



Paradigm Shift of BIM + Ideological and Political Education for Moral Cultivation in Construction Cost Engineering in the Digital Age

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Abstract: Addressing the separation between technology orientation and value education in BIM-related courses, this paper proposes a new "BIM + Ideological and Political Education" paradigm. Its theoretical connotation is elaborated from three dimensions: value, content, and methodology. Taking construction cost engineering as an example, a four-in-one implementation framework of "objectives, content, methods, and evaluation" is constructed. The essence of this paradigm is not a simple superimposition of technology and ideological education, but the use of digital technology to reshape the spatiotemporal boundaries and experiential methods of moral education, achieving a paradigm shift from instrumental rationality to value rationality.

Keywords: BIM + Ideological and Political Education, Fostering Virtue and Cultivating Talents, Construction Cost Engineering Major, Curriculum-based Ideological and Political Education

1. Introduction

The application of technologies such as BIM requires cost engineers not only to perform quantity takeoff and pricing [1], but also to understand the overall project landscape, identify cost risks, and make value judgments within digital models. However, a common dilemma persists in construction cost engineering teaching: BIM courses focus on "how to model," while ideological and political education addresses "why to be a virtuous person." BIM courses thus degenerate into mere skills training [2], where students master operations but lack critical thinking, while ideological and political education falls into empty preaching [3], detached from professional contexts [4].

Therefore, it is essential to truly understand the relationship between BIM and ideological and political education. Taking the undergraduate construction cost engineering program as a sample, this paper proposes a new paradigm of "BIM + Ideological and Political Education" for moral cultivation, elucidating its theoretical logic and practical pathways, aiming to provide a new framework for cultivating engineering talents in the digital age.

2. Theoretical Logic of 'BIM + Ideological and Political Education'

2.1 Structural Coupling Between BIM's Technical Characteristics and Ideological and Political Values

BIM's core feature is its "systematic nature" as an integrated platform for the entire building lifecycle. From design to construction to operation [5], the BIM model carries geometric and parametric data. Three technical characteristics of BIM demonstrate a natural "affinity" with ideological and political values:

(1) Collaboration and the Spirit of Collectivism: BIM's core value lies in multi-party collaboration. Different stakeholders work on the same model, sharing information and resolving conflicts. This logic conveys that collaboration outperforms individual effort and the whole is greater than the sum of its parts. When students perform clash detection and collaborative modeling, they not only learn technology but also experience the ethics of responsibility within the 'engineering community.'

(2) Whole Lifecycle Perspective and Social Responsibility: BIM spans the entire process of a building 'from cradle to grave,' requiring users to possess a whole lifecycle cost awareness and a vision of sustainable development. 'Cost control' is no longer simply about 'saving money,' but involves complex value judgments concerning the environmental impact of material selection, the social costs of construction methods, and the long-term benefits of building operation. This serves as an excellent entry point for social responsibility education.

(3) Information Transparency and Engineering Ethics: The traceability of the BIM model means that every change and every decision leaves a trail. This 'transparency' itself helps shape a certain professional ethic: cost engineering is not 'cooking the books,' but rather fact-based, honest judgment. When students perform change management and claims analysis in a BIM environment, they face not only technical problems but also the ethical question of 'what is right.'

2.2 From Instrumental Rationality to Value Rationality: The Essence of the Paradigm Shift

‘BIM + Ideological and Political Education’ represents a shift from ‘instrumental rationality’ to ‘value rationality,’ encompassing three levels:

(1) Cognitive level: BIM is redefined from "modeling software" to a "simulation environment for engineering decision-making." Students complete simulated responses to real problems and a rehearsal of professional responsibilities.

(2) Practical level: Technical operations and value judgments are welded together. In rebar takeoff teaching, students learn not only "how to calculate" but also the dual impact of errors on quality and cost, establishing that "precision is responsibility."

(3) Reflective level: Technical practice becomes a medium for value reflection. Each "miscalculation-correction" during BIM training is an embodied experience of integrity and rigor, not an abstract sermon.

3. Practical Framework of ‘BIM + Ideological and Political Education’

Based on the above theoretical logic, this paper constructs a four-in-one implementation framework of ‘BIM + Ideological and Political Education’ encompassing ‘objectives, content, methods, and evaluation,’ and elaborates on its application using core courses of the construction cost engineering major as scenarios.

3.1 Objective System: A Three-Dimensional Integrated Cultivation Framework

The educational objectives of ‘BIM + Ideological and Political Education’ can be summarized as a "three-dimensional integration" structure: Knowledge Dimension, Competence Dimension, Value Dimension.

The three dimensions are nested: the value dimension permeates knowledge and competence cultivation, and value judgment infuses technical operations. For example, in teaching BIM-based bill of quantities preparation, students not only master procedures but also reflect on what item omissions mean for both contractor and owner — a concrete manifestation of responsibility ethics education.

3.2 Content Carrier: Embedding Ideological & Political Elements

Embedding is not "labeling" but finding "resonance points" between technical nodes and value themes. Based on the curriculum structure, integration points are summarized as follows:

(1) Norm Awareness & Rule of Law. BIM modeling reinforces "understanding, following, and applying rules" through standards and specifications.

(2) Craftsmanship & Quality. Through multi-calculation comparison, students learn that "a slight error leads to huge deviation," reinforcing "precision is responsibility."

(3) Engineering Ethics and Integrity Education. Change management and claims analysis in BIM are natural vehicles for ethics education. In BIM5D Construction Simulation teaching, scenarios like "cost overrun—scheme adjustment" can guide students to discuss "how to choose when cost control conflicts with quality," fostering professional conscience through simulated decision-making.

(4) Patriotism and Mission. Through BIM models of mega-projects like the Hong Kong-Zhuhai-Macao Bridge, students develop professional identity and a sense of mission.

(5) Green & Low-Carbon. BIM energy analysis and carbon calculation enable tasks like "envelope scheme energy comparison," helping students grasp the "dual carbon" strategy through data.

3.3 Methodological Innovation: Immersive Value Education via Technology

The core innovation is using digital technology to reshape value education from listening to doing, and from passive reception to embodied experience.

(1) Blended Teaching and Context Creation. A online + offline blended teaching model is constructed using teaching platforms. Online components deliver materials on engineering cases and ethical dilemmas, while offline classroom sessions conduct BIM-model-based simulated decision-making and group debates, allowing students to experience the weight of professional responsibility through ‘doing.’

(2) Task-Driven Learning and Role-Playing. Multi-role tasks are designed in BIM training, enabling students to understand different perspectives and experience value conflicts through role-playing. Such perspective-taking serves as a means of cultivating empathy and social responsibility.

(3) Immersive Experience and Emotional Resonance. By leveraging technologies such as VR, students can ‘inspect’ the construction site within a virtual BIM model environment, identify safety hazards, and detect quality issues, thereby establishing the professional belief that ‘safety comes first, quality is fundamental.’ The emotional impact of immersive

experience far surpasses that of classroom lectures on safety regulations.

3.4 Evaluation Reform: From Outcome Assessment to Process Tracking

Evaluation shifts from ‘can operate?’ to ‘what value judgments?’ — outcome to process tracking. Strategies: document key decision justifications as evidence; include compliance and collaboration in scoring to assess values like rigor.

4. Implementation Safeguards and Key Issues

4.1 Teacher Capacity Transformation: From ‘Technical Coach’ to ‘Value Guide’

‘BIM + Ideological Education’ requires teachers to master BIM and possess ideological sensitivity. Approaches: (1) train BIM teachers to identify integration points; (2) establish joint lesson preparation to integrate technical and ideological content.

4.2 Teaching Resource Development: Case Base and Platform Support

A ‘BIM + Ideological and Political Education’ case base should be developed, collecting typical engineering cases that embody engineering ethics, craftsmanship spirit, and patriotism, accompanied by BIM models and teaching design plans; develop or integrate a BIM teaching platform that supports ‘ideological and political tagging,’ marking integration points within the model, allowing students to access relevant value guidance prompts at any time during operation.

4.3 Avoiding the ‘Two-Skin’ Phenomenon: Integration Rather than Collage

The risk is forcing political discourse into technical teaching, undermining value education. Ideological elements must grow from BIM's logic, not be pasted on.

5. Conclusion

The theoretical contribution of the new ‘BIM + Ideological and Political Education’ paradigm lies in revealing the structural conditions that make BIM a value carrier, and in demonstrating the possibility and necessity of integrating technical education with value education. Its practical value lies in providing a set of operable frameworks and methods for the curriculum-based ideological and political construction of the construction cost engineering major.

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