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Research on Innovation of Cultivation Path for "Dual-Carbon" Literacy of Economics-Related Majors Under the Background of Green and Low-Carbon Transition

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Abstract: Against the dual-strategic background of national green and low-carbon transition and the fostering of new-quality productive forces, industrial markets have put forward brand-new requirements for the low-carbon literacy and green practical capabilities of talents majoring in economics-related disciplines in application-oriented undergraduate universities. Traditional talent-cultivation systems built upon theoretical emphasis and conventional economic paradigms can hardly adapt to the practical demands of green-industry development and low-carbon upgrading of economic structures. Application-oriented undergraduate universities take fostering high-quality applied talents as their core orientation. Focusing on talent shortages brought by regional green-economic development and implementation of low-carbon industries, promoting the construction of "dual-carbon" literacy-cultivation systems and the reconstruction of practical-teaching systems for economics-related majors constitutes a key measure for advancing specialty transformation and upgrading, adapting to the development of new-quality productive forces, and enhancing the core competitiveness of talents, which deserves in-depth exploration and practice.

Keywords: Green and low-carbon transition; Dual-carbon literacy; Economics-related majors; Practical teaching

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1 Overview of connotations of green low-carbon development and "dual-carbon" literacy

1.1. Theoretical background of green and low-carbon transition

Green and low-carbon transition represents the core component of high-quality economic development in China in the new era. Its essence is to break the extensive economic-development model featuring high energy consumption, high emissions, and high pollution through technological innovation, institutional innovation and paradigm innovation, and build a modern economic-development system with low energy consumption, low emissions, high efficiency and sustainability, which bears economic, social and ecological attributes at the same time. From a theoretical perspective, green and low-carbon transition is not a simple ecological-en

vironmental-protection reform, but a systematic transformation covering multiple fields including industrial structure, economic paradigm, market rules and resource-allocation modes. Its core is to realize coordinated coupling and dynamic balance between economic development and ecological protection. For the economic sector, green and low-carbon transition reshapes the development logic of traditional economics, breaks the single development-evaluation criterion centered on economic growth rate, incorporates ecological costs, low-carbon benefits and green value into the economic-development accounting system, and constructs a new theoretical framework integrating green economy, low-carbon economy and circular economy. Meanwhile, it defines new value guidance and theoretical categories for talent cultivation of economics-related majors in application-oriented undergraduate universities [1].

1.2. Connotation of "dual-carbon" literacy cultivation for economics-related majors

The "dual-carbon" literacy for economics-related majors that fits the talent-cultivation orientation of application-oriented undergraduate universities refers to specialized and professional comprehensive literacy cultivated for students of economics-related majors on the basis of general environmental-protection literacy. Constructed based on core theories such as green economics, low-carbon finance and ecological economics, this literacy serves as an extension and expansion of core literacy for talents majoring in economics-related disciplines in the new era. Theoretically, it can be decomposed into three core connotations: dual-carbon theoretical cognitive literacy, green-economic thinking literacy, and low-carbon professional-value literacy. Among them, theoretical cognitive literacy acts as the foundation, covering professional theoretical knowledge such as dual-carbon policies, principles of the low-carbon economy, and green-accounting rules. Green-economic thinking literacy serves as the key, focusing on breaking the shackles of traditional economic thinking and fostering development concepts that coordinate ecological protection and economic development. Low-carbon professional-value literacy represents the soul, namely core qualities and values that meet the demands of post-green industries [2-3]. The three elements interpenetrate and progress step-by-step, jointly forming a literacy-theoretical framework for students of economics-related majors to adapt to market demands for green and low-carbon development.

1.3. Theoretical mechanism of new-quality productive forces empowering literacy cultivation

New-quality productive forces represent a new-type development logic led by scientific-and-technological innovation and characterized by high efficiency, high quality and green orientation. It shares profound theoretical compatibility with "dual-carbon" literacy cultivation and practical-teaching reform for economics-related majors, and provides brand-new theoretical support for educational-reform practices in application-oriented undergraduate universities. Breaking the developmental shackles of traditional productive forces, new-quality productive forces fully integrates green innovation, low-carbon technologies and digital empowerment into the whole process of economic and industrial development, and drives talent cultivation in the economic field to transform from the traditional theoretical-indoctrination mode toward cultivation of innovative, practical and green-oriented capabilities. From the perspective of educational theories, the development of new-quality productive forces gives rise to new business forms, new posts and new demands in the green-economy sector, and promotes iterative upgrading of talent-cultivation objectives, teaching systems and literacy standards for higher education. Its core empowerment mechanism is reflected in the following aspects: forcing teaching reform through industrial innovation, updating professional

knowledge systems with green-industry theories, reshaping the logic of student literacy cultivation with innovative-productive-forces thinking, and realizing theoretical synchronization and goal alignment between higher-education talent cultivation and high-quality industrial development.

2. Current status and problems of "dual-carbon" literacy cultivation for economics-related majors

2.1. Insufficient integration of dual-carbon educational objectives and weak specialty adaptability

The original school-running orientations of most economics-related majors mainly focus on traditional economics, finance, trade and other fields. "Dual-carbon" literacy has not been systematically embedded into top-level specialty design as a core talent-cultivation objective. Most colleges and universities merely regard dual-carbon-related content as extended knowledge, and fail to define competency standards for students to master carbon accounting, carbon markets, green economy, and other capabilities in combination with the characteristics of economics-discipline talent cultivation. Revisions to talent-cultivation schemes lag. Specialty-training objectives and graduation requirements are disconnected from demands of the dual-carbon strategy. Differentiated positioning of dual-carbon talent cultivation between economics-related majors and environmental- or energy-related majors cannot be clearly distinguished. Though some colleges and universities have added dual-carbon-related lectures, they have not carried out systematic planning from the perspective of long-term specialty development. As a result, dual-carbon literacy cultivation becomes a mere formality. Compound economic talents who can analyze carbon policies, carbon trading, and green investment and financing from an economic perspective cannot be cultivated. There exists an obvious mismatch between talent output and actual employment demands of green and low-carbon industries [4-5].

2.2. Fragmented curriculum, simplified contents and disconnection between theory and practice

Existing curriculum systems for economics-related majors lack systematic dual-carbon curriculum structures. Relevant knowledge is scattered and attached to original courses, without forming independent and complete curriculum modules. Theoretical-course contents mostly focus on macro-level policy publicity, while in-depth explanations for major teaching contents such as carbon pricing, carbon taxes, and green finance from an economic perspective are insufficient. Textbooks are updated slowly, and cutting-edge carbon-economic cases are scarce. Deficiencies exist in practical teaching: for instance, there are no on-campus training platforms for carbon simulated trading or carbon-accounting practice, and off-campus practical projects are few. In terms of curriculum arrangement, theoretical learning is separated from practical training. Classroom teaching cannot connect with real-world carbon-market business scenarios. Students can only memorize concepts, without receiving training on analyzing low-carbon cost-benefits via economic models or evaluating green-project operations. Logical connections are absent among courses. Knowledge points are scattered and unsystematic, making it difficult for students to form complete dual-carbon-economic thinking.

2.3. Insufficient in-depth university-enterprise collaboration and limited supply of educational resources

Industry-education integration for dual-carbon directions of economics-related majors mostly stays at a shallow-cooperation stage. University-enterprise cooperation is largely confined to short-term visits and

special lectures, and stable long-term collaborative-education mechanisms have not been established. Low-carbon enterprises, carbon-consulting institutions and carbon-market participants show low enthusiasm for participating in talent cultivation. They seldom take part in core teaching links such as curriculum development, teaching-design and practical-training guidance. Front-line practical carbon-economic cases and industrial data can hardly be integrated into classroom instruction, and real-world enterprise projects have not been transformed into teaching projects. In addition, most on-campus teachers lack front-line working experience in carbon markets and green industries. There is no regular institutional guarantee for industry experts to deliver lectures on campus [6]. Obvious resource barriers of talent, information, and platforms exist between universities and enterprises. Post-competence demands from the industrial side cannot be fed back to specialty teaching in a timely manner, and existing industry-education integration can hardly support the development of students' practical dual-carbon capabilities.

3. Cultivation paths for "dual-carbon" literacy of economics-related majors under the background of green and low-carbon transition

3.1. Based on application-oriented school-running orientation, construct a hierarchical theoretical system for dual-carbon literacy cultivation

Oriented toward regional-economic-development demands, application-oriented undergraduate universities differ from research-oriented universities that adopt theory-intensive talent-cultivation modes and higher-vocational colleges that adopt pure skill-oriented training modes. Relying on the school-running characteristics of economics-related majors and the talent demands of the dual-carbon transition, they shall build a hierarchical, systematic, and highly-adaptable theoretical system for dual-carbon literacy cultivation, fundamentally solving problems including the absence of green-low-carbon theories, fragmented literacy cultivation, and disconnection between theories and industries in traditional specialty education [7-8]. This system follows a hierarchical logic of basic theories, specialty-specific theories and cutting-edge theories. It popularizes basic theories of green low-carbon development, the dual-carbon strategy and ecological economics among all students of economics-related majors to cultivate their general dual-carbon cognitive literacy. It incorporates specialized dual-carbon theoretical knowledge such as green finance, low-carbon trade, green marketing and industrial low-carbon upgrading to enrich the core of specialty-characteristic literacy. Meanwhile, in light of development trends of new-quality productive forces, cutting-edge theories including digital low-carbon economy, green-innovation industries and digital dual-carbon accounting are incorporated into the cultivation system. Theoretical-teaching contents shall be dynamically updated, and traditional economic-theoretical paradigms shall be discarded to precisely meet the demands of the national dual-carbon strategy, industrial green upgrading, and the development of new-quality productive forces. It lays a solid theoretical foundation for students' future career development and post-graduation operations, and gives full play to the pertinence and adaptability of talent cultivation in application-oriented undergraduate majors.

3.2. Follow the logic of new-quality productive forces, reconstruct a three-dimensional specialty practical-teaching system

The green, digital and innovative developmental features of new-quality productive forces have thoroughly changed practical-operation modes and post-competence requirements of green-economy industries. They also force economics-related majors in application-oriented undergraduate universities to break traditional single,

rigid, and simulation-biased practical-teaching modes, and reconstruct a three-dimensional practical-teaching system that meets the demands of dual-carbon transition and industrial innovation. Traditional practical teaching for economics-related majors mostly revolves around industrial-economic scenarios of conventional industries, lacking practical modules for green low-carbon development. It is disconnected from digital low-carbon industries and green-innovative business forms empowered by new-quality productive forces, and can hardly cultivate students' practical dual-carbon application capabilities [9-10]. Therefore, the reconstruction of practical-teaching systems shall take the cultivation of applied-talent practical capabilities as its fundamental starting point, break educational barriers among classroom practice, on-campus practical-training and off-campus industrial practice, and fully integrate innovative thinking of new-quality productive forces, digital technologies and green-development concepts into every link of practical teaching. Build a green-economy simulation practical-training platform on campus, and launch new practical-training projects such as dual-carbon accounting, green-project evaluation and low-carbon-market operation. Deepen university-enterprise cooperation with regional green enterprises, low-carbon industrial parks and new-energy-economy platforms off campus, and build regular practical-education bases to promote students' in-depth participation in real-world green-industry projects. Meanwhile, integrate innovation-and-entrepreneurship practice, and guide students to carry out green-economic innovative-practice activities based on dual-carbon policies, so as to comprehensively improve students' practical dual-carbon capabilities and innovative-application abilities.

3.3. Deepen curriculum-system reform and build dual-carbon-integrated specialty-teaching carriers

Curricula constitute the primary carrier for literacy cultivation and teaching reform. Against the background of the green and low-carbon transition, application-oriented undergraduate universities offering economics-related majors shall take dual-carbon literacy cultivation as their fundamental objective, promote all-round reform of curriculum systems, break barriers among traditional courses, and build multi-dimensional integrated dual-carbon-teaching carriers to resolve problems of disconnection between specialty courses and dual-carbon themes as well as fragmented green-teaching contents. At present, most courses for economics-related majors in application-oriented undergraduate universities are still dominated by traditional curricula, lacking systematic curriculum support, which makes regular literacy cultivation difficult [11]. Hence, comprehensive dual-carbon integration for general-education courses, specialty-basic courses and core specialty courses shall be advanced. Add content about the green-low-carbon economy and dual-carbon policies and regulations in general-education courses; incorporate ecological-economics and green-resource-allocation content into specialty-basic courses; embed specialty-characteristic dual-carbon modules into core specialty courses to realize in-depth integration of dual-carbon knowledge and specialty teaching. Meanwhile, in view of the development of new-quality productive forces, develop digital dual-carbon characteristic courses, high-quality online resources and case-teaching resources. Adopt real-world regional green-economic cases and enterprise low-carbon-transition cases for teaching, so that dual-carbon literacy cultivation runs through the whole process of specialty learning, and realize organic unification of theoretical teaching, literacy cultivation and specialty empowerment.

3.4. Focus on in-depth industry-education integration and improve long-term cultivation mechanisms for dual-carbon literacy

Industry-education integration serves as a core channel for application-oriented undergraduate universities to

connect with industrial demands and improve talent-cultivation quality. It also acts as an important guarantee for the implementation of dual-carbon literacy and the improvement of practical-teaching quality. Under the dual background of green-low-carbon transition and development of new-quality productive forces, it is necessary to deepen industry-education integration and improve long-term cultivation mechanisms, so as to realize precise docking and dynamic adaptation between literacy cultivation and industrial demands. Under traditional educational modes, talent-cultivation schemes and teaching contents in universities are disconnected from the green, low-carbon post-industrial demands of enterprises. Regular university-enterprise collaborative-education mechanisms are absent, making it hard for students' dual-carbon literacy and practical capabilities to satisfy industrial-development requirements [12-14]. Therefore, universities shall cooperate with leading regional green enterprises, low-carbon-industry associations and economic-research institutions to jointly formulate dual-carbon talent-cultivation standards, revise talent-cultivation schemes and jointly build teaching faculties. Promote industry experts to participate in the whole process of classroom teaching, practical-training guidance and curriculum design. Meanwhile, construct a dynamic educational-adjustment mechanism, keep track of development trends including changes in dual-carbon policies, updates of green industries and emergence of new-quality-productive-forces-driven business forms, and adjust literacy-cultivation contents and practical-teaching forms in a timely manner. Improve an integrated evaluation system covering teaching assessment, practical-training examination and competency certification, and build a long-term dual-carbon-literacy cultivation mechanism featuring university-enterprise cooperation, dynamic updating and whole-process empowerment, so as to effectively enhance green-oriented employability of economics-related specialty talents.

4. Conclusion

Against the background of green and low-carbon transition, the cultivation of "dual-carbon" literacy for talents of economics-related majors constitutes a key measure for adapting to the development of low-carbon industries, improving the talent system for green economy and facilitating the implementation of the national dual-carbon strategy [15]. The rapid development of the green-low-carbon economy has raised brand-new requirements for the professional capabilities of compound economics-related talents, such as carbon-market analysis, green-finance judgment, and low-carbon-economic accounting. Economics-related majors must adapt to development demands of the times, innovate educational paths, optimize educational systems and remedy deficiencies in dual-carbon-oriented education. In the future, it is still necessary to continuously deepen the reform of educational modes and explore dual-carbon-cultivation systems suited to the disciplinary characteristics of economics in combination with industrial-development trends and changes in post demands, so as to deliver high-quality professional talents for the green economy of society and contribute to high-quality green-low-carbon development at regional and national levels.

Disclosure statement

The authors declare no conflict of interest.

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