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Research on the School-Enterprise Dual-Element Education Model for the New Energy Vehicle Technology Major in Higher Vocational Colleges from the Perspective of New Quality Productive Forces

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Abstract: Against the backdrop of the rapid transformation of the new energy vehicle industry towards intelligence, electrification, and connectivity, traditional talent cultivation models can no longer meet the demand for high-quality technical and skilled talents required by industrial upgrading. Based on the core connotation of new quality productive forces, this paper analyzes the challenges currently faced by the school-enterprise dual-element education model in the new energy vehicle technology major in higher vocational colleges, proposes innovative pathways for school-enterprise dual-element education, aiming to provide theoretical reference for cultivating high-quality talents with digital literacy, innovative capabilities, and craftsmanship spirit for the new energy vehicle industry.

Keywords: new quality productive forces; higher vocational education; new energy vehicles; school-enterprise dual-element education; integration of industry and education

1. INTRODUCTION

With the in-depth development of a new round of global technological revolution and industrial transformation, the new energy vehicle industry is undergoing a major shift from traditional fuel vehicles to electrification, intelligence, and connectivity. It has become a core component of China's strategic emerging industries and a model for forming and shaping new quality productive forces. Higher vocational colleges, as the main front for cultivating technical and skilled talents, shoulder the important mission of supplying high-quality talents for the new energy vehicle industry chain. Especially under the background where new quality productive forces emphasize "high technology, high efficiency, and high quality," exploring new models of deep school-enterprise dual-element collaborative education is of significant practical importance for promoting the organic connection between the education chain, talent chain, industry chain, and innovation chain.

2. THE CONNOTATION OF NEW QUALITY PRODUCTIVE FORCES AND ITS NEW REQUIREMENTS FOR HIGHER VOCATIONAL EDUCATION

2.1 The Connotation of New Quality Productive Forces

New quality productive forces are an advanced form of productivity led by technological innovation, characterized by high technology, high efficiency, and high quality. In the automotive industry field, new quality productive forces are mainly reflected in three aspects: First, technology-driven, such as improvements in battery energy density, iterations of intelligent driving algorithms, and the application of vehicle networking technologies; Second, digital and intelligent empowerment, where production processes increasingly rely on data-driven and intelligent control, and the digital level of R&D and manufacturing links continues to improve; Third, green development, where new energy vehicles themselves represent green productive forces, requiring the implementation of low-carbon and environmentally friendly concepts throughout the entire lifecycle.

2.2 New Requirements for Higher Vocational Talent Cultivation

The development of new quality productive forces imposes multi-dimensional new requirements on the cultivation of talents in the new energy vehicle major in higher vocational colleges. First, composite competency requirements: talents not only need to master traditional mechanical maintenance skills but also possess an interdisciplinary knowledge structure integrating "mechanics, electricity, control, and networking." Second, digital literacy requirements: students need to be proficient in using virtual simulation software, intelligent diagnostic equipment, and possess certain data analysis capabilities. Third, innovation awareness requirements: facing not yet fully mature new energy technologies, talents need to have the adaptability for technological iteration and the ability to solve on-site technical problems. Finally, professional spirit requirements: new energy vehicles involve high-voltage safety, requiring practitioners to possess rigorous craftsmanship spirit, a sense of responsibility, and ethical literacy.

3. THE REALISTIC DILEMMAS OF SCHOOL-ENTERPRISE DUAL-ELEMENT EDUCATION IN THE HIGHER VOCATIONAL NEW ENERGY VEHICLE MAJOR

Although school-enterprise cooperation has become a consensus in higher vocational colleges, under the background of new quality productive forces, the existing education models still face many challenges.

3.1 Structural Mismatch Between Talent Cultivation and Enterprise Demand

Some higher vocational colleges' new energy vehicle technology majors have transitioned from traditional automotive-related majors, and the curriculum system still carries a strong traditional vehicle imprint. The teaching content lacks sufficient coverage of core technologies such as vehicle controllers, battery management systems, and motor control systems, leading to a significant gap between what students learn and the actual job requirements of enterprises.

3.2 Curriculum Content Lags Behind the Speed of Technological Iteration

Some higher vocational colleges, constrained by hardware conditions, are still teaching technologies of early vehicle models that have been phased out by the market, with relatively scarce cutting-edge content such as virtual simulation and intelligent networking. The lag in curriculum content results in students struggling to quickly adapt to job positions after graduation, and enterprises need to invest significant costs in secondary training.

3.3 Insufficient Practical Ability of the "Dual-Qualified" Teacher Team

Currently, teachers in the new energy vehicle major in higher vocational colleges mostly come from traditional mechanical and automotive majors, generally exhibiting a phenomenon of "strong in theory, weak in practice," lacking practical experience in the frontline of new energy vehicle R&D, manufacturing, and after-sales service. Some teachers have insufficient deep mastery of high-voltage system safety operations, intelligent driving calibration, fault diagnosis logic, etc., making it difficult to effectively integrate the latest industry cases and technical specifications into teaching.

3.4 Insufficient Depth of School-Enterprise Cooperation and Inadequate Collaborative Mechanisms

Currently, many school-enterprise cooperations remain at a superficial level, such as establishing internship bases, donating a small amount of equipment, and arranging post internships. Enterprises lack motivation to participate in talent cultivation, lacking deep involvement in the entire process from talent cultivation plan formulation, curriculum development, teaching implementation to assessment and evaluation. The institutional guarantees for personnel exchange, technology sharing, and benefit distribution between schools and enterprises are imperfect, leading to the persistent phenomenon of "schools being enthusiastic while enterprises are cold."

4. INNOVATIVE CONSTRUCTION OF THE SCHOOL-ENTERPRISE DUAL-ELEMENT EDUCATION MODEL FROM THE PERSPECTIVE OF NEW QUALITY PRODUCTIVE FORCES

To address the above dilemmas, higher vocational colleges need to be guided by new quality productive forces, reconstruct the school-enterprise dual-element education model, and achieve a transformation from "simple cooperation" to "deep integration."

4.1 Building an Integrated Education Platform with Deep Integration of Industry and Education

The development of new quality productive forces requires education and industry to resonate at the same frequency. Higher vocational colleges should actively collaborate with leading enterprises in the industry to jointly build industry colleges or training bases integrating "teaching, production, R&D, training, and competitions." Taking our school's Li Auto school-enterprise cooperation order class as an example, the school and enterprise jointly implement an order-based talent cultivation model, formulating personalized training plans based on enterprise needs. The enterprise invests in training facilities and equipment that meet the talent cultivation needs of the enterprise, establishing on-campus training bases that highly replicate the real working environment of the enterprise, allowing students to be exposed to the latest industry technologies and equipment during their learning process, improving their practical operational skills. After completing on-campus studies, students enter Li Auto for follow-up internships, effectively shortening the job adaptation period.

4.2 Reconstructing a Modular Curriculum System Integrating "Post, Course, Competition, and Certificate"

Curriculum is the core carrier of education. From the perspective of new quality productive forces, the curriculum system must closely follow industrial technological changes, strengthening the integration of digital and intelligent elements.

First, driven by job requirements. Deeply analyze the competency requirements of typical positions in new energy vehicle design, key component testing, intelligent driving calibration, high-voltage system maintenance, etc., extract core knowledge points and skill points, and use these as the logical starting point for curriculum design.

Second, deep integration of courses and certificates. Integrate the requirements of "1+X" vocational skill level certificates, low-voltage electrician certificates, and other certificates into the course syllabus.

Third, mutual promotion between courses and competitions. Transform the content of vocational skill competition events into teaching projects. For example, decompose tasks such as sensor calibration from the Intelligent Connected Vehicle Technology competition event into course modules, achieving "promoting

teaching through competition and promoting learning through competition."

Fourth, modular curriculum reconstruction. Break the traditional discipline-oriented curriculum system, and construct a modular, progressive curriculum system according to the logic of "basic cognition—core skills—comprehensive application—innovation expansion," so that the cultivation of students' abilities precisely aligns with job levels.

4.3 Building a "Dual-Qualified" Teaching Team with School-Enterprise Interconnection and a Combination of Full-time and Part-time Teachers

A high-quality teaching team is the key to the success of school-enterprise dual-element education. To address the issue of insufficient practical ability among teachers, it is necessary to establish a mechanism of "two-way flow between school and enterprise, mutual appointment and joint training of personnel."

First, regularizing teacher entry into enterprises for practice. School teachers actively participate in enterprise training and dual-qualification certification, enhancing their professional capabilities and practical teaching levels. Teachers regularly engage in enterprise practice, understand the actual production and operation and technological needs of enterprises, and integrate actual enterprise cases and work experience into teaching, making the teaching content more targeted.

Second, institutionalizing the entry of enterprise experts into the classroom. Hire enterprise technical backbones and skill masters as part-time teachers to undertake practical course teaching, etc. Directly transmit the enterprise's understanding of new technologies and processes to students, enhancing the practicality and frontier nature of teaching.

Third, jointly building master studios by schools and enterprises. Form master studios with a dual-subject structure of "on-campus leading teachers + enterprise skill masters." Conduct joint research around actual technical challenges of enterprises, with teachers and students jointly participating in research projects, achieving "integration of science and education." The intellectual property rights of related research results are shared by the school and enterprise, both serving enterprise development and enhancing the innovative capabilities of teachers and students.

4.4 Establishing a Long-Term Operational and Evaluation Mechanism for Mutual Benefit and Win-Win

The sustainable development of the school-enterprise dual-element education model cannot be separated from sound institutional guarantees and a scientific evaluation system.

First, clarifying the responsibilities of the three parties. Construct a tripartite collaborative mechanism of "OEM + school + service outlet." The OEM provides technical standards, teacher training, and teaching equipment; the school is responsible for venue construction, teaching organization, and student management; the service outlet provides internship positions, selects mentors, and participates in assessment. Shared responsibilities and shared benefits form an educational synergy.

Second, innovating the evaluation mechanism. Establish a diversified evaluation system combining process evaluation and summative evaluation. Introduce enterprise evaluation of internship performance and task completion quality, incorporating professional literacy, teamwork, and innovation capability into the assessment dimensions. For example, evaluation indicators covering school-enterprise collaboration degree, student participation, professional literacy performance, enterprise satisfaction, etc., can be established to ensure the evaluation results comprehensively reflect the effectiveness of education.

Third, strengthening incentives and guarantees. For enterprises actively participating in school-enterprise cooperation, colleges should proactively assist in applying for relevant policy benefits for industry-education integration enterprises. Within the school, incorporate teachers' participation in enterprise practice, guiding student competitions, conducting horizontal research projects, etc., into performance assessment and professional title evaluation, stimulating teachers' endogenous motivation to engage in industry-education integration.

5. CONCLUSION

New quality productive forces point out a new direction for talent cultivation in the higher vocational new energy vehicle technology major and also pose new challenges. Facing the rapid transformation of the industry, higher vocational colleges must break away from traditional thinking patterns, take school-enterprise dual-element education as the starting point, deepen the integration of industry and education, build a platform for deep integration of industry and education, reconstruct a curriculum system integrating "post, course, competition, and certificate," build a high-level "dual-qualified" team, and establish a long-term mechanism for mutual benefit and win-win, effectively solving the pain points in current talent cultivation, and cultivating high-quality technical and skilled talents that meet the requirements of new quality productive forces.

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