

Research on the Dual Carbon Talent Training Model for the Construction Engineering Technology Major in Higher Vocational Education

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Abstract: Against the backdrop of global climate change and China's "dual carbon" goals, the green transformation of the construction industry is imperative, and completing the transformation requires many dual carbon talents to support it. This article focuses on the construction engineering technology major in higher vocational education. It explores in depth the specific requirements for construction engineering technology talents in terms of professional knowledge, vocational skills, and literacy under the dual carbon mode. Based on this, corresponding dual carbon talent training courses are proposed, aiming to provide theoretical support and practical guidance for cultivating high-quality dual carbon talents that meet the needs of the new era.

Keywords: Vocational education; Construction engineering technology; Dual carbon talents; Training mode

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1. Introduction

With the increasingly severe issue of global climate change, reducing carbon emissions has become a global consensus. China has proposed the "dual carbon" goal of "peak carbon emissions and carbon neutrality," and the construction industry, as an important sector of carbon emissions, is facing enormous pressure and transformation challenges^[1]. In this context, cultivating construction engineering technical talents who can adapt to the dual carbon goals has become an important task of higher vocational education. Exploring effective models for cultivating dual carbon talents in the construction engineering technology major of higher vocational education, optimizing the curriculum system, improving teaching methods, and strengthening practical teaching to enhance the quality of talent cultivation, will provide strong talent support for the green and low-carbon development of the construction industry^[2].

2. Specific requirements for construction engineering technical talents under the dual carbon background

2.1. Professional knowledge requirements

Under the trend led by the dual carbon target, the professional knowledge required for vocational construction engineering technical talents presents multidimensional and comprehensive characteristics. Firstly, it is necessary to have a solid grasp of architectural physics knowledge and clarify the principles of heat transfer, lighting, ventilation, etc., to optimize the energy utilization efficiency of buildings. Secondly, it is necessary to have a deep understanding of green building design concepts, including natural lighting and shading design, passive energy-saving strategies, etc., to integrate low-carbon thinking into the design stage. Furthermore, familiarity with the characteristics and applications of various low-carbon and environmentally friendly building materials, such as high-performance insulation materials, recyclable building materials, etc., provides a scientific basis for material selection. Simultaneously, mastering the integration and utilization of renewable energy, energy storage and management technologies, etc., to achieve self-sufficiency and efficient allocation of building energy. Additionally, one should be proficient in the calculation and evaluation methods of building carbon emissions, be able to accurately quantify the carbon emissions throughout the entire life cycle of buildings, and develop emission reduction plans based on this. Moreover, a clear understanding of building intelligent control technology is required to achieve precise control of building equipment and reduce energy consumption through intelligent systems. Finally, it is important to update relevant policies, regulations, and industry standards to ensure that construction projects achieve low-carbon emissions reduction to the greatest extent possible while complying with regulations ^[3].

2.2. Skill requirements

Under the dual carbon background, vocational construction engineering technical talents need to possess a series of key skills as follows.

- (1) Possess precise skills in calculating and analyzing building energy consumption, able to use professional software and methods to conduct detailed evaluations of the energy usage status of various buildings, and accurately identify energy-saving potential areas.
- (2) Master advanced green building construction technology and process management skills, be able to plan the construction sequence reasonably, and strictly control resource consumption and waste discharge in the construction process.
- (3) Possess practical skills in using new low-carbon building materials, familiar with material characteristics and construction points, and ensure that the building achieves low-carbon environmental protection in the material use process.
- (4) Master the monitoring and data processing skills of building carbon emissions, be able to use professional instruments and tools to collect carbon emission data, and conduct effective analysis and reporting.
- (5) Possess Building Information Modeling (BIM) based carbon management skills for the entire lifecycle of buildings, utilizing BIM models to simulate and optimize carbon emissions from design, from construction to operation.
- (6) Possess innovative thinking and solution optimization skills, able to propose innovative solutions and optimization plans for carbon reduction challenges in construction projects ^[4].

2.3. Literacy requirements

Under the trend of dual carbon background, vocational construction engineering technical talents need to

possess various qualities, such as strong environmental awareness and social responsibility, and actively practice the dual carbon concept in their work. Capable of innovative thinking and teamwork as well as able to solve complex engineering problems in the context of dual carbon. Having the ability to continuously learn, constantly update knowledge and skills, and adapt to the development and changes of the industry.

3. Curriculum design for dual carbon talent training

Talent training courses are set up based on the specific requirements for the knowledge, skills, and literacy of construction engineering technical talents in the context of dual carbon. The curriculum is divided into four categories: basic courses, professional core courses, practical courses, and extended courses. To lay a solid theoretical foundation for students majoring in Construction Engineering Technology in vocational colleges under the dual carbon background through the study of basic courses. Professional core courses help cultivate students' professional abilities in energy conservation and emission reduction in construction engineering technology under the dual carbon background. The practical course will help students better apply theoretical knowledge to practice and enhance their ability to solve construction engineering technical problems in the context of dual carbon. Expanding courses help broaden students' horizons and enhance their comprehensive literacy and innovation abilities in the dual carbon field. The specific course offerings are shown in **Table 1**.

Table 1. Curriculum design for dual carbon talent training in construction engineering technology

Course category	Course name	Course content
Basic courses	Principles and Technologies of Building Energy Efficiency	Introduce the basic principles, energy-saving strategies, and common energy-saving techniques for building energy efficiency
	Introduction to Green Building	Enable students to understand the concept, design principles, and evaluation criteria of green buildings
	Application of Renewable Energy in Buildings	Teach the principles and methods of using renewable energy sources such as solar, wind, and geothermal energy in buildings
	Built Environment and Carbon Emissions	Analyze the impact of the built environment on carbon emissions, and how to reduce carbon emissions by optimizing the environment
	Low Carbon Building Materials	Study the characteristics, production processes, and application scope of various low-carbon and environmentally friendly building materials.
	Building Informatization and Carbon Management	Explain how to use information technology such as Building Information Modeling (BIM) to manage and control building carbon emissions
Professional core courses	Building Regulations and Dual Carbon Policy	Familiarize students with building regulations and policies related to dual carbon goals, ensuring that construction projects comply with legal and policy requirements
	Green Construction Technology and Management	Covers specific technologies, processes, and management methods for green construction to reduce energy consumption and carbon emissions during the construction process
	Building Energy Systems and Energy Conservation Control	Explain the composition and operating principles of building energy systems, as well as strategies and technologies for energy conservation control
	Cost Management of Construction Projects under the Dual Carbon Target	Exploring how to estimate, budget, and control construction project costs under the dual carbon background, considering the costs and benefits of energy-saving and emission-reduction measures
	Assessment and Monitoring of Building Carbon Emissions	To enable students to master the assessment methods and monitoring techniques for building carbon emissions, and to accurately calculate and monitor the carbon emissions throughout the entire life cycle of buildings
	Application of BIM Technology in Dual Carbon Buildings	This article focuses on the application of BIM technology in the planning, design, construction, and operation stages of dual carbon buildings to improve energy efficiency and reduce carbon emissions
	Low Carbon Building Equipment Engineering	Teach the selection, installation, operation, and maintenance of various equipment in low-carbon buildings to ensure efficient and energy-saving operation of the equipment

Table 1 (Continued)

Course category	Course name	Course content
Practical courses	Low Carbon Building Materials Experiment and Application	Students personally conduct performance testing experiments on low carbon building materials and apply them to the production of actual building models or components.
	Green Construction Technology Training	Students participate in the operation of green construction technology in simulated or actual construction sites, such as the installation of energy-saving equipment and the classification and treatment of construction waste
	Practice of Debugging and Optimizing Building Energy Systems	Debugging and optimizing building energy systems, and mastering methods to improve energy utilization efficiency through practical operations
	Internship in Building Carbon Emission Monitoring and Data Analysis	Students participate in the carbon emission monitoring work of actual building projects, collect data, analyze it, and propose emission reduction suggestions
	BIM Dual Carbon Building Modeling and Simulation Practice	Using BIM software to create dual carbon building models, conduct energy consumption simulation and carbon emission analysis, and optimize design schemes
	Comprehensive Practice of Low Carbon Building Projects	Students are divided into groups to complete a low carbon building project, including simulation of the planning, design, construction, and operation stages, and apply their learned knowledge and skills comprehensively.
	Case Analysis and Practice of Construction Projects under the Dual Carbon Policy	Conduct case analysis on actual construction projects to study their response strategies and effects under the dual carbon policy.
Expanding courses	Carbon Trading and Construction Market	Introduce the mechanism and rules of carbon trading, as well as its application and impact on the construction market
	Building Feng Shui and Low Carbon Environment Creation	Exploring how to combine the principles of building Feng Shui to create a low carbon and comfortable building environment.
	Intelligent Buildings and Dual Carbon Integration	It discusses how intelligent building technology can be integrated with dual carbon goals to achieve more efficient energy management and emissions reduction
	Architectural Culture and Low Carbon Lifestyle	From the perspective of architectural culture, guide students to think about how to promote a low carbon lifestyle
	Management of Construction Enterprises under the Dual Carbon Background	Explain the management strategies and development directions of construction enterprises under the dual carbon target
	Architectural Art and Energy Conservation and Emission Reduction	Analyze the relationship between architectural art and energy conservation and emission reduction, and cultivate students' aesthetic and environmental awareness
	New Energy Vehicles and Building Facilities Support	Research on the planning and design of charging, parking, and other supporting facilities for new energy vehicles in building facilities

4. Teaching methods and practices for cultivating dual carbon talents

4.1. Reform of teaching methods

The cultivation of dual carbon talents is an important guarantee for achieving China's dual carbon goals, and the reform of teaching methods is the key to improving the quality of dual carbon talent cultivation. Project-driven teaching methods can be adopted, using actual construction projects as carriers to enable students to master dual carbon-related knowledge and skills in the process of completing projects. Simultaneously, using the case study teaching method, by analyzing successful green building cases locally and internationally, students' innovative thinking is stimulated ^[5].

4.2. Practical teaching session

Practical teaching not only helps students transform theoretical knowledge into practical application abilities but also enables them to gain a deeper understanding of practical problems and workflow in the dual carbon field, cultivating their ability to solve complex problems. In terms of practical teaching, it is necessary to strengthen the construction of

on-campus training bases, equip them with advanced experimental equipment and simulation software, and provide students with a good practical environment. Concurrently, establish close cooperative relationships with enterprises, arrange for students to intern at enterprises, and participate in actual dual carbon engineering projects.

4.3. Construction of teaching staff

In the cultivation of dual carbon talents, the teaching staff plays a key leading and guiding role. In the process of building the teaching staff, teachers can be encouraged to participate in dual carbon-related training and academic exchange activities to improve their professional level. At the same time, we will introduce experts in the dual carbon field with rich practical experience to enrich the teaching staff.

5. Conclusion

The cultivation of dual carbon talents in the construction engineering technology major of vocational colleges is an inevitable requirement to adapt to the green development of the construction industry. By clarifying the specific requirements for talents under the dual carbon model, setting up a reasonable curriculum system, reforming teaching methods, and strengthening practical teaching, we can cultivate dual carbon talents with solid professional knowledge, proficient skills, good qualities, and contribute to the sustainable development of the construction industry.

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