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Evaluation of CIPP model of industrial colleges based on AHP method and analysis of collaborative education effect of industry-teaching integration

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Abstract As an important initiative to deepen the reform of education system, the integration of industry and education plays a key role in cultivating high-quality applied talents. CIPP model, as a decision-oriented evaluation model, can assess the whole process of the integration of industry and education in four dimensions, namely, background, input, process and output. This paper constructs the evaluation system of industry-teaching integration and collaborative education based on the CIPP model, and adopts the combination of hierarchical analysis method and cloud model to evaluate and analyze the effect of industry-teaching integration in industrial colleges. Firstly, the CIPP model is used to construct a three-level evaluation index system from the four dimensions of safeguard measures, resource allocation, cultivation process, and quality effectiveness, and the weights of each index are determined through the hierarchical analysis method, in which the weight of the cultivation process of the integration of industry and education is the highest at 0.4131, and the weight of the resource allocation of the integration of industry and education is the lowest at 0.1471, and then the cloud model is constructed to evaluate the grading standard, and the evaluation result is classified into five levels: excellent, good, medium, pass, and poor five grades, and establish the corresponding cloud feature parameters. Taking the engineering management major of HZ University as the empirical object, 10 experts were invited to conduct the evaluation, and the comprehensive cloud eigenvalue of the effect of industry-teaching integration of the major was (8.8327,0.5216,0.3321) through the calculation of the similarity of the cloud model. The results show that the similarity between this program and the good grade is 0.8957, and the similarity between this program and the excellent grade is 0.7125, and the overall evaluation results are located between good and excellent and closer to the good grade. The study shows that the evaluation method based on the AHP-CIPP cloud model can effectively quantify the effect of collaborative education in the integration of industry and education, and provides a scientific theoretical basis and practical analytical tool for the evaluation of the quality of the integration of industry and education in colleges and universities.

Index Terms Industry-teaching integration, CIPP model, hierarchical analysis method, cloud model, collaborative parenting, evaluation system

I. Introduction

Under the background of industrial transformation and upgrading, higher vocational colleges and universities have been implementing education to promote production and industry to help education, accelerating the formation of a development pattern of deep integration of industry and education with benign interaction between industry and education and complementary advantages of schools and enterprises, and providing strong human resources support for the comprehensive construction of a modernized socialist country [1]-[3]. At the same time, as the integration of vocational education has entered a new stage of comprehensive deepening and quality improvement, the integration of vocational education will make a significant contribution to economic and social development by focusing on “empowerment” and “enhancement” [4]-[6]. Therefore, how to improve the quality has become the top priority in the construction of the integration of production and education.

Industry-education integration, i.e., the deep combination of education and industry, is regarded as an effective way to improve the quality of education and meet the needs of industrial development [7]. Through school-enterprise cooperation, it realizes the precise docking between educational resources and industrial demand, promotes the innovation of educational content and teaching methods, and provides students with an educational experience that is closer to the actual work demand [8]-[10]. The integration of industry and education is an important part of the action plan of “improving quality and cultivating excellence” of higher vocational colleges and universities, and the quality of the integration of industry and education is directly related to the quality of talent cultivation and the quality of employment in higher vocational education [11]. However, the integration of industry and education faces many challenges in practice. Inadequate school-enterprise cooperation mechanisms, the disconnection between educational content and industrial demand, and the imperfection of the evaluation system have all constrained the in-depth development of the integration of industry and education [12], [13]. The existence of these problems not only affects the improvement of education quality, but also weakens the supportive role of education for industrial development [14]. Therefore, it is of practical significance to establish and improve the quality evaluation system of the integration of vocational education and industry in order to promote the action plan of higher vocational colleges and universities to "improve quality and cultivate excellence" [15]-[17].

As an important direction of modern education reform, the integration of industry and education has become a key path to improve the quality of higher education and cultivate applied talents through the deep cooperation between schools and enterprises to realize the organic combination of talent cultivation and industrial demand. As an important carrier of the integration of industry and education, industrial colleges play an important role in promoting the organic convergence of the education chain, talent chain and industrial chain and innovation chain. However, the current development process of industry-education integration still exists problems such as imperfect evaluation system, lack of systematic evaluation indexes, relatively single evaluation method, etc. There is a lack of scientific and effective evaluation tools to measure the actual effect of industry-education integration. The CIPP model was proposed by American education evaluation expert Stafelbeim, as a decision-making and improvement-oriented evaluation model, which divides the evaluation into four stages: background evaluation, input evaluation, process evaluation and output evaluation. Evaluation and output evaluation of four stages, forming a complete cycle system, with the characteristics of systematic, targeted, improvement and development, which is more suitable for the evaluation of the performance of the practical training base of industry-teaching integration. Hierarchical analysis is a decision analysis method that combines qualitative analysis and quantitative calculation organically by decomposing the complex system layer by layer, forming a multi-level goal structure diagram, and quantifying the relative importance of the elements at each level through pair-by-pair comparison. As a mathematical model for dealing with uncertain decision-making, the cloud model can mathematically reflect the relationship between things in terms of vagueness and randomness, overcoming the shortcomings of the traditional fuzzy evaluation which is difficult to quantify the concepts and making the evaluation results more accurate.

This study uses the combination of CIPP model, hierarchical analysis method and cloud model to construct the evaluation system of collaborative education effect of industry-teaching integration. Firstly, based on the CIPP model, a three-level evaluation index system is constructed from the four dimensions of safeguard measures, resource allocation, cultivation process, and quality effectiveness, and the hierarchical analysis method is used to determine the weights of each index to establish a scientific and reasonable evaluation index system. Then, the cloud model evaluation standard is constructed, the standard cloud feature parameters corresponding to the five evaluation levels are established, and the expert scoring data are transformed into cloud model digital features through the inverse cloud generator, and the comprehensive cloud feature values are calculated. Finally, the cloud model similarity calculation method is applied to compare the actual evaluation cloud with the standard evaluation cloud to determine the evaluation level of the effect of industry-education integration. Taking the engineering management program of HZ University as the empirical object, the scientificity and effectiveness of the evaluation method are verified to provide theoretical basis and practical guidance for the quality evaluation of industry-teaching integration.

II. Evaluation of collaborative education effect of industry-teaching integration under CIPP model

II. A. Indicator System of Collaborative Education for Industry-Teaching Integration under CIPP Model

II. A. 1) Framework for assessing the CIPP model

The CIPP model was proposed by Stafelbeim, an American education evaluation expert. As a decision-making and improvement-oriented evaluation model, it divides the evaluation into four stages, namely, background evaluation, input evaluation, process evaluation and output evaluation, to form a complete cyclic system, which can systematically evaluate the industry-teaching integration training base based on the dimensions of space, time and value [18]. At the same time, it can penetrate into the whole process of the construction of industry-teaching integration training base to carry out formative evaluation and diagnostic evaluation. It can be seen that the CIPP model has the characteristics of systematic, targeted, improvement and development, which is more suitable for the performance evaluation of industry-teaching integration practical training base. Based on this, the CIPP model is used to construct an evaluation index system from the four aspects of the construction background, input, process and output of the industry-teaching integration training bases, and to further carry out the performance evaluation of the industry-teaching integration training bases in vocational education.

II. A. 2) Principles for the design of the indicator system

In designing the indicator system, the first should follow the principle of balancing the interests of the relevant core subjects, the second should follow the principle of evaluating systematically and scientifically, and the third should implement the principle of combining qualitative and quantitative.

II. A. 3) Construction of the indicator system

1. Construction of first-level indicators

Based on the CIPP model and analyzing the above documents, four first-level evaluation indicators of "safeguard measures", "resource allocation", "cultivation process" and "quality effectiveness" were obtained, which corresponded to the four dimensions of the model.

2. Construction of secondary indicators

(1) "Background evaluation" dimension index selection

The background evaluation dimension needs to analyze the implementation background, feasibility and necessity of the integration of industry and education. Three secondary indicators of "policy system", "institutional setting" and "internal and external environment" were collated.

(2) Select the dimension index of "input evaluation".

Refer to the provisions on the investment of resources for the integration of industry and education in the "Work on Supporting the Development of Application-oriented Undergraduate Universities" published by the Department of Development Planning of the Ministry of Education of the People's Republic of China, and combine it with relevant research results. Accordingly, five secondary indicators of "information infrastructure", "training base construction", "education and teaching investment", "teacher composition" and "teacher quality" were established.

(3) Selection of "process evaluation" dimension indicators

Process evaluation is based on the actual implementation of activities and measures the implementation of activities. In the integration of industry and education, universities and enterprises should closely focus on the cultivation of high-quality talents, therefore, all aspects of school-enterprise joint training of talents should be used as an important reference standard for the selection of evaluation indicators in the process of this paper. According to the requirements of the relevant policy documents issued by the government and the relevant research results of Zhang Jie and others, three secondary indicators of "school-enterprise co-construction of majors and courses", "school-enterprise collaboration to carry out practical teaching" and "school-enterprise collaborative education" were collated.

Table 1: The quality evaluation index system of the production and teaching

Primary indicator	Secondary indicator
Production and education integration guarantee measures(A)	Policy system(A1)
	Institutional setting(A2)
	Internal and external environment(A3)
Production and teaching fusion resource allocation(B)	Information infrastructure(B1)
	Construction of training bases(B2)
	Education input(B3)
	Teacher composition(B4)
	Teacher quality(B5)
The process of culture fusion culture(C)	The university enterprises build major and curriculum(C1)
	The school enterprises cooperate to carry out practical teaching(C2)
	The school enterprise synergies the people(C3)
The quality of the production of the production(D)	Graduate development(D1)
	School benefit(D2)
	Enterprise benefit(D3)
	Regional benefit(D4)

(4) Selection of "Result Evaluation" dimension indicators

The evaluation of the results of the integration of industry and education is to measure the effectiveness of school-enterprise collaborative education and collaborative innovation. In the process of integration of industry and education, all participants promote and develop each other, among which graduate development is the core to measure the effect of school-enterprise collaborative education. In addition, it is also necessary to fully consider the benefits obtained by other subjects through the integration of industry and education. Referring to the provisions of the "Opinions" on the evaluation of the results of the integration of industry and education and the research results of Qin Fengmei et al., four secondary indicators of "graduate development", "school benefit", "enterprise benefit" and "regional benefit" were established.

3. Construction of three-level indicators

On the basis of the first and second level evaluation indexes that have been set up, and following the principle of authority and accessibility of evaluation index data, referring to the key construction task indexes of the integration of industry and education involved in the policy documents, utilizing the model selected in this paper, and combining the statistical and research methods, we finally constructed the evaluation index system of the integration of the quality of industry and education in applied undergraduate colleges and universities, as shown in Table 1.

II. B. AHP-based indicator assignment

II. B. 1) Principles of Hierarchical Analysis

Hierarchical analysis method through a system, a huge scale and contains a multi-level structure of the object for in-depth analysis, layer by layer decomposition, and ultimately form a multi-level, multi-dimensional structure of the objectives of the structure, the structure can be divided into the shallow to the deep goal layer, the guidelines layer and the program layer, and ultimately the program layer includes a number of interconnected interacting factors, through the comparison of the pair-by-pair, to quantify the relative importance of the elements of the various levels of elements between, using linear algebra Mathematical methods such as linear algebra are used to analyze and finally the total ranking of relative importance is performed [19]. It is a decision analysis method that combines the qualitative analysis and quantitative calculation of decision makers. The method is systematic, flexible, efficient and practical in project management.

II. B. 2) Steps in applying hierarchical analysis

The use of hierarchical analysis should involve the following steps:

1. Determine the research object

The use of hierarchical analysis should have a clear objective, first of all, it is necessary to systematically analyze the objective, determine the depth that should be achieved in the evaluation of the research object, and determine the research scope of the research object according to national and industry laws and regulations and other constraints. At the same time, the actual situation of the research object should be widely collected, and the supporting documents such as organizational structure, management process, financial data, technical data, etc. should be collected and arranged, and the truthfulness and validity of the data and materials should be ensured, so as to make full preparation for the data analysis work.

2. Constructing a multilevel step-by-step structural model

After determining the research object, through system analysis, seize the main influencing factors of the research object, analyze the research object layer by layer from coarse to fine, from shallow to deep, and form a multilevel step-by-step structure, which is usually divided into the target layer, the guideline layer, and the program layer. The objective layer is the goal or result that the system wants to achieve, and it is the primary criterion for system evaluation. The criterion layer is a smaller unit of objectives set up to achieve the objective layer.

II. C. Cloud model for evaluating the effect of collaborative education in industry-teaching integration

II. C. 1) Principles of Cloud Modeling

In 1995, academician Deyi Li proposed a model to deal with uncertain decision-making - cloud model [20]. It reflects the relationship between things in a mathematical way in terms of vagueness and randomness, overcomes the shortcomings of traditional fuzzy evaluation which is difficult to quantify the concepts, and makes the evaluation results more accurate. The cloud model is defined as follows: suppose U is a quantitative domain and C is a qualitative expression on U, if there exists a quantitative value $x \in u$ and x is also a one-time stochastic realization on C, and at the same time satisfies that the degree of subordination of x to C, $\mu(x) \in [0,1]$, is a random number with a stabilizing tendency. Then the distribution of $\mu(x)$ has the following pattern:

$$\mu : U \to [0,1], \forall x \in U, x \to \mu(x) \tag{1}$$

Then a single x is called a cloud droplet, and the distribution presented by the whole x on U is called a cloud.

Normal distribution is generally expressed in terms of mean and variance; fuzzy set theory is mainly represented by bell-type affiliation function, i.e.:

$$\mu(x) = \exp\left\{-\frac{-(x-a)}{2b^2}\right\}^2 \tag{2}$$

The normal distribution is further combined with fuzzy sets when the degree of affiliation of $x \sim N(Ex, En^{'}), En^{'} \sim NEn, He^2)$ to C is satisfied:

$$\mu(x) = e^{\frac{-(x-Ex)^2}{2(En)}} \tag{3}$$

Then the distribution of x over the domain U is said to be a normal cloud. The cloud models applied in this paper are all normal clouds.

In cloud modeling, cloud generators are the key tools for computing cloud parameters, including forward cloud generators and inverse cloud generators.

II. C. 2) Cloud model construction process

In this paper, the specific implementation steps for constructing the cloud model are as follows:

(1) Determine the rubric set

According to the industry-education integration program, the evaluation index set U is established, on the basis of which the rubric set V of each index is established, and it is divided into various different grades. The determination of the number of grades is very critical, if the value is too large, the metrics of the research object will not be accurate enough, if the value is too small, it will lead to the lack of ambiguity of the research object. Therefore, the set of rubrics should be determined by combining the actual situation of the industry-education integration program.

(2) Construct the rubric evaluation level cloud scale

Setting the largest boundary in the comment set as V_{max} and the smallest boundary as V_{min}, the bilateral constraints of the comment set are $[V_{\min}, V_{\max}]$, and the comment set is reduced to the standard cloud parameters (E_x, E_n, H_e), and the transformation process is shown below:

$$\begin{cases} Ex = \dfrac{(V_{\max} + V_{\min})}{2} \\ E_n = \dfrac{(V_{\max} - V_{\min})}{6} \\ He = k \end{cases} \tag{4}$$

where k is a constant and the superentropy He is generally taken as 0.1.

(3) Calculate the cloud aggregation of individual indicators

The evaluation cloud parameter is to use the inverse cloud generator to transform the scoring data of individual indicators x_i into three numerical features (E_x, E_n, H_e) of the corresponding cloud model, and the calculation formulas are as shown in (5) to equation (8). The scoring data refers to the process of collecting and organizing the scoring data by designing the questionnaire and inviting experts to assign scores to each risk indicator of the project according to the evaluation index level.

Calculate the mean value of the sample:

$$Ex = \bar{X} = \frac{1}{n}\sum_{i=1}^{n}(x_i) \tag{5}$$

Calculate the variance of the sample:

$$S^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{X}) \tag{6}$$

Calculate the entropy of cloud drops En:

$$En = \sqrt{\frac{\pi}{2}} \times \frac{1}{n}\sum_{i=1}^{n}| x_i - Ex | \tag{7}$$

Compute the superentropy of cloud drops He:

$$He = \sqrt{| S^2 - En^2 |} \tag{8}$$

(4) Integration of evaluation cloud parameters

Combining the ANP selected in this paper to calculate the weights, the result obtained is Z. The cloud model digital features of the first-level indicators and the project as a whole are calculated separately, and the calculation formula is shown in (9) below:

$$\begin{cases} Ex = \dfrac{Z_1Ex_1 + Z_2Ex_2 + ... + ZnEx_n}{\sum\limits_{i=1}^{n}} \\ En = \dfrac{Z_1{}^2En_1 + Z_2{}^2En_2 + ...Z_n{}^2En_n}{\sum\limits_{i=1}^{n}(Zi)^2} \\ He = \dfrac{Z_1{}^2He_1 + Z_2{}^2He_2 + ...Z_n{}^2He_n}{\sum\limits_{i=1}^{n}(Z_i)^2} \end{cases} \tag{9}$$

(5) Generate risk cloud map.

Using the mathematical software Matlab to program the code of the forward cloud generator, the actual risk map is compared one by one with the standard cloud map, and the area with the highest degree of overlap is recognized as the current risk level. Among them, the realization process of one-dimensional forward cloud conversion is:

1) Generate a normal random number $E'n$ that satisfies the condition $E'n \sim N(En, He^2)$.

2) Generate a normal random number x that satisfies the condition $x \sim N(Ex, E'n)$.

3) Compute the degree of affiliation: $\mu' = e^{\frac{-(ai-Ex)}{2(E'n)}}$.

4) Generate cloud droplets (x, μ') and continue to repeat 1)~3) until the expected number N of cloud droplets is obtained.

(6) Quantitative evaluation results

In this paper, we cite a normal cloud similarity calculation method based on combined fuzzy posting progress proposed by Gong Yanbing scholars, which has the following calculation process:

If we set two evaluation clouds as V_1 and V_2, and their corresponding cloud numerical eigenvalues are $V_1(Ex_1, En_1, He_1)$, and $V_2(Ex_2, En_2, He_2)$, if the similarity of these two clouds is $V(V_1, V_2)$:

$$V = (V_1, V_2) = \frac{1}{2} + \frac{1}{2\mu} - \mu \tag{10}$$

where μ is calculated as follows:

$$\mu = \int_{-\infty}^{\beta} \frac{1}{\sqrt{2\pi}} e^{-\frac{t^2}{2}} dt \tag{11}$$

The formula for β is as follows:

$$\beta = \frac{|Ex_2 - Ex_1|}{\sqrt{En_1{}^2 + He_1{}^2} + \sqrt{En_2{}^2 + He_2{}^2}} \tag{12}$$

After the calculation of the above formula, the similarity between the first-level indicators of the tourism characteristic town project and the evaluation level standard cloud can be obtained, and then the similarity between the overall evaluation cloud of the project and the standard cloud of each evaluation level can be calculated in the same way.

The similarity between the evaluation cloud of the first-level indicators and the evaluation cloud of the project as a whole and the evaluation cloud of each evaluation level is normalized, so as to get the affiliation degree of the first-level indicators and the project as a whole in each evaluation level. According to the principle of maximum affiliation, the larger the affiliation degree, the more the actual risk of the industry-teaching integration collaborative parenting cloud model is in line with the evaluation level. The calculation formula is as follows:

$$p_i = \frac{V(V_i, V_j)}{\sum V(V_i, V_j)} \tag{13}$$

III. Empirical analysis of the evaluation model

III. A. Hierarchical analysis method to calculate indicator weights

The Engineering Management program at HZ University is known for its comprehensive curriculum design and practice-oriented instruction. The program attracts students from all over the country with diverse backgrounds covering a wide range of fields from engineering technology to project management. As of the most recent academic year, the program had 410 students, including 310 undergraduates and 100 graduate students. Taking the first-level indicators as an example, the analysis process of the AHP method was elaborated as shown in Table 2.

Table 2: The first level index corresponds to the matrix

Primary indicator	A	B	C	D
A	2	3	1/4	4
B	1/3	2	1/4	3
C	4	4	2	5
D	1/3	1/3	1/4	1

In the construction of the target level “engineering management professional industry-teaching integration”, the weights of the indicators among the four first-level indicators of industry-teaching integration safeguard measures (A), industry-teaching integration resource allocation (B), industry-teaching integration cultivation process (C), and quality effectiveness of industry-teaching integration (D) are shown in Table 3. The subjective weights of the first-level indicators of industry-teaching integration safeguard measures (A), industry-teaching integration resource allocation (B), industry-teaching integration cultivation process (C), and the quality effectiveness of industry-teaching integration (D) are 0.2457, 0.1471, 0.4131, and 0.1941 in order.From the point of view of the weights of the indicators, the weights of the indicators of the university-enterprise collaboration in practical teaching, the university-enterprise co-construction of specialties and curricula, and the policies and systems are higher than the weights of the indicators of the first-level indicators. High. In contrast, the first-level indicator “resource allocation for industry-education integration” has the lowest weight (0.0317) for the construction of practical training bases. Through this weighting, educators and policymakers can more effectively design curricula and assessment systems to ensure that students can achieve balanced and comprehensive development in key areas to meet the complex demands of the future workplace.

Table 3: Index weight

Primary indicator	Secondary indicator	Primary index weight	The overall weight of the secondary index
Production and education integration guarantee measures(A)	Policy system	0.2457	0.0783
	Institutional setting		0.0598
	Internal and external environment		0.0651
Production and teaching fusion resource allocation(B)	Information infrastructure	0.1471	0.0632
	Construction of training bases		0.0317
	Education input		0.0424
	Teacher composition		0.0871
	Teacher quality		0.0632
The process of culture fusion culture(C)	The university enterprises build major and curriculum	0.4131	0.0931
	The school enterprises cooperate to carry out practical teaching		0.0891
	The school enterprise synergies the people		0.0672
The quality of the production of the production(D)	Graduate development	0.1941	0.0779
	School benefit		0.0734
	Enterprise benefit		0.0593
	Regional benefit		0.0492

III. B. Comprehensive evaluation using the evaluation cloud model

(1) Determine the evaluation standard cloud eigenvalues

According to the above, the evaluation score interval of each index is [0,10], and the evaluation results are divided into 5 levels, and the standard cloud eigenvalues corresponding to each evaluation level are obtained through calculation as shown in Table 4, and the standard cloud diagram of industry-teaching integration in industrial colleges is drawn using the drawing software as shown in Figure 1.

Table 4: The quality evaluation standard cloud parameters of the production and teaching

Evaluation grade	Fractional interval	Cloud model characteristics parameter
Excellence	[9,10]	(9.4783,0.1537,0.05)
Good	[8,9)	(8.4783,0.1537,0.05)
Medium	[7,8)	(7.4783,0.1537,0.05)
Passing	[6,7)	(6.4783,0.1537,0.05)
Difference	[0,6)	(3.4783,1. 1537,0.05)

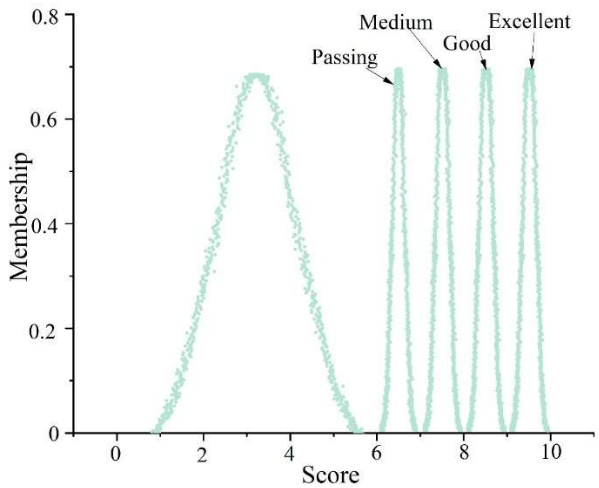

Figure 1: The standard cloud map of the production and teaching fusion evaluation

(2) Determining the cloud eigenvalues of each indicator

In order to calculate the characteristic value of each indicator cloud, 10 expert teachers in the field of education are invited to evaluate the vocational skills situation of Student A. According to the scoring of the experts, the indicator cloud digital characteristics of each evaluation index of Student A are calculated by the formula as shown in Table 5.

Table 5: Evaluation index weight and index cloud eigenvalue

Evaluation index	Index weight	Index cloud eigenvalue
A1	0.0347	(9.1,0.4423,0.3157)
A2	0.0347	(9.1,0.6578,0.2851)
A3	0.0573	(8.6,0.6109,0.3164)
B1	0.1228	(9,0.4922,0.4414)
B2	0.0536	(9,0.2613,0.3843)
B3	0.0309	(9,0.7728,0.3208)
B4	0.0309	(8.2,0.3915,0.1251)
B5	0.0741	(8.5,0.6341,0.3184)
C1	0.1187	(9,0.2742,0.3815)
C2	0.0296	(9.6,0.6153,0.3128)
C3	0.2075	(8.6,0.6147,0.3284)
D1	0.0184	(9.4,0.7738,0.2543)
D2	0.0617	(9,0.5161,0.4537)
D3	0.0187	(8.9,0.6583,0.2758)
D4	0.1064	(8.7,0.7142,0.1873)

(3) Determine the comprehensive cloud eigenvalue

The integrated cloud eigenvalue of student A is calculated by the formula (8.8327,0.5216,0.3321), and the corresponding integrated cloud diagram is plotted using the plotting software as shown in Fig. 2.

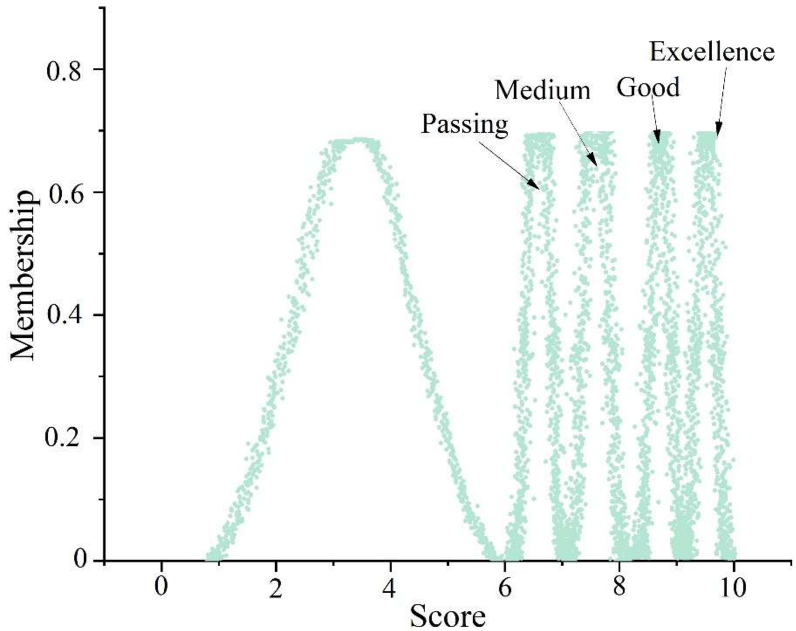

Figure 2: A student skill effect synthesis cloud map

(4) Calculate the similarity

The eigenvalue of the comprehensive cloud of student A is C=(8.8327, 0.5216, 0.3321), and the eigenvalue of the comprehensive cloud of the "poor" grade is C_1=(2.8914, 0.9753, 0.04). The eigenvalues of the "pass" grade were C_2=(6.4528, 0.1458, 0.04), and the eigenvalues of the "medium" grade were C_3=(7.4183, 0.1578, 0.04). The eigenvalues of the "Good" grade were C_4=(8.5123, 0.1586, 0.04), and the "Good" grade was C_5=(9.4571, 0.1571, 0.04).

Using the formula, the similarity of student A to the "poor" grade is $ECM(c_1,c)$=0, the similarity to the "passing" grade is $ECM(c_2,c)$=0.0004, the similarity to the "moderate" grade is $ECM(c_3,c)$=0.0514, and the similarity to the "good" grade is $ECM(c_4,c)$ = 0.8957, which is similar to the excellent grade is $ECM(c,c_5)$=0.7125.

III. C. Analysis of evaluation results

According to the results of the "Comprehensive Cloud Map of the Effect of Student A's Vocational Learning Skills" and the similarity degree, it can be found that Student A's vocational learning skills are between "good" and "excellent", and they are closer to the "good" level, and the effect of vocational learning skills is better.

Through comparison, it is found that the results of the evaluation of students' vocational skills learning effect based on the cloud model method of industry-education integration collaborative education are basically consistent with the results of expert review and teachers' actual test, which are more objective and credible.

IV. Conclusion

The evaluation system of collaborative cultivation effect of industry-teaching integration based on AHP-CIPP cloud model can effectively quantify the quality of industry-teaching integration and provide a scientific basis for educational decision-making. Calculated by the hierarchical analysis method, the cultivation process of industry-teaching integration has the highest weight of 0.4131 among the first-level indicators, reflecting the core position of practical teaching link in industry-teaching integration. The construction of training bases has the lowest weight of 0.0317 as a second-level indicator, indicating that the current evaluation system pays more attention to soft process management than hardware infrastructure construction. The cloud model evaluation method is established through the standard cloud parameters of five grades, in which the cloud eigenvalue of excellent grade is (9.4783,0.1537,0.05), which effectively solves the ambiguity problem of the traditional evaluation method. The empirical analysis shows that the comprehensive cloud eigenvalue of engineering management major of HZ University is (8.8327,0.5216,0.3321), and the similarity with the good grade is 0.8957, which proves that the integration of industry and education in this major is effective. The evaluation system not only accurately identifies the development level of industry-education integration, but also identifies the key influencing factors through weighting analysis, providing quantitative support for universities to optimize their industry-education integration strategies. The introduction of the cloud model makes the evaluation results more objective and credible, avoids the limitations of subjective judgment, and provides a new theoretical framework and technical path for constructing a scientific quality evaluation standard system for the integration of industry and education.

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