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# Digital Empowerment in the Reconstruction of Curriculum-Based Ideological and Political Education: A Case Study of Civil Engineering Majors

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**ABSTRACT:** Curriculum-based ideological and political education (CIPE) is a strategic initiative for implementing the fundamental task of fostering virtue through education. With the deep integration of digital technologies into the field of education, traditional CIPE is facing new pressures for transformation in terms of content design, instructional approaches, and evaluation mechanisms. Taking civil engineering majors as a case study, this paper analyzes the current status and challenges of CIPE construction under the specific characteristics of the discipline. On this basis, it proposes a digitally reconstructed CIPE framework centered on resource intensification, multi-dimensional digital learning environments, and whole-process formative evaluation. Drawing on the teaching practice of the Bridge Engineering course, the study demonstrates how digital technologies can empower the precise achievement of CIPE objectives and presents concrete implementation strategies and optimization recommendations. The findings indicate that this model enhances students' value identification, strengthens professional confidence, and fosters a stronger sense of social responsibility, thereby providing a reference for promoting the digital transformation of CIPE in higher education institutions.

**KEYWORDS:** Curriculum-based ideological and political education; Digital education; Civil engineering majors; Educational system; Whole-process evaluation

## I. INTRODUCTION

In the context of higher education in the new era, curriculum-based ideological and political education (CIPE) is no longer solely the responsibility of instructors of political theory courses; rather, it has become a shared educational mission undertaken by all faculty members and embedded across the entire curriculum system [1]. The Guidelines for the Construction of Curriculum-Based Ideological and Political Education in Higher Education Institutions explicitly state that ideological and political education should be integrated throughout the entire teaching process, so as to achieve the organic unity of knowledge transmission, ability cultivation, and value guidance. Meanwhile, the Report to the 20th National Congress of the Communist Party of China called for advancing the digitalization of education and emphasized promoting educational reform through information technology, marking the entry of educational digitalization into a strategically accelerated phase.

Civil engineering majors constitute an important component of application-oriented universities. Their professional courses are not only highly technical and practice-oriented, but also closely related to national infrastructure development and green development strategies, thereby possessing inherent ideological and political educational resources. However, in the process of course implementation, problems such as fragmented content, disconnection between ideological elements and professional knowledge, and the lack of immersive learning experiences still persist. Traditional approaches that forcibly or abruptly insert ideological content into professional courses often fail to resonate with students, resulting in unsatisfactory teaching outcomes.

The rapid development of digital technologies—particularly virtual reality, artificial intelligence, and big data analytics—has provided entirely new implementation approaches and evaluation tools for curriculum-based ideological



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and political education. By constructing interactive learning platforms, scenario-based teaching environments, and dynamic evaluation mechanisms, it is possible to effectively promote the deep integration of professional courses and ideological education, thereby enabling a genuine transition from superficial incorporation to profound integration.

Against the backdrop of educational digitalization, this study integrates the practical teaching context of civil engineering courses to propose a digitally empowered curriculum-based ideological and political education system that is operable, assessable, and scalable. Taking the Bridge Engineering course as an example, the study conducts a practical exploration and provides a reference framework for the implementation of curriculum-based ideological and political education in other science and engineering disciplines.

### II. ANALYSIS OF THE NECESSITY FOR THE DIGITALIZATION OF CURRICULUM-BASED IDEOLOGICAL AND POLITICAL EDUCATION

#### 2.1 Problems Existing in the Current Implementation of Curriculum-Based Ideological and Political Education

Although curriculum-based ideological and political education (CIPE) has received strong policy-level attention and has gradually been integrated into various university courses, multiple difficulties and challenges remain in its practical implementation within professional courses. First, CIPE resources are often fragmented, with instructors largely relying on independently collected cases, videos, and textual materials. This leads to inconsistent content standards, redundant development, and difficulties in forming a systematic resource framework [3]. Second, teaching approaches remain relatively traditional, predominantly centered on PowerPoint-based lectures, with limited classroom interaction and insufficient immersive or visualized support, making it difficult to stimulate students' emotional resonance and deep engagement [4]. Third, evaluation mechanisms for CIPE are generally underdeveloped and lack scientific quantitative indicators. Most rely on uniform and subjective assessment methods, which fail to accurately reflect students' ideological growth and value development [5]. Finally, some instructors demonstrate limited capacity in extracting ideological elements and integrating them with information technologies, due to insufficient systematic training and practical support, thereby affecting course design quality and implementation effectiveness [6]. Collectively, these issues constrain the in-depth advancement of CIPE within professional education.

#### 2.2 Advantages of Digital Technologies in Empowering Curriculum-Based Ideological and Political Education

Driven by a new wave of educational digitalization, digital technologies have not only transformed the form of education but have also brought about a systematic shift in educational paradigms. As an important vehicle for value guidance, curriculum-based ideological and political education (CIPE) has gained new opportunities for development through digital empowerment. First, in terms of resource development, artificial intelligence and big data analytics enable the automatic matching of professional knowledge points with ideological modules, facilitating the construction of a well-structured and standardized "CIPE resource repository," thereby significantly enhancing resource usability and shareability [7]. Second, regarding instructional methods, the application of virtual reality (VR) and augmented reality (AR) technologies allows major engineering scenarios to be realistically recreated, providing students with immersive learning experiences and deepening their understanding of both professional knowledge and underlying value connotations [8]. Third, in terms of evaluation systems, learning behavior data analysis can be employed to dynamically track and visually present the attainment of CIPE objectives, making educational outcomes visible, assessable, and improvable [9]. Moreover, diversified digital dissemination channels—such as WeChat public accounts, short-video platforms, and learning applications—enable seamless integration between in-class and out-of-class activities, as well as multi-scenario collaborative dissemination. This broadens the educational impact and extends the spatial and temporal dimensions of value guidance [10].

#### 2.3 Unique Advantages of Integrating Curriculum-Based Ideological and Political Education into Civil Engineering Programs

As a discipline serving national infrastructure development, civil engineering inherently contains rich ideological and political educational resources and broad space for value guidance. The field is closely aligned with national development strategies, and numerous landmark engineering projects embody profound spiritual connotations and patriotic sentiments. For example, the Three Gorges Project, the South-to-North Water Diversion Project, the Qinghai–Tibet Railway, and the Hong Kong–Zhuhai–Macao Bridge not only demonstrate China's capacity for independent technological innovation in engineering but also reflect the responsibility, perseverance, and selfless dedication of their builders. By deeply exploring the historical context, scientific breakthroughs, and personal narratives behind these representative projects, values such as patriotism, craftsmanship, and green development can be effectively integrated



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into professional teaching. This approach helps stimulate students' national pride and professional identity, thereby achieving the deep integration of knowledge transmission and value cultivation [11–13]. The implementation of curriculum-based ideological and political education within civil engineering programs thus possesses clear objectives, abundant materials, and well-defined pathways, laying a solid foundation for constructing an educational system that balances disciplinary rigor with ideological depth.

### III. DESIGN OF THE RECONSTRUCTION PATH OR THE CURRICULUM-BASED IDEOLOGICAL AND POLITICAL EDUCATION SYSTEM

To effectively address the problems currently encountered in the practice of curriculum-based ideological and political education—such as fragmented resources, single instructional approaches, and lagging evaluation mechanisms—this study proposes, under the background of digitalization, a three-dimensional reconstruction path characterized by resource platform intensification, immersive multi-dimensional learning environments, and intelligent whole-process evaluation. By establishing an operable and sustainable digital CIPE practice framework, the model aims to achieve the deep integration of moral cultivation and professional education.

#### 3.1 Construction of an Intensified Curriculum-Based Ideological and Political Education Resource Platform

The systematic construction of curriculum-based ideological and political education (CIPE) resources constitutes the foundation of a digitally empowered educational system. To address the problems of fragmented resources and inconsistent content standards in traditional teaching, high-quality ideological resources from both within and outside the university should be integrated to establish a university-level “CIPE Resource Center.” This center would enable unified collection, structured reorganization, and modular dissemination of resources. Platform resources should be organized into “micro-modules” as basic units, designed around representative themes such as “Bridge Safety Responsibility,” “Green Construction Philosophy,” and “Stories of Bridge Engineering Heroes,” thereby forming pedagogically guided content units. Instructors may flexibly select and combine these modules according to teaching progress to generate customized “ideological teaching resource packages,” which may include case-study videos, textual and visual materials, discussion questions, and task descriptions to support differentiated instructional needs. Furthermore, the platform should be compatible across multiple terminals, allowing synchronized access via personal computers, mobile devices, and tablets. This facilitates pre-class preparation, in-class participation, and post-class extension activities, thereby enhancing teaching interaction efficiency and fostering students' autonomous learning capabilities.

#### 3.2 Construction and Application of Multi-Dimensional Digital Learning Environments

Innovation in teaching environments is a crucial pathway for enhancing the immersive and experiential integration of curriculum-based ideological and political education (CIPE) content. By leveraging advanced technologies such as virtual reality (VR), augmented reality (AR), and metaverse-based scenario design, it is possible to transcend the limitations of physical classrooms and create a digitally integrated “virtual–real” teaching environment. In practical application, simulation platforms such as Unity or Unreal Engine can be used to develop bridge construction site simulation systems, enabling the virtual reconstruction of the entire engineering process, including bridge assembly, material inspection, and construction scheduling. This allows students to participate immersively in engineering practice, thereby deepening their understanding of concepts such as engineering responsibility and life safety. Moreover, task cards and guided questions can be embedded within the virtual scenarios—for example, “How can construction safety be ensured to prevent tragic accidents?”—to stimulate students' in-depth reflection and value-based decision-making. In addition, the platform may include “bridge culture experience zones,” such as exhibition halls on early national bridge development or memorial walls dedicated to engineering heroes. These spaces can showcase the spiritual significance and historical background of landmark projects such as the Yangtze River Bridge, thereby creating a CIPE environment characterized by warmth, depth, and emotional engagement.

#### 3.3 Construction of a Whole-Process Formative and Accompanying Comprehensive Evaluation Mechanism

The effectiveness of curriculum-based ideological and political education (CIPE) should not be reflected solely in classroom performance, but should extend throughout the entire process of students' cognitive development, value formation, and behavioral decision-making. To achieve this, it is necessary to construct a comprehensive evaluation mechanism covering the full chain of “pre-class, in-class, post-class, and summary” stages, with data-driven tools enabling process monitoring and visualization of outcomes. First, in the pre-class stage, learning surveys and background questionnaires can be employed to identify students' initial value perceptions and career expectations,



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thereby providing a basis for differentiated instruction. Second, during the teaching process, platform-based behavioral data monitoring and learning trajectory analysis can be used to track key indicators such as learning duration, participation frequency, and interaction activity in real time, allowing dynamic adjustment of teaching strategies. After class, outcome-oriented tasks—such as writing analytical reports on ideological cases, delivering thematic presentations, or proposing problem-solving plans—can be assigned to evaluate students' comprehensive expression abilities and depth of value understanding. Finally, based on data collected at each stage, the system can generate visualized radar charts and individual growth portfolios to present a holistic picture of educational outcomes. This not only facilitates precise evaluation by instructors but also supports students' self-awareness and reflection, thereby truly achieving the educational objectives of making CIPE outcomes visible, measurable, and improvable.

### IV. EXPLORATION OF PRACTICAL IMPLEMENTATION PATHWAYS IN THE BRIDGE ENGINEERING COURSE

#### 4.1 Course Background and Instructional Design

As one of the core courses in civil engineering, Bridge Engineering covers key technologies including bridge design, construction, and maintenance, serving as an essential link between students' theoretical knowledge and practical competencies. The teaching objectives are defined as follows:

Knowledge objective: To master various bridge structural systems and design methods;  
Competency objective: To develop the ability to evaluate bridge schemes and plan construction organization;  
Ideological objective: To strengthen students' sense of responsibility, cultivate craftsmanship spirit, promote green development philosophy, and foster a commitment to serving the nation through science and technology.

#### 4.2 Design of Ideological Case Integration

Representative case studies were carefully selected and integrated with major national engineering projects to design teaching scenarios characterized by both depth and emotional resonance:

Case 1: The Spirit of the Hong Kong–Zhuhai–Macao Bridge Project Teaching focus: World-leading design complexity and technological breakthroughs in the integrated construction of bridge, island, and tunnel systems. Ideological elements: Independent innovation, sense of responsibility in the new era, and serving the nation through technological advancement Technical support: VR-based immersive tunnel-crossing experience combined with technical animation explanations.

Case 2: Reflection on a Bridge Safety Accident Case scenario: A serious bridge collapse accident in a certain region resulting in casualties. Guiding questions: What responsibilities should engineers bear in such incidents? How can design strategies prevent similar tragedies? Teaching method: Real-time polling via the Rain Classroom platform combined with group debates.

Case 3: Green Construction and Low-Carbon Bridge Design Introduction of the “dual-carbon” goals and discussion of green materials and sustainable construction technologies Associated task: Students complete a “Future Green Bridge Concept Proposal” and upload it to the digital platform for presentation and review.

#### 4.3 Teaching Effectiveness Feedback

After the implementation of this teaching scheme at an application-oriented university in 2024, a total of 120 students participated in the course feedback survey. The results are summarized as follows:

Recognition of ideological integration: Over 95% of students agreed that the integration of ideological elements with professional content was natural and well-aligned.

Teaching interaction and participation: The average number of daily active replies in the online discussion forum increased by 67%, and the post-class assignment submission rate reached 98%.

Representative student feedback: “Through the stories of bridge projects, I realized for the first time that engineering technology also carries the responsibility of national development.”

### V. TEACHING EVALUATION AND OPTIMIZATION RECOMMENDATIONS

Based on platform data analysis and student feedback survey results, it can be concluded that the overall teaching effectiveness of the Bridge Engineering course improved significantly after the implementation of the digitally empowered curriculum-based ideological and political education (CIPE) scheme. Specifically, while mastering professional knowledge, students developed a deeper understanding of engineering responsibility, social value, and national development strategies, achieving a dual enhancement of professional identity and value identification.



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Classroom participation and learning enthusiasm increased markedly, with students actively engaging in online discussions and post-class assignments, and expressing their personal viewpoints and ideological positions. In addition, instructors demonstrated greater confidence in integrating ideological content into course design and instructional practice, and both teaching satisfaction and course recognition improved substantially. However, certain issues also emerged during implementation. For example, platform stability requires further improvement under high-frequency usage, and some virtual reality equipment experienced lagging problems, affecting the immersive learning experience. Moreover, a small number of instructors still showed limitations in selecting and integrating ideological content, indicating the need for systematic training to enhance instructional design capabilities. In addition, the course platform's analysis of students' learning behavior data remains insufficiently in-depth, making it difficult to achieve truly personalized instructional support. In response to these issues, the following recommendations are proposed: first, strengthen professional development programs that integrate CIPE and digital technology, thereby enhancing teachers' capacity to effectively combine instructional tools and ideological content; second, introduce advanced data mining techniques, such as AI-driven analytics, to improve the depth and precision of learning behavior tracking, enabling accurate student profiling and personalized guidance; third, establish regional digital CIPE resource-sharing platforms to promote inter-university collaboration and resource co-construction, thereby facilitating broader coverage and deeper integration of CIPE across institutions.

### VI. CONCLUSIONS

As an important component of the higher education talent cultivation system, curriculum-based ideological and political education (CIPE) must be empowered by digital technologies in the new era to achieve a profound transformation from passive instruction to active resonance. Taking civil engineering majors as the research focus, this study constructed a systematic digitally empowered CIPE framework and conducted an empirical exploration within the Bridge Engineering course. The findings indicate that, through reform pathways characterized by resource intensification, diversified learning environments, and intelligent evaluation mechanisms, the approach not only enhances the educational function of professional courses but also provides a paradigmatic reference for the high-quality development of CIPE in higher education institutions.

In the future, further exploration should focus on university-enterprise collaboration in developing digital platforms, promoting cross-disciplinary integration of ideological content, and establishing long-term tracking mechanisms for evaluating CIPE effectiveness. Such efforts will help build a full-process, full-chain, and ecosystem-oriented digital education system, thereby contributing to the cultivation of a new generation capable of undertaking the mission of national rejuvenation.

### VII. FUNDING

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### REFERENCES

- [1] Ministry of Education of the People's Republic of China. Guidelines for the Construction of Curriculum-Based Ideological and Political Education in Higher Education Institutions [EB/OL]. Available at: [https://www.gov.cn/zhengce/zhengceku/2020-06/06/content\\_5517606.htm](https://www.gov.cn/zhengce/zhengceku/2020-06/06/content_5517606.htm)
- [2] Central Committee of the Communist Party of China. Report to the 20th National Congress of the Communist Party of China [Z]. Beijing: People's Publishing House, 2022.
- [3] Hao, Deyong. The problem orientation, logical mechanism, and construction mechanism of curriculum-based ideological and political education. *Higher Education Research*, 2021, 42(7): 85–91.
- [4] Fan, Lidan; Li, Peitao; Xu, Ping; Jiao, Huazhe. Research on the construction pathway of curriculum-based ideological and political education based on case teaching of new civil engineering materials. *Higher Education Journal*, 2025(36): 175–179.
- [5] Liu, Rui. Research on the construction of a curriculum-based ideological and political education community in universities. *Ideological Front*, 2023, 49(1): 165–172.



## International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

- [6] Zhang, Shuhui; Gao, Leihong; Yang, Yang. Dilemmas and improvement strategies of blended teaching in curriculum-based ideological and political education in universities. *Theory and Practice of Education*, 2023, 43(3): 57–60.
- [7] Du, Zhenyu; Zhang, Meiling; Qiao, Fang. Teaching evaluation principles, standards, and operational strategies for curriculum-based ideological and political education in science and engineering courses. *Ideological and Theoretical Education*, 2020(7): 70–74.
- [8] Luo, Jingya; Li, Lishuo. Deepening professional course teachers' identification with curriculum-based ideological and political education. *China Higher Education*, 2021(9): 43–45.
- [9] Wang, Xiaoyan; Hu, Xiaoqin. Theoretical construction and practice of the “Internet+ curriculum-based ideological and political education” teaching model. *Education Teaching Forum*, 2022(33): 137–140.
- [10] Yu, Yuefan; Zhou, Xiaoyun; Yang, Xianmin. Construction of metaverse-based online-offline integrated (OMO) learning spaces and instructional model design. *Distance Education Journal*, 2022, 40(4): 14–22.
- [11] Miao, Fengchun. Educational digital transformation in the context of digital civilization change. *E-Education Research*, 2023, 44(2): 47–63.
- [12] Qiu, Wei; Nan, Jun; Liu, Bingfeng. Implicit integration of curriculum-based ideological and political education with online teaching: A case study of the “Water Engineering Construction” course. *Research in Higher Engineering Education*, 2020(6): 57–61.
- [13] Li, Qian; Liu, Wanhai. Perspective shift and conceptual elevation of curriculum-based ideological and political education. *Heilongjiang Researches on Higher Education*, 2023(3): 149–154.



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