Research on the Integration Path of Industry and Education in Vocational Colleges, Utilizing the Principles of Symbiosis Theory

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Abstract. This study employs literature analysis and interdisciplinary research methods to analyze industry-education integration (IEI) in vocational colleges. Based on a review of relevant research on IEI, a detailed analysis of the three elements of symbiosis theory is conducted from the perspective of symbiosis theory. A combination of quantitative and qualitative analysis was used to analyze typical cases of school-enterprise industry education integration. The research results indicate that there are differences in the symbiotic model of industry education integration among vocational colleges of different scales. The current integration of industry and education in vocational colleges has problems such as a low level of symbiosis, low quality of talent cultivation, and failure to form a long-term symbiotic relationship. Specifically, these problems include: low level of cooperation, poor cooperation effect, poor quality of cooperative teaching, low student satisfaction with internships, deviation in cooperation goals, and low efficiency of enterprise participation. The influencing factors of the symbiotic relationship between schools and enterprises can be classified into three dimensions: schools, enterprises, and students. To address the three challenges of integrating industry and education in vocational colleges, this study proposes targeted optimization paths. The government and industry organizations should provide a good symbiotic environment for IEI.

Keywords: Symbiosis theory; Vocational colleges; Integration of industry and education; Path research

1 Introduction

The deep integration of industry and education in vocational colleges in the new era has entered a deep reform zone, shifting the focus from low-level scale balance to connotation quality balance. Promoting the integrated development of the industrial chain, education chain, and talent chain is crucial [1]. Vocational colleges proactively investigate the dynamics of industry-education integration, align themselves with the market environment, incorporate themselves into the complete industry cycle, adjust to developmental trends, and generate innovative ideas. They continuously explore novel models of industry-education integration (IEI) within vocational education, ensuring that

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IEI permeates throughout the entire process of student development, teaching resources, curriculum design, program offerings, and faculty training. The government actively plays a leading role in overall planning, stimulating cooperation among all parties through the construction of demonstration vocational education groups and provincial-level industry-education integration enterprises, creating a good cooperation environment for enterprises and universities. Various universities take multiple measures to actively connect with industrial development, and achieve the integration of job standards and talent training standards by promoting modern apprenticeship and 1+X certificate systems; integrating teaching and competition, utilizing skills competitions to enhance students' practical abilities and innovative spirit [2].

Busemeyer and Trampusch (2012) developed a classic analytical framework for skill formation, categorizing it into four models based on the level of government and business participation: liberal, separatist, nationalist, and collectivist [3]. Scholars such as Joel Yager (2011) and Kari Laine (2015) advocate for leveraging the strengths of vocational schools by establishing industry-aligned programs and utilizing school-run businesses to provide practical experience for students and teachers. Senker emphasizes the importance of school-business partnerships in expanding funding opportunities, enhancing capabilities, and facilitating the commercialization of research and development, leading to economic growth [4-5].

Scholars' research on IEI mostly focuses on grasping the connotation, studying the model, and exploring problem solutions [6]. Scholars have rarely used theory to analyze the problems of industry and education integration, and have not systematically analyzed the complex connections between various subjects in industry and education integration [7]. Therefore, this article attempts to analyze the difficulties in the process of industry education integration in higher vocational colleges from the perspective of symbiosis theory, clarify the symbiotic relationship between each unit, and then explore the path construction of deepening IEI in Guangdong Province's higher vocational colleges.

This article studies the construction of a symbiotic system for the IEI in vocational colleges under the guidance of symbiosis theory. It provides a detailed analysis of the symbiotic environment, symbiotic units, and symbiotic models of IEI in vocational colleges. It also conducts case analysis and in-depth research on the current situation of industry and education integration in vocational colleges, and analyzes the problems and reasons for the current integration. Finally, an optimization path has been proposed to address the difficulties in IEI in vocational colleges. Only with the joint efforts of various symbiotic units can the deep development of industry and education integration be promoted.

2 The Current Situation and Dilemmas of IEI

This article collected data through a questionnaire survey. Twenty vocational colleges in China were selected for the survey due to data availability. The survey targeted management personnel, frontline teachers, and other staff members of vocational colleges

and investigated the current situation, problems, and needs of industry-education integration in schools and enterprises. Of the 560 questionnaires distributed, 10 were excluded due to ineligibility, resulting in a total of 450 valid responses. The effective response rate was over 80%.

Vocational colleges have a high overall willingness to cooperate with enterprises, with a proportion of 98.75% being "relatively willing" or above. Vocational colleges have a strong intention to cooperate in nine ways: cooperative education, co construction of majors, co construction of courses, co construction of textbooks, co construction of teaching staff, sharing of training venues and equipment, joint technical research, joint provision of social services, and co construction of economic entities.

The most common mode for vocational colleges to participate in IEI is order based training, followed by co construction of practical training bases, modern apprenticeship system, technical cooperation, and vocational education group mode, all of which exceed half. Less than half of vocational colleges participate in school enterprise cooperation through the joint construction of secondary colleges, and even fewer vocational colleges cooperate with enterprises based on scientific and technological research projects, accounting for 36.76% (Figure 1a). The cooperation goals of vocational colleges are diverse, with over 81.6% of vocational colleges expecting to provide students with internship and training positions, understand industry information, obtain enterprise equipment, and acquire enterprise technical talents through cooperation. In addition, 28.35% of vocational colleges have other cooperation goals, but overall, the demand for job positions and industry information is almost the cooperation goal of all vocational colleges (Figure 1b).

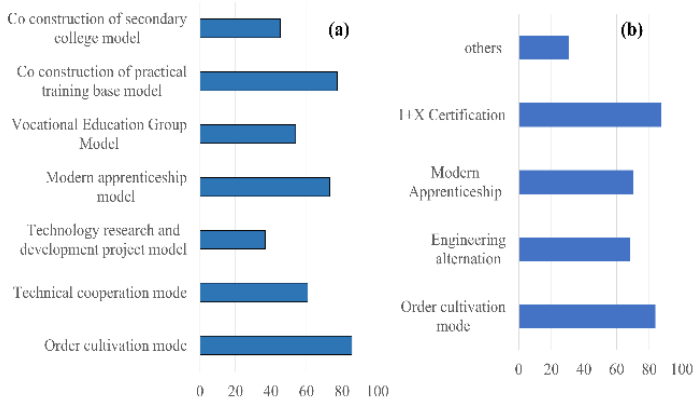

Fig. 1. School enterprise cooperation model in vocational colleges(a). Talent training mode in vocational colleges(b).

In the early stages of school-enterprise cooperation, vocational colleges consider the following factors when selecting partners: industry standing, number of positions offered, management philosophy, technical support, and equipment support. These fac-

tors account for 85.05%, 82.24%, 79.75%, 77.26%, and 68.22%, respectively. Additionally, 22.43% of vocational colleges identified other influencing factors. Over 76.01% of vocational colleges believe that the primary factors affecting student internship satisfaction are prolonged engagement in menial tasks and a lack of educational guidance within enterprises. More than half of vocational colleges attribute low internship satisfaction to the poor professional of managers responsible for school-enterprise cooperation in enterprises. Furthermore, 43.93% of vocational colleges indicate that frequent staff turnover within enterprises can negatively impact student internship satisfaction (Figure 2).

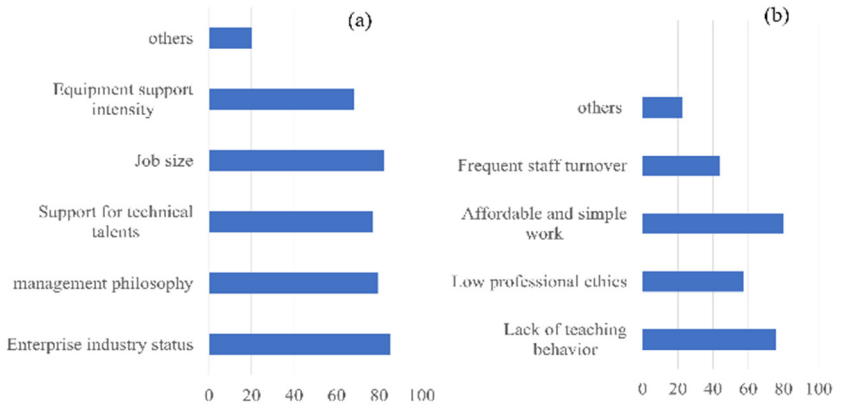

Fig. 2. The influencing factors of school enterprise cooperation among enterprises(a). Factors influencing student internship satisfaction(b).

On average, the percentage of majors in vocational colleges that maintain long-term partnerships with enterprises varies between 26% and 50%. The lowest proportion of long-term cooperative relationships is found among majors with 76% to 100% long-term cooperation, indicating a lower level of industry-education integration in these programs.

Only half of the majors in vocational colleges have established stable, long-term cooperative relationships with enterprises. This suggests that long-term cooperation is not yet widespread, and most collaborations are short-term in nature. Consequently, the overall level of IEI in vocational colleges remains low.

A cross-analysis of school size and the prevalence of long-term cooperative relationships reveals that vocational colleges with fewer than 5,000 students have the lowest proportion of majors with 51% to 100% long-term cooperation. Among these colleges, majors with 76% to 100% long-term cooperation account for the smallest proportion, indicating the lowest level of industry-education integration.

Vocational colleges with 5,000 to 10,000 students have a higher proportion of majors with 51% to 100% long-term cooperation than those with fewer than 5,000 students.

The proportion of majors with 76% to 100% long-term cooperation is also higher, suggesting a greater degree of industry-education integration in this group of colleges.

Vocational colleges with 15,000 to 20,000 students or more have an increasing number of majors with a high proportion of long-term cooperative relationships. This indicates a higher level of IEI in these larger colleges.

3 The Dilemma of IEI in Guangdong Vocational Colleges from the Perspective of Symbiosis Theory

According to the symbiosis theory, the scale of industry-education integration in vocational colleges is positively correlated with the number of majors and cooperative partners involved. Additionally, the proportion of majors engaged in long-term cooperative relationships within IEI initiatives influences the specificity and stability of such collaborations.

As illustrated in Table 1, there are significant variations in the scale and stability of industry-education integration among vocational colleges. Notably, the larger the scale of industry-education integration, the higher its stability.

Specifically, among vocational colleges with 1-5 majors involved in industry-education integration, approximately 70.2% have established long-term cooperative relationships with less than 25% of those majors. This suggests that the stability of IEI in such colleges is relatively low. However, it is important to consider that the small scale of industry-education integration may also contribute to this result.

In contrast, vocational colleges with 6-10 or 10-15 majors involved in industry-education integration exhibit similar levels of specificity. The proportion of majors engaged in long-term cooperative relationships in these colleges ranges from 23.1% to 30.2%.

Vocational colleges with 16 or more majors involved in industry-education integration demonstrate a higher degree of stability, with 63.1% establishing long-term cooperative relationships with over 50% of those majors. This indicates that more than half of these colleges have formed sustainable industry-education integration partnerships. Based on the symbiotic model of industry-education integration, vocational colleges with 1-5 majors typically exhibit point symbiosis, those with 6-10 or 10-15 majors exhibit intermittent symbiosis, and those with 16 or more majors exhibit continuous symbiosis. As show in table 1.

Table 1. Cross tabulation of the number of industry education integration majors in schools and the proportion of long-term cooperative majors (%). IIE means the number of majors integrating industry and education.

IIE	The proportion of majors that have established long-term partnerships through IEI in schools, %				
	0-25	26-50	51-75	76-100	Total
1-5	70.2	21.1	8.8	0	100
6-10	21.8	55.1	20.5	2.6	100
10-15	17	52.8	26.4	3.8	100

Above 16	8.3	28.6	30.8	32.3	100
Total	24	37.7	23.7	14.6	100

As the main body of IEI, enterprises, schools, and students have multiple factors that jointly affect the promotion of industry-education integration, and each cooperative subject has a high degree of recognition of these influencing factors. In addition, the scale of higher vocational colleges also affects the effect of industry-education integration. The larger the scale of the school, the higher the stability of long-term cooperation between schools and enterprises.

In terms of enterprises actively participating in the IEI of higher vocational colleges, enterprises attach great importance to investing in the construction of practice bases, focus on the development of teaching materials and the training of teachers, so as to achieve the goal of cultivating students' talents. However, in the process of school-enterprise interaction, enterprises play a dominant role and fail to fully highlight the role of schools in cultivating talents, mainly manifested in the following aspects: insufficient communication between the two parties in the development of talent training programs and teaching resources, and the students' single knowledge background.

Based on the analysis of the research results of higher vocational colleges in Guangdong Province, it can be seen that the satisfaction of cooperation is very high, but compared with the willingness of cooperation, the satisfaction of cooperation is relatively low, indicating that the results of the current cooperation between higher vocational colleges and enterprises are significant, but lower than that of higher vocational colleges. The expected value of the school shows that the cooperation between schools and enterprises is a shallow cooperation. The main problems are as follows: there are deviations in the cooperation goals between schools and enterprises, the scale of industry-education integration in various higher vocational colleges is different, enterprises have many concerns about participating in industry-education integration and the benefits are not high, and the satisfaction of students is not high. At present, the IEI of higher vocational colleges is in a difficult period. Generally speaking, higher vocational colleges are at a shallow level of cooperation, the cooperation effect is lower than expected, and a long-term symbiotic relationship has not yet been formed. In the future, all symbiotic units still need to work together to promote the deepening of IEI.

4 Possible Reasons for the Difficulties in IEI in Vocational Colleges

IEI in vocational colleges is characterized by a low level of cooperation between schools and enterprises. This is attributed to several factors.

Firstly, the coverage of industry-education integration is limited. Secondly, there is a significant disparity in the experience of vocational colleges in participating in industry-education integration, as evidenced by the varying durations of school-enterprise cooperation among different institutions. Thirdly, while the forms of cooperation between schools and enterprises are diverse, the depth of cooperation remains insufficient.

Both schools and enterprises tend to engage in superficial forms of cooperation, such as order cultivation and joint establishment of practical training bases. Deeper forms of

integration, such as modern apprenticeship, technical cooperation, joint construction of secondary colleges, and scientific and technological research projects, are less common.

Additionally, many small and medium-sized enterprises participate in industry-education integration projects in vocational colleges. However, these enterprises often lack the capacity for deep engagement. Consequently, industry-education integration activities are primarily limited to superficial interactions, such as enterprise visits, campus simulations, or internships in basic positions.

Furthermore, some enterprises participate in industry-education integration solely to access government subsidies rather than to engage in meaningful collaboration.

5 A Multidimensional Optimization Path for IEI in Vocational Colleges

To foster industry-education integration, a comprehensive communication platform is crucial. The government should assume a leadership role in establishing a cloud-based platform dedicated to industry-education integration. Industry organizations, leveraging their information gathering capabilities, should enhance the development of industry-education integration platforms. The information advantage possessed by industry organizations can facilitate the sharing of industry-education information resources.

A comprehensive communication network for industry-education integration should encompass a wide range of channels. Establishing a robust organizational structure is essential for ensuring the active participation of both schools and enterprises.

Grassroots party organizations, with their role in community building, can serve as effective communication channels. Research has demonstrated that party organizations contribute positively to improving corporate governance, strengthening school-enterprise communication mechanisms, and promoting corporate social responsibility awareness.

Schools and enterprises should strengthen communication to eliminate cooperation obstacles caused by incompatible quality parameters as much as possible. Schools and enterprises should clarify the talent training goals for community construction; Establish a sound communication mechanism and jointly develop management systems for school enterprise cooperation personnel. In addition, enterprises should pay attention to the education and teaching of students, improve information disclosure systems, and improve the guarantee mechanism for student salaries and benefits; Vocational colleges should accurately position the demands of the industrial chain, promote the construction of professional groups, strengthen their self-generating ability, improve the quality of talent supply, and enhance the service capabilities of enterprises.

6 Conclusion

The factors that affect IEI in vocational colleges are complex and can be discussed separately from three symbiotic entities. From the perspective of enterprises, the industry status, job size provided, management philosophy, technical backbone support, and equipment support of the enterprise are all important considerations that affect the selection of cooperative enterprises by vocational colleges. From the perspective of student participation in IEI, student personal safety and high student turnover rate are the main factors that cause concerns for enterprises. From the perspective of schools, the scale of schools, lagging behind the needs of enterprises in talent cultivation, and insufficient teaching staff are important factors affecting the long-term cooperation relationship of industry education integration.

The practical difficulties in IEI in vocational colleges are manifested in the following three aspects: low level of integration of industry and education, insufficient improvement in the quality of talent cultivation through integration of industry and education, and failure to form a long-term cooperative symbiotic relationship.

To address the three challenges of IEI in vocational colleges, this article proposes targeted optimization paths. The government and industry organizations should provide a good symbiotic environment for IEI. Schools and enterprises should strengthen communication to eliminate cooperation obstacles caused by incompatible quality parameters as much as possible. In addition, enterprises should pay attention to the education and teaching of students, improve information disclosure systems, and improve the guarantee mechanism for student salaries and benefits; Vocational colleges should accurately position the demands of the industrial chain, promote the construction of professional groups, strengthen their self generating ability, improve the quality of talent supply, and enhance the service capabilities of enterprises.

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References

1. Greinert,W.D. Marktmodell Schulmodell Duales system:Grundtypen Formalisierter Berufsbildung. Die Berufsbildende Schule,1988,40(3):145-156.
2. Jon Whittle, John Hutchinson. Mismatches between Industry Practice and Teaching of Model Driven Software Development. Models in Software Engineering,2012,67,40-47.
3. Busemeyer M,Trampusch C.The comparative Political Economy of Collective Skill Formation. Oxford, New York: Oxford University Press,2012,3-38.
4. Joel Yager. Adapting to Decreased Industry Support of CME: Lifelong Education in an Industry Lite World. Academic Psychiatry, 2011, 101-105.

5. Kari Laine. Open Innovation Between Higher Education and Industry. Journal of the Knowledge Economy, 2015,6,589-610.
6. Yan L .Research on Optimizing the Talent Training Mode of School-Enterprise Cooperation in Vocational Education Under the Background of Industry and Education Integration. Education Journal,2024,7(2),72009-.
7. Fang B .Construction of a personalized learning platform based on genetic algorithm for specialized education in industrial colleges in the context of industry-education integration. Applied Mathematics and Nonlinear Sciences,2024,9(1),00325-.