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The Construction of a Postgraduate Training System for Architecture that Integrates Government, Industry, Academia, Research and Application Based on Digital Technology

Xin Yang*

North China University of Technology, Beijing 100144, China

Author to whom correspondence should be addressed.

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Abstract: This paper explores the construction of a government-industry-academia-research-application integrated postgraduate training system for architecture, guided by green development and driven by digital technology. It proposes a "three-in-one" talent cultivation model integrating research, teaching, and practice, establishing three curriculum subsystems—digital foundational skills, specialized research directions, and practical application—forming a full-process practical innovation platform. The system closely aligns with the green and digital transformation demands of the construction industry, aiming to cultivate highly skilled architectural talents with both theoretical knowledge and practical innovation capabilities.

Keywords: Postgraduate training; Architecture; Government-industry-academia-research-application integration; Digital technology; Green development

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1. Research background

1.1 Educational ideology: Led by green development, digital empowerment for architectural talent cultivation

The discipline of architecture at North China University of Technology has developed a clear educational ideology of "cultivating high-skilled architectural talents that meet the demands of the era of green development in China", which closely aligns with the broader context of the transformation of China's construction industry from traditional functional forms to green digital technologies. The discipline is positioned at a high level of application, with a clear goal of cultivating practical and innovative high-skilled talents who have both solid professional theoretical knowledge and innovative practical ability, and can skillfully apply green concepts and digital technologies, in line with market demands and industry

development. These talents can not only play important roles in architectural design companies, construction enterprises and other units, but also contribute their own strength to the green transformation and digital upgrade of the construction industry.

The concept of green development runs through the entire education process, aiming to cultivate postgraduates with ecological and environmental awareness and social responsibility. In the field of architecture, the traditional model of high energy consumption and high pollution buildings can no longer meet the requirements of sustainable development. Therefore, the discipline education emphasizes that graduate students should have an in-depth understanding of the design principles, techniques and methods of green buildings, and always prioritize environmental protection and resource conservation throughout the entire life cycle of the building, from planning and design to construction and operation. Meanwhile, the introduction of digital technology has brought new vitality to architectural education. With the rapid development of information technology, new technologies such as digital design, virtual simulation, and smart buildings are constantly emerging. Discipline education encourages graduate students to actively master digital tools and methods and to improve the quality and efficiency of architectural design through digital means [1].

1.2. Talent cultivation model: Integration of three aspects, collaboration of government, industry, academia, research and application, and construction of the whole process cultivation system

The innovative three-integration talent cultivation model constructed by the discipline of architecture at North China University of Technology is an important part of its educational achievements. The model is characterized by the integration of research, teaching and practice, guided by government, industry, academia and research, and based on green building digital technology to cultivate the comprehensive abilities of postgraduate students in all aspects.

The so-called integration of research, teaching and practice means closely combining research activities with the teaching process, enabling postgraduate students to participate in actual research projects while learning professional knowledge, and improving research capabilities and innovative thinking; Integrate teaching and practical activities organically by organizing various practical teaching activities to enable postgraduate students to apply the knowledge they have learned to actual engineering and enhance their practical operation ability. Encourage graduate students to participate in research projects under the guidance of their mentors, transform research results into teaching resources, and enrich teaching content.

The orientation of government, industry, academia, research and application provides a broad platform and abundant resources for talent cultivation. The discipline actively builds partnerships with government departments, enterprises and research institutions to carry out talent cultivation jointly, research cooperation and project practice. Policy support and guidance from government departments provide a strong guarantee for the development of the discipline; Enterprises provide students with internship and employment opportunities and practical project training platforms, enabling graduate students to understand the latest industry trends and enterprise demands; Research institutions have advanced research equipment and excellent research teams, providing good conditions for graduate students to carry out research activities.

Disciplines establish a postgraduate training system based on mentors' research, with innovative course content as the carrier, extracurricular practice as the auxiliary, and full-process cultivation as the feature. Mentors play a crucial role in the development of graduate students, formulating individualized training

programs based on their interests and characteristics, and guiding them in conducting research projects and practical training. Innovative course content provides graduate students with cutting-edge theoretical knowledge and practical skills, covering areas such as green buildings, digital design, architectural history and theory. Extracurricular activities include various subject competitions, club activities, social research, etc. Through participating in these activities, graduate students can broaden their horizons and develop teamwork and communication skills [2].

At the same time, the discipline builds an innovative practice platform for cultivating talents needed for the country's construction and development. This platform integrates various resources both within and outside the university, providing postgraduate students with multi-level and all-round practical opportunities.

1.3. Curriculum system: Thinking integration modular architecture to enhance graduate students' professional competence in all aspects

This achievement realizes the optimization and characteristic construction of the postgraduate curriculum system based on the "Green Building Digital Curriculum Cluster". The discipline divides architecture education into a digital basic skills curriculum system, a characteristic research direction in-depth curriculum system, and a practical application cultivation system based on in-depth stages. Each system has clear goals and contents, is interrelated and complementary, and together constitutes a complete curriculum system.

1.4. Digital basic skills curriculum system: Laying a solid foundation and mastering cutting-edge technologies

The Digital Foundation Skills Curriculum System is the foundation of the entire curriculum system, designed to enable graduate students to master the basic application of cutting-edge technologies and digital tools in architecture. The system covers courses such as Computer-aided design (CAD), Building Information Modeling (BIM), geographic Information System (GIS), virtual reality (VR), etc. Through these courses, graduate students are able to skillfully use digital tools for architectural design, analysis, and presentation. Associate green building knowledge such as building energy consumption simulation, renewable energy, and material innovation with BIM (Building Information Modeling), IoT (Internet of Things), and AI algorithms, for example, simulating natural ventilation with CFD (Computational Fluid Dynamics) and optimizing shading systems with machine learning.

In addition, this system also focuses on cultivating postgraduate students' mathematical foundation and algorithm design ability, laying a solid foundation for their subsequent learning and application of more advanced digital technologies. It enables graduate students to master mathematical tools and methods and use mathematical models to solve practical problems in the field of architecture [3].

1.5. Specialized research directions in the curriculum system: Focus on the frontiers and cultivate research and innovation capabilities

The curriculum system focuses on the cultivation of mentors' research achievements, offering a series of cutting-edge and innovative courses based on the research direction of the discipline and the research achievements of the mentors. These courses cover a wide range of areas, including green building technology, digital architectural design, and conservation of architectural history and culture, allowing graduate students to conduct in-depth learning and research under the guidance of their mentors. In the Green Building technology course, graduate students will study the latest research results and application technologies in

building energy conservation, renewable energy utilization, indoor environmental quality, etc., and develop green building design and management capabilities; In the Digital Architectural Design course, graduate students will study cutting-edge technologies such as parametric design, algorithm-generated design, and AI-assisted design, and explore innovative applications of digital technology in architectural design; In the course of architectural historical and cultural conservation, graduate students will study the theories and methods of architectural history and the conservation of architectural cultural heritage, develop a sense of respect and protection for traditional architectural culture, and master the technical means of architectural restoration and conservation.

Through project-based learning and specialized training camps on cutting-edge technologies, graduate students will be able to gain an in-depth understanding of the cutting-edge hot issues in the discipline, develop independent thinking and research innovation capabilities, and lay a solid foundation for future academic research and career development.

1.6. Practical application cultivation system: Apply what you have learned to enhance comprehensive practical abilities

The practical application cultivation system is based on the framework of government, industry, academia, research and application, emphasizing that graduate students apply the knowledge they have learned to actual engineering to enhance their comprehensive practical ability and the ability to solve practical problems. The system includes architectural internships, project practice, graduation design, and other links, and through school-enterprise cooperation, industry-university-research joint training, and other methods, enables postgraduate students to participate in actual architectural projects and communicate and cooperate with professionals in enterprises and industries [4].

In the construction internship, a school-enterprise data sharing pool, a mentor dual-track system, and internship base 2.0 are established. Graduate students learn about the work processes and management models of the construction industry and participate in the design and construction of actual projects. Through the internship, graduate students can combine the theoretical knowledge they have learned with practical work and improve their practical operation skills and professional qualities. The project practice is based on actual engineering projects, allowing graduate students to form teams and participate in all aspects of the project, from planning and design to implementation and acceptance, and be involved in the full life cycle management of the project. Through project practice, graduate students can exercise their teamwork skills, communication skills and project management skills [5,6].

2. Research innovation

(1) Closely aligned with the major direction of national talent needs and the transformation of the construction industry, this achievement meets the core requirements of practical innovation for the cultivation of high-skilled talents in the discipline of architecture. It innovatively constructs a digital basic skills curriculum system, with characteristic research directions deeply integrated into the curriculum system and the practical application cultivation system. The three curriculum systems interact and connect, forming a full-process practical innovation platform. Combined with the four-dimensional integrated modular teaching content, the postgraduate training system of government, industry, academia, research and application is constructed from the four aspects of basic theory, digital tools, innovative experiments and ethical policies.

(2) Establish a postgraduate education ideology with green development and digital technology as the main line, in line with the trend of the development of the construction industry from traditional functional forms to green digital technology. The discipline of architecture at North China University of Technology proposed the educational concept of "cultivating high-skilled architectural talents that meet the demands of China's green development era", based on a high-level application-oriented positioning, precisely aligned with market demands and industry development, and committed to cultivating practical and innovative high-skilled talents, pointing out a new direction for postgraduate education in architecture to adapt to the development of The Times.

3. Conclusion

The architecture postgraduate talent cultivation system, which focuses on green development and digital technology as the main line and innovatively integrates talent cultivation, has established a talent orientation based on the university and aims to cultivate high-skilled architecture talents that meet the demands of the era of green development in China. By optimizing the construction of the postgraduate curriculum cluster, a talent cultivation model featuring the integration of research, teaching and practice, guided by government, industry, academia and research, and based on green building digital technology has been established, with rich achievements in teaching, research and scientific research.

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