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Original Paper

Research on Reform and Innovation of Training Mode of Civil and Hydraulic Engineering Graduate Students under the Background of "Dual Carbon" Goals

Guo Yuanxin[1], Zhou Xiaolong[1], Kong Zhe[2*], Quan Hongzhu[1] & Li Qiuyi[1]

[1] College of civil engineering and architecture, Qingdao Agricultural University, Qingdao, China

[2] College of civil engineering, Qingdao City University, Qingdao, China

[*] Kong Zhe, E-mail: zhe.kong@qdc.edu.cn

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Abstract

As an important part of the overall layout of ecological civilization construction, carbon peaking and carbon neutrality provide strategic opportunities for low-carbon energy transformation and innovative development of higher education. Based on the training of civil and water conservancy professional postgraduate students, this paper builds an interdisciplinary teaching system centering on the concept of "dual carbon", and explores the relationship between energy transformation and energy conservation and emission reduction, engineering technology and green development, practical cases and analysis and other course systems through the establishment of a composite innovative teaching team of civil and water conservancy and innovative personnel training mode. In order to achieve the "dual carbon" goals of the society, this paper puts forward the model of university-enterprise cooperation and the integration of science, production and education.

Keywords

dual carbon, civil and hydraulic engineering, graduate training, reform and innovation

1. Introduction

Carbon Peaking and Carbon Neutrality Goals is a two-stage carbon reduction strategy proposed by the Chinese government. The goal is to achieve peak carbon dioxide emissions before 2030 and achieve carbon neutrality by 2060. In 2022, the Ministry of Education issued the "Work Plan on Strengthening the Construction of the Talent Cultivation System for Higher Education with Carbon Peaking and Carbon Neutrality", which requires to accelerate the training of urgently needed talents and improve

the training quality of professionals related to Carbon peaking and Carbon neutrality for the Carbon Peaking and Carbon Neutrality Goals.

The major of civil and hydraulic engineering belongs to the discipline of civil engineering. The traditional teaching system centering on the basic theoretical knowledge of engineering mechanics, fluid mechanics and civil engineering has been unable to meet the requirements for talents in modern civil engineering industry. Therefore, the current important task is how to integrate the "dual carbon" concept in postgraduate education and teaching, and cultivate high-quality talents with environmental awareness and sustainable development.

2. Current Situation of Graduate Training in Civil and Hydraulic Engineering

With the continuous advancement of the significant educational strategic decision of "Double First-Class", China has been attaching increasing importance to higher education, constantly elevating the educational level, and steadily moving forward towards the goal of aligning with the world. However, at present, there are still numerous problems in the education and training of postgraduates majoring in civil and hydraulic engineering. The traditional training mode for postgraduates in this field can no longer meet the training requirements of the current "dual carbon" goals, and the cross-disciplinary thinking awareness of postgraduates needs to be further enhanced. Summarizing the status of postgraduate training in civil and hydraulic engineering, there are mainly three aspects of problems.

2.1 The Curriculum System for Cultivating Innovative Talents in Civil and Hydraulic Engineering Postgraduates for Achieving "Dual Carbon" Goals Needs To Be Improved

At present, the postgraduate courses of civil and hydraulic engineering mainly focus on architectural design, construction management, building materials and water conservancy engineering, and there is a lack of relevant courses with carbon reduction as the main content. Under the guidance of the policy, the concept, knowledge and practice of carbon peaking and carbon neutrality should be reasonably integrated into the curriculum system of civil and hydraulic engineering graduate students, and energy conservation and emission reduction, green building, renewable energy and other disciplines should be vigorously developed. At the same time, in the setting of postgraduate curriculum system, there is a lack of practical teaching content related to carbon peaking and carbon neutrality, which cannot meet the practical ability training goal of "dual carbon" innovative talents.

2.2 The Talent Cultivation Mode in Civil and Hydraulic Engineering Postgraduates for Achieving "Dual Carbon" Goals Needs To Be Improved

Cultivating "dual carbon" talents is an internal requirement for colleges and universities to deepen their own reform. Strengthening the cultivation of "dual carbon" talents mainly involves important changes in talent training concepts, modes and methods. However, the current graduate talent cultivation of civil and hydraulic engineering still adopts the traditional mode, which is manifested as "top-down,

project-led, separation of science and education". This traditional mode leads to some problems, such as narrow curriculum, single teaching mode, lagging teaching syllabus, and disconnection between training objectives and talent training objectives under the background of "dual carbon". For example, the teaching syllabus, course materials and courseware of most graduate students lag the development of civil and hydraulic engineering under the background of "dual carbon" to varying degrees, and some data and indicators in the original teaching course are difficult to meet the actual needs of the current construction of green and low-carbon economic system, which hinders the training speed of "dual carbon" high-quality talents in civil and hydraulic engineering.

2.3 The Compound and Innovative Teaching Team in Civil and Hydraulic Engineering Postgraduates for Achieving "Dual Carbon" Goals Needs To Be Improved

At present, although the teaching team is committed to cultivating talents in the field of "dual carbon" with scientific literacy, innovation awareness and cross-border ability, it faces many challenges in practice. On the one hand, the team members' cognition of the "dual carbon" goals are not enough, and some teachers are relatively short of professional knowledge and teaching experience in the "dual carbon" field, which affects the quality of talent training to a certain extent. On the other hand, as the field of "dual carbon" is a new and complex interdisciplinary subject, the team has difficulties in curriculum system design and interdisciplinary integration, and it is difficult to organically integrate the concept of "dual carbon" into related teaching activities.

3. Training Model and Method of Civil and Hydraulic Engineering Graduate Students under the Background of "Dual Carbon" Goals

The teaching reform of civil and hydraulic engineering postgraduate education under the background of "dual carbon" goals is a systematic project, which needs support and cooperation from various aspects, as shown in Figure 1. The innovation and development of civil and hydraulic engineering can be promoted through the following measures, including training more high-quality talents with environmental awareness and sustainable development concepts, including the establishment of research groups, the formulation of training plans, the reform of teaching methods, the strengthening of school-enterprise cooperation, the promotion of international exchanges and cooperation, the improvement of teaching evaluation system, and the strengthening of teacher construction. Based on the training system of civil and hydraulic engineering graduate students in College of Civil Engineering and Architectural of Qingdao Agricultural University, this paper analyzes the key factors that affect the training of graduate students' innovative ability, and explores the training mode and method of civil engineering graduate students from the following three aspects.

Figure 1. Design and Route of Education and Teaching Reform Program

3.1 The Construction of Interdisciplinary Knowledge System

We have added "dual carbon" knowledge, low-carbon technology and sustainable development content in the curriculum, focusing on cultivating graduate students' environmental awareness and sustainable development concept. We also strengthen international exchanges and cooperation by participating in international conferences and student exchange programs to broaden the international horizon of graduate students and learn from foreign advanced concepts and technologies. And we improve the evaluation system, establish a scientific evaluation system, comprehensive evaluation of graduate students' academic ability, practical ability, innovation ability and other aspects of performance. At the same time, the "dual carbon" goals can be incorporated into the evaluation system to encourage graduate students to pay attention to and solve problems such as low carbon and sustainable development. As shown in Figure 2.

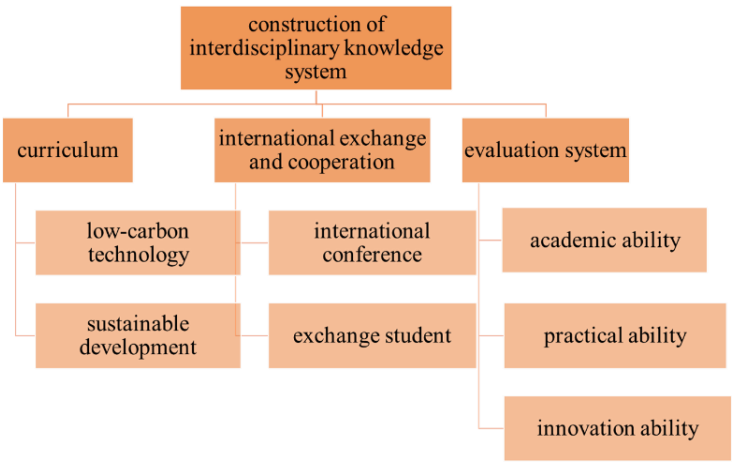

Figure 2. Construction of Interdisciplinary Knowledge System around the "Dual Carbon" Goals

3.2 The Construction of the Cooperative Education Model of the Integration of Science, Production and Education

Explore the talent training mode of the integration of science, production and education, and cooperate with enterprises and scientific research institutions to jointly promote graduate training and strengthen the cultivation of graduate students' innovative ability and practical ability, as shown in Figure 3. Strengthen practical teaching, cultivate graduate students' practical ability and engineering experience through school-enterprise cooperation and practical projects, and introduce green and low-carbon technologies to carry out relevant practical projects; Graduate students are encouraged to participate in "dual carbon" related scientific research projects, especially in the field of low-carbon technology and sustainable development in the field of civil and hydraulic engineering, and cultivate their independent thinking and innovation ability.

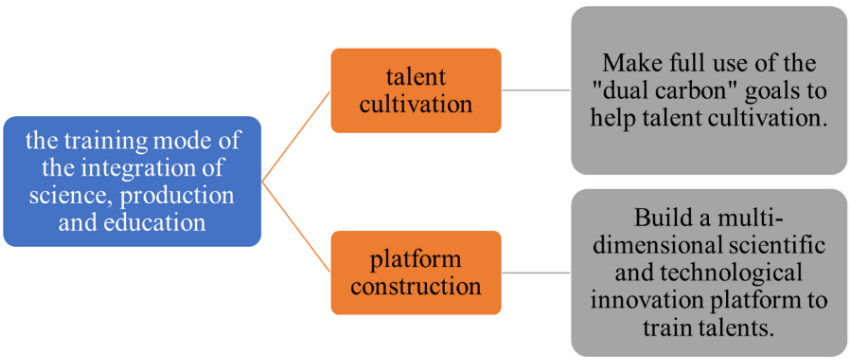

Figure 3. Construction of Innovative Collaborative Education Mode of Integration of Science, Production and Education

3.3 The Construction of Teaching Team

We continue to improve the quality of teachers, introducing and training a team of teachers with "dual carbon" knowledge and practical experience, improving the research level and engineering experience of teachers, so that they can better guide and train graduate students. We can train basic teachers in the field of "dual carbon" by holding various types of senior seminars and training classes. And we can select some teachers and carry out training activities with knowledge popularization and professional teaching as the main content to supplement basic teachers. At the same time, we can draw on the relatively mature EU carbon trading talent training experience, increase the introduction of overseas outstanding talents in the field of carbon finance and carbon management, and support the construction of carbon finance and carbon management teachers.

4. Conclusion

To achieve Carbon Peaking and Carbon Neutrality Goals constitutes an important strategic goal of the country. The civil and hydraulic industry, as a significant part of the national infrastructure construction, is required to actively respond to the national strategy and promote green and low-carbon development. This paper investigates the training mode and method for graduate students majoring in civil and hydraulic engineering, optimizes the top-level design for cultivating high-quality talents with a "dual carbon" goals, defines the training objectives, enhances the construction of the postgraduate curriculum system, innovates the mode of integrating production and education, strengthens the teaching staff, and builds a teaching team with a "dual carbon" goals. Training civil and hydraulic engineering talents with strong innovation ability, engineering practice ability, and an international vision under the "dual carbon" strategy holds positive reference significance for engineering graduate education under the new situation.

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