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Research on Teaching Strategies for Prefabricated-Building Construction Major Under the Background of Artificial Intelligence

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Abstract: With the in-depth integration of artificial-intelligence technology and building industrialization, the prefabricated-building industry is undergoing full-chain intelligent transformation covering design, production, construction, and operation and maintenance. This transformation brings unprecedented challenges as well as opportunities for talent cultivation in the traditional prefabricated-building construction major. This paper systematically explores the core problems existing in the teaching of the prefabricated-building construction major in the context of artificial intelligence. Firstly, it analyzes how AI technologies (such as BIM, Internet of Things, machine vision, intelligent robots, big-data analytics, etc.) reshape management, technological processes and decision-making modes on prefabricated-building construction sites. It further analyzes new requirements for knowledge structure, skill literacy and innovation capacity of construction-specialty talents brought by such changes. On this basis, this paper puts forward an integrated and dynamic teaching-strategy system oriented toward the future, covering multiple dimensions including curriculum-system reconstruction, teaching-scene innovation, faculty-competency improvement, evaluation-mode transformation and deeper integration of industry and education. It aims to cultivate compound high-end technical-skill talents who are capable of mastering intelligent tools, solving complex engineering problems and possessing capabilities of continuous learning and innovation.

Keywords: Artificial intelligence; Prefabricated building; Construction major; Teaching strategy; Intelligent construction

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1. Introduction

Featuring standardized design, factory-based production, prefabricated construction, integrated decoration, and information-based management, prefabricated buildings constitute an important path for the transformation and upgrading of the construction industry and the realization of green and sustainable development. In recent years, new-generation information technologies driven by artificial intelligence have penetrated the construction field with unprecedented depth and breadth, giving rise to the new paradigm of "intelligent construction". In prefabricated-building construction scenarios, artificial-intelligence technologies deconstruct and reconstruct traditional operation and management workflows from multiple levels. Image-recognition technologies based on deep learning are applied for component quality inspection and on-site safety monitoring; intelligent algorithms optimize construction schedules and resource allocation; robots automatically complete high-risk and complicated installation and welding work; digital-twin technology realizes accurate simulation and real-time regulation of the whole construction process through virtual-physical mapping [1].

Such profound technological changes bring risks of lag or even disconnection for the knowledge system and skill-training modes relied on by traditional teaching for the prefabricated-building construction major. At present, teaching contents in many colleges and universities still focus on manual and semi-mechanized techniques such as hoisting and connection of traditional prefabricated components, with insufficient coverage of emerging fields including intelligent-construction-equipment operation, data-stream management and human-robot collaboration. Teaching methods are mostly dominated by classroom lectures and static practical training, lacking effective connection with dynamic, complex and information-based real intelligent-construction scenarios. Therefore, how to systematically adjust teaching strategies so as to realize precise docking between the supply side of talent cultivation and the demand side of industrial intelligence has become a major urgent issue in prefabricated-building education [2]. Based on long-term industrial observation and teaching practice, this paper attempts to construct a teaching-strategy framework for the prefabricated-building construction major adapted to the artificial-intelligence era.

2. New business forms and new competency requirements for prefabricated-building construction empowered by AI technologies

To formulate effective teaching strategies, it is necessary to clearly understand how artificial-intelligence technologies change prefabricated-building-construction practices and what new competency requirements for talents are derived accordingly.

2.1. Digital management and control of the whole construction process

Core roles of BIM and digital twin. AI technologies inject new vitality into Building Information Modeling (BIM). BIM is no longer merely a static three-dimensional model, but a project data hub integrating multi-dimensional information such as schedule (4D), cost (5D), as well as safety and quality. Combined with sensing data from the Internet of Things (IoT), a "digital-twin" construction site can be built, which realizes synchronous mapping and interactive feedback with the physical construction site. This requires construction-specialty talents to not only "read" BIM models, but also "utilize" BIM data for construction simulation (collision inspection, optimization of construction procedures), accurate formulation of resource plans, as well as progress-deviation analysis and dynamic adjustment based on real-time data [3].

2.2. Intellectualization and robotization of construction equipment

Automated wall-panel installation robots, steel-bar-tying robots, survey-and-layout robots and other equipment have been applied on construction sites. In the future, construction technicians will gradually shift from direct operators to coordinators responsible for robot programming, scheduling, maintenance and human-robot collaboration. They need to understand the working principles and operational boundaries of robots, and be capable of commanding robots to finish tasks safely and efficiently in complex on-site environments.

2.3. Construction decision-making based on data and algorithms

AI algorithms can process massive historical project data and real-time sensing data, and provide data-driven decision-making support for comparison and selection of construction schemes, risk early-warning (e.g. hoisting risks of large-scale components), and intelligent identification of potential safety hazards (e.g. failure to wear safety helmets, intrusion into hazardous zones). Construction managers shall possess data literacy, understand the logic and limitations of algorithm outputs, convert data insights into effective management actions, and realize the transformation from “experience-driven” to “data-driven” decision-making modes.

2.4. Cross-integrated knowledge structure

The traditional knowledge structure of “civil engineering + component technology” is no longer sufficient for intelligent construction. Students need to supplement basic computer-science knowledge (e.g., Python programming for data processing), automation principles, sensor technologies, and even basic machine-learning concepts. The goal is not to train programmers, but to cultivate “engineering + digital” compound talents who can “communicate” with intelligent systems, put forward clear technical requirements and leverage tools to solve practical problems [4].

To sum up, talents for prefabricated-building construction under the AI background shall possess compound competency characteristics of “proficient in specialty, familiar with data, good at tool application, capable of collaboration and persistent in innovation”. This serves as the fundamental objective for teaching-strategy reform.

3. Teaching-strategy system for prefabricated-building construction major in the artificial-intelligence era

To cope with the above-mentioned challenges and cultivate talents meeting future industrial demands, systematic teaching reform must be carried out. A multi-level and integrated set of teaching strategies is proposed as follows.

3.1. Strategy 1: Reconstruct the “modular, dynamic and interdisciplinary” curriculum system

Break original disciplinary barriers and construct modular curriculum groups centered on the “intelligent-construction workflow”. For the basic module, while strengthening traditional core courses such as engineering mechanics, building materials, building construction, prefabrication technology and building structures, add general-education courses for digital literacy, including *Fundamentals of Artificial Intelligence and Big Data*, *Python for Engineering Applications*, and *Introduction to Internet-of-Things Technology*. For the core module, upgrade *Prefabricated-Building Construction Technology* to *Intelligent Prefabricated-Building Construction and Management*, and integrate new knowledge including full-process BIM application, principles and operation of intelligent construction equipment, collection and analysis of construction data, and digital-twin construction-site management. Offer *Intelligent-Construction Project Management*, which focuses on data-driven management of schedule, cost, quality and safety. For expansion and frontier modules, set up elective courses or workshops such as *Fundamentals of Construction Robotics*, *Application of Computer Vision in Construction*, and *Green and Intelligent Operation-Maintenance of*

Prefabricated Buildings, so as to keep curriculum contents updated synchronously with technological development. A dynamic-adjustment mechanism for curriculum contents shall be established to track the iterative progress of industrial technologies closely [5].

3.2. Strategy 2: Build intelligent teaching scenarios featuring "virtual-physical integration and human-machine interaction"

Constructing practical-training environments synchronized with or even moderately ahead of industries is critical for competency cultivation. It is necessary to build intelligent teaching scenarios featuring "virtual-physical integration and human-machine interaction" [6]. Introduce or develop high-fidelity virtual-simulation software for intelligent prefabricated-building construction. In virtual environments, students can conduct risk-free training, including simulation of complex-node construction, robot path planning, and decision-making for construction-organization optimization, and obtain instant feedback and evaluation from the system. Build practical-training bases equipped with BIM workstations, intelligent survey equipment (e.g., laser scanners), lightweight construction robots (e.g., collaborative robotic arms), and various sensors (displacement, stress, environmental sensors). Priority shall be given to training students' capabilities in operating, integrating, and maintaining such intelligent equipment, and helping them experience the complete closed loop of exporting, processing, and positioning data from BIM models to drive physical-equipment operation. Leverage data from completed typical intelligent-construction projects to build "digital-twin" cases that can be repeatedly retrieved, analyzed, and practiced for teaching, so that students can learn decision-making in highly real-world-like data environments.

3.3. Strategy 3: Implement teaching-method reform of "project-oriented, data-driven and human-machine-collaborative" teaching

Comprehensive semester-long projects shall be designed, for instance, "intelligent construction organization and execution of a precast-concrete residential building". Students form teams to complete the whole workflow, including BIM detailed design, intelligent optimization of construction schemes (using algorithms), robot task scheduling, virtual-simulation of construction processes, and data analysis. Teachers transform their roles into project tutors and resource coordinators. Adopt real-world enterprise project cases, especially those with existing problems and challenges. Guide students to apply data-analysis tools to mine information from construction logs, monitoring data, images and video materials, diagnose problem causes, and put forward optimization schemes, so as to foster data-oriented thinking. Implement "teacher-intelligent-system-student" collaborative teaching [7]. Intelligent teaching systems (e.g., adaptive learning platforms, virtual tutors) can undertake partial knowledge imparting and skill training and provide personalized learning paths. Teachers shall focus more on inspiring thinking, guiding innovation, addressing complex engineering-ethical issues, and promoting teamwork. Accordingly, it is necessary to carry out teaching-method reform featuring "project-oriented, data-driven and human-machine-collaborative" teaching.

3.4. Strategy 4: Build a "dual-competency and interdisciplinary" teaching staff team

Teachers constitute the decisive factor for reform success. Build a "dual-competency and interdisciplinary" teaching staff team. Establish a regular mechanism for teachers to pursue practical further-education in leading intelligent-construction enterprises and research institutes, so as to keep teachers' knowledge reserves aligned with cutting-edge technologies. Actively introduce doctors or engineers with artificial-intelligence, computer-science, and automation backgrounds into teaching teams. Meanwhile, employ enterprise intelligent-construction project managers and technical directors as industrial tutors to form interdisciplinary teaching synergy. Encourage teachers to convert scientific-research projects in the field of intelligent construction into teaching cases and experimental content, and lead students to participate in frontier-subject research to cultivate innovative talents in scientific-research practice.

3.5. Strategy 5: Construct a “process-oriented, multi-dimensional and competency-based” teaching-evaluation system

Abandon the single final-written-examination evaluation mode. Leverage the Learning Management System (LMS) to record process data such as students’ operation tracks in virtual practical training, decision-making processes, and contributions in projects [8]. Evaluation contents shall shift from knowledge memorization toward comprehensive assessment of multi-dimensional competencies including proficiency in BIM-tool application, quality of data-analysis reports, human-machine-collaboration scheme design, and innovation in solving complex engineering problems. Incorporate industry-recognized skill certifications for intelligent-co nstruction-related software (e.g., advanced-level BIM application) and results of industrial-skill competitions into academic-evaluation systems, so as to promote alignment between teaching and industrial standards [9].

3.6. Strategy 6: Deepen the industry-education-integration mechanism of “symbiotic development and resource sharing”

Establish strategic-cooperation relationships with leading industrial enterprises, and jointly build industrial colleges and collaborative-innovation centers. Co-develop loose-leaf textbooks, work-manual-style textbooks, and supporting digital resources reflecting the latest technical practices together with enterprise experts. Enterprises provide the latest software platforms (e.g., cloud-BIM platforms), equipment interfaces, and desensitized real-project data for teaching; universities offer employee training, technical pre-research, and talent reserves for enterprises. Carry out joint applied scientific-research on common technical bottlenecks in intelligent prefabricated-building construction, and feed research achievements back into teaching to form a virtuous cycle of “industry-university-research-application” [10].

4. Conclusion and prospects

The in-depth integration of artificial intelligence and prefabricated buildings represents an irreversible trend of the times. It brings subversive impacts on traditional construction-specialty education, and meanwhile offers historic opportunities for its leap-forward development. As educators, we must embrace such changes with a positive attitude and carry out systematic and in-depth reforms covering educational concepts, curriculum contents, teaching methods and evaluation systems. The teaching-strategy system proposed in this paper takes industrial demands as the fundamental orientation, regards in-depth integration of digital technologies and professional knowledge as the core, relies on virtual-physical integrated teaching scenarios, and takes interdisciplinary teaching staff as a guarantee, aiming to build an open, dynamic and adaptive educational ecosystem. Its implementation cannot be accomplished overnight, and will inevitably face multiple challenges including faculty transformation, resource investment and depth of university-enterprise cooperation. It requires forward-looking strategic vision from college administrators, continuous learning and innovative efforts from front-line teachers, and joint efforts of governments, industrial enterprises, and all sectors of society, so as to jointly contribute to cultivating outstanding engineering talents who will lead the future development of China's intelligent-construction industry.

Future graduates majoring in prefabricated-building-construction will be "craftsmen of the digital age" — holding drawings in one hand and data in the other, who are well grounded in real-world engineering sites and capable of working in digital virtual spaces. They will become key human resources for promoting high-quality development of the construction industry and realizing the leap-forward from "construction" to "intelligent construction". We have full expectations for this, and are willing to explore and practice continuously on the path of teaching reform together with our peers.

Disclosure statement

The author declares no conflict of interest.

References

[1] Guo W, Cheng Y, Zhang S, et al., 2024, Summary of Application of Intelligent-Construction Technologies in Prefabricated Buildings. Proceedings of the 2024 National Engineering-Construction-Industry Construction-Technology Exchange Conference (Volume II), 2024: 926–929.

[2] Zhang Y, 2025, Exploration on Talent Cultivation of Intelligent-Construction-Technology Major in Five-Year Higher Vocational Education. Innovation and Entrepreneurship Theory Research and Practice, 8(11): 85–87.

[3] Qiu J, Zhao X, Li H, et al., 2024, Summary on Practical Application of BIM Technology in Construction of a Large-Scale Complex in Beijing. Intelligent Building & Smart City, 2024(3): 85–87.

[4] Fu C, Pan L, 2025, Exploration on Reform of Talent-Cultivation Mode for Architectural-Engineering-Technology Major Under the Background of Intelligent Construction. New Curriculum Research, 2025(30): 79–81.

[5] Ding L, 2019, Thoughts on Cultivation of Innovative Engineering-Science-and-Technology Talents for Intelligent Construction. Research in Higher Education of Engineering, 2019(5): 1–4 + 29.

[6] Yan X, Wu Q, 2024, Exploration on AIGC Empowering Digital-Transformation of Higher-Vocational-College Teaching. Vocational Education Research, 2024(5): 26–31.

[7] Lu X, Lin L, 2025, "Teacher-Machine-Student" Ternary Teaching Model Based on Generative Learning and Its Practice. Journal of Higher Continuing Education, 38(2): 73–80.

[8] Niu J, Wei C, 2026, Logical Shift, Mechanism Reconstruction and Governance Path of University Knowledge Production in the Digital-Intelligence Era. Jiangsu Higher Education, 2026(1): 10–18.

[9] Qin F, 2017, Cross-Border Collaboration and Path Selection for the Construction System of "Dual-Competency Teachers" in Higher Vocational Colleges. Vocational Education Forum, 2017(23): 9–12+39.

[10] Xiang C, 2025, Exploration and Practice of "Teaching-Learning-Research-Innovation" Integrated Training Mode Based on LMS — Taking K-12 Artificial-Intelligence Teachers as an Example. Educational Information Technology, 2025(Z2): 156–160.