

Research on Quality Evaluation of Talent Cultivation in Modern Industrial Colleges based on CIPP Model

Evaluation of Talent Cultivation by CIPP

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Abstract: As an important carrier for the implementation of transformation and development of applied undergraduate colleges and universities and the carrier for the integration of industry and education, as well as collaborative education, modern industrial colleges are the solid foundation for establishing a modern application-oriented vocational education system for undergraduate students and cultivating more highly skilled personnel. The quality evaluation of their talent cultivation involves multiple dimensions and levels, including both time and space dimensions, as well as value dimension. Taking the CIPP evaluation model as the basis, following the principles of dynamic development and effectiveness balance, targeting at the talent cultivation goal of modern industry college of applied undergraduate colleges, this paper constructs a talent training quality evaluation index system with four primary indicators and their corresponding secondary indicators from four dimensions: background evaluation, input evaluation, process evaluation and result evaluation, so as to conduct comprehensive and systematic supervision and feedback on the dynamic process of talent cultivation for the purpose of providing reference for optimizing the talent cultivation quality of modern industrial colleges.

Keywords: CIPP; Talent Cultivation; Modern Industrial Colleges; Quality Evaluation.

1. Introduction

As a new type of school organization jointly built and managed by universities and local governments, industry associations, industrial cluster enterprises, etc. under the background of "New Engineering", modern industrial colleges are also the repositioning and sustainable development of traditional industrial colleges [1]. In the Guideline for the Construction of Modern Industrial Colleges which was jointly issued by the Ministry of Education and the Ministry of Industry and Information Technology in August 2020, it is clearly proposed that driven by the development needs of regional strategic emerging industries and local advantageous industries, a number of modern industrial colleges shall be built focusing on application-oriented universities with distinct industrial characteristics and close links with industries [2]. Marked by the recognition of the first batch of modern industrial colleges by the Ministry of Education in December 2021, the construction work of modern industrial colleges which integrates the functions of talent training, industrial services and scientific and technological innovation, has entered a new and more challenging stage [3]. The teaching management of higher education is an important guarantee for the normal development of teaching activities, stable operation of teaching order, continuous improvement of teachers' teaching ability and continuous improvement of talent cultivation quality in colleges and universities. Determined by the community attributes of modern industrial colleges, the teaching management needs to involve the inheritance and innovation of diversified management systems such as existing higher education teaching management, traditional industrial college teaching management and enterprise talent cultivation management [4,5].

It is believed by foreign scholars that the integration of

industry and education is a highly participatory relationship or a kind of standards-based education. The typical foreign models of innovation in the integration of industry and education are "enterprise studying visit" in Japan [6], "dual system" in Germany [7], cooperative education model in Canada [8], the "new apprenticeship era" supported by the Cameron government in the UK [9], and the "project cluster" promoted by the Obama administration [10], among which, the German "dual system" deeply influenced by the enterprise quality concept has changed the quality concept of modern vocational education. The United States, Germany and Japan have incorporated the quality evaluation of industry-education integration into their education laws [11].

The stakeholder theory and the triple helix theory were proposed by some scholars to analyze and introduce them into the evaluation of industry-education integration [12]. It is shown from relevant foreign studies that the integration of industry and education has a promoting effect on the aspects of academic ability and employment competitiveness of talent development indicators. The integration of industry and education can effectively solve the "two skins" phenomenon that separates talent training from social needs. Being firstly proposed at the national level in the document "Decision on Several Major Issues of Comprehensively Deepening Reform" issued by the Central Committee of the Communist Party of China in 2013, the concept of "industry-education integration" has experienced the development from a model to a cooperative relationship and then to a cross-integration system [13]. Instead of being limited to the mode or relationship, its connotation has risen to a basic system of national vocational education. Presently, the researches on the construction of domestic modern industrial colleges mainly includes: Zhu Linghua discussed the logic and path of constructing modern accounting industrial colleges in higher education institutions; taking Dongguan Institute of

Technology Advanced Manufacturing College (Chang'an) as an example [14]. Scholars have made tentative exploration and research on the construction of modern industrial college, while some specific research results have yet to be further tested empirically in practical application. For that purpose, we should improve the quality of talent cultivation in modern industrial colleges, explore the main factors influencing the quality of talent cultivation, and build a set of talent training quality evaluation index system systematically, so as to promote the deepening of reform, stimulate the vitality of education, and provide society with application-based talents that meet market demand.

As an important way to improve and guarantee the quality of education in modern industrial colleges, quality evaluation of talent cultivation is also one of the core works of establishing a modern industrial college system. The reform of education quality evaluation can promote the innovation of teaching and research system and governance system of the university. On the one hand, scientific and applicable talent cultivation quality evaluation can point out the construction objective, content and direction of the school-enterprise dual body from the perspective of goal management, and guide both sides to carry out in-depth cooperation closely by focusing on the joint construction objective and content; on the other hand, it can promote the relevant subjects of modern industrial colleges to reflect, diagnose and improve in time from the perspective of evaluation process management, so as to form a good communication and coordination mechanism.

The main innovations of this work can be summarized in the following aspects:

1) As far as we know, this is a novel method to evaluate talent training quality of modern industrial colleges.

2) This paper explored the talent training quality evaluation index system with four primary indicators and feedback on the dynamic process of talent cultivation for the purpose of providing reference for optimizing the talent cultivation quality of modern industrial colleges.

2. Appropriateness of CIPP Evaluation Model and Quality Assurance of Talent Training

2.1. Analysis on the Demand for Talents Quality Cultivation in Modern Industrial Colleges

From the perspective of running a school, the higher education in China can generally be divided into several categories such as research universities, application-oriented universities, and higher education institutions, etc. As a product of the combination between application-oriented universities and social needs, modern industrial college has a main characteristic of cultivating "application-oriented", "local-oriented" and "industrialized" related talents. In other words, the teaching process focuses on the application of knowledge and problem solving, and the training mode is mostly based on school-enterprise cooperation and engineering combination; relying on local or regional advantageous resources, the profession setting closely matches the advantages of local industries to provide local-oriented technology and R&D services; at the same time, subject research should be carried out around the needs of the industry and enterprises, so as to solve the practical problems of production and research and development, pay attention to

the transformation and application of scientific and technological achievements. The cultivation of talents in modern industrial colleges cannot be separated from the development of local or regional economy and industry, therefore, the educational objects of different levels, such as undergraduates and postgraduates, have different educational goals in universities, even in the same type of colleges and universities with different geographical locations. All these determine the complexity and variability of quality evaluation objectives for talent cultivation. With the characteristic of changing goal-oriented method to decision-oriented, the CIPP model can effectively solve the above problems. It fully indicates that educational evaluation should not be limited to the extent to which certain goals are met, but rather should be the process that provides useful information for educational decision-making [15].

2.2. Analysis on Appropriateness of CIPP Model and Application-Oriented Talent Cultivation Quality

The CIPP evaluation model is also known as the decision-oriented evaluation model. The model is composed of four evaluation activities: background evaluation, input evaluation, process evaluation, and result evaluation [16]. That is, the evaluation should be carried out from four aspects: judging the needs (background evaluation), judging the reliability of the design or scheme (input evaluation), assessing the execution of the scheme (process evaluation), and assessing the result achieved (result evaluation). It has the characteristics of full duration, process and feedback. As an education-oriented management model, the CIPP model takes the quality process as the timeline, emphasizes decision making, process and improvement throughout the process, and makes decisions on the problems encountered from the four aspects of environment, resources, process and achievement while taking advantage of the management-oriented CIPP model's full duration feature, and then gives timely feedback to the decision makers according to the feedback feature of the model. Instead of evaluating simply at the end like the more commonly used Koch model, the CIPP model conducts dynamical tracking to identify gaps in the cultivation process, address them in a timely manner, provide real-time feedback, and make adjustments at any time. In this way, the CIPP model will optimize the effectiveness of talent development result.

The CIPP model is applicable for the complexity characteristic of talent development evaluation in modern industrial colleges. This model has features of flexibility and operability. Since the evaluation process of talent cultivation effectiveness is long and complex, under the help of its evaluation model, scattered indicators can be transformed into a whole, and numerous small and scattered indicators can be filled into a complete evaluation framework due to the strong operability of the CIPP model. At the same time, obtaining relevant indicators from different aspects at different stages during the process, and obtaining a wide range of feedback information have great benefit to the improvement of the program. The construction feasibility of the talent cultivation evaluation system is ensured by the strong procedural nature of the model.

It can be concluded that the introduction of CIPP model into the talent cultivation quality evaluation model of modern industrial colleges is a dual decision consideration from the aspects of teaching and college attributes. Teaching enables

students to have the inherent ability of developing theoretical knowledge into practical results, however, there is still a lack of scientifically valid, accurate and objective evaluation methods. The examination criteria based solely on the degree of goal attainment and effectiveness can neither fully reflect the individual level of students, nor efficiently and reasonably reflect the overall level. A sustainable university operation process must take evaluation as an improvement tool to support the continuous operation of the policy, and run it throughout every aspect of application-oriented talent cultivation, be able to monitor the whole process of cultivation, and provide timely feedback. It shall focus on formative evaluation, so as to provide information for cultivation decisions and thus improve the quality of application-oriented talent cultivation.

3. Construction of Quality Evaluation Indicator System for Talent Cultivation

The quality of talent training in modern industrial colleges should have specific evaluation indicators and evaluation systems. Whether the training quality can reach the standard depends on whether the established training objectives are reached. Schools should be the main body, while the evaluation of local governments, industrial enterprises and students should also be taken into account. In addition to the evaluation subject, the evaluation content as well as the application direction and other comprehensive factors should also be considered for diversified evaluation. Taking the talent training goal construction with a background evaluation basis as the premise, resource allocation with an input evaluation basis as the guarantee, course operation and implementation with a process evaluation basis as the core, and the impact and effectiveness of talent training with a result evaluation basis as the key.

3.1. Identification of Evaluation Indicators

Based on the CIPP evaluation model, four indicators are identified for the evaluation of the quality of applied talent cultivation, namely evaluation of cultivation background, evaluation of cultivation input, evaluation of cultivation process and evaluation of cultivation results. 16 secondary indicators are selected to complete the construction of talent cultivation quality evaluation system in modern industrial colleges.

The background evaluation mainly assesses the demand, current situation, development advantages and opportunities of application-oriented talent cultivation, etc. The secondary indicators of cultivation background evaluation should be set as the following four: policy support, social demand, cultivation goal, and teaching management system. The input evaluation mainly assesses the guarantee situation of human, financial and material resources necessary for the cultivation of application-oriented talents. Based on the theory of production factors and considering the difference between higher education talent cultivation and social production activities, the secondary indicators of cultivation input evaluation are set as follows: teaching funds, faculty strength, cooperative enterprises and student learning. Process evaluation mainly assesses the teaching methods and contents adopted in the process of talent training, as well as the teaching management, etc. Combining with the unique teaching characteristics of talent cultivation in modern

industrial colleges, the secondary indicators are set as follows: teaching methods and contents, internship in an enterprise, discipline and profession construction, and assessment methods. Mainly from the perspective of student knowledge and ability literacy and meeting social needs, the result evaluation assesses the degree of completion and execution results. Considering the sustainability of evaluation model, its secondary indicators are determined as: student employment, social recognition, student satisfaction, and enterprise benefit. The final indicators of quality evaluation system for talent training in modern industrial colleges are shown in Table 1.

Table 1. Indicators of talent training quality evaluation system of modern industrial college

Level 1 indicators	Level 2 indicators	Level 1 indicators	Level 2 indicators
Background evaluation (X1)	Policy support (B1)	Process evaluation (X3)	Teaching methods and content (B9)
	Social Needs (B2)		Enterprise attachment (B10)
	Training Objectives (B3)		Discipline construction (B11)
	Teaching management system (B4)		Assessment methods (B12)
Input evaluation (X2)	Teaching Funding (B5)	Results evaluation (X4)	Students' employment (B13)
	Faculty strength (B6)		Social recognition (B14)
	Cooperating enterprises (B7)		Student satisfaction (B15)
	Student Learning (B8)		Enterprise Benefit (B16)

3.2. Weight Setting of Evaluation Indicators

The weights of the indicators in Table 1 are calculated through the AHP hierarchical analysis method after combining with the dynamic and developmental characteristics of modern industrial colleges, and it is conducted according to the following steps respectively [17].

Step 1: Constructing judgment matrix

Experts and scholars with many years of teaching and application experience in our university were invited to compare and score the above indicators in pairs. Taking the judgment matrix of an expert as an example, here is the detail:

$$A = \begin{bmatrix} 1 & 2 & 5 & 7 \\ 1/2 & 1 & 3 & 5 \\ 1/5 & 1/3 & 1 & 3 \\ 1/7 & 1/5 & 1/3 & 7 \end{bmatrix} \quad (1)$$

$$X1 = \begin{bmatrix} 1 & 1/3 & 1/3 & 3 \\ 3 & 1 & 1/3 & 5 \\ 3 & 3 & 1 & 9 \\ 1/3 & 1/3 & 1/9 & 1 \end{bmatrix} \quad (2)$$

$$X2 = \begin{bmatrix} 1 & 1/5 & 1/3 & 1/6 \\ 5 & 1 & 3 & 5 \\ 3 & 1/3 & 1 & 3 \\ 6 & 1/5 & 1/3 & 1 \end{bmatrix} \quad (3)$$

$$X3 = \begin{bmatrix} 1 & 3 & 1/5 & 1/4 \\ 1/3 & 1 & 1/6 & 1/3 \\ 5 & 6 & 1 & 3 \\ 4 & 3 & 1/3 & 1 \end{bmatrix} \quad (4)$$

$$X_4 = \begin{bmatrix} 1 & 1/3 & 1 & 1/3 \\ 3 & 1 & 3 & 1 \\ 1 & 1/3 & 1 & 1/3 \\ 3 & 1 & 3 & 1 \end{bmatrix} \quad (5)$$

Step 2: Consistency check
The consistency of the above five matrices is checked through MATLAB software, and the results are shown in Table 2, CI is the consistency indicators, CR is the freedom indicators.

Table 2. The weights and consistency test results of the five judgment matrices (Expert 1)

A		B1		B2		B3		B4	
indicator	weight	indicator	weight	indicator	weight	indicator	weight	indicator	weight
X1	0.2011	B1	0.2143	B5	0.2934	B9	0.5048	B13	0.2805
X2	0.0524	B2	0.0983	B6	0.5279	B10	0.2876	B14	0.1077
X3	0.6622	B3	0.6483	B7	0.0625	B11	0.0645	B15	0.5595
X4	0.0844	B4	0.0391	B8	0.1163	B12	0.1431	B16	0.0523
Lmax=4.2188		Lmax=4.2572		Lmax=4.2503		Lmax=4.1981		Lmax=4.1205	
CI=0.0729		CI=0.0857		CI=0.0834		CI=0.0660		CI=0.0402	
CR=0.0819<0.1		CR=0.0963<0.1		CR=0.0937<0.1		CR=0.0742<0.1		CR=0.0451<0.1	
Passing the consistency test		Passing the consistency test		Passing the consistency test		Passing the consistency test		Passing the consistency test	

According to the above method and process, the weight results of the remaining four experts were obtained, and the average weights of the indicators of the five experts were

derived separately. The final table of indicator weight is shown in Table 3.

Table 3. Weights of indicators for evaluating of talent cultivation quality

Level 1 indicators	Weights	Level 2 indicators	Single layer weights	Total weights
Background evaluation (X1)	0.2535	Policy support (B1)	0.2747	0.0696
		Social Needs (B2)	0.1578	0.0400
		Training Objectives (B3)	0.4973	0.1261
		Teaching management system (B4)	0.0703	0.0178
Input evaluation (X2)	0.1212	Teaching Funding (B5)	0.3473	0.0421
		Faculty strength (B6)	0.4622	0.0560
		Cooperating enterprises (B7)	0.0751	0.0091
		Student Learning (B8)	0.1154	0.0140
Process evaluation (X3)	0.3742	Teaching methods and content (B9)	0.3136	0.5277
		Enterprise attachment (B10)	0.5310	0.2595
		Discipline construction (B11)	0.0854	0.1317
		Assessment methods (B12)	0.0700	0.0811
Results evaluation (X4)	0.2512	Students employment (B13)	0.4197	0.1054
		Social recognition (B14)	0.1874	0.0471
		Student satisfaction (B15)	0.3176	0.0798
		Enterprise Benefit (B16)	0.0753	0.0189

4. Discussion and Conclusion

4.1. Background Evaluation on the Quality of Talent Cultivation in Modern Industrial College

The weight of training goal is the highest among the four factors of contextual evaluation, and the score of the training goal satisfaction is not high according to the data of fuzzy evaluation, which means both teachers and students consider that the training goal needs to be adjusted appropriately. For the determination of training goals, it should be based on "applicability", "sociality" and "industry" through combining with local socio-economic characteristics, emphasizing the importance of sustainable development such as the

integration of theory and practice, cooperation and communication and lifelong learning ability. The differences of individual students should be recognized for the purpose of fully personalizing the training objectives. What necessary for the development of training objectives are the participation of front-line teachers, enterprises and other parties, and the integration of diverse suggestions, so that the industry characteristics of application-oriented talents can be reflected in the specific professional quality training goals.

4.2. Input Evaluation of Talent Training Quality Input in Modern Industrial College

The weight of faculty is the highest in the input background evaluation section. More attention has been paid to the power

input of enterprises such as school-enterprise cooperation in the current training of application-oriented talents instead of the improvement of teachers' own ability. The school-enterprise cooperation has played a role in the process of training applied talents undoubtedly. However, the teacher's professional literacy ability can directly constrain the foundation of student's professional cognitive during their undergraduate study. For that purpose, we should firstly improve the faculty, especially provide enterprise practice opportunities for front-line teachers regularly, provide opportunities of academic exchanges for teachers of major institutions, stimulate teachers' motivation of independent learning, and enable front-line teachers' professionalism to be the top of the industry; secondly, we should deepen the cooperation between schools and enterprises, introduce enterprise technical standards into professional courses. Both the university and the enterprise participate in the selection and revision of teaching content and textbooks, timely update the professional teaching knowledge system, to realize the deep linkage between the university and the enterprise.

4.3. Process Evaluation of Talent Training Quality Input in Modern Industrial College

Teaching contents and methods have a high weight in the process evaluation. In addition to theoretical teaching, the cultivation of application-oriented talents should pay more attention to practical teaching: establish a diversified practical teaching operation mechanism applicable to the cultivation of application-oriented talents, increase the proportion of practical teaching, refine teaching goals and teaching links, strengthen case teaching, focus on the advancement, practicability and systematization of teaching contents, and effectively increase the investment of practical teaching funds and the construction of practical teaching bases. We should also perfect the disciplines and specialties construction continuously on this basis, improve the teaching assessment methods, to form a virtuous improvement cycle for the purpose of maximizing the role of practical teaching in the process of training application-oriented talents.

4.4. Results Evaluation of Talent Training Quality Input in Modern Industrial College

As an important factor affecting the sustainable development of colleges and universities, the issue of employment rate of college graduates is also an important symbol reflecting the result of application-oriented talent cultivation and the recognition degree of society and enterprises. However, the employment rate of graduates is not high according to the data of fuzzy evaluation. Both the self-satisfaction and social acceptance are unsatisfactory. These are related to the unclear training goals, the disconnection between major setting and social needs, and the backward curriculum system and evaluation mode, etc. For that purpose, we should start from the methods of enhancing school influence, cultivating brand specialties, serving the local society and economy, clarifying the training objectives and deepening the cultivation process for the employment-oriented training of applied talents, so as to effectively improve the self-satisfaction of the society and students, increase the employment rate of graduates, cultivate excellent application-oriented talents for the society and enterprises,

and bring local and enterprises with actual benefits.

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