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*Original Paper*

# Research on the Construction Path of Practical Teaching in Engineering Management Major Empowered by Digital Education

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***Abstract***

*Against the backdrop of the comprehensive advancement of the digital education strategy and the digital transformation of the construction industry, the traditional practical teaching model for engineering management is plagued by drawbacks including obsolete practical training scenarios, inflexible teaching resources, high practical operation costs, and insufficient educational efficiency, making it difficult to meet the talent cultivation needs of smart engineering and digital construction in the new era. Digital education provides technical support and innovative ideas for the reform of practical teaching in engineering management. By adopting digital technologies including BIM, virtual simulation, big data and cloud computing, universities can effectively break the bottlenecks of traditional practical teaching. This paper, based on the development trend of digital education, analyzes the main problems existing in the current practical teaching of engineering management, and explores the path to restructure the practical teaching system, resource construction, model innovation, teacher training, and evaluation optimization under digital empowerment. The aim is to build a practical teaching system adapted to the development of the digital industry, improve the quality of cultivating interdisciplinary digital talents in engineering management, and provide a reference for the transformation and upgrading of engineering management teaching in universities.*

***Keywords***

*Digitalization of education, Engineering management, Practical teaching, Digital empowerment*

## 1. Introduction

With the deepening implementation of the national digital education strategy, higher education has entered a new stage of comprehensive digital and intelligent transformation. The deep integration of digital technology and professional education has become the core direction of teaching reform in higher education institutions. At the same time, the construction industry is accelerating its transformation towards digital construction, smart construction sites, and intelligent management. New technologies such as BIM, digital twins, and digital management of prefabricated buildings are widely applied across the life cycle of engineering projects. The market has put forward new requirements for the digital practical skills and intelligent management capabilities of engineering management talents.

The engineering management specialty has the dual attributes of technology and management, and is highly practical and application-oriented. Practical teaching is the core link to connect theoretical teaching with industry posts and cultivate students' practical ability. Traditional engineering management practice teaching mostly relies on offline site practice training, paper case teaching, and basic software operation. There are problems such as limited training scenarios, inability to practice high-risk projects, lagging updates of teaching resources, lack of personalized teaching, and extensive teaching evaluation. As a result, students' practical capabilities in digital engineering remain inadequate, and it is difficult to adapt to the job requirements of the intelligent engineering industry.

In this context, with the digital empowerment of education as the starting point, it is an inevitable trend for the high-quality development of the engineering management specialty in colleges and universities to promote the full-process digital upgrading of practical teaching of engineering management specialty, reconstruct the digital practical teaching system, innovate the teaching mode, and improve the guarantee and evaluation mechanism. In-depth study of the construction path of educational digital empowerment practice teaching has important theoretical value and practical significance for solving the pain points of traditional teaching, meeting the needs of digital intelligence transformation of the industry, and cultivating high-quality digital engineering management and control talents.

## 2. Current Status of Research at Home and Abroad

In recent years, research findings on the digital transformation of education by scholars both domestically and internationally have gradually increased. Typical viewpoints from international scholars include: digital technology has become an important component of modern education, promoting the expansion of time and space boundaries and enriching the learning environment (Selwyn & Facer, 2014); widespread digital technology has made learning a behavior in various environments, including the workplace (Sjoberg & Holmgren, 2021), the home (Nazare et al., 2022), and online communities (Tang & Lam); digital technology has stimulated rapid change and considerable challenges throughout the modern world. The 2019 COVID-19 pandemic spurred a surge in remote work and remote learning (Christensen & Alexander, 2020; Al Lily, 2020). The emergence of digital technology has led to the creation of several informal learning environments (Greenhow & Lewin, 2019), which exhibit different forms, functions, characteristics, and patterns compared to traditional learning environments (Nygren et al., 2019).

The earliest domestic research on digital education originated in 2011 with the discussion of the digital transformation of educational publishing. Since the novel coronavirus epidemic in 2020, the large-scale online teaching practice in China has catalyzed the process of digital transformation of education, which has led domestic scholars to think about the digital transformation in the field of education. Since 2022, the number of research literature on the digital transformation of education in the CNKI database has risen sharply. Among them, Weng Weibin (2023) believes that using digital technology, intelligent teaching assistants and online resource libraries are integrated into the learning environment, and an new immersive and intelligent education model is constructed in both physical and virtual spaces to provide learners with more suitable resources and services, and virtual simulation learning environment can be used to improve learning effectiveness. Yu Yan et al. (2022) believe that in the digital era, a complete digital evaluation system should be gradually established, and effective diagnosis and objective analysis should be carried out in time according to students' ability differences and behavioral characteristics through digital technology, so as to break through the traditional simplified and one-sided evaluation model. Penny (2024) discussed in depth the profound impact of digital transformation on the classroom of higher vocational education, and tried to construct a set of reform path of vocational college classrooms to meet the requirements of digital transformation.

Foreign scholars' research on education digitization mainly focuses on the stage of higher education, focusing on the transformation of education time, place and form caused by education digitization. Domestic scholars have studied the path of digitally empowered higher education from different aspects, such as the construction of educational infrastructure and the construction of teaching evaluation mechanism, and based on classroom theoretical teaching and higher vocational education. Based on the practical teaching platform of engineering management specialty, this paper explores the all-round innovation of technology, resources, mode and evaluation, so as to improve the quality and efficiency of practical teaching and accurately adapt to the talent demand of digital engineering industry.

## 3. Existing Shortcomings in Digitalization of Practical Teaching in Engineering Management

Currently, engineering management majors in domestic universities have gradually introduced digital teaching tools, but the overall level of digital construction is low, and the integration of digital technology and practical teaching is superficial. A systematic and normalized digital practical teaching system has not yet been formed, which is mainly reflected in the following aspects.

*3.1 The Digital Teaching System Is Incomplete and the Integration Is Superficial*

At present, the digital construction of most colleges and universities only stays at the level of tool application. The application of BIM cost software and the combination of online and offline are equivalent to digital teaching, and the practical teaching system is not reconstructed in combination with the training objectives of engineering management professionals and the digital transformation of construction enterprises. The existing practical teaching courses are still based on traditional offline training, such as curriculum design, graduation design, professional practice, and offline site practice. The traditional offline site training is limited by the long construction period of the project, the limited construction site, and the high risk of safety responsibility. It is impossible to fully carry out practical teaching in all aspects of engineering management, and high-quality engineering cases and cutting-edge technical resources are difficult to be efficiently shared between schools due to time and space constraints. The digital training modules are fragmented. Digital technology has not been deeply integrated into the core practical links such as construction engineering measurement and valuation, construction organization management, project cost control, and risk assessment. The connection between online and offline teaching is not smooth, and the advantages of digital education cannot be fully utilized.

*3.2 Digital Teaching Resources Are Scarce and Their Updates Are Lagging Behind*

High-quality and rich digital teaching resources are the basis of digital implementation of practical teaching. At present, there are many problems in colleges and universities, such as insufficient number of digital resources, low quality and slow update and iteration speed. On the one hand, the existing resources are mostly 5–10-year-old engineering cases, lack of virtual simulation projects that fit smart construction sites, digital construction, and high-quality digital case libraries. It is impossible to synchronize the latest digital technology and management models in the construction industry, and it is difficult to adapt to the training needs of digital engineering positions. On the other hand, there is a lack of sharing mechanism of digital resources among universities, low utilization rate of resources in schools, insufficient inter-school communication, and prominent waste of resources.

*3.3 Weak Digital Teaching Capabilities among Teachers*

The digitization of practical teaching requires teachers to have both civil engineering professional knowledge, industry digital technology ability and digital teaching ability. At present, most teachers of engineering management major have solid traditional professional teaching ability, . Their cognition of industry digital frontier lags behind the demand of enterprise employment. They are not proficient in BIM full lifecycle application, engineering big data analysis, virtual simulation teaching design and other skills. It is difficult to design high-quality digital training courses and effectively guide students to carry out digital practical training, which has become the core bottleneck restricting the digital transformation of teaching.

### *3.4 The Digital Training Scenarios Are Monotonous and Lack Practical Operation Experience*

Although many colleges and universities have completed the construction of digital training platforms, the problems of homogenization and simplification of platform functions are prominent. The training focuses on BIM basic modeling skills training, and lacks the whole-process training environment based on digital twin architectures. There are obvious shortcomings in the training content of interdisciplinary post ability such as dynamic adjustment of project schedule, construction collision analysis, cost scheme optimization and intelligent early warning of safety risk. The single software operation training mode severs the internal connections among various engineering businesses, which is not conducive to the establishment of systematic digital engineering management logic by students, and also restricts the development of their comprehensive practical ability. On the other hand, the coverage of immersive VR/AR training equipment is insufficient, and the modern training mode of virtual and real linkage has not been widely used, resulting in insufficient simulation of training scenarios and greatly reduced training teaching effect.

### *3.5 Lack of Digital Evaluation Mechanism and Unclear Educational Orientation*

The existing practice teaching evaluation is still mainly based on the traditional result assessment, focusing on the practice training report, experimental report, written assessments for graduation projects, etc., which attaches little importance on pre-class learning assessment, in-class practical operation and post-class feedback. The assessment indicators do not cover the core digital capabilities such as digital software operation, digital scene practice, data processing ability, and intelligent engineering management and control thinking. At the same time, there is a lack of big data dynamic evaluation and process evaluation mechanism. It is impossible to accurately measure the level of students' digital practice, and it is difficult to provide personalized guidance and support, which restricts the quality of digital talent cultivation.

## 4. Optimization Path of Education Digitalization Empowering Engineering Management Practice Teaching

Combined with the shortcomings of the current digital construction of practical teaching, based on the strategic requirements of digital education and the demand for digital and intelligent talents in the industry, from the five dimensions of teaching system, resource construction, scene construction, teacher training and evaluation mechanism, a comprehensive and systematic digital practical teaching construction path is constructed to realize the deep integration of digital technology and practical teaching.

### *4.1 Reconstructing the Digitalized Tiered Practical Teaching System*

Taking the ability demand of digital engineering post as the core, an advanced practical teaching system is constructed to gradually realize the full coverage of digital teaching. First of all, the basic layer focuses on the digital basic ability, and integrates BIM basic modeling, engineering digital mapping, online cost software operation and other basic contents in the course training to consolidate the students' digital practical foundation. Secondly, the special layer focuses on the core digital skills of the post, and sets up special digital training courses such as BIM life cycle management, ERP sand table simulation, intelligent site construction and control, digital bidding, digital twin project operation and maintenance, so as to fill the short board of core skills in the industry. Finally, the comprehensive layer carries out comprehensive digital training, takes the real intelligent engineering project as the carrier, carries out the whole process digital project management training, combines comprehensive training, graduation design and post practice, cultivates students' systematic digital engineering management ability, and realizes the progressive improvement from single skill to comprehensive quality.

*4.2 Establishing a Systematic Digital Teaching Resource Database*

Integrate high-quality resources inside and outside the school, and build a digital practical teaching resource platform that is dynamically updated, co-constructed and shared. The first is to establish online practical courses: standardize the courseware, lesson plans, syllabi, homework library, test question library and operational process of practical courses, integrate common and common practical methods, unify practical operation norms and standards, and promote the integration and development of digitization and practical courses. Second, schools and enterprises jointly develop digital teaching resources, combine digital construction enterprises and smart sites, collect real digital construction project cases, smart site practical operation processes, and the latest technical standards of the industry, write digital training textbooks, make micro-course videos, and build standardized training question banks. The third is to establish a dynamic update mechanism of resources, keep up with the iteration of industry digital technology, regularly update case resources and training projects, and build an inter-school resource sharing platform to improve resource utilization. The Superstar Fanya Learning Platform is used to carry out teaching activities such as pre-class learning situation analysis, real-time interaction in class, and feedback tracking after class, so as to construct a practical teaching mode that complements each other online and offline, and integrates virtual and reality. Improve the design of practical teaching, teachers change from speakers to guides, students change from passive practice to active inquiry, and practical classroom change from one-way teaching to multi-dimensional interaction.

*4.3 Innovate the Digital Training Model That Integrates Virtual and Real Learning*

This paper breaks the traditional single training mode, digitizes the practice training base, constructs the intelligent construction site with the help of school-enterprise cooperation resources, and uses AR and MR technology to carry out the digital practice teaching scene of "virtual operation and physical feeling". By building an immersive virtual training scene, students can complete high-risk complex and long-term engineering management training in a virtual environment. Students' internships are no longer limited to the site of the construction site, but can be repeatedly operated and error-corrected, avoiding the risks and limitations of offline training. At the same time, online digital empowerment is combined with offline practice. Online training, case learning and skill brushing are carried out on the cloud platform. Offline physical project practice and digital software practice are carried out to achieve virtual and real complementarity and combination of learning and practice. In addition, the digital architecture innovation competition, BIM graduation design competition and intelligent residential design competition are carried out regularly, so as to promote learning and practice through competition, and strengthen students' digital practical ability.

*4.4 Construction of a Interdisciplinary Digital Teaching Team*

Build a three-in-one digital teacher training system of "on-campus cultivation, off-campus introduction, and school-enterprise co-education". For full-time teachers in the school, a normalized digital ability training mechanism should be established, and special trainings such as BIM technology, digital twin technology and digital teaching methods should be carried out regularly. Relying on the winter and summer vacations, teachers are organized to go to the practice of intelligent engineering enterprises, and gain first-line practical experience in intelligent construction enterprises to master the cutting-edge digital technology and post practical norms. At the same time, teachers are encouraged to apply for digital teaching reform projects, participate in virtual simulation teaching project research and development, and further strengthen digital teaching research and project development capabilities. On this basis, senior digital engineering practitioners and intelligent site technical managers are introduced to the industry as part-time tutors to participate in the teaching and practical guidance of digital training courses. Through the cultivation mode of internal and external combination and two-way coordination, a interdisciplinary teaching team with professional quality, digital technology application ability and teaching practice ability is built to ensure the landing of digital teaching in professional practice.

*4.5 Building a Data-Driven Multi-Dimensional Evaluation System*

Through big data, we collect, analyze and report on the digital training operation records, software operation proficiency, case analysis results and virtual project completion quality in the process of students' practice, so as to realize accurate and efficient practice teaching management. Relying on educational digital technology, a combination of "process data evaluation" and "final comprehensive evaluation" is established to pay attention to the progress and growth of students in the process of learning practice and give encouragement and guidance. Establish a digital evaluation mechanism and real-time feedback mechanism with multi-subject participation, so that teachers can adjust the teaching mode in time according to the personalized growth of students. At the same time, the introduction of enterprise tutor evaluation, group mutual evaluation, student self-evaluation mechanism, combined with online data assessment and offline practical performance, comprehensive and accurate evaluation of students' digital comprehensive practical ability, give full play to the guiding and incentive role of evaluation.

**5. Conclusion**

The digitization of higher education is the trend of the times, and practical teaching, as the core link of the education system of engineering management specialty, is an important way to improve students' application ability and innovation ability. Based on the cultivation of students' practical ability and innovative spirit, promoting the digital transformation of practical teaching is the key link for colleges and universities to cultivate engineering applied talents that keep pace with the times. Due to the shortcomings of digital construction in the current practice teaching of engineering management specialty, it is difficult to meet the needs of talent cultivation in the field of intelligent engineering. This paper proposes to reconstruct the digitalized tiered practical teaching system, establish a systematic digital teaching resource database, innovate the digital training model that integrates virtual and real learning, construct a interdisciplinary digital teaching team, and build a data-driven multi-evaluation system. Five construction paths will comprehensively promote the digital and intelligent upgrading of engineering management practice teaching, and realize the accurate docking of talent cultivation and post practical standards. In the future, colleges and universities need to continue to deepen the deep integration of digital technology and practical teaching, continue to iteratively optimize the teaching mode and resource system, and continuously improve the quality of digital and interdisciplinary engineering management personnel training, so as to provide solid talent support for the high-quality development of the construction industry.

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**References**

Christensen, R., & Alexander, C. (2020). Preparing K-12 schools for a pandemic before it occurs. *Journal of Technology and Teacher Education*, *28*(2), 261-272. https://doi.org/10.70725/884574uilsbl

Greenhow, C., & Lewin, C. (2019). Social media and education: Reconceptualizing the boundaries of formal and informal learning. In *Social Media and Education* (pp. 6-30). Routledge. https://doi.org/10.4324/9781315121697-2

Pan, N., Zhou, B., & Xiao, L. L. (2024). Research and practice on the integration of big data and accounting major with innovation and entrepreneurship education in higher vocational colleges: A case study of Liuzhou Vocational & Technical College. *Accountant*, (11), 105-107.

Selwyn, N., & Facer, K. (2014). The sociology of education and digital technology: Past, present and future. *Oxford Review of Education*, *40*(4), 482-496. https://doi.org/10.1080/03054985.2014.933005

Sjöberg, D., & Holmgren, R. (2021). Informal workplace learning in Swedish police education: A teacher perspective. *Vocations and Learning*, *14*, 265-284. https://doi.org/10.1007/s12186-021-09267-3

Weng, W. B. (2023). Digital construction of education against the backdrop of high-quality development: Value dimensions and limitations. *Journal of Shanghai Normal University (Philosophy & Social Sciences)*, *52*(4), 102-109.

Yu, Y., & Lin, G. R. (2022). Digital technology empowering high-quality development of postgraduate education: Possibility and practical approaches. *Chinese Higher Education Research*, (11), 53-60.