as the indicator [2]. Based on the CIPP model,

Professor Guo Fengting constructed an ideological and political evaluation system for college physical education courses, and further conducted a scientific test using fuzzy comprehensive evaluation [3]. The CIPP evaluation model is an evaluation that serves decision-making and covers the entire process of education. It can provide effective information for educational decision-makers, facilitate feedback on educational effectiveness, and be used for later teaching adjustments. From the above literature, it can be seen that many scholars and teachers have tried to use the CIPP model for the evaluation of ideological and political education in general courses, ideological and political courses, and other courses, but there are also studies and references on the ideological and political aspects of computer courses.

Therefore, this article proposes to construct a computer curriculum ideological and political evaluation index system based on the CIPP model, and uses the analytic hierarchy process to allocate the weight of the index, which is verified through consistency. Then, based on the questionnaire data, combined with the principal component analysis method to explore the internal relationship of the data, the high-dimensional data was reduced in dimension, and the weight distribution was again completed using the reduced features. The distribution was basically consistent with the weight distribution of the previous indicators, verifying the scientific nature of the evaluation system.

2   Construction of Ideological and Political Evaluation System for Computer Courses Based on CIPP Model

2.1   CIPP Evaluation Theory

In 1967, American scholar Staffer proposed the CIPP evaluation model (also known as the decision-oriented evaluation model) based on Taylor's goal evaluation model. The basic point is that the most important purpose of evaluation is not to prove, but to improve. The CIPP evaluation mode consists of four links: context evaluation, input evaluation, process evaluation, and product evaluation. The CIPP model has the advantages of process orientation and decision improvement, and can objectively evaluate the tested object from a process, comprehensive, and holistic perspective. The CIPP evaluation model is used to evaluate the computer course ideological and political education based on the explicit and implicit collaborative model proposed in this article. Among them, background evaluation refers to the evaluation of influencing factors in the overall environment of implementing curriculum ideological and political policies; Input evaluation refers to the evaluation of various guarantee conditions that need to be invested in the ideological and political education of the curriculum, with the purpose of ensuring the feasibility of the implementation of the ideological and political education of the curriculum; Process evaluation refers to the evaluation of specific situations such as design plans, teaching content, and student performance during the implementation of curriculum ideological and political education, and feedback on the effectiveness of curriculum ideological and political education; Achievement evaluation is an evaluation of the results and impact of the implementation of curriculum ideological and political policies, which is used to modify and improve the implementation plan.

2.2 Construction of Evaluation Index System

Based on the survey of relevant professional curriculum teachers and the opinions of multiple experts, a computer curriculum ideological and political evaluation index system based on the CIPP model was constructed. The indicator system includes four first level indicators, 14 s level indicators, and 34 third level indicators.

The Level1 indicators include: Ideological And Political Background (A), Ideological And Political Investment (B), Ideological And Political Process (C), Ideological And Political Effects (D).

The Level2 indicators include: Policy Background (A1), Course Background (A2), Job Background (A3), Ideological And Political Resources (B1), Teacher Construction (B2), Information Platform (B3), Organizational System (B4), Teaching Objectives (C1), Instructional Design (C2), Content Of Courses (C3), Course Assessment (C4), Evaluate Teachers (D1), Evaluate Students (D2), Evaluation Organization (D3).

The Level3 indicators include: The degree of support for ideological and political policies from educational administration departments in schools (A11), The degree to which the curriculum team uses ideological and political policies to guide education (A12), Student's understanding of the ideological and political aspects of the course (A13), The curriculum system meets the talent training objectives (A21), Clear objectives for ideological and political teaching of the course (A22), Talent demand and service demand of industry posts (A31), Development positioning of industry posts (A32), There is a matching set of curriculum ideological and political cases (B11), Have a mechanism and method for updating curriculum ideological and political materials (B12), Have corresponding training platforms or cooperation bases (B13), Develop curriculum ideological and political teaching ability training (B21), Teachers' ability to integrate ideological and political knowledge and deepen subject knowledge (B22), Rich interactive skills between teachers and students in curriculum ideological and political education (B23), Building a sharing platform for ideological and political resources (B31), Sharing course information resources through internet teaching platform (B32), Develop relevant systems such as curriculum ideological and political implementation plans, opinions, and methods (B41), Special financial support for curriculum ideological and political education (B42), Integration of teaching objectives into ideological and political concepts (C11), The degree to which the teaching content supports the ideological and political objectives of the course (C12), The conformity between curriculum design and curriculum ideology and politics (C21), Matching degree between classroom teaching methods and curriculum ideological and political education (C22), Consistency between the ideological and political teaching plan and the ideological and political theory course (C23), Combination of curriculum ideological and political education and classroom teaching content (C31), Student participation in the ideological and political curriculum (C32), Teaching content can reflect social hot spots and the forefront of discipline development (C33), Effectively reflecting the ideological and political teaching effect of the course (C41), Effective feedback on the quality improvement of students after ideological and political courses (C42), Achievement of ideological and political objectives of the course (D11), Students' satisfaction and sense of achievement with the ideological and political aspects of the curriculum (D12), Country: patriotic love for the party, four self-confidence, two maintenance, and military mission (D21), Social:

Table 1. Comparison and Judgment Matrix of Level1 Indicators

Primary indicator	IPB	IPI	IPP	IPE
IPB	1	1/3	1/4	1/6
IPI	3	1	2/3	1/2
IPP	4	3/2	1	2/3
IPE	6	2	3/2	1

social responsibility, legal awareness, humanistic literacy, team awareness (D22), Personal: professional quality, life planning, value orientation, mental health, and innovation awareness (D23), The effectiveness of organizational system in curriculum ideological and political affairs (D31), Education level of the organizer during the implementation process (D32).

3   Determination of Weights of Ideological and Political Evaluation Indicators for Computer Courses

3.1   Weight Calculation of Evaluation Indicators

Index weight reflects the importance of current evaluation indicators in the overall evaluation system. Fill in the comparative values of the first level indicators and construct a judgment matrix through the instruction scheme of 10 experts in the relevant fields, as shown in Table 1.

3.2   Normalization and Weight Calculation of Index Matrix

The AHP (sum-product method) is used to calculate the weighting of research experts. Normalize each column element of the judgment matrix:

$$b'_{ij} = \frac{b_{ij}}{\sum_{i=1}^{n} b_{ij}} \ i,j = 1, 2, \cdots \tag{1}$$

Add the normalized judgment matrix of each column by column:

$$w'_i = \sum_{j=1}^{n} b'_{ij} \ i = 1, 2, \ldots, n \tag{2}$$

Normalize vectors $W' = \left(w'_1, w'_2, \ldots, w'_n\right)^T$:

$$w_i = \frac{w'_i}{\sum_{i=1}^{n} w'_i} \ i = 1, 2, \ldots, n \tag{3}$$

Get a vector $W = (w_1, w_2, \ldots, w_n)^T$ is the approximate solution of the obtained eigenvector.

Calculating the maximum eigenvalue of a judgment matrix λmax:

$$\lambda_{\max} = \frac{1}{n} \sum_{i=1}^{n} \frac{BW}{w_i} \tag{4}$$

The characteristic vectors of the first level indicators ideological and political background, ideological and political input, ideological and political process, and ideological and political effect are obtained as follows: (0.285, 0.831, 1.174, 1.710). The corresponding weight values are: 7.125%, 20.765%, 29.361%, 42.749%. Maximum characteristic value is 4.002, CI is 0.001.

3.3 Consistency Test of Index Weight

Consistency index CI of judgment matrix, get CI = 0.001.

By introducing the average random consistency index RI and looking up the table based on the order of the judgment matrix, it can be concluded that: RI = 0.89.

Random consistency ratio CR:

$$CR = \frac{CI}{RI} \tag{4}$$

where: CR value is 0.001. The CR value is 0.001 < 0.1, which means that the first-level index judgment matrix meets the consistency test and the calculated weights have consistency.

3.4 Determination of Weights of Other Indicators at All Levels

Using the above methods and formulas, calculate the weights of other level indicators relative to the upper-level indicators through the analytic hierarchy process, and there will be no repetition. The weights of indicators at all levels are shown in Table 2. Indicators at all levels have passed the consistency test.

From the constructed ideological and political evaluation index system for computer courses, it can be seen that the four first-level indicators are ranked according to their importance: ideological and political effect, ideological and political process, ideological and political investment, and ideological and political background. The large proportion of ideological and political effects in the overall proportion indicates that the effectiveness of ideological and political education is an important evaluation factor for feedback on the quality of curriculum ideological and political education, which provides decision-makers with directions for improving curriculum ideological and political education; From the secondary indicators, it can be seen that ideological and political education evaluation for students occupies a prominent position in curriculum ideological and political evaluation, indicating that all teaching activities and evaluation methods are student-centered, serving to promote their practical progress and long-term development.

Table 2. Ideological and political evaluation index system of computer courses

Indicators (Level 1)	Indicators (Level 2)	Indicators (Level 3)	Weight	Indicators (Level 1)	Indicators (Level 2)	Indicators (Level 3)	Weight
A 7.13%	A1 0.92%	A11	0.29%	C 29.37%	C1 2.60%	C11	1.30%
		A12	0.51%			C12	1.30%
		A13	0.12%		C2 6.80%	C21	2.72%
	A2 1.97%	A21	0.99%			C22	2.72%
		A22	0.98%			C23	1.36%
	A3 4.24%	A31	2.30%		C3 14.58%	C31	3.06%
		A32	1.94%			C32	8.02%
B 20.77%	B1 6.36%	B11	3.24%			C33	3.50%
		B12	2.16%		C4 5.39%	C41	5.39%
		B13	0.96%	D 42.74%	D1 17.10%	D11	8.55%
	B2 9.04%	B21	3.32%			D12	8.55%
		B22	2.76%		D2 21.37%	D21	10.69%
		B23	2.96%			D22	6.41%
	B3 2.67%	B31	1.83%			D23	4.27%
		B32	0.84%		D3 4.27%	D31	2.99%
	B4 2.70%	B41	0.81%			D32	1.28%
		B42	1.89%				

4 Principal Component Analysis (PCA) Validation Evaluation Indicators

4.1 Principle of PCA Method

Principal Component Analysis is a linear dimensionality reduction method that uses a projection matrix to linearly project the original sample points in a high-dimensional space into a low-dimensional space to achieve dimensionality reduction. PCA aims to use sample data to map p indicators into m comprehensive indicators (m < p). By weighted summation of m comprehensive indicators, comprehensive evaluation values can be obtained [5]. The principal component analysis method eliminates the correlation between various indicators and captures the main components of the expression of things on the basis of ensuring the integrity of the original data as much as possible.

The specific implementation steps of the PCA algorithm are as follows:

(1) Obtain raw sample data. M sample data with n-dimensional sample characteristics form a sample set X. X is a m × n matrix of n.

(2) Standardize the values of each element of the matrix using standard deviation and sample mean.

$$x'_{ij} = \frac{(x_{ij} - \bar{x}_j)}{s_j} \quad i = 1, 2, \ldots, m; j = 1, 2, \ldots, n \tag{5}$$

where: s_j is the standard deviation corresponding to the jth index, and is the mean value of m independent observation samples. Continue to use X to represent the normalized matrix.

(3) The covariance of characteristic x and characteristic y is cov(x, y), let the number of samples be m, and the corresponding formulas are:

$$\text{cov}(x, y) = \frac{1}{m-1} \sum_{i=1}^{m} (x_i - \bar{x})(y_i - \bar{y}) \tag{6}$$

(4) Calculate the characteristic roots of the covariance matrix C and arrange them in descending order, get $\lambda_1 \geq \lambda_2 \geq \cdots \geq \lambda_n \geq 0$, and write it as the eigenvector matrix U.

$$U = [a_1, a_2, \ldots, a_n] \tag{7}$$

When solving practical problems, it is generally not necessary to take n principal components and preset a threshold value based on the cumulative contribution rate to extract the first k components, and the size of the feature values should be greater than 1. Therefore, the first k columns of the feature vector matrix are selected.

The principal component F_i is derived:

$$F_i = a_{i1}X_1 + a_{i2}X_2 + \cdots + a_{ik}X_k \quad i = 1, 2, \ldots, m \tag{8}$$

4.2 Questionnaire Data Processing

In order to reduce the dimension of evaluation indicators and evaluate the ideological and political subjects of courses with fewer comprehensive indicators, this paper uses the principal component analysis method to verify the above formulation of secondary evaluation indicators. This paper distributed 50 questionnaires to relevant experts, course team teachers, and 2022 level students, with 50 points recovered, for sample data collection.

(1) Using 14 secondary indicators as principal component analysis, factor analysis can only be performed if the KMO is greater than 0.5. Based on the KMO and Bartlett test results, it is found that the KMO value is 0.813, indicating that there is a correlation between the variables in the questionnaire; The correlation Bartlett statistic is 939.118, and the significance P value is 0.000, which indicates that principal component analysis is suitable and passes the test.
(2) After principal component analysis, there are five components with an initial characteristic value greater than 1, as shown in Table 3. The cumulative total variance interpretation value is 87.449%, which is greater than the threshold value of 85%, indicating that these five components meet the requirements for interpreting all variables.

Table 3. Interpretation of total variance of components

Number	Characteristic Root	Variance Interpretation Rate%	Cumulative%
1	3.957	28.262	28.262
2	3.324	23.743	52.005
3	2.226	15.898	67.903
4	1.685	12.034	79.937
5	1.052	7.512	87.449

(3) As can be seen from the explanatory value of the total variance of components, 14 indicators are divided into 5 comprehensive indicators. Calculating the coefficients in a linear combination refers to calculating the linear coefficients of each of the 14 indicators and normalizing the coefficients to obtain the weights of the 14 indicators, and the corresponding accumulation of the 4 first-level indicators can be obtained, as shown in Table 4.

4.3 Result Analysis

In the evaluation index system based on AHP, the ranking of the first level indicators is: ideological and political effect, ideological and political process, ideological and political design, ideological and political background; The first five indicators of the second level indicators are: Evaluating students, evaluating teachers, teaching content, teacher construction, and teaching design. In the evaluation index system based on principal component analysis, the ranking of the first level indicators is: ideological and political effect, ideological and political process, ideological and political design, ideological and political background; The first five indicators of the second level indicators are: evaluation of students, evaluation of teachers, teaching content, evaluation organization, and teaching design. From the above results, it can be seen that the weight distribution of the indicators obtained by the two analysis methods is basically consistent, as shown in Fig. 1, further verifying the accuracy and rationality of the computer curriculum ideological and political evaluation system built based on the CIPP model in this article.

From the perspective of the distribution of weights, the evaluation system emphasizes feedback information on the effectiveness of ideological and political education, which directly reflects the effectiveness of ideological and political education and has strong reference value; The ideological and political process and ideological and political input are the main links in the implementation of ideological and political education in the curriculum. It is necessary to feed back information to decision makers according to the process, and consider the amount of ideological and political investment in the next step, which has strong practical significance; The ideological and political background mainly reflects the direction of social and national ideological and political education in the curriculum, and is equally important. Among the secondary indicators, the more prominent weights are evaluation of students, evaluation of teachers, and teaching content. As the main body of ideological and political education, the quality improvement of

Table 4. Index Load Factor and Weight

| Indicators (Level 2)	Component					Weight	
	Component1	Component2	Component3	Component4	Component5		
Policy Background	0.300	−0.261	0.134	−0.440	0.066	1.88%	4.21%
Course Background	−0.234	0.366	0.316	−0.014	0.057	0.30%	
Job Background	0.228	−0.163	0.025	−0.463	0.519	2.03%	
Ideological and political resources	0.303	−0.019	0.234	0.421	0.439	7.35%	25.85%
Teacher construction	0.069	0.493	0.078	−0.264	0.122	6.62%	
Information platform	0.157	0.259	0.223	0.133	−0.006	7.47%	
Organizational system	−0.258	0.230	0.435	−0.129	0.002	4.41%	
Teaching objectives	0.271	0.197	0.338	−0.131	−0.241	5.36%	30.95%
Instructional design	−0.388	−0.138	0.255	0.086	0.074	9.94%	
Content of courses	0.302	0.168	−0.241	0.032	−0.508	10.16%	
Course Assessment	−0.022	0.412	−0.125	0.163	0.186	5.49%	
Evaluate teachers	−0.350	0.084	−0.306	0.008	0.250	14.53%	38.99%
Evaluate students	0.353	0.211	−0.325	0.252	0.311	14.91%	
Evaluation organization	0.103	−0.317	0.358	0.442	−0.031	9.55%	
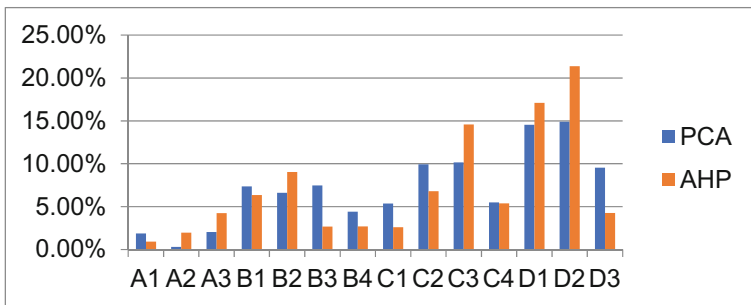
Fig. 1. Weight distribution of secondary indicators using analytic hierarchy process and principal component analysis

students in the process of ideological and political education is the most important indicator for evaluating the ideological and political quality of courses. As the implementer of ideological and political education, teachers play a direct role in the implementation effect of curriculum ideological and political education, and are the main indicators of ideological and political evaluation. The richness, professionalism, and integration of teaching content with ideological and political education directly determine the quality of curriculum ideological and political education, and are also decisive factors in the evaluation system. It can be seen that the establishment of the evaluation index system has guiding value and significance for the implementation of curriculum ideological and political education.

5   Summaries

This article explores the application of explicit education and implicit education in computer curriculum ideological and political education, and proposes a curriculum ideological and political model based on explicit and implicit collaboration. Considering the advantages of CIPP model in process orientation and decision-making improvement, a curriculum ideological and political evaluation index system based on CIPP model was constructed. Using the analytic hierarchy process and principal component analysis method to analyze the weight of secondary indicators in the evaluation system, the reliability of the evaluation index system was verified. This system can effectively evaluate the teaching quality of ideological and political education in computer courses, thereby promoting the construction of ideological and political education in courses. In the future, it is necessary to further increase the number of samples, explore the internal relationship between indicators, and strengthen the scientific and practical nature of the evaluation system.

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