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Research on Curriculum Ideological and Political Education in Higher Vocational Colleges Driven by Both New Infrastructure Empowerment and Integration of Production and Education

Yongfeng Li, Hu Sun*, Zhuyao Du, Rong Chen, Jia He

School of architecture and thermal engineering, Shaanxi Institute of Technology, Xian Shaanxi, 710300, China

Corresponding author: Hu Sun, 632193711@qq.com

Abstract: Against the dual backdrop of the in-depth advancement of the national new infrastructure strategy and the deepened development of industry-education integration in vocational education, curriculum ideological and political education in higher vocational colleges is confronted with practical challenges such as insufficient technical empowerment and lack of collaborative mechanisms. Taking the course Highway Construction Organization and Budget Estimation as the research carrier, this paper proposes a "three-dimensional integration" theoretical framework of "new infrastructure empowerment - industry-education integration - curriculum ideological and political education", systematically analyzes the collaborative education mechanism of the three, explores the practical path of in-depth integration of "technology + ideological and political education + industry", and constructs a dynamic and multi-dimensional evaluation system. Research shows that this model can effectively realize the organic unity of technical and skill imparting, professional quality cultivation and ideological and political value guidance, providing a replicable and promotable innovative paradigm for the high-quality development of curriculum ideological and political education in higher vocational colleges.

KeyWords: New Infrastructure; Industry-Education Integration; Curriculum Ideological and Political Education

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1.Research Background

At present, China is in a critical period of implementing the new infrastructure strategy, and new technologies such as intelligent construction and green transportation are accelerating the reshaping of the development pattern of the highway industry. This has put forward new requirements for the training of vocational transportation professionals, including "strong technology, comprehensive literacy, and firm value". The 2020 Guiding Outline for the Construction of Ideological and Political Education in Higher Education Curriculum issued by the Ministry of Education clearly states that it is necessary to "make all types of courses and ideological and political courses go in the same direction and form a collaborative educational effect"[1]. As the most closely related type of education to the industry, vocational education must base its curriculum ideological and political construction on the characteristic of "combining engineering and technology", and achieve a deep integration of professional education and ideological and political education.

Emphasize that ideological and political education courses in vocational education should be based on professional characteristics, integrating professional spirit and craftsmanship into the curriculum system[2]; From a theoretical and logical perspective, it is proposed that curriculum ideology should achieve a trinity of "knowledge imparting, ability cultivation, and value guidance". In the field of engineering, some studies attempt to embed ideological and political elements such as professional ethics and integrity in courses such as preliminary budgeting and construction organization, but most of them are fragmented and lack systematic design. With the advancement of the new infrastructure strategy, the academic community has begun to pay attention to the impact of technological changes on vocational education. Under the background of new infrastructure, vocational education needs to accelerate its digital transformation and build a teaching model that integrates online and offline teaching[3-4]; Taking civil engineering as an example, explore the integration path of intelligent construction technology and talent cultivation[5-6]. However, existing research mostly focuses on the application level of technology and fails to organically combine the technological attributes of new infrastructure with the value attributes of ideological and political education[7]. Overall, existing research has achieved certain results in a single dimension, but there are significant gaps in the synergy of new infrastructure, industry education integration, and curriculum ideology and politics[8-9]. There are still problems in the current ideological and political practice of higher vocational courses, such as the disconnection between the application of new infrastructure technology and the exploration of ideological and political value, insufficient coordination between industry education integration practice and ideological and political education, and the mismatch between curriculum ideological and political evaluation and professional training objectives. In this context, exploring the curriculum ideological and political model under the dual drive of new infrastructure and industry education integration has become the key to solving the problem of vocational education.

2.Construction of the "Three Dimensional Fusion" Theoretical Framework

2.1 Theoretical Basis: Dual Support of Systems Theory and Synergy Theory

Systems theory holds that things are an organic whole composed of interconnected elements, and their function is greater than the sum of each element. Regard new infrastructure, integration of industry and education, and curriculum ideology and politics as three core elements, which are not simply stacked, but form a synergistic effect through the interaction between the elements. The collaborative theory further points out that the orderly interaction of internal elements in the system is the key to achieving overall optimization, which provides methodological guidance for the analysis of the mechanism of "three-dimensional fusion".

In this dynamic system, each element not only maintains its independent core value but also serves as a catalyst to activate the potential of the other two components. New infrastructure, with its digital and intelligent features, breaks through the spatial and temporal limitations of industry-education integration and curriculum ideology and politics, enabling real-time resource sharing and collaborative innovation. Industry-education integration, in turn, provides a practical scenario for curriculum ideology and politics, making ideological guidance more down-to-earth and targeted. Meanwhile, curriculum ideology and politics endows the development of new infrastructure and industry-education integration with a value core, ensuring that all collaborative practices move forward in the direction of cultivating high-quality talents with both moral integrity and professional ability. This mutually reinforcing relationship is exactly the embodiment of synergy theory in practical application, laying a solid theoretical foundation for the efficient operation of the three-dimensional fusion mechanism.

2.2 The core connotation and interactive logic of "three-dimensional fusion"

The three-dimensional integration theoretical framework of "New Infrastructure Empowerment - Industry Education Integration - Curriculum Ideology and Politics" includes three core dimensions: the first is the technology empowerment dimension, which uses new infrastructure technologies such as intelligent construction organization and low-carbon cost management as carriers to explore ideological and political elements such as national strategy, innovation spirit, and ecological concept; The second dimension is collaborative education, which transforms the professional ethics and craftsmanship spirit of enterprises into ideological and political education resources through the integration of industry and education models such as school enterprise dual main sports personnel and modern apprenticeship system; The third is the dimension of value guidance, constructing a three in one educational goal of "technical skills professional ethics ideological

and political values", and achieving resonance between knowledge imparting and value guidance.

The interactive logic of the three is manifested as follows: new infrastructure technology provides a digital and intelligent practical carrier for the integration of industry and education, industry education integration injects industry practice genes into curriculum ideology, and curriculum ideology endows the application of new infrastructure technology and the integration of industry and education with value soul, forming a closed-loop education system of "technical support industry collaboration value guidance".

3.The practical path of ideological and political education in the "three-dimensional integration" course

3.1 Teaching Content Reconstruction: Exploring Ideological and Political Elements in New Infrastructure Scenarios

Based on the course of "Highway Construction Organization and Preliminary Budget" as the core, reconstruct the teaching content according to the logic of "professional knowledge+ideological and political elements+industry demand". In the "Construction Schedule Planning" module, combining BIM+GIS intelligent schedule management technology, integrating the analysis of the "Transportation Power" strategy and the cultivation of teamwork spirit; In the "Engineering Cost Estimation" module, focusing on the pricing of green and low-carbon materials, incorporating the concept of sustainable development and ecological responsibility education; In the "Construction Scheme Comparison" module, through the analysis of smart high-speed construction cases, students' awareness of technological innovation and the quality of overcoming difficulties are cultivated. By establishing a mapping table of "professional knowledge points ideological and political elements industrial needs", the organic connection between ideological and political content and professional teaching can be achieved[10]. When explaining the construction organization of prefabricated bridges, not only are technical points such as component prefabrication and hoisting introduced, but also super engineering cases such as the Hong Kong Zhuhai Macao Bridge are combined to explain the scientific research spirit and national engineering strength behind the "Great Nation Heavy Machinery", so that students can enhance their national pride in technical learning.

3.2 Development of Teaching Resources: Building an Intelligent Resource Ecology for School Enterprise Collaboration

Teaching resources are the key carrier for the implementation of the "three-dimensional integration" model. Adopting the model of "school enterprise data sharing, technology co research, and resource co construction", jointly developing a digital resource library of "new infrastructure+curriculum ideological and political education" with industry enterprises. The resource library consists of three major modules: firstly, a typical engineering case library, which includes cases of new infrastructure projects such as smart highways and low-carbon highways. Each case has three sub columns: "Technical Analysis", "Ideological and Political Highlights", and "Industry Connection", which not only explain the technical principles of intelligent monitoring systems, but also extract the craftsmanship spirit of "striving for excellence and pursuing excellence"; The second is the virtual simulation project library, which uses VR technology to restore scenes such as tunnel construction and roadbed cost. Students can master the technical points through immersive operations, and receive responsibility education in the "construction safety accident simulation" section; The third is the ideological and political micro course video library, which collects a series of micro courses recorded by enterprise technical experts and industry model workers, showcasing their professional insights and value pursuits in frontline work.

3.3 Construction of Teaching Staff: Building a "Dual Teacher and Dual Ability" Ideological and Political Education Team

The teaching staff is the core force in implementing the "three-dimensional integration" model. Build a three in one teaching team consisting of on campus teachers, enterprise mentors, and ideological and political experts, and enhance the team's ideological and political education capabilities through "special training, mutual recruitment between schools and enterprises, and joint teaching and research". One is to empower teachers through specialized training, regularly organizing them to participate in specialized training on topics such as "Integration of New Infrastructure Technology and Curriculum Ideology and Politics" and "Integration of Industry and Education Education Mechanism". The second is mutual employment and

exchange between schools and enterprises, arranging teachers on campus to work in enterprises for training, participating in real engineering project construction, understanding the latest technology and ideological and political education needs of the industry, and hiring senior engineers from enterprises as part-time teachers to undertake practical teaching and ideological and political case explanation tasks.

3.4 Innovation of Teaching Mode: Building a Blended Teaching System with School Enterprise Collaboration

Adopting a blended learning model of "online self-learning+offline practice deepening+enterprise field research". Online, relying on the digital resource library jointly built by schools and enterprises, students complete tasks such as "virtual simulation operation+ideological and political micro course learning+case analysis and discussion" through the online platform. Teachers track learning data through the platform and assign personalized assignments accordingly; Offline teaching is divided into "theoretical lectures+project training". In theoretical courses, "problem oriented+case teaching" is used to guide students to think about the concept of green development through the question of "how to reduce carbon emissions from highway construction"; Implement "project driven teaching" in practical training courses, divide students into groups of 6-8 people, and use real enterprise projects as task carriers to complete the entire process from construction organization design to cost preparation. Teachers and enterprise mentors work together to guide and integrate professional ethics education such as teamwork and cost control into project implementation.

3.5 Optimization of Evaluation System: Establishing a Dynamic and Multidimensional Evaluation Mechanism

Construct a "three-dimensional twelve index" evaluation system from three dimensions: technical skills, professional ethics, and ideological and political values. Setting indicators such as intelligent cost software operation and construction plan design in the dimension of technical skills; The dimension of professional ethics includes indicators such as team collaboration and sense of responsibility; The dimensions of ideological and political values include indicators such as patriotism and green concepts. The Analytic Hierarchy Process is used to determine the weights of indicators, with technical skills accounting for 40%, professional ethics accounting for 35%, and ideological and political values accounting for 25%. Introduce a diversified evaluation subject of "student self-evaluation peer evaluation teacher evaluation enterprise evaluation", combined with process evaluation (classroom performance, project practice records) and outcome evaluation (assessment scores, enterprise feedback), to achieve dynamic and accurate evaluation process. Develop a "Course Ideological and Political Evaluation Management System" to automatically collect student learning data, generate "Personal Growth Reports" and "Class Overall Analysis Reports", and provide data support for teaching improvement. In the assessment of the "Highway Engineering Cost Compilation" project, not only is the accuracy of students' cost results (technical skills) evaluated, but their innovative consciousness (professional ethics) is also evaluated through the "Cost Optimization Suggestions" in the project report, and their ecological concept (ideological and political value) is evaluated through the "Green Material Selection Instructions".

3.5.1 Teaching Content Reconstruction: Exploring Ideological and Political Elements in New Infrastructure Scenarios

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on the digital resource library jointly built by schools and enterprises online, develop virtual simulation projects to enable students to learn technology and gain insights into ideological and political education through simulating smart highway construction scenarios; Establish a joint teaching and research group composed of teachers and enterprise engineers offline, transform real enterprise projects into teaching cases, and integrate professional ethics education into the practical training process; Regularly organize students to study at leading enterprises in the industry, and through communication with frontline technical personnel, they can intuitively experience the spirit of craftsmanship and innovative culture.

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4.Practical achievements

Since January 2025, the teaching pilot program for civil engineering related majors in Shaanxi Defense Industry Vocational and Technical College for the class of 2025 has been carried out. Through a one-year practice, the "three-dimensional integration" model has achieved significant results, manifested as "three improvements and two breakthroughs".

Significant improvement in students' comprehensive abilities: Firstly, there has been a significant improvement in professional skills, with pilot class students winning 5 awards in the provincial vocational skills competition, an increase of 60% compared to the previous session. Secondly, there has been a significant improvement in professional ethics. Through feedback from internships in enterprises, students' team collaboration, communication, and problem-solving abilities have been scored 10 points higher than the average score of non pilot classes. The overall satisfaction rate of graduates from enterprises has increased from 82% to 93%; The third is the deep internalization of ideological and political consciousness. A questionnaire survey shows that 87% of students have a deep understanding of the mission and responsibility of highway builders, and 92% of students believe that learning new infrastructure technologies enhances their patriotism. The number of students actively participating in social practice activities such as "green campus construction" and "rural road research" has increased compared to before the pilot.

Continuous breakthroughs in teaching reform achievements: Firstly, significant progress has been made in the construction of teaching resources, with a cumulative visit volume of 10000 to the digital resource library jointly built by schools and enterprises. Secondly, research and teaching achievements continue to emerge, with the team publishing 3 papers related to ideological and political education in courses and applying for 1 provincial-level teaching reform project. The third is to deepen the cooperation between schools and enterprises, and jointly establish a "Course Ideological and Political Training Base" with multiple companies, forming a good situation of "school enterprise collaboration, mutual benefit and win-win".

5.Research prospects

Although the "three-dimensional integration" model has achieved certain results in practice, it still faces some challenges, such as the incomplete establishment of a long-term mechanism for school enterprise cooperation in education, and the need to improve the accuracy of intelligent evaluation tools. Future research can be deepened in the following four directions.

5.1 Expansion Mode Application Fields and Levels

On the one hand, the "three-dimensional integration" model will be promoted from the course of "Highway Construction Organization and Preliminary Budget" to other vocational civil engineering majors such as construction engineering technology, engineering cost, municipal engineering technology, etc., forming a "civil engineering professional course ideological and political cluster"; On the other hand, exploring cooperation with application-oriented undergraduate

colleges, building a "vocational college undergraduate" integrated curriculum ideological and political system, and achieving collaborative education at different educational levels. At the same time, we will attempt to apply the model to the field of vocational skills training, providing "technology+ideological and political" continuing education services for industry employees, and helping them improve their professional ethics.

5.2 Develop intelligent ideological and political evaluation tools

Collaborate with experts in the fields of computer science and educational technology to develop a "Course Ideological and Political Intelligent Evaluation System" using big data and artificial intelligence technology. By analyzing textual and behavioral data such as students' classroom speeches, project reports, and practical performance, and using technologies such as natural language processing and sentiment analysis, automatic evaluation and dynamic tracking of the internalization effect of students' ideological and political values can be achieved. Establish a 'student ideological and political growth model', develop personalized ideological and political education plans for each student, and enhance the accuracy and effectiveness of ideological and political education.

5.3 Building a long-term mechanism for school enterprise collaboration

Suggest that the government introduce more incentive policies and provide tax exemptions, credit points, and other benefits to enterprises participating in ideological and political education courses, in order to stimulate their intrinsic motivation to participate; The school and the enterprise signed a "Curriculum Ideological and Political Co construction Agreement", clarifying the rights and obligations of both parties in resource development, teacher recruitment, teaching implementation, and establishing a cooperation mechanism of "benefit sharing and risk sharing"; Establish the "Industry Curriculum Ideological and Political Alliance", unite various forces such as universities, enterprises, and industry associations to jointly develop standards for curriculum ideological and political construction, promote resource sharing and mutual recognition of achievements.

5.4 Deepen the integration and innovation of new infrastructure technology and ideological and political education

Track the application of cutting-edge new infrastructure technologies such as 5G, IoT, and digital twins in the highway industry, timely explore their ideological and political elements, systematic thinking in digital twin technology, and collaborative concepts in IoT technology. Explore the teaching mode of "metaverse+curriculum ideological and political education", use metaverse technology to construct virtual highway construction scenes, allow students to experience the entire process of building a "transportation power" in a virtual environment, and enhance the immersion and attractiveness of ideological and political education. At the same time, studying the impact of new infrastructure technologies on professional ethics, such as the fairness of intelligent algorithms and the importance of data security, integrating them into ideological and political education courses, and cultivating students' awareness of technological ethics.

6.Conclusion

Under the dual drive of new infrastructure empowerment and integration of industry and education, the ideological and political education of higher vocational courses is an innovative exploration of implementing the fundamental task of moral education and talent cultivation in vocational education in the new era. It is also an inevitable requirement for responding to industrial changes and cultivating high-quality technical and skilled talents. The "three-dimensional integration" model breaks the traditional situation of "two skins" between professional teaching and ideological and political education through the construction of theoretical frameworks, innovation of practical paths, and optimization of evaluation systems, achieving the organic unity of technology, industry, and ideological and political education. In practice, this model not only enhances students' comprehensive abilities, but also promotes the deep development of teaching reform and school enterprise cooperation. In the future, it is necessary to further deepen the collaboration between schools and enterprises, strengthen technical support, improve guarantee mechanisms, and continue to explore the innovative path of "new infrastructure+integration of industry and education+curriculum ideology and politics", so that curriculum ideology and politics can truly become the "soul project" of vocational education talent cultivation, cultivate more high-quality technical and skilled talents who combine morality and technology, and integrate knowledge and practice for the implementation

of national strategies and industrial upgrading, and contribute wisdom and strength to the high-quality development of vocational education.

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Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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