

Exploring Pathways to Integrate Green and Low-Carbon Concepts into the Entire Educational Process in Universities

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Abstract

This study explores how to integrate green and low-carbon principles into the entire process of education in universities within the context of global sustainable development. The article analyzes the current challenges faced by universities in curriculum systems, practical components, and evaluation mechanisms. Then it proposes solutions such as constructing a systematic green curriculum system, deepening the connotation of green practices, and improving the evaluation system. The aim is to cultivate interdisciplinary talents with both professional competence and ecological responsibility through the entire process of education model, providing talent support for the national "dual carbon" strategy.

Keywords

Green and Low-Carbon, Entire Process of Education, Higher Education.

1. Introduction

In the context of global sustainable development, green low-carbon literacy has become one of the core competencies in higher education talent cultivation. The UNESCO report "Learning to Integrate into the World: Education for Future Survival" published in 2020 clearly points out that green education is a key pathway to addressing ecological crises. The report of the 20th National Congress of the Communist Party of China elevated "promoting green development and fostering harmonious coexistence between humans and nature" to a national strategy. As the main battleground for talent cultivation, higher education urgently needs to deeply integrate green low-carbon concepts throughout the entire educational process. The "Implementation Plan for National Education System Green Low-Carbon Development" issued by the Ministry of Education in 2022 further clarified the direction for universities, requiring the cultivation of compound talents with both professional capabilities and ecological responsibility awareness through multi-dimensional collaboration in curriculum, practice, and culture, which further highlights the critical role of universities in promoting sustainable development.

Meanwhile, the talent cultivation model in universities is undergoing profound changes. General Secretary Xi Jinping emphasized at the National Education Conference that the fundamental task of "strengthening moral education and cultivating people" must be integrated throughout all aspects of education and teaching. The Ministry of Education's "Notice on Launching Comprehensive Reform Pilot Work of 'Three-All Education'" proposes an educational framework of "all staff, throughout the entire process, in all aspects" [1], which

provides a systematic framework for green and low-carbon education and serves as a new guiding principle for educational reform in Chinese universities. However, the current integration of green and low-carbon concepts in universities still faces problems such as fragmented curriculum, formalized practice, and imperfect mechanisms, necessitating the exploration of effective pathway designs. This study takes "whole-process education" as its entry point to explore the integration path of green and low-carbon concepts with the university talent cultivation system, which is not only an active response to the national "dual carbon" strategy but also a contemporary answer to the fundamental educational questions of "who to cultivate and how to cultivate."

2. The Connotation and Significance of Integrating Green Low-Carbon Concepts into Higher Education

2.1. The Connotation of Green Low-Carbon Concepts

Green and low-carbon development embodies the unique wisdom of Chinese-style modernization and represents an innovative path and strategic approach that China offers to the global sustainable development process[2]. This development concept transcends traditional growth logic by placing ecological civilization and the harmonious coexistence between humans and nature at the core of modernization, reflecting a broader and more profound vision of civilizational progress.

"Green" as a strategic concept for national development, provides a deep-seated value orientation for social progress. It transcends traditional development models, advocating a paradigm that combines efficiency, harmony, and sustainability, demonstrating a more far-sighted development wisdom[3]. "Low-carbon" is the practical path and technological support for realizing the concept of green development. It focuses on the revolutionary transformation of energy consumption, providing a concrete and feasible action framework for the sustainable development of the economy and society by reducing resource consumption and optimizing the energy structure. This concept not only reshapes the technological roadmap of development but also constructs a completely new institutional logic for resource utilization and environmental protection [2],[3].

2.2. The Significance of Integrating Green and Low-Carbon Principles into the Entire Educational Process in Universities

In the process of Chinese-style modernization, the cultivation of green and low-carbon concepts has become a strategic task for higher education. Integrating green and low-carbon ideas throughout the entire educational process in universities not only helps promote ecological civilization construction, but also provides crucial talent support and intellectual guarantee for achieving the "dual carbon" goals.

2.2.1. Realizing Value-Guiding Functions

Ecological civilization construction is the fundamental requirement for the perpetual development of the Chinese nation. Green low-carbon development is an innovative transformative concept to balance ecological values and economic benefits. The core of this development model lies in constructing a multi-dimensional, multi-level collaborative development system through technological innovation, institutional reform, and value reconstruction, ultimately achieving harmonious coexistence of economy, environment, and climate. By integrating green low-carbon concepts into curriculum teaching, ideological and political education, and social practice, universities can effectively enhance students' ecological civilization awareness, guide value shaping, and promote the formation of a modernized development model of harmonious coexistence between humans and nature.

2.2.2. Promote Innovation in the Higher Education System

China's initial concept of "green education" encompassed "green campuses, green environments, green classrooms, and green teachers," and has gradually evolved into the currently popular education for sustainable development system[4]. By optimizing curriculum design, updating teaching content, and strengthening practical components, students' green and low-carbon literacy can be comprehensively enhanced. Furthermore, through innovation in evaluation systems, green and low-carbon concepts can be integrated into the evaluation indicators for higher education's cultivation of talent, thereby promoting a long-term mechanism for green education throughout the entire higher education process[5].

2.2.3. Cultivating New Talent for the Green and Low-Carbon Era

College students are regarded as a reserve force for social development and have a significant impact on the nation's future prosperity and growth. The university period is a crucial stage for cultivating students' correct values, as well as guiding them to develop scientific thinking and firm ideals and beliefs[5]. The educational task during this period is not only to impart knowledge but, more importantly, to elevate students' ideological awareness and moral standards. Integrating the concept of green and low-carbon development throughout the entire talent cultivation process in higher education helps deeply embed the idea of ecological civilization into students' knowledge systems, value orientations, and behaviors, making them an important driving force for sustainable development[4]. Incorporating green and low-carbon concepts throughout the education process in universities means not only infusing ecological knowledge into professional courses but also constructing an overall green development ecosystem within students' daily lives, campus culture, and value pursuits. This approach is not only a practical response to climate change but also the fundamental path to cultivating green and low-carbon talents for the future..

3. Analysis of the Dilemmas in Integrating the Green and Low-Carbon Concept into the Entire Process of Education

3.1. Fragmented Curriculum System with Lack of Systematic Integration of Concepts

In the process of integrating green and low-carbon concepts into higher education, a curriculum system that runs through the entire talent cultivation process has not yet been constructed. Currently, green and low-carbon related content is scattered across different disciplines or elective courses, mostly appearing as sporadic electives or special lectures. Due to the lack of top-level design and interconnection between courses, there are even instances of content repetition or conflict, causing students' understanding of the concept to remain superficial and making it difficult to form a systematic and internalized value recognition.

On one hand, apart from majors directly related to "dual carbon" goals such as environment and energy, most undergraduate programs have not systematically integrated green and low-carbon concepts into their curriculum. Traditional talent cultivation models excessively focus on professional skill development, aiming to cultivate "high-level, precise, and cutting-edge" technical talents while overlooking the holistic needs of ecological civilization education[5]. This leads to green and low-carbon concepts struggling to permeate the entire professional education process.

On the other hand, students' understanding of green and low-carbon concepts mostly remains surface-level, lacking systematic comprehension. Higher education emphasizes "innovation" and "challenge" while neglecting the cultivation of a holistic perspective of "harmonious development". As a result, students may possess professional skills but lack profound insights into core issues such as resource limitations and ecological integrity[6]. This fragmented and

superficial status not only hinders the implementation of green and low-carbon concepts but also deviates from the original intention of ecological civilization education to cultivate high-quality talents who can coexist harmoniously with nature.

3.2. Insufficient Formalization of Practical Segments and Action Transformation

Currently, green low-carbon practical education exhibits a tendency of "emphasizing form over internalization," with educational activities disconnected from students' professional growth and behavioral cultivation. This leads to concepts remaining at the level of "ritualistic participation" without transforming into intrinsic action consciousness. The implementation of green low-carbon concepts in professional education appears fragmented across different educational stages, with urgent need to strengthen inter-connection between grade levels.

Some teachers have biased perceptions of green low-carbon concepts, positioning themselves merely as "knowledge transmitters" and considering students' green awareness education as solely a moral education concern. They focus only on improving subject teaching capabilities. In professional teaching segments, they simply superficially embed low-carbon concepts, mechanically accumulating green educational elements to fulfill task requirements, thereby weakening the crucial role of green low-carbon concepts in higher education talent cultivation. Inter-grade concept transmission mechanisms remain unestablished, and the collaborative nature between ideological-political education and professional education urgently needs enhancement.

Moreover, common environmental protection volunteer activities and low-carbon knowledge competitions often remain in short-term, fragmented forms, failing to effectively connect professional learning with practical innovation. Students' participation depth and intrinsic motivation are severely insufficient. Universities lack sustained practical education tracking mechanisms, unable to accurately assess students' long-term behavioral transformation effects, rendering practical education an isolated segment difficult to quantify. This fragmented, formalistic practical education model not only undermines the educational value of green low-carbon concepts but also struggles to cultivate students' sustainable development awareness and innovative capabilities[7].

3.3. Absence of Evaluation Mechanisms and Unclear Educational Guidance

Universities commonly face issues of absent evaluation mechanisms and unclear educational guidance in the process of cultivating green and low-carbon talent, which severely restricts the effective achievement of educational goals. On the one hand, although some universities have introduced low-carbon topics into their professional courses, they have failed to construct a corresponding evaluation framework for educational effectiveness. This leads to teachers embedding green and low-carbon elements in a distorted manner, resulting in formalized lesson plan filling and superficial case listing. Existing evaluation systems still focus on traditional knowledge assessment, lacking quantitative observation indicators for students' core competencies such as green values and low-carbon behavioral habits, resulting in a serious lack of green literacy evaluation dimensions. On the other hand, the evaluation subject is excessively concentrated on the teacher level, lacking diverse evaluation methods such as student self-evaluation and industry or enterprise participation. The evaluation results fail to form a closed loop with teaching improvement and lack connection with incentive mechanisms such as credit recognition and honor systems. A virtuous cycle mechanism of "evaluation-improvement-enhancement" has yet to be established.

4. Path Design for Integrating Green Low-Carbon Concepts Throughout the Entire Process

4.1. Constructing a Systematic Green Curriculum System to Enhance Collaborative Education

Targeting the issues of curriculum fragmentation and lack of systematization in integrating green low-carbon concepts in higher education, there is a need to build a three-in-one curriculum system of "foundational general education - professional integration - practical innovation", strengthening the collaborative education effect[8]. On one hand, disciplinary barriers should be broken down, internal high-quality resources integrated, and a cross-disciplinary modular course group constructed, guiding students to deeply understand green low-carbon concepts from multiple perspectives through setting diverse course modules. On the other hand, professional courses should emphasize green transformation, organically integrating green low-carbon concepts into professional knowledge systems based on different professional characteristics, achieving deep integration of professional education and green concepts. In addition, a tiered curriculum system needs to be constructed across the four years of undergraduate study. This system will progress from green general education in the lower grades to professional green courses in the higher grades, and then to green research projects and practical activities, gradually improving students' green literacy and practical abilities in a comprehensive manner. Simultaneously, fully utilizing online open courses and other information technology means can break spatial-temporal limitations and promote the sharing of high-quality educational resources. Accordingly, a curriculum system reflecting green low-carbon concepts is established, enhancing collaborative education and cultivating new-era talents with green low-carbon awareness for society.

4.2. Deepening the Connotation of Green Practices and Constructing a Comprehensive Talent Cultivation Model

To address the tendency of "emphasizing form over internalization," it is necessary to closely link educational activities with students' professional growth and behavioral development, avoiding superficial participation. On one hand, universities should strengthen teachers' training in green and low-carbon concepts, guiding them to transform their perspectives and recognize the importance of green education in talent cultivation, and organically integrate green concepts into professional teaching rather than simply stacking content. On the other hand, innovative practical education approaches should be developed, focusing on promoting practical teaching methods that enable students to gain in-depth understanding of green and low-carbon development through experiments, field research, and other approaches[6]. Additionally, universities should establish a continuous tracking mechanism for practical education, using methods such as questionnaire surveys and interviews to long-term evaluate the transformation effect of students' green behaviors, and continuously improve the practical education plan based on assessment results. By constructing a comprehensive talent cultivation model, green and low-carbon concepts can be truly transformed into students' conscious actions, cultivating talents with sustainable development awareness and innovative capabilities.

4.3. Improving the Evaluation System and Enhancing Process-Oriented Education

The core of green low-carbon education lies in integrating value shaping throughout students' cognitive iteration and behavioral development. The optimization of the evaluation system needs to shift from "result control" to "process immersion," using dynamic tracking, feedback, and adaptation to make the evaluation itself a carrier for releasing educational effectiveness.

While some universities have added low-carbon knowledge modules to course assessments, they still primarily rely on summative examinations, which fail to capture students' staged growth in green values and cannot stimulate teachers' initiative in continuously embedding low-carbon ethics in teaching.

On one hand, universities can adopt process-based evaluation methods, such as establishing learning journals, conducting group discussions, and organizing case analyses, to comprehensively record students' low-carbon cognition and behavior across course learning, scientific research innovation, and social practice during their academic tenure. Timely feedback and guidance can be provided through periodic semester assessment reports. On the other hand, by strengthening the two-way interaction between evaluation and teaching, real-time feedback can be used to revise course syllabus and optimize teaching methods, promoting teachers' role transformation into "value guides."

This mechanism of driving processes through evaluation and reshaping behavior through processes integrates evaluation into the entire green low-carbon education process. It guides students to continuously learn, reflect, and grow through participation, truly leveraging the process-oriented educational effectiveness of the evaluation system and achieving green low-carbon educational objectives.

5. Conclusion

In summary, to address the challenges of integrating green and low-carbon concepts throughout the educational process in higher education, it is necessary to: construct a systematic green curriculum system to effectively integrate concepts; deepen practical content and overcome the formalistic shortcomings of practical links; and finally, improve the evaluation system to enhance the effectiveness of process-based education. Through the collaborative advancement of these three pathways, we can improve the effectiveness of green and low-carbon concept integration in comprehensive education, cultivating new talents with a strong sense of social responsibility and sustainable development capabilities.

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