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Research on the Practical Pathways of Integrating the Green Low-Carbon Concept into the Carbon Emission Course Teaching in Universities

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Abstract: Against the background of the continuous advancement of the "dual carbon" goals, university carbon emission courses have become a key carrier for conveying green low-carbon concepts and cultivating professional talents. From the perspective of the needs of curriculum teaching reform, this paper first briefly elaborates on the value implications of integrating the green low-carbon concept into university carbon emission course teaching from two aspects: talent cultivation and university responsibilities. On the one hand, this initiative is an important means to cultivate students' low-carbon literacy and improve their practical abilities; on the other hand, it is an inevitable requirement for universities to actively promote green campus construction and assume social responsibilities. On this basis, this paper specifically expounds the practical pathways of integrating the green low-carbon concept into university carbon emission course teaching, hoping to provide theoretical support and practical guidance for the teaching reform of university carbon emission courses, promote the transformation of courses from the previous "knowledge transmission" to "literacy cultivation", and thus make a modest contribution to the cultivation of compound low-carbon talents and the realization of the national "dual carbon" goals.

Keywords: Green low-carbon concept; Universities; Carbon emission courses; Practical pathways

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1. Introduction

The process of global climate governance is accelerating, and "carbon peaking and carbon neutrality" have become key strategic orientations for China to promote high-quality development. The green low-carbon concept is being fully integrated into all fields of the economy and society. Universities are not only the forefront of modern talent cultivation but also important venues for scientific and technological innovation. Therefore, they should take the initiative to assume the important mission of promoting low-carbon development and cultivating

professional talents. Carbon emission courses have inherent advantages in implementing low-carbon education, and their teaching quality is not only closely related to the effect of low-carbon talent cultivation but also affects the spread of the green low-carbon concept. Thus, this paper's exploration of the value implications and practical pathways of integrating the green low-carbon concept into university carbon emission course teaching is of great practical significance.

2. Value implications of integrating the green low-carbon concept into university carbon emission course teaching

2.1. Facilitate the comprehensive development of talents: A key measure to cultivate compound low-carbon literacy

The achievement of the "dual carbon" goals is inseparable from the support of compound talents who are proficient in both professional carbon emission knowledge and green low-carbon concepts. Universities offering carbon emission-related courses and deeply integrating the green low-carbon concept into teaching are of great significance for improving students' comprehensive literacy. Traditional carbon emission courses mostly focus on imparting theoretical knowledge, such as carbon accounting and carbon emission models, but neglect concept guidance and value shaping. This may result in some students mastering professional skills but lacking a sense of responsibility and execution for low-carbon development [1]. Optimizing curriculum design under the guidance of the green low-carbon concept can encourage students to "integrate learning and application", guide them to truly connect low-carbon development with ecological protection and economic development, improve their ability to put theory into practice, and lay a foundation for their future professional work in carbon emission monitoring and carbon management. Such a teaching model plays a positive role in promoting the teaching reform of carbon emission courses and meeting the diverse needs of talents in the new era [2].

2.2. Empower the connotative development of universities: An inherent requirement for practicing green development responsibilities

From the perspective of green campus construction, carbon emission courses play an important role in conveying campus's low-carbon culture. Through classroom teaching, the course can influence the thinking of teachers and students, expand the radiation scope of the low-carbon concept, spread it from the classroom to campus life, and then lead the popularization of low-carbon behaviors such as energy conservation and emission reduction, garbage classification, and green travel, creating a green and friendly campus environment [3]. From the perspective of education and teaching reform, the green low-carbon concept forces the optimization and reconstruction of the carbon emission curriculum system, breaks the barriers between traditional disciplines, enhances the forward-looking nature of teaching content, and at the same time drives the innovation of teaching methods and evaluation models, thereby promoting the joint development of related disciplines such as environmental science, energy engineering, and economics [4].

3. Practical pathways of integrating the green low-carbon concept into university carbon emission course teaching

3.1. Optimize teaching content: Construct a "Concept-Knowledge-Application" trinity curriculum system

Teaching content is the key to integrating the green low-carbon concept into carbon emission courses. Therefore,

teachers need to break through the constraints of traditional courses that "emphasize theory, neglect concepts, and weaken application", and actively build a systematic, practical, and value-leading curriculum content system. First, strengthen the intuitive integration of the green low-carbon concept. For example, before the formal teaching of the carbon emission course, teachers can introduce content related to "dual carbon strategy and low-carbon development ethics". Actual teaching can start with the interpretation of relevant national policy documents, and at the same time, closely link global climate governance cases, allowing students to deeply understand the contemporary significance and core value of the low-carbon concept [5]. For another example, when teaching content such as "carbon accounting" and "carbon emission source identification", teachers can also integrate value orientations such as "low-carbon responsibility" and "ecological protection" to give full play to the unique educational role of the course.

Second, keep pace with the times and supplement cutting-edge practical content oriented to meeting the needs of the low-carbon industry. Teachers can actively invite industry experts to jointly compile school-based textbooks or case textbooks, and broaden students' horizons by elaborately designing topics such as "Application of Carbon Capture, Utilization and Storage (CCUS) Technology", "Construction of Enterprise Carbon Management Systems", and "Practice of Carbon Trading Market Operation", so that carbon emission classrooms are no longer limited to traditional textbooks [6].

Third, increase interdisciplinary teaching content and organically integrate relevant knowledge from disciplines such as environmental science, economics, and engineering to help students build an interdisciplinary knowledge system and fully prepare for solving complex problems in the future. For example, integrate "green taxation system" from economics, "low-carbon supply chain management" from management, and "energy-saving technological transformation" from engineering into the module of "analysis of factors affecting carbon emissions", so as to improve students' systematic thinking ability through interdisciplinary knowledge.

3.2. Innovate teaching methods: Create "Immersive-Interactive-Inquiry-Based" teaching scenarios

Traditional "cramming" teaching makes it difficult to achieve the in-depth penetration of the green low-carbon concept. Therefore, teachers need to actively update teaching methods and strive to guide students to actively perceive, participate, and think deeply through diversified teaching scenarios, so as to maximize teaching effects. First, adopt Project-Based Learning (PBL). Teachers need to design low-carbon topics in advance around teaching content and divide students into several project groups. Each group is mainly responsible for one practical project, such as "interpretation of low-carbon policies", "design of carbon management plans", "promotion of low-carbon technologies", etc [7]. Students need to complete a series of tasks such as preliminary research, data analysis, and program practice according to the project. For example, for the project "carbon emission reduction pathways in regional agriculture", students need to go deep into rural areas to investigate carbon emissions in links such as farming and breeding, then formulate targeted solutions by integrating low-carbon agricultural technologies such as straw returning to the field and ecological breeding, and finally promote them to local farmers.

Second, immersive teaching methods. Teachers need to simulate industrial enterprise carbon emission monitoring scenarios relying on advanced Virtual Reality (VR) technology. In this way, students feel as if they are in the entire process of emission reduction and transformation of high-energy-consuming enterprises, gaining an immersive learning experience. In addition, teachers can guide students to carry out simulated carbon trading operation training through online simulation platforms, allowing them to deeply understand the operation principles of the carbon market and the significance of the low-carbon economy in a virtual trading world [8].

Finally, the "case discussion + debate competition" teaching model. Teachers can select controversial topics for students to debate, such as "the balance between low-carbon development and economic growth" and "the costs and benefits of enterprise low-carbon transformation", so as to cultivate students' good dialectical thinking through intense debates. Teachers can also actively introduce typical cases for students to discuss in groups, such as the construction of "zero-waste cities" in Zhejiang, to deepen the understanding and cognition of the practical application of the low-carbon concept.

3.3. Build practical platforms: Form a three-dimensional carrier of "School-enterprise collaboration-campus real scenarios-social services"

Practice is an indispensable link for the internalization of concepts. Teachers need to break through the limitations of the classroom, build diversified practical platforms, and allow students to understand and practice the green low-carbon concept in real scenarios. First, deepen school-enterprise cooperation and give full play to the role of school-enterprise collaboration. Relying on the school-enterprise cooperation platform, teachers need to work with enterprise personnel to build practical platforms for students. Enterprises should provide students with on-the-job internship opportunities such as carbon accounting, carbon auditing, and low-carbon project planning [9]. Students need to actively participate in practical projects provided by enterprises, such as assisting enterprises in completing annual carbon emission accounting and formulating low-carbon transformation plans. In addition, on-campus teachers and off-campus tutors should form a teaching team to jointly take charge of the teaching of carbon emission courses, such as giving lectures or providing practical guidance to students.

Second, organically integrate on-campus resources, give full play to the advantages of campus real scenario resources, encourage students to actively participate in green campus construction, and provide favorable conditions and convenient venues for students to carry out low-carbon technology research and development and practical operations by establishing a "campus low-carbon innovation laboratory". Students can independently carry out a series of experiments in the laboratory, such as developing an intelligent identification system for campus garbage classification or designing an energy-saving electricity plan for dormitories [10]. In addition, teachers should encourage students to actively participate in "low-carbon creativity competitions" at the school, municipal, or higher levels, allowing them to give full play to their creativity and imagination to formulate targeted campus low-carbon transformation creative plans according to the actual situation of the school. Teachers can select excellent plans and recommend them to school leaders.

Third, develop new approaches for social service practice. Teachers should regularly arrange for students to participate in voluntary service activities such as community low-carbon publicity, rural low-carbon poverty alleviation, and regional carbon emission surveys. They can organize college students to popularize low-carbon knowledge in primary and secondary schools in the form of a "low-carbon publicity group" and provide them with opportunities to participate in carbon emission surveys carried out by local governments, aiming to make their own contributions to regional low-carbon planning [11]. Teachers can also organize college students to enter factories, mines, and rural communities to understand the progress of carbon peaking and carbon neutrality work and vigorously cultivate ecological civilization practice student associations to carry out summer social practice activities.

3.4. Improve the evaluation mechanism: Establish a "Knowledge-Ability-Literacy" multi-dimensional evaluation system

A scientific evaluation mechanism can guide the direction of teaching. Teachers need to break through the "score-only theory" and actively build a multi-dimensional evaluation system integrating knowledge mastery, ability

improvement, and literacy cultivation, so as to comprehensively improve the scientificity, fairness, and objectivity of evaluation. First, optimize evaluation indicators. Teachers should take the practice of the green low-carbon concept as an important evaluation indicator to evaluate the overall integration of the green low-carbon concept into the teaching of carbon emission courses [12]. Evaluation can be carried out from the following dimensions: concept expression in classroom case discussions, low-carbon scheme design in practical projects, and low-carbon behavior performance in campus life. In terms of knowledge, emphasis should be placed on examining professional knowledge, such as carbon accounting and low-carbon technologies; in terms of ability, emphasis should be placed on assessing abilities, such as project execution, scheme design, and team cooperation.

Second, update evaluation methods. Teachers should closely combine process evaluation and summative evaluation and appropriately adjust their proportions. Among them, process evaluation can account for 60%, including 15% for classroom performance, 20% for practical reports, and 25% for project results; summative evaluation accounts for the remaining 40%, which can adopt the form of "open-book exam + scheme design" [13]. Exam questions should focus on examining students' ability to use knowledge to solve practical low-carbon problems, such as asking students to design a low-carbon transformation plan for a certain enterprise.

Finally, introduce multiple evaluation subjects. In addition to teacher evaluation, enterprise mentor evaluation for practical links, student mutual evaluation for project collaboration, and community evaluation for social services should be added to ensure that the evaluation results are objective and comprehensive. In addition, teachers should pay attention to establishing and improving the evaluation feedback mechanism, especially by timely informing students of the evaluation results, guiding them to make targeted improvements, and thus form a cycle of "evaluation-feedback-improvement" [14,15].

4. Conclusion

Based on the above research and analysis, it is an irresistible trend to integrate the green low-carbon concept into university carbon emission courses. This is an inherent requirement for universities to fulfill their social responsibilities and an important measure to cultivate talents meeting the requirements of modern society. Following the core idea of explaining value implications and constructing practical pathways, this paper summarizes and puts forward feasible practical pathways, including constructing a "concept-knowledge-application" trinity curriculum system; creating "immersive-interactive-inquiry-based" teaching scenarios; forming a three-dimensional carrier of "school-enterprise collaboration-campus real scenarios-social services"; and establishing a "knowledge-ability-literacy" multi-dimensional evaluation system. It is hoped that this can promote the continuous optimization and innovation of university carbon emission course teaching, truly make low-carbon education take root and bear fruit in universities, and make a modest contribution to building a sustainable development pattern of harmonious coexistence between humans and nature.

Disclosure statement

The author declares no conflict of interest.

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