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Research on the Construction of Evaluation Index System for the Integration of Industry and Education in Higher Vocational Colleges under the Background of "Double High"

Xiujuan Fei

Zhejiang Industry & Trade Vocational College, Wenzhou, China

Abstract

The quality evaluation of the integration of industry and education in higher vocational colleges is of great significance for achieving the high-quality construction of the "dual high plan" in vocational colleges. In response to the current research status of the quality evaluation of industry education integration in vocational colleges, a deep analysis is conducted on the demands and responsibilities of stakeholders, which are transformed into corresponding indicators. Based on the CIPP education evaluation model, a three-layer indicator system is constructed, and the weights are determined using the Analytic Hierarchy Process to achieve a combination of qualitative and quantitative analysis. A scientific and effective evaluation indicator system for industry education integration in vocational colleges is established, in order to provide a basis for evaluating the development of industry education integration in vocational colleges.

Keywords

Higher Vocational Colleges; Integration of Industry and Education; Evaluation Indicators; Building Research.

1. Research Background

With the rapid development of China's economy and society and industrial upgrading, the development of vocational education in China has entered a critical transition period. In April 2019, the Ministry of Education and the Ministry of Finance jointly issued the Opinions on the Implementation of the Construction Plan for High-level Vocational Schools and Majors with Chinese Characteristics, focusing on cultivating and developing a number of high-level vocational colleges and brand majors, and the "Double High School Plan" was officially launched. In June 2023, the National Development and Reform Commission, the Ministry of Education and other eight departments jointly issued the "Implementation Action Plan for The Integration of Industry and Education in Vocational Education (2023-2025)", which put forward 19 policy measures in five aspects to build a community of industry and education integration in key industries and fields, and build a new ecology of cultivating applied talents in universities with industry characteristics. The continuous introduction of policies has effectively promoted the rapid development of the integration of industry and education in higher vocational colleges. In January 2024, the first round of "double High Plan" performance evaluation was launched, and the first batch of 197 construction units were assessed, including: high-level "double division" team, school-enterprise cooperation level, social services and other aspects. As an important measure to promote the integrated development of "education, science and technology, and talent", "industry-education integration" provides strong support for the comprehensive deepening and quality improvement of vocational education in China. At present, the development and effectiveness of the integration of industry and education in higher vocational colleges are uneven. Therefore, it is necessary to supervise and manage the integration of industry and education, build a systematic and scientific quality evaluation

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system for the integration of industry and education, ensure that the education system and industrial system can be highly integrated, and promote the high-quality development of vocational education in China.

2. Overview of Research on the Evaluation of Industry Education Integration at Home and Abroad

There are many educational evaluation index systems in the world, and the research on the integration of industry and education in higher vocational education is not sufficient. There is no special concept of the integration of industry and education in foreign countries, and the main work is the joint education between schools and enterprises. The representative ones are the "enterprise visiting school" in Japan, the "dual system" in Germany, the cooperative education model in Canada, the "new apprenticeship era" supported by the Cameron government in the United Kingdom, and the "community college" in the United States. The theoretical research based on the cooperation between the school side and the enterprise is relatively sound. Some scholars have introduced the stakeholder theory of Freeman or Mitchell into the integration evaluation of industry and education, which has effectively improved the quality of educational evaluation.

Lv Luping applied the project management method and stakeholder theory to the quality evaluation of industry and education, used Mitchell classification to screen stakeholders and designed an operational quality evaluation system; Zhang Junxian established the whole process evaluation model of quality of industry and education based on the data model through literature analysis, hierarchical analysis and questionnaire survey; and Jiang Jie constructed the efficiency evaluation system through expert consultation and factor analysis. On the basis of sorting out the needs and responsibilities of stakeholders, Yang Chao et al. used the CIPP evaluation model and hierarchical analysis method to build a three-level index system. Tang Xianchao used the key performance index method to discuss the quality evaluation index system of industry and education integration based on the four stages of CIPP, and took N College as an example for an empirical study.

After combing the domestic and foreign literature, it can be seen that the foreign school-enterprise cooperation research is early, the system is sound, and the theoretical system is complete, while the integration of domestic industry and education is not diversified in the theoretical research, and the evaluation subject is not enough. The number of studies is relatively small, and the evaluation research on the integration of industry and education in higher vocational colleges is even more scarce. Based on the theoretical basis and realistic demand of higher vocational colleges, this study through the questionnaire survey and expert consultation, combined with the stakeholder theory, consider multiple evaluation subject, fully analyze the demand and responsibilities and its corresponding stakeholders, using CIPP evaluation model and hierarchy analysis, build the fusion evaluation index system of higher vocational colleges, aims to ensure comprehensive, objective and fair, and promote the healthy development of higher vocational education.

3. Construction of the Evaluation Index System for the Integration of Industry and Education in Higher Vocational Colleges

3.1. Stakeholder Analysis

The integration of industry and education in higher vocational colleges is characterized by comprehensive, systematic and cross-border characteristics, which needs to fully meet the interests of all parties in the process of the integration of industry and education. The subjects include schools, enterprises, governments, students, industry associations, etc., and each

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Table 1. Core Stakeholder Analysis

Stakeholders	Interest Demands	Fulfilling Responsibilities	Corresponding Indicators
Higher Vocational School	1) Access to funds, equipment, technology, teachers, practice and training sites and other resources. 2) To achieve the supply of talents consistent with the demand of enterprises, improve the quality of applied talents training, and promote the transformation of scientific research achievements. 3) Improve the school teachers' practical teaching ability and social service ability.	1) Establish relevant management and incentive systems to create a good policy environment for the integration of industry and education. 2) Increase the investment of practice funds and teachers for the integration of industry and education, to create good hardware and software conditions. 3) Provide high-quality teachers and technical support. Work together with enterprises to develop talent training programs, develop related courses, and explore professional construction, etc.	1) Number of industrial colleges, the number of high-level professional groups above the provincial level 2) Government investment accounts for the teaching income 3) School internship special funds investment 4) The proportion of "double-teacher" teachers in full-time teachers 5) The total number of teachers involved in the integration of industry and education is 1000 per year 6) Number of virtual simulation, industry and education integration training bases 7) Schools and enterprises to jointly develop courses, mathematics and professional teaching standards 8) Horizontal technical service to amount 9) School-enterprise collaborative teaching quality satisfaction
Enterprise	1) Get the required original technology, improve the quality of enterprise products, and improve productivity. 2) To obtain the technical skills matching with the enterprise position. 3) Improve the visibility of the enterprise, and obtain a good reputation in the society.	1) Cultivate teachers' "double teacher" quality, provide students with jobs, and build training bases and platforms with schools, etc. 2) Cooperate with the school to educate people, send staff to the school as part-time teachers, training and guidance to teachers and students. 3)We will fulfill our social responsibilities and promote industrial upgrading.	1) Number of production and education integration enterprises above the municipal level 2) Number of high-level skilled part-time teachers 3) Number of intellectual property rights projects obtained 4) Non-academic training to the account of funds 5) Economic benefits of horizontal technical services 6) Enterprise satisfaction with internship students
Student	1) Enhance professional skills, accumulate work experience, and improve the comprehensive quality. 2) Understand the corporate culture, deepen the understanding of the position, improve the employability.	1) Actively practice, master professional skills, improve professional ability, and strive to become the applied high-quality talents needed by the enterprise, to create value for the enterprise. 2) Keep learning and developing, and make a good career planning.	1) Number of internship students on the job 2) Number of students 3) Graduate employment major matching rate 4) The acquisition rate of student vocational qualification certificate in school 5) Student satisfaction with vocational skills

interest subject has different expectations and requirements for the quality of industry-education integration. The theoretical system of "stakeholders" is complete, which provides a basis for the quality evaluation of vocational education. Thus, according to Freeman, R.E. The

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proposed "stakeholder" theory analyzes the interest demands and fulfillment responsibilities of all stakeholders in the industry and education circles, and is divided into three categories: core stakeholders, indirect stakeholders and marginal stakeholders, as shown in Table 1-3. The needs and responsibilities of various interest subjects are clarified, and according to the requirements of the integration of industry and education in higher vocational colleges, the interest demands and responsibilities of the three types of stakeholders are transformed into indicators corresponding to the relevant subjects, so as to achieve common goals and benefits and give full play to the maximum effect of the integration of industry and education in colleges and universities.

Table 2. Indirect Stakeholder Analysis

Stakeholders	Interest Demands	Fulfilling Responsibilities	Corresponding Indicators
Government	1) To solve the problem of the mismatch between education supply and the demand of enterprises, and improve the employment rate of college students. 2) Promote the optimization and upgrading of the local industrial structure and promote economic development. 3) We will implement the national policy on integrating industry and education, and promote collaborative innovation between universities and enterprises.	1) Do a good job in top-level design and promote the smooth integration of industry and education. 2) We will promote the implementation of policies and implement process supervision. 3) Provide funding, equipment, land, projects and other forms of support.	1) Local governments will introduce relevant policies to conduct top-level design. 2) Coordination of the integration of industry and education. 3)Annual special financial funds.
Industry Associations	4) Improve the guidance ability of industry development, post standard formulation and professional curriculum standard formulation. 5) To promote industry transformation, upgrading and development.	1) Promote the development of the industry and create a good market competition order. 2) Formulate industry standards, coordinate enterprise relations, and safeguard industry interests.	1) Industry associations shall issue relevant policies to coordinate their work.

Table 3. Analysis of Marginal Stakeholders

Stakeholders	Interest Demands	Fulfilling Responsibilities	Corresponding Indicators
The Head of a Family	1) Children have learned something, improve their skills, to achieve high-quality employment.	1) Provide economic support and growth guidance for their children, and urge them to actively practice practice.	1) Parent satisfaction and recognition.

3.2. Construction of the Evaluation Index System

In order to avoid the cross-connection between stakeholders in their interest demands and fulfilling responsibilities, learn from Stufflebeam, D.L. The proposed CIPP education evaluation model classifies and combines the indicators corresponding to stakeholders, and constructs the background evaluation, input evaluation, process evaluation and result evaluation included in CIPP, according construct the integration evaluation index system of industry and education in

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higher vocational colleges. The index system includes 4 first-level indicators, 10 second-level indicators and 32 three-level indicators.

In the background evaluation, policy support and organization are selected as the second-level indicators. Under the background of vocational education reform, the deep development of the integration of industry and education in higher vocational colleges needs the policy support of the government and the guarantee of various systems. Therefore, the integration and design of policy documents, rules and regulations and operation of the integration of industry and education to evaluate the implementation basis of the integration of industry and education in higher vocational colleges.

In the investment evaluation, it involves the investment of human resources, material resources, financial resources and other resources in the integration of industry and education, which is a necessary condition to ensure the high-quality development of the deep integration of industry and education. It is mainly manifested in the aspects of fund investment, teacher construction and platform construction of training base, the proportion of government investment, the proportion of special funds for school practice, and the proportion of "double teacher" teachers are selected to evaluate the allocation of resources in the integration of industry and education in higher vocational colleges.

In the process of evaluation, select collaborative education and teaching reform for the secondary index, mainly from the field practice students, 1 + X certificate pilot professional coverage, order training students, develop curriculum and professional teaching standard proportion indicators such as evaluation, check the fusion process and feedback, ensure the smoothness and effectiveness of teaching integration.

In achievement evaluation, considering the quality of talent training in higher vocational colleges, the contribution of regional economic development and the stakeholders of satisfaction, select personnel training, technical services, satisfaction for the secondary index, can be integrated into graduate employment professional counterpart rate, students' vocational qualification certificate gain rate, horizontal technical services to the amount, obtain intellectual property projects, horizontal technical services, and schools, enterprises, students, social satisfaction indicators.

3.3. Determination of Indicator Weights

Considering the diversity and uncertainty of evaluation indexes, hierarchical analysis was used to calculate the weight of each evaluation index for the integration of industry and education. A total of 15 teachers from higher vocational colleges engaged in school-enterprise cooperation, managers of local cooperative enterprises and experts from relevant government departments were invited to carry out a weighted questionnaire survey. Construction of index system: divided into four levels, divided into target layer, first level index layer, second level index layer and three level index layer. The judgment comparison matrix is calculated, and the 9 scales of 1-9 are used as the judgment scale of the elements in the judgment matrix. In the judgment matrix, the expert matrix is combined to obtain the relative weight. Through the consistency test, the weight of the quality of industry-education integration in higher vocational colleges is finally determined, as shown in Table 4.

(1) Establish the Judgment Contrast Matrix A:

$$A_{n\times n} = \begin{bmatrix} a_{11} & a_{12} & a_{1..} & a_{1n} \\ a_{21} & a_{22} & a_{2..} & a_{2n} \\ a_{..} & a_{..} & a_{..} & a_{..} \\ a_{n1} & a_{n2} & a_{n..} & a_{nn} \end{bmatrix}$$

(2) Combine the expert matrix, use the geometric average method to ensure the consistency check, and combine m experts (m=1,2,.. K) The scoring matrix is multiplied by bit, and then the m power to obtain the unique integration matrix:$\overline{A}$

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Table 4. Evaluation Index System and Weight of the Integration of Industry and Education in Higher Vocational Colleges

Level 1 Indicators	Relative Weight W1	Secondary Indicators	Relative Weight W2	Level 3 Indicators	Relative Weight W3
A Background Evaluation	0.1437	A1 Policy Support	0.3331	A11 Number of relevant policy documents issued by local governments and industries	0.2975
				A12 The number of rules and regulations jointly formulated by schools and enterprises, as well as the number of cooperation agreements signed for development	0.2339
				A13 Coordination mechanism of industry-education integration	0.4686
		A2 Organizational Structure	0.6669	A21 Number of organizations jointly built by banks, enterprises and schools	0.3350
				A22 Number of Industrial Colleges	0.2286
				A23 Number of high-level majors at or above the provincial level	0.2705
				A24 Number of industry education integration enterprises at or above the municipal level	0.1659
B Investment Evaluation	0.2753	B1 Funding Input	0.1274	B11 The ratio of government investment in teaching income	0.2056
				B12 The proportion of special funds invested in school internships	0.2932
				B13 The proportion of practical teaching equipment provided by enterprises to practical training equipment	0.5012
		B2 Teacher Construction	0.3051	B21 The ratio of "double-teacher" teachers to full-time teachers	0.3024
				B22 Annual total number of teachers participating in the integration of industry and education	0.4672
				B23 Number of high-level skilled part-time teachers	0.2304
		B3 Construction of Practical Training Base Platform	0.5675	B31 Average area of internship and training base per student	0.2056
				B32 Number of smart classroom or multimedia teachers per student	0.3209
				B33 Virtual simulation, production and education integration training base number	0.4736
C Process Evaluation	0.3548	C1 Collaborative Education	0.5867	C11 The number of internship students	0.3472
				C12 1+X certificate pilot professional coverage rate	0.2679
				C13 Number of students trained in orders	0.3849
		C2 Teaching Reform	0.4133	C21 The ratio of school-enterprise joint development courses to the total number of courses offered	0.2191
				C22 The proportion of teaching standards of majors	0.4902
				C23 Collaborative development of job skill level standards by schools and enterprises	0.2907
D Assessment of Results	0.2263	D1 Talent Training	0.5291	D11 Matching rate of employment majors for graduates	0.6175
				D12 The rate of obtaining vocational qualification certificates for students during their school years	0.3825
		D2 Technical Services	0.3405	D21 Horizontal technical services up to payment	0.3432
				D22 Number of intellectual property projects obtained	0.2238
				D23 Funds for non-academic training	0.2741
				D24 Economic benefits generated by horizontal technical services	0.1588
		D3 Satisfaction	0.1304	D31 Satisfaction with school-enterprise collaborative teaching quality	0.1423
				D32 Student satisfaction with vocational skills	0.1801
				D33 Enterprises' satisfaction with internship students	0.2658
				D34 Graduate parents and social recognition	0.4118

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$$\overline{A} = (\prod_{k=1}^{m} a_{ij}^{k})^{\frac{1}{m}}$$

(3) Calculate the Relative Weight of the Judgment Matrix

Take the integrated unique matrix by geometric averaging:

$$W_i = \frac{(\prod_{j=1}^{n} a_{ij})^{\frac{1}{n}}}{\sum_{i=1}^{n}(\prod_{j=1}^{n} a_{ij})^{\frac{1}{n}}} \quad , \quad i = 1,2,3..,n$$

(4) Judge the Consistency of the Matrix

In general, CR is used as the criterion to judge the consistency of the matrix, and CR is the ratio of the consistency index CI and the average random consistency index RI. If CR <0.1 indicates that the matrix meets the requirements without modification; otherwise, ask an expert to correct the judgment matrix again to make the final calculation result CR <0.1.

Calculation formula of CR:

$$CR = \frac{CI}{RI} = \frac{\lambda_{max} - n}{(n-1)RI} < 0.1$$

4. Conclusion

The integration evaluation of industry and education has important functions of guidance, regulation, diagnosis, incentive and management. Each participant can analyze its own existing problems and make timely adjustments according to the evaluation results. This paper draws on the theory of stakeholders, to higher vocational colleges in the process of fusion schools, enterprises, students, government, industry associations, parents, analyze the demands and responsibilities of the six stakeholders, combing and converted into corresponding evaluation index, using CIPP model classification integration corresponding index, and based on the questionnaire and expert score, through the hierarchy analysis index weight, maximum ensure the pertinence, scientific and effective evaluation index. In the future research, some empirical research can be further carried out to continuously optimize and improve the evaluation system of the integration of industry and education, and promote the better development of the integration of industry and education in higher vocational colleges.

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