

Research on the Cultivation Mode of New Liberal Arts Talents under the “Dual Carbon” Goals

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Abstract

The cultivation of new liberal arts talents faces an important topic and challenge in achieving the “dual carbon” goals. This article analyzes the current situation of “dual carbon” talent cultivation in Chinese universities and highlights the scarcity of liberal arts majors related to “dual carbon” and the limited leading role of liberal arts. Moreover, the curriculum system still follows the traditional “small workshop” training model, leading to a misalignment between the supply and demand of “dual carbon” talents. By integrating the strategic goals of “dual carbon” and the content of new liberal arts construction, this article explores the reform of the talent cultivation model for “dual carbon” in new liberal arts, including aspects like knowledge structure, curriculum design, faculty team, and teaching platform.

Keywords

Carbon peak, Carbon neutrality, New liberal arts, Talent cultivation model.

1. Introduction

Given the escalating issue of climate change, the Chinese government has made solemn commitments to the world regarding the “dual carbon” goals of peaking carbon emissions by 2030 and achieving carbon neutrality by 2060. To ensure the timely achievement of the “dual carbon” goals, China has integrated the objectives of peaking carbon emissions and achieving carbon neutrality into its comprehensive economic and social development plan. This integration involves specifying the tasks related to peaking carbon emissions in different regions, sectors, and industries, which in turn stimulates the demand for professionals in the fields of new energy, low-carbon, and environmental protection. The Chinese Ministry of Education issued the “Action Plan for Carbon Neutrality Technological Innovation in Higher Education Institutions” and the “Work Plan for Strengthening the Construction of Talent Training System for Peak Carbon Emissions and Carbon Neutrality in Higher Education” in 2021 and 2022. These plans mandate higher education institutions to enhance the training of “dual carbon” talents and conduct research on technological innovation. Additionally, the plans set the objective of establishing several world-leading disciplines in basic research on carbon neutrality.

Since its introduction in China in 2018, the concept of “New Liberal Arts” has garnered significant attention and exploration. The construction of new liberal arts in China is a systematic transformation project in higher education that integrates the characteristics of the contemporary era, Chinese culture, a global perspective, innovation, technology, and human values. Its core essence is reflected in two dimensions: “inheritance” and “creation”. The former focuses on the continuation of human civilization, outstanding traditional culture, and classical thoughts, while the latter is dedicated to advancing and innovating knowledge production and talent cultivation in the field of humanities and social sciences (Yan and Lei, 2024). The

“Guidelines for New Liberal Arts Research and Practice Projects” issued by the Chinese Ministry of Education in March 2021 cover six aspects of the reform and construction of new liberal arts: new development concepts and practices, optimization of disciplines and majors, reform of talent cultivation models, promotion of key areas, construction of teaching staff, and development of distinctive quality culture.

The advancement of the “dual carbon” goal undoubtedly brings important topics and challenges for transforming traditional majors and constructing new liberal arts disciplines. Research on cultivating “dual carbon” talents in new liberal arts can also ensure the availability of talents to achieve the “dual carbon” goal. Currently, more studies are focusing on cultivating “dual carbon” talents in new engineering disciplines (Chen et al., 2022; Zhu et al., 2023; Gao and Zhao, 2024). Discussions on the construction of new liberal arts under the “dual carbon” background, combined with research on talent cultivation, are insufficient, especially regarding the integration of the “dual carbon” background with the construction and talent cultivation of new liberal arts. Huang et al. (2021) discussed the construction issues of the “low-carbon technology and management” major in universities under the “dual carbon” goal. Li and Gong (2023) studied the training program for management accounting talents under the “dual carbon” background, and Li et al. (2023) explored the talent training mechanism for economic management talents oriented towards the new finance under the “dual carbon” strategy. These studies provide ideas for cultivating “dual carbon” talents in new liberal arts, but they either focus on a specific professional direction or emphasize a specific course, lacking further thinking and refinement of the overall law of talent cultivation in new liberal arts. Therefore, this article combines the “dual carbon” strategic goals with the content of new liberal arts construction to discuss the cultivation model of “dual carbon” talents in new liberal arts, covering aspects such as knowledge structure, curriculum setting, faculty team, and teaching platform.

2. The Problems Existing in the Cultivation of “Dual Carbon” Talents in the New Liberal Arts

Since the proposal of the concept of “dual carbon”, the Chinese government has placed great emphasis on “dual carbon” education and professional talent training. The State Council and various ministries have issued a series of documents successively, focusing on energy conservation, carbon reduction, research and application of new energy technologies, establishment of national key laboratories, national technology innovation centers, and major scientific and technological innovation platforms. These measures promote universities to accelerate the construction of related disciplines and talent training. On September 27, 2022, the newly revised “Occupational Classification Code of the People’s Republic of China” added 134 new green occupations, accounting for approximately 8% of the total number of occupations. This includes newly added humanities-based occupations, such as carbon emission managers and carbon offset traders. Domestic universities are actively establishing “dual carbon” colleges and research institutes, with 21 “double first-class” universities engaging in carbon neutrality. Some universities have also formed cross-university alliances related to “dual carbon”. For example, in April 2021, Tongji University took the lead in jointly establishing the “Yangtze River Delta Sustainable Development University Alliance” with the “East China Eight Universities” to cultivate talents in the field of “dual carbon”. In October 2021, world-renowned universities such as Southeast University in China and the University of Birmingham in the UK jointly established the world’s first “World University Alliance”, which focuses on talent cultivation and research cooperation in the field of carbon neutrality technology. In terms of textbook compilation, in December 2021, the Institute of Ecological Civilization Research of the Chinese Academy of Social Sciences organized the publication of a series of textbooks on

“Climate Change Economics”, with the participation of nearly one hundred scholars nationwide in the writing process. Additionally, the “First National Higher Education Carbon Neutrality Talent Training Seminar” was held in Chengdu on July 16, 2022. The world’s first textbook on carbon neutrality technology, “Introduction to Carbon Neutrality Technology”, has been officially released. It provides a systematic introduction to the fundamental principles, processes, characteristics, and development trends of different carbon neutrality technologies. While many domestic universities have actively responded to the national strategy and implemented reforms and practices in cultivating “dual carbon” talents, there are still some issues in training “dual carbon” talents in new liberal arts.

2.1. The Leading Functions of Liberal Arts Are Not Prominent

The humanities and social sciences focus on studying human beings and human society, encompassing political, economic, and cultural aspects. It comprises two main components: the humanities and social sciences, which encompass knowledge categories pertaining to human beings, society, and the relationship between humanity and the world they inhabit. The humanities explore the spiritual realm of human beings and the cultural heritage of humanity, encompassing representative disciplines such as literature, history, philosophy, and art. The social sciences investigate social development, social issues, and the laws governing social operation, encompassing representative disciplines such as law, economics, management, education, and sociology.

According to recent data released by the Ministry of Education, undergraduate majors related to low-carbon in Chinese universities are primarily concentrated in environmental engineering, environmental science and engineering, new energy science and engineering, energy and environmental system engineering, energy economics, resource and environmental economics, and public utility management. These majors are currently offered by environmental colleges, energy and power colleges, economics colleges, and public management colleges, covering three main fields: engineering, economics, and management. Among these, majors related to low-carbon are mainly focused on engineering and economics, with only public utility management falling under the management category. The proportion of these majors in “Double First-Class” universities is relatively low, indicating that current talent cultivation in Chinese universities is more focused on training engineering low-carbon technical talents, such as environmental engineering and new energy science and engineering. However, there is insufficient emphasis on cultivating low-carbon composite talents who possess both technological and managerial skills. This discrepancy is related to the current employment needs of enterprises and industries. The “dual carbon” process in China is still in its early stages and requires expert technical talents who can establish rules and standards to guide its development. Central enterprises and large factories are undergoing transformations and require professional technical talents to develop decarbonization strategies, offer solutions, and address industry gaps. Furthermore, this phenomenon is also linked to the underdevelopment of liberal arts disciplines and social biases in China. Particularly since the industrial revolution, the influence of pragmatism and utilitarianism, as well as the limited emphasis on utilitarian values and the delayed and implicit impact of liberal arts, particularly humanities, coupled with the challenges of high-level development, have hindered their recognition in resource allocation and policy-making biases. It can be argued that without fully realizing moral values, even with a highly developed talent cultivation process, the outcomes of cultivation will not be of high quality. Achieving the “dual carbon” goal requires support from both “technology” and “management”. Technology refers to improving energy efficiency, reducing reliance on fossil energy, enhancing the efficiency of renewable energy utilization, and establishing effective carbon offset schemes during the carbon neutralization process. This provides technical support for carbon emitters to achieve carbon neutrality. Management

involves guiding, rewarding, and penalizing to encourage carbon emitters to correct their values, actively engage in and practice carbon emission reduction, and ensure progress towards carbon neutrality. In summary, the construction of the new liberal arts is not about rejecting tradition, but rather about clarifying the human-centered concept of humanities education, emphasizing the organic integration of subject development and talent cultivation, enriching the academic paradigm of humanities with high-tech elements, and integrating global changes and the fate of humanity into humanities and its education, thereby contributing to the construction of a community with a shared future for mankind. Cultivating and utilizing “dual carbon” talents takes time and requires a long-term perspective. Therefore, talent cultivation must satisfy current technical talent needs while also preparing for the future. It is also crucial to highlight and leverage the value, guidance, and role of humanities and social sciences in developing versatile “dual carbon” talents.

2.2. Talent Training Supply and Demand Are Not Coordinated

Among the various factors in the talent training model, such as the curriculum system, teaching methods, and teaching team, curriculum design and teaching are the most important ones. In the enrollment brochures and training plans of Chinese universities that offer low-carbon majors, the teaching methods for these majors are still primarily focused on theoretical courses, with practical courses being supplementary. Course internships and graduation designs are the main components of practical teaching activities. Regarding curriculum design, the differences in the curriculum settings of low-carbon related majors are mainly evident in professional education. Specifically, the curriculum system for liberal arts courses typically follows a linear module structure that includes general public courses, professional courses, and practical experimental education courses. However, these courses are often fragmented and place more emphasis on theory than practice. This approach is not conducive to cultivating “dual carbon” talents with comprehensive qualities and long-term career development capabilities, resulting in a gap between the skills of students and the needs of enterprises.

According to data released by the China Petroleum and Chemical Industry Federation, China will require approximately 550,000 to 1 million “dual carbon” professionals during the “14th Five-Year Plan” period. Currently, there are only approximately 100,000 professionals in this field, leading to a significant talent shortage. Data from the “2023 Digital Age Talent Migration Report” reveals that the carbon neutrality sector experienced a growth of 109.8% in 2022 compared to previous years. The demand for talent is primarily focused on technical and composite skills, necessitating individuals with diverse skill sets, several years of work experience, and high entry requirements. For instance, Netease is currently seeking carbon neutrality experts with 5-10 years of work experience. They should possess skills in organizing and analyzing policy reports, contributing to consulting and internal carbon dual field solution formulation, engaging in carbon neutrality digital product planning and design, participating in policy, park, and corporate carbon dual project planning and implementation, as well as possessing ESG-related business capabilities. Despite the attractive salary, applicants lacking interdisciplinary knowledge accumulation are not eligible for consideration.

A company in Zhejiang is currently hiring a climate low-carbon research officer, whose responsibilities include compiling inventories for energy, industry, agriculture, and other sectors, participating in greenhouse gas emission and energy-related model and scenario analysis, as well as conducting data analysis in related fields. It is evident that both large corporations and small businesses have stringent requirements for the skills of potential employees. The “Dual Carbon Talent Insight Report” states that the job market demands an average experience level of 3-6 years. However, currently, most practitioners have less than 3 years of experience, and only a few meet the requirements. Therefore, “dual carbon” talent development should prioritize interdisciplinary studies and practical experiences.

Currently, many low-carbon majors in Chinese universities are developed based on existing disciplines. The curriculum system of traditional liberal arts education is highly rigid, and the issue of closed and conservative teaching methods hinders the cultivation of “dual carbon” talents. On one hand, there is excessive emphasis on imparting theoretical knowledge, resulting in inadequate development of practical skills. Moreover, following the sequence of general education, professional education, experimental training, and graduation design, the progression is clear but the modules are inflexible, resulting in slow updates of course content due to information blockages. The phenomenon of isolation and fragmentation between courses is widespread. On the other hand, liberal arts education not only has the responsibility of cultivating talents within its own discipline, but also plays a role in guiding students in disciplines such as engineering, agriculture, and medicine to develop character and literacy. In comparison, liberal arts education should be more open; however, in practice, it is constrained by professional boundaries, resulting in limited communication between liberal arts and other disciplines and inadequate cross-disciplinary integration. Many courses are conducted in a small workshop-style format within their traditional professional frameworks to train talents. Therefore, in line with national policies and corporate employment needs, the new “dual carbon” curriculum system in liberal arts education needs to overcome disciplinary barriers and transform into a more specialized, diversified, and practical curriculum system.

3. A Study on the Reform of the “Dual Carbon” Talent Training Mode in the New Liberal Arts

Based on the previous analysis, the diverse skills required in the field of “dual carbon” necessitate exploring the reform of the talent cultivation model for “dual carbon” in new liberal arts at universities. This exploration should cover various aspects including knowledge structure, curriculum system, faculty team, and practical platform.

3.1. Condensing the “Three-in-One” Knowledge Structure

The current disciplinary division in domestic universities provides a starting point for promoting the updating of course content by reconstructing the knowledge structure and reforming the related curriculum system. The demand for compound skills of “dual carbon” talents can be categorized into three types of knowledge: conceptual, technological, and managerial. Conceptual knowledge (CK) involves a deep understanding and positive recognition of concepts related to low-carbon and environmental protection, covering various aspects such as low-carbon, environmental protection, global perspective, and social responsibility. Technological knowledge (TK) refers to the professional knowledge and skills required to address environmental challenges and conduct “dual carbon” governance. It mainly covers professional knowledge and skills in clean energy technology, low-carbon technology, environmental monitoring and governance technology, carbon emission management technology, as well as digitalization and intelligent technology. Management knowledge (MK) refers to the ability and art required to scientifically supervise “dual carbon” projects and achieve the sustainable development of enterprises and the environment. It covers professional knowledge and skills in carbon emission management, environmental management, sustainable development strategy, green supply chain management, and social responsibility management.

Conceptual knowledge, technological knowledge, and management knowledge have distinct characteristics in fostering “dual carbon” talents, yet they are interconnected. Conceptual knowledge primarily focuses on an individual’s attitude towards low-carbon environmental protection, encompassing comprehension and conviction of concepts such as environmental protection and carbon emission reduction. This type of knowledge tends to emphasize “value rationality”, which means consciously holding a steadfast and pure belief in the value of a

particular behavior (ethical, aesthetic, religious, or any other interpretation), regardless of outcome. It underscores the importance of unwavering belief and faith. Technological knowledge centers around the expertise in professional technology and scientific knowledge that “dual carbon” talents possess to tackle environmental challenges and drive the advancement of low-carbon technologies. This type of knowledge emphasizes “instrumental rationality”, which is a rational value system that strives to attain desired outcomes by anticipating external factors and the actions of others. It promotes functionalism and technicism, while placing emphasis on utility and efficiency. Management knowledge encompasses carbon emission management, environmental management, and sustainable development strategies within organizations. It emphasizes the efficient execution of environmental protection and carbon reduction initiatives at the organizational level. This type of knowledge resides between the two rationalities and strives for a harmonious equilibrium. These three types of knowledge are interconnected. Conceptual knowledge offers value orientation and guiding principles for technological and management knowledge. Technological knowledge, in turn, provides technical support and solutions for implementing management knowledge. Additionally, management knowledge integrates and applies concepts and technologies at the organizational level to advance sustainable development goals for both enterprises and society. As a result, these three types of knowledge together form a crucial component of the comprehensive literacy of “dual carbon” talents, as they integrate and support one another, jointly facilitating the smooth progress of environmental protection and carbon reduction efforts.

The truly needed compound “dual carbon” talents of the times are those who are committed to technology and have a good understanding of management. When designing courses for “dual carbon” talents, each course should cover three categories of knowledge. Especially in cultivating new liberal arts “dual carbon” talents, it is important not only to rely on traditional speculative ethical education, but also to explore and delve into engineering and management technology. Depending on the specific courses and training goals, the emphasis and presentation of these three types of knowledge can vary. For example, in a carbon audit course, it is necessary to establish the correct values and professional beliefs, and also to understand relevant policies, regulations, and carbon audit skills. Therefore, it is important to place significant emphasis on the construction of conceptual and technological knowledge. Drawing inspiration from the DNA double helix model, a “three-in-one” knowledge construction framework can be established (Fig. 1).

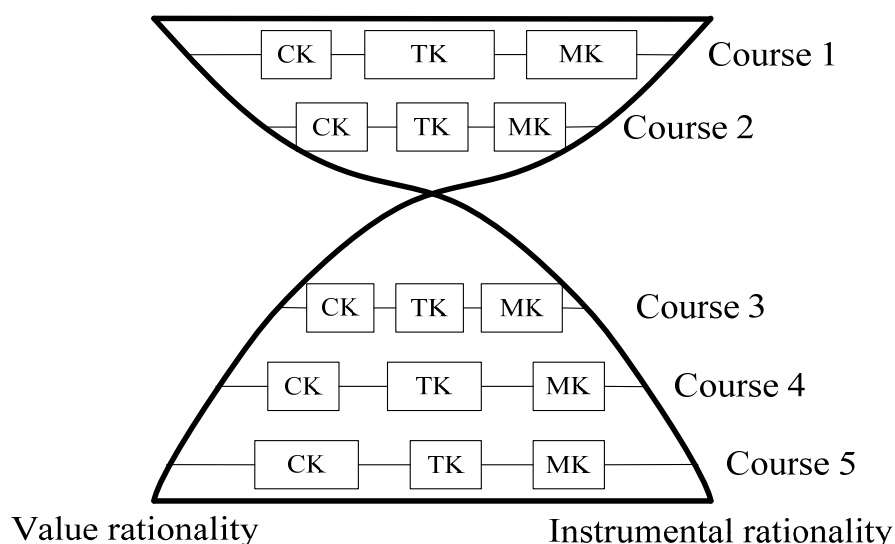


Figure 1. “Three-in-one” knowledge structure of each course

3.2. Establishing An Interdisciplinary Curriculum System

The specific courses offered cannot be standardized due to the different characteristics and foundations of each school's liberal arts programs. This article only discusses the direction and categories of courses, not the specific content. Based on the research of Huang et al. (2021) and considering industry demand for talent, the current new liberal arts "dual carbon" courses can be divided into two main categories. One category focuses on shaping values (carbon views), such as the "dual carbon" concept. For example, courses in humanities disciplines can be offered as general knowledge. The other category covers specific technical and management knowledge related to low-carbon practices, carbon reduction, decarbonization, etc. For instance, courses in economics and management in the social sciences can be offered as professional courses. These two types of courses specifically cover six interrelated professional knowledge areas: shaping correct carbon values, commitment to carbon neutrality, carbon emission reduction, carbon emission offsets, communication of carbon neutrality, and promotion of carbon neutrality.

When establishing the correct direction for carbon values, consideration should be given to offering courses in low-carbon philosophy, economics, and environmental studies. To clarify the responsibilities of various stakeholders in terms of carbon responsibility, courses related to carbon accounting, supply chain carbon footprint accounting, government carbon verification, and enterprise low-carbon strategic management can be established. In terms of incentives for carbon emission reduction, the focus should be on core courses such as low-carbon technology innovation, employee low-carbon management, new energy development management, low-carbon production operation and management, and low-carbon technology and management. This involves carbon reduction technologies and pathways such as carbon separation and capture, as well as incentive factors for carbon emission reduction. The main topics in carbon offset management include theories and methods of carbon trading management, negative carbon and carbon sequestration technologies and pathways. The courses will primarily cover the carbon emission rights trading mechanism, carbon trading and management, and carbon offset management. The main topics in carbon information disclosure cover theories and accounting methods, forms, and effects of disclosing carbon information. The courses will introduce carbon information disclosure, low-carbon marketing, and carbon auditing. The main topics in carbon effect incentives involve market responses and feedback on corporate carbon emission reduction, evaluation techniques and methods for measuring the impact of carbon emission reduction. Additional courses can be considered on carbon finance, corporate low-carbon internationalization, and corporate low-carbon resilience.

Furthermore, since many low-carbon professions have emerged from existing disciplines, curriculum reform needs to be implemented gradually. This article does not challenge the categorization of courses into three types: general education, professional education, and practical training. Instead, it expands the linear relationship between traditional course modules and transforms it into a network structure. Moreover, considering the skills needed in the digital economy, big data, and emerging professions, it is advisable to incorporate relevant knowledge from other disciplines into general education, professional education, and practical training. This will create a new interdisciplinary "dual carbon" curriculum system, as illustrated in Fig. 2.

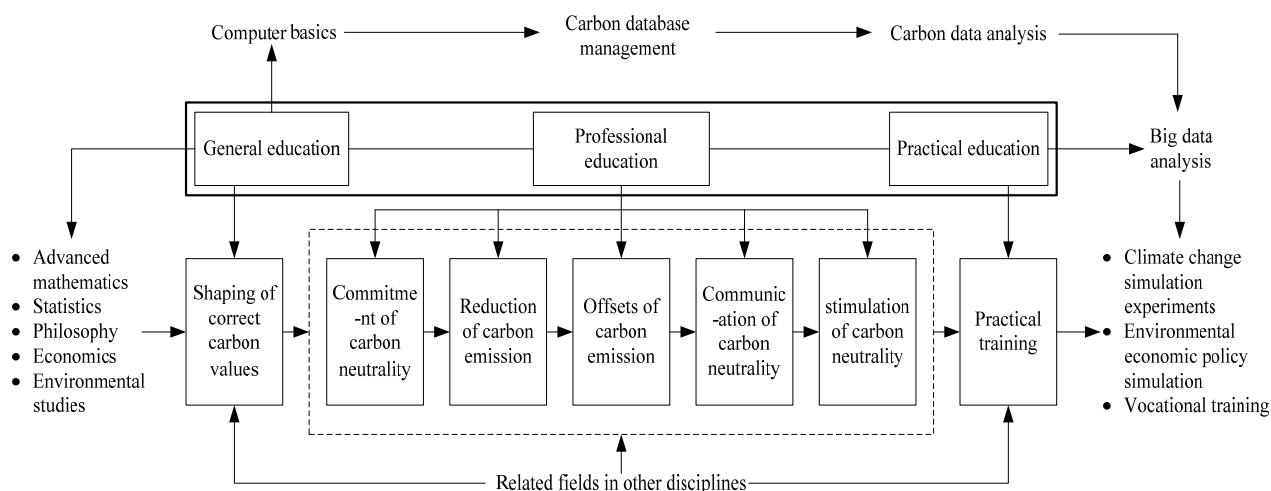


Figure 2. New interdisciplinary “dual carbon” network curriculum system in new liberal arts

3.3. Building A High-quality Teaching Staff

Promoting new knowledge structures and curriculum systems relies heavily on building a high-quality teaching team. Building a new liberal arts “dual carbon” teaching team is essential for talent development models and requires a multi-faceted approach. Firstly, define the objectives of teaching team development to guarantee its long-term growth and quality improvement. To organically integrate the construction of new liberal arts majors with the cultivation of “dual carbon” talents, it is recommended to optimize courses and structures around the knowledge structure of “concept — technology — management” through interdisciplinary collaboration and the integration of teaching and research. Based on the characteristics of disciplines and talent cultivation objectives, define core courses and elective courses, select appropriate course leaders, and build teaching teams. Secondly, strengthen the diversified construction of the teacher team by recruiting teachers with diverse disciplinary backgrounds to promote disciplinary integration and interdisciplinary cooperation. Continuously improve the professional literacy of the teacher team by offering training courses to help teachers understand the latest developments in the field of “dual carbon” and enhance their professional knowledge and practical abilities. Encourage teachers to participate in practical projects such as carbon neutrality practices and energy management projects to cultivate their innovative and problem-solving abilities, and provide feedback on the results and experiences for curriculum construction. Lastly, improve teacher-student interaction and cooperation, encourage the exchange and integration of ideas, and collaborate to enhance and improve the “dual carbon” curriculum system according to students’ interests and needs. In conclusion, fostering new talents in the “dual carbon” field of liberal arts necessitates establishing an interdisciplinary teacher team with diverse backgrounds, extensive professional knowledge, and exceptional practical skills, which will greatly contribute to the advancement of environmental protection and carbon emission reduction in education.

3.4. Creating A Diverse Teaching Platform

Training in the “dual carbon” field should focus on interdisciplinary and practical aspects, requiring an appropriate teaching platform. A diverse teaching platform, integrating online and offline methods, interdisciplinary approaches, and the blend of theory and practice, can overcome traditional classroom limitations. This platform will offer an optimal learning environment and resources for developing talents in the “dual carbon” field. Firstly, fully utilize online teaching tools and combine them with offline methods to form a comprehensive learning platform characterized by course materials, learning aids, and interactive communication. This

approach makes it easier for students to access materials, participate in discussions, and submit assignments. Secondly, promote interdisciplinary collaboration and ensure regular updates to course content based on the latest “dual carbon” advancements. This keeps teaching materials current and practical, providing students with a broad learning experience. Thirdly, prioritize practical teaching by developing training bases, using virtual labs, on-site inspections, and internship projects. This approach enables students to gain hands-on experience and learn about the “dual carbon” field. Additionally, foster extracurricular teacher-student interaction through online offices, forums, Q&A platforms, classroom integration of research findings, and student participation in teacher-led projects. Finally, adopt an integrated training approach that combines production, education, and research, like talent customization and joint teaching. This method enhances the collaborative talent development among universities, businesses, and governments, addressing the supply-demand gap in “dual carbon” talent training.

4. Conclusion

The new liberal arts development highlights the interaction between humanities and technology, alongside the integration of diverse disciplines. Peak carbon and carbon neutrality strategies introduce significant topics and challenges in this context. This article examines the professional setting and curriculum design issues within the new liberal arts “dual carbon” talent training model. It delves into the knowledge structure, curriculum design, faculty composition, and teaching platforms, proposing reform suggestions for the talent training model.

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