

Research on the Transfer of New Major of Intelligent Construction Technology in Higher Vocational Colleges in the Greater Bay Area: A Case Study of Dongguan Polytechnic

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Abstract

The construction industry is transforming into a new era of building industrialization. The new major of intelligent construction technology at the higher vocational level is set up with the needs of the transformation and upgrading of the construction industry. The number of talents trained in intelligent construction technology in the Guangdong-Hong Kong-Macao Greater Bay Area is far from meeting the talent needs of the development of local construction industry. The establishment of new majors in intelligent construction technology in vocational colleges needs to rely on a solid school running foundation and meet the school running conditions of practical teaching, so as to form a multi-disciplinary training scheme, curriculum system, practical innovation system, teaching staff, project platform and management mechanism. We can take such effective measures to meet the demand of “intelligent construction” in the construction industry of the Guangdong-Hong Kong-Macao Greater Bay Area for high-quality and compound talents.

Keywords

Intelligent construction technology; Transformation and upgrading; Higher vocational colleges; Personnel training.

1. Introduction

Intelligent construction covers the whole life cycle of the building, involving many subsystems such as building system, structural system, construction equipment system and operation and maintenance management system [1] [2]. Among them, the production of factory components and parts is the basis of intelligent construction, digital technology is the guarantee of intelligent construction, and the construction scheme based on perception is the mode of intelligent construction. Intelligent construction major is a newly added Civil Engineering Major Facing the national strategic needs and the upgrading and transformation of the construction industry [3] [4]. It is an emerging interdisciplinary discipline developed by integrating new technologies such as big data, artificial intelligence and the Internet of things on the basis of civil engineering major. Intelligent construction major is the demand of the times for the transformation and upgrading of construction industry and manufacturing industry. It is an important measure to promote the construction of new engineering.

In the newly revised 2021 edition of the Catalogue of Higher Vocational Majors, the category of civil construction still ranks at the first level, and the number of majors has increased from 32 to 34, including the major of “intelligent construction technology”; This reflects the expectation of the education administration department and the society for the development prospect of Civil Engineering Major in higher vocational education, and also fully shows that the construction and development of this major is to meet the needs of national economic and social development, and the cultivation of professional talents is to support China’s new economic development and the adjustment and upgrading of industrial structure.

2. Industry Background of New Major Setting of Intelligent Construction Technology

Since the 13th Five Year Plan period, under the background of a new round of scientific and technological revolution and industrial transformation of “Made in China 2025”, the construction industry has initially transformed into the era of new building industrialization, and various new technologies and models have been emerging. Intelligent construction, Bim and assembly have broken the traditional construction mode with their green and efficient characteristics, which has brought a strong thrust to the development of the whole construction industry.

During the 14th Five Year Plan period, the world scientific and technological revolution will continue to evolve, and reform and innovation remain the key to industrial transformation and upgrading. For the construction field, new construction concepts such as green intensification, cost reduction and efficiency increase and smart construction are still the inevitable choice for the transformation and development of the industry [5] [6].

The relevant documents formulated by the state and Guangdong Province in recent five years have defined the main objectives and development direction of the construction industry in the next five years, as shown in Table 1.

It can be seen that the construction industry will continue to flourish. Construction industrialization, informatization, prefabricated construction, green intensification, cost reduction and efficiency increase, and intelligent construction are the new direction of the development of the construction industry. According to the industry resource survey report organized by the Ministry of Education and the Ministry of Housing and Urban Rural Development, the shortage of intelligent construction technology talents is prominently reflected in professional fields such as intelligent design, intelligent equipment and construction, intelligent operation and maintenance and management [7] [8]. The change of information technology has brought unprecedented challenges and opportunities to the global infrastructure engineering construction. Civil engineering construction is developing towards mechanization, automation and intelligence. By 2030, the proportion of intelligent construction technology and management personnel in infrastructure construction will reach 20%. Social development has a strong demand for talents in this major [9].

At present, the average informatization rate of the global construction industry is about 0.3%, while that of China is only 0.03%. The popularization rate of BIM application in China is low. The degree of construction industrialization in Europe and America is as high as 75%, while the degree of construction industrialization in China is less than 5%. The implementation and application level of new construction and intelligent construction methods is still low, so there is a huge space for the development of intelligent construction.

3. Analysis on the Demand of Construction Industry for Intelligent Construction Technology Professionals at Higher Vocational Level

3.1. . Opening of Related Majors in Undergraduate Colleges

According to the Notice of the Ministry of Education on Publishing the Filing and Approval Results of Undergraduate Majors in Universities in 2017 (JGH [2018] No. 4), intelligent construction has been incorporated into the new undergraduate education major of universities in China. The intelligent construction major at the undergraduate level is a four-year system, which is based on the traditional civil engineering major and is set up for the transformation and upgrading of the construction industry [10].

Table 1. Relevant Policy Documents in Recent Five Years

Year	Time/Document	Detailed Information
2022	“The 14th Five Year Plan” for the Development of Guangdong’s Construction Industry issued by Guangdong Provincial Department of Housing and Urban Rural Development	Guiding Guangzhou to build a green and low-carbon design and construction center; Guiding Shenzhen to build a modern architectural design and prefabricated building R & D center; Guiding Dongguan and other cities to build production bases of prefabricated building parts.
2020	The Guiding Opinions on Promoting the Coordinated Development of Intelligent Construction and Building Industrialization jointly issued by the Ministry of Housing and Urban Rural Development and the National Development and Reform Commission	Vigorously developing building industrialization as the carrier; Taking digitization and intelligent upgrading as the driving force, innovating and breaking through relevant core technologies; increasing the application of intelligent construction in all links of engineering construction, and forming an intelligent construction industrial system integrating the whole industrial chain including scientific research, design, production and processing, construction assembly and operation.
2019	The Catalogue of Green Industry Guidance (2019 Edition) issued by the National Development and Reform Commission In March	Green building, prefabricated building, green construction, etc.
	The Draft of the Guidance Catalogue for Industrial Structure Adjustment (2019) released by the National Development and Reform Commission in April	Development and application of prefabricated building technology, building information model (BIM), energy-saving building, green building and other related technologies
	The Guidelines for the Development of Prefabricated Concrete Building Technology System (Residential Buildings) issued by the Ministry of housing and urban rural development in July	Vigorously promoting prefabricated buildings
	The Guidance on Improving the Quality Assurance System and Improving the Quality of Construction Projects issued the Ministry of Housing and Urban Rural Development in September	Vigorously developing prefabricated buildings and promote green construction; Promoting the integrated application of building information model (BIM), big data, mobile Internet, cloud computing, Internet of things, artificial intelligence and other technologies in the whole process of design, construction, operation and maintenance.
2018	BIM Application Guide for Urban Rail Transit issued by the Ministry of Housing and Urban Rural Development in May	BIM creation, use and management of new construction, reconstruction and expansion projects of urban rail transit projects
	Interim Measures for the Management of Prefabricated Building Demonstration Projects, Interim Measures for the Management of Prefabricated Building Industrial Bases and Interim Measures for the Management of Prefabricated Building Demonstration Cities (Counties and Districts) issued by the Department of Housing and Urban Rural Development of Guangdong Province in October	Vigorously promoting prefabricated buildings

Since 2017, only 44 undergraduate universities in China have offered courses in intelligent construction, including Tsinghua University, Tongji University, Southeast University and other "Double First-Class" universities in civil engineering. In Guangdong, only Guangzhou College of South China University of technology has successfully applied for the bid, and universities in Dongguan have not opened a new major in intelligent construction technology. Talent training is far from meeting the development needs of the construction industry in the Guangdong-Hong Kong-Macao Greater Bay Area.

3.2. Demand Analysis of Construction Industry for Intelligent Construction Technology Professionals at Higher Vocational Level

According to the analysis of the employment situation of the professional group of Construction Engineering Technology in the College of Architecture of Dongguan Polytechnic in recent years and the survey of relevant universities inside and outside the province, the employment rate of graduates of the College of Architecture has reached more than 97%. It can be seen that the employment prospect of construction talents in higher vocational colleges is very broad and scarce.

The supply side structural reform of the construction industry makes the construction industry face a shortage of new professional and technical talents. The construction industry needs to cultivate applied, innovative and compound professionals who adapt to industrial upgrading. The school urgently needs to train corresponding professionals and industrial workers to realize effective connection with market demand, which has become a new mission of talent training in the construction industry.

Higher vocational colleges focus on cultivating comprehensive and effective skilled construction talents with professional knowledge operation ability, professional qualification certificate and academic certificate, and strong and rapid post adaptability. The training focus and direction can be complementary to undergraduate colleges. The intelligent construction technology major group at the higher vocational level is oriented to the design, construction, management, operation and maintenance and other jobs in the transformation and upgrading of the construction industry, cultivate and master the basic theory and knowledge of Engineering Technology in the construction industry, have good construction site technology and engineering management ability, have good professional innovation consciousness and ethics, keep improving craftsman spirit, and have safety, environmental protection and quality consciousness, The employability and sustainable development ability of the exchange of professional posts in the group, and the compound high-quality technical talents engaged in the front-line construction, such as constructors, quality personnel, cost personnel and building model information personnel, are the front-line management and technical talents urgently needed for the development of intelligent construction in the construction industry [11] [12] [13] [14].

4. Feasibility Analysis of Dongguan Polytechnic Transferring to Intelligent Construction Technology Major

4.1. Urgent Need of Locally-cultivated Intelligent Construction Talents for the Construction of the Greater Bay Area Especially Dongguan

President Xi Jinping personally planned and promoted the construction of the Guangdong-Hong Kong-Macao Greater Bay Area. The Guangdong-Hong Kong-Macao Greater Bay Area is still an area with rapid population growth, and the construction of the Guangdong-Hong Kong-Macao Greater Bay Area will attract more talents. From "urbanization" to "urbanization" and "new urbanization", the network development of metropolitan areas, urban agglomerations, urban

belts, central cities, rural revitalization, characteristic towns and large, medium and small cities has ushered in a broader space for the construction industry.

The 14th Five Year Plan for the Development of the Construction Industry in Dongguan also puts forward that by 2025, the total output value of the construction industry in Dongguan will exceed 200 billion yuan, with an average growth rate of more than 20%, and fully realize the goal of “100 billion industry and modern construction”; In the future, the construction industry will accelerate industrialization and high-quality development, and we should promote the east to build a strong construction city with “100 billion industry and modern construction”. We should accelerate the industrialization of new buildings represented by prefabricated buildings. By the end of 2025, the proportion of prefabricated building area in the newly-built building area in Dongguan will reach more than 35%. The government will give priority to the use of prefabricated construction in construction projects, so as to cultivate and form a new type of intelligent construction with Dongguan characteristics.

Within the scope of Guangdong Province, only Guangzhou College of South China University of technology has successfully applied for the intelligent construction major, and there is no university in Dongguan, so the number of talent training is far from meeting the demand for intelligent construction talents for the development of local construction industry; There is an urgent need for universities in Dongguan to cultivate local intelligent construction technical talents in the construction industry who can adapt to the digital transformation and upgrading of the industry and engage in the establishment and application of building information model, the management and maintenance of intelligent construction system, intelligent manufacturing quality management, intelligent construction technology administrator, intelligent site system operation and maintenance, etc.

4.2. Foundation of New Major Transfer of Architecture College of Dongguan Polytechnic

The College of Architecture of Dongguan Polytechnic is a secondary college established in the form of mixed ownership in 2015 by five units, including Dongguan Polytechnic, Dongguan Construction Engineering Testing Center, Dongguan Institute of construction science, Dongguan Vanke Real Estate Co., Ltd. and Dongguan Daye Construction Technology Consulting Co., Ltd; It is a successful example of in-depth cooperation between schools and enterprises and in-depth integration of industry and education in the construction industry under the governance of the mixed school running mechanism first established in the whole province and even the whole country.

The construction engineering technology professional group of Dongguan Polytechnic is composed of four majors: construction engineering management, construction engineering technology, garden engineering technology and building intelligent engineering technology. It entered the construction of high-level professional group in Guangdong Province in 2021 and is the characteristic professional group of the school. The major of landscape engineering technology and building intelligent engineering technology in the group has been running for a long time. It has experienced the construction of Guangdong demonstration school, Guangdong double universities, innovative and strong schools and other projects. Lingnan landscape college is the first industrial college built by our university, and the BIM certification point of building information modeler is the first batch of “1 + X” certificate pilot units established in China, “Intelligent Construction Virtual Simulation Training Base” has entered the demonstration virtual simulation construction unit in Guangdong Province.

In order to meet the talent demand of the construction industry for the major of intelligent construction technology, Dongguan Polytechnic applies to transfer the major of “construction engineering management” to the major of “intelligent construction technology”, and build the “intelligent construction” technology of Construction Engineering in Guangdong, Hong Kong

and Macao together with the existing three specialties of construction engineering technology, garden engineering technology and building intelligent engineering technology, Build a high-level professional group of Construction Engineering Technology in line with the development trend of the construction industry. The new professional group of construction engineering technology and intelligent construction technology (including BIM, assembly, intelligent construction site, informatization and intellectualization) form a whole industry chain, which can cultivate high-quality skilled talents for BIM design, intelligent construction, operation and maintenance and other posts.

5. Conclusion

The new major of intelligent construction technology is established with the needs of the transformation and upgrading of the construction industry. Its application and establishment rely on the provincial high-level professional group of construction engineering technology of Dongguan Polytechnic. It has a group of teachers with solid theoretical foundation and rich practical teaching skills, and can explore the complex and innovative technology in the way of interdisciplinary integration in combination with cutting-edge technologies such as artificial intelligence and big data application technology. The high-tech and personalized talent training mode will form a multi-disciplinary training scheme, curriculum system, practical innovation system, teaching staff, project platform and management mechanism combined with engineering practice, and strive to cultivate functional construction technical talents with solid theoretical foundation and excellent engineering quality, master mechanized, controlled and intelligent construction technology and international vision, Gradually build a first-class practice base for new engineering skills of intelligent construction technology and a teaching, scientific research, R & D and innovation base in the province, so as to better meet the large demand for high-quality and compound talents in the construction of the Guangdong-Hong Kong-Macao Greater Bay Area, especially the "intelligent construction" of Dongguan construction industry.

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