

# *Exploration on the Mode of Collaborative Education between Schools and Enterprises under the Background of Integration of Industry and Education*

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**Abstract:** This paper takes the integration of industry and education and the joint training of schools and enterprises as the starting point, based on the front-line employment needs of enterprises, expounds the characteristics of prefabricated buildings and the required talents, and analyzes the importance of the integration of industry and education and the joint training. Combined with the basic situation of the industry and the school, this paper puts forward specific talent training strategies to promote the direction of prefabricated buildings, and provides reference suggestions for the talent training mode in the exploration.

## 1. Introduction

In March 2022, the Ministry of Housing and Urban-Rural Development of the People's of China issued the 14th five year plan for building energy conservation and green building development, which clearly stated that new buildings in cities and towns will be fully green buildings by 2025 <sup>[1]</sup>. This also means that the traditional building forms will be completely banned, and will greatly promote the rapid development of green construction, intelligent construction and other technologies. Prefabricated buildings not only conform to the concept of green construction, but also meet the basic demand for resource conservation, which is the future development direction of the construction industry.

As a new industry, prefabricated building has many problems, such as weak foundation, shortage of talents, imperfect industrial chain and easy decoupling. Under the background of great changes in the construction industry, talent training is facing great challenges: on the one hand, the supply of personnel mastering traditional construction technology will exceed the demand; on the other hand, there is a huge gap of new talents mastering assembly construction technology <sup>[2]</sup>. Therefore, training professional skilled personnel with certain professional skills can effectively improve the industrial maturity of prefabricated buildings, and is also an important measure to improve the integration of various production and construction links.

The teaching content is relatively unfamiliar, the teaching resources are relatively scarce, the talent input is unstable, and the professional technology is not up to the standard. These are the problems that must be faced in exploring the reform of the training system of prefabricated construction talents and cultivating application-oriented talents in the new era<sup>[3]</sup>. In January 2019, the State Council issued the national vocational education reform implementation plan, which pointed out that vocational schools should carry out vocational education reform according to social needs and their own characteristics. Schools should take the initiative in school enterprise cooperation, and cooperate with enterprises in many aspects, including talent training, social services, employment and entrepreneurship. Enterprises should also actively mobilize funds, technology, equipment and management to participate in school enterprise cooperation, and schools and enterprises should work together to promote the reform of Vocational Education<sup>[4]</sup>.

## 2. Current Situation of Prefabricated Buildings

Prefabricated building is a modern building form based on the green concept, which can effectively shorten the construction period and reduce the labour force. Around the 1950s, China began to learn from the experience of other countries and popularize industrialized and standardized prefabricated components and prefabricated buildings in China. In the following 30 years, a variety of concrete prefabricated systems have developed rapidly. By the end of the 1980s, tens of thousands of prefabricated component factories had been formed in China. Then, cause of the technical conditions, the aseismic performance, thermal insulation performance, impermeability performance and sound insulation performance of prefabricated buildings can not be guaranteed, and the development of prefabricated buildings has entered a low tide period<sup>[5]</sup>. Almost at the same time, foreign developed countries began to pay attention to the development of prefabricated building technology, and the assembly rate of new houses in the United States, Japan, Britain and other countries has been very considerable.

With the maturing of China's construction industry, various construction technologies have made great progress, laying a solid foundation for prefabricated buildings. At the same time, under the multiple pressures of declining population dividend and double carbon emission reduction, China's construction industrialization has become the only way for the construction industry.



(1 is the least in need and 5 is the most in need)

Figure 1: Shortage of Types of Work on the Site of Prefabricated Buildings

In the 10 years from 2010 to 2020, the production capacity of assembled components and parts in China increased from 13 million m<sup>3</sup> to 92 million m<sup>3</sup>. With the continuous expansion of the

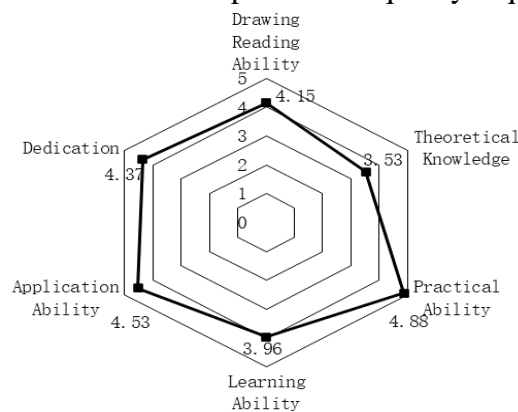
proportion of prefabricated buildings in the market, the demand for skilled workers with a certain professional level in the prefabricated construction industry is increasingly strong. Some scholars have conducted research on the demand of assembling talents and the construction of talent team [6,7]. In 2021, the National Bureau of statistics released the monitoring and investigation report on migrant workers, which showed that there were about 55.57 million migrant workers engaged in the construction industry in China. Prefabricated buildings can save 50% of labour, and the talent gap of prefabricated construction workers may reach tens of millions. According to the investigation of Shen Qiyu [8], there is a great shortage of talents for various types of work, as shown in Figure 1.

As the popularity of prefabricated buildings continues to expand, this number will gradually rise. However, higher vocational colleges are still at the exploratory stage in terms of personnel training of prefabricated buildings. How to cultivate professional and comprehensive application-oriented talents is a common concern of Higher Vocational Colleges and enterprises.

### 3. Characteristics of Talent Demand in Prefabricated Construction Industry

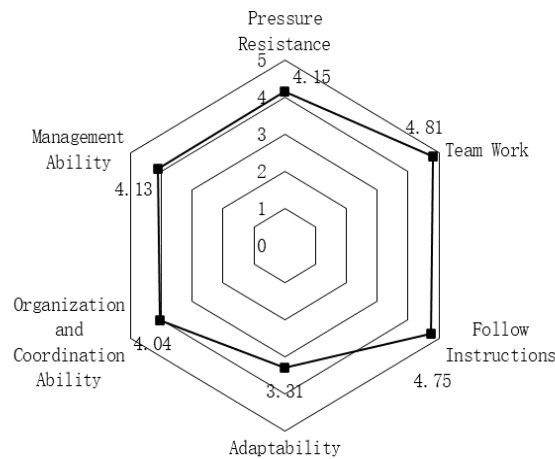
Although both prefabricated concrete buildings and traditional concrete buildings belong to concrete structures, the production and construction methods of prefabricated buildings are obviously different from those of traditional buildings, which leads to a large number of traditional construction workers unable to immediately change their identities and become industrial workers who can adapt to the production and construction of prefabricated buildings. Because the prefabricated building needs a considerable professional level in the production and construction process, the prefabricated building has higher requirements for the professional quality of industrial workers.

In the process of assembly type production, workers are required to carry out mold placement, rebar processing, embedded parts placement and concrete pouring according to the drawings, which requires workers' ability to read drawings and operate; In the transportation stage, the components need to be transported onto the vehicle and unloaded at the construction site. In this process, workers need to master a certain degree of mechanical knowledge and management ability; In the construction process, workers need to construct according to the drawings and assemble and grout the components. These processes require workers to have certain hands-on ability and organization and coordination ability. The statistical radar charts of Figure 2 and Figure 3 are obtained by visiting and investigating the management personnel and industrial workers of Dadongwu Construction Science & Technology Co., Ltd. Figure 2 shows the professional level required by industrial workers, and Figure 3 shows the comprehensive quality required by industrial workers.



(1 is the least important and 5 is the most important)

Figure 2: Professional competence requirements of assembly workers



(1 is the least important and 5 is the most important)

Figure 3: Comprehensive ability demand of assembly workers

Figure 2 shows that in terms of professional quality, the enterprise needs front-line workers to have strong hands-on ability and professional spirit, to master certain map reading ability and the ability to apply knowledge to practice, and has low requirements on workers' ability to master theoretical knowledge and learning ability. Figure 3 shows that in terms of comprehensive ability, assembly workers need to have a high degree of command obedience and teamwork spirit, and need a certain degree of pressure resistance, management ability and organization and coordination ability. It is not recommended that workers should dispose at will according to their own cognition.

#### 4. The Integration of Production and Education in the Prefabricated Construction Talents

At present, due to the strong demand of enterprises for assembly talents, a considerable number of Vocational Colleges and assembly enterprises have tried to integrate production and education in personnel training. At present, the training mode of integration of industry and education is mainly based on modern apprenticeship system and targeted training. It has become a new trend for schools and enterprises to jointly build training bases and jointly revise curriculum construction and training programs. The main directions are:

1). School enterprise resource sharing. The school has advantages in terms of policy, funds, venues and teachers, while the enterprise has advantages in terms of market sensitivity, information channels and technology update and iteration. According to their respective advantages and characteristics, schools and enterprises should build a mutually beneficial resource sharing platform. One of the measures is to jointly build a training base.

In 2019, education identified 1164 productive training bases and more than 200 collaborative innovation centers<sup>[9]</sup>. The construction of productive practical training base and system innovation center will bring together the academic resources of the University and the production resources of enterprises. It will greatly improve the practical training conditions of students in Higher Vocational Colleges and effectively improve their practical ability, application ability and comprehensive quality. The training base is divided into an on-campus learning training base and an off campus production training base, both of which have their own characteristics and complement each other. However, there are certain safety risks in the study of the off campus production training base.

2). Construction of professional groups. Higher vocational colleges should actively adapt to the needs of enterprises, actively connect with enterprises in terms of training objectives, professional settings, curriculum system, teaching staff, etc., and complete the deep integration of talents jointly trained by schools and enterprises. In the specific practice of teaching reform, how to cultivate

talents who can meet the actual needs of enterprises is the core of the reform.

According to the demand of enterprises in Fujian Province for prefabricated construction talents, Fujian Jiangxia university aims to cultivate prefabricated talents who can be competent for front-line work. Fujian Jiangxia University has established a characteristic professional group of civil engineering, industrial engineering, engineering management, engineering cost and other disciplines. Relying on the resources of the University, it has adopted measures such as the construction of application-oriented professional system, the reform of application-oriented talent training mode, the deep participation of industrial enterprises, and the construction of double qualified and double capable teachers, and achieved good results<sup>[10]</sup>.

3). Order class and post internship. At present, order classes and on-the-job internships have become one of the long-term measures for Higher Vocational Colleges and enterprises to jointly cultivate talents. Under this mode, enterprises can participate in the training of talents more directly and quickly, reducing the strangeness of students entering enterprises directly. At present, this mode should be embodied by the combination of work and study, post practice and order type talent training. Some enterprises have explored and made certain achievements<sup>[11,12]</sup>.

## **5. Thinking of Talent Training under the Mode of Integration of Production and Education**

1). Build a school enterprise collaborative management platform. Higher vocational colleges and enterprises are two units with different natures. Their cooperation requires both parties to break the stereotype and cooperate wholeheartedly. The construction of a common management platform can effectively coordinate the contradictions in the specific implementation process. First of all, the collaborative management platform requires the participation of both schools and enterprises, and the school representatives and enterprise representatives should ensure a certain proportion. Secondly, the representatives of both parties involved should have clear job responsibilities. In terms of curriculum construction, practical training management, teaching training, safety management, etc., both schools and enterprises should have corresponding representatives responsible. Third, both schools and enterprises should make clear the talent training objectives and the resources that should be invested by both parties, as well as the measures to ensure the achievement of the teaching objectives.

2). Faculty management. There is a direct relationship between the quality of personnel training and the strength of teachers. As the prefabricated building has only been gradually popular in Chinese Mainland in recent years, the training of prefabricated building talents is being carried out in Vocational Colleges and enterprises. However, most of the teachers lack the ability to teach the professional theoretical knowledge and practical knowledge of prefabricated buildings. When both schools and enterprises jointly train talents, the nature of the courses can be classified. The basic and public courses are the responsibility of the full-time teachers in the school; The practical courses can be taken charge by enterprise engineers. At the same time, young teachers can be arranged to take a temporary post in the enterprise to participate in specific projects and learn the design, production, construction and management of prefabricated buildings.

3). Implement process assessment. In order to train the assembling talents that meet the social needs, the assessment method of school enterprise cooperative education should be improved. The assessment methods, methods and contents should be distinguished from the traditional school education, and should be based on the principle of diversified and flexible assessment methods. The assessment process takes the ability assessment as the core, and should be based on the assessment of application ability and practical ability, supplemented by the assessment of knowledge mastery.

It is necessary to establish an evaluation system aiming at evaluating practical and cooperative abilities. In the practical assessment, the assessment results are composed of professional teacher

evaluation, student group self-evaluation and mutual evaluation. Take the actual completion degree of the project as an indicator to evaluate the practical ability of students.

## 6. Conclusion

Prefabricated building is the trend of future architecture development. Higher vocational colleges are responsible for the task of delivering qualified talents to enterprises. Making use of its own advantages, adjusting the direction of professional construction and talent training program, and cultivating assembled talents with enterprises are the problems that higher vocational colleges must solve. Deepening the integration of industry and education, building a school enterprise collaborative management platform, building a teaching team with school theoretical teachers and enterprise practice teachers, and refining the assessment scheme can make the vocational education achieve the expected goals and improve the overall production and construction level of prefabricated buildings in China.

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