

Reform and Innovation of Practice-Oriented Education Models in Engineering Management Programs under the New Engineering Paradigm: A Case Study of Jiangxi Normal University

Zhangsheng Liu, Qian Li

College of City Construction, Jiangxi Normal University, Nanchang, China

Email: xiaoliu8033@126.com

How to cite this paper: Liu, Z. S., & Li, Q. (2025). Paper Title Reform and Innovation of Practice-Oriented Education Models in Engineering Management Programs under the New Engineering Paradigm: A Case Study of Jiangxi Normal University. *Open Journal of Social Sciences*, 13, 85-95. <https://doi.org/10.4236/jss.2025.1312007>

Received: October 16, 2025

Accepted: December 12, 2025

Published: December 15, 2025

Copyright © 2025 by author(s) and Scientific Research Publishing Inc. This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

Against the backdrop of an accelerating technological revolution and industrial transformation, the construction industry is undergoing digital transformation and intelligent upgrading, placing higher demands on the practical skills, innovative capabilities, and comprehensive competencies of engineering management professionals. Traditional practical teaching models in engineering management programs suffer from issues such as a lack of progressive workflow, insufficient integration of teaching methods, and inadequate targeted support, making them ill-suited to meet the requirements of new engineering education development. Jiangxi Normal University's Engineering Management program, guided by the principles of "Emphasizing Practice, Capability, and Innovation," has established a practical education model characterized by "Three-Tier Progression, Three-Dimensional Integration, and Four-Pronged Measures." This model systematically advances the restructuring of practical teaching processes, innovation in educational approaches, and the upgrading of support mechanisms. After years of implementation, this model has significantly enhanced students' engineering practice and innovation capabilities, driving a comprehensive leap in program development and talent cultivation quality, and demonstrating strong potential for broader application.

Keywords

New Engineering Paradigm, Engineering Management Program, Practice-Based Education Model

1. Introduction

Against the backdrop of an accelerating technological revolution and industrial transformation, the construction industry is undergoing a critical phase of transition from traditional construction to digital and intelligent practices (Lee et al., 2019). The widespread adoption of technologies such as prefabricated construction, Building Information Modeling (BIM), and smart construction sites imposes higher demands on the practical skills, innovative capabilities, and interdisciplinary competencies of engineering management professionals (Liu et al., 2025a). As an educational strategy responding to industrial transformation, the development of new engineering disciplines explicitly requires engineering programs to break down traditional teaching barriers and establish a talent cultivation system centered on competency development and deeply aligned with industry needs. Practical teaching, serving as the critical link between theoretical knowledge and engineering practice, directly determines the quality of talent cultivation through its reform outcomes (Zhong, 2017).

However, the current traditional practical teaching model in engineering management programs commonly suffers from three major pain points: First, the practical process lacks progression, often designed around single-course or discipline-specific requirements, making it difficult to achieve the stepwise cultivation of “knowledge comprehension—knowledge application—innovative practice”, which fails to meet the competency gradient requirements of New Engineering (Jin, 2025). Second, teaching methods lack integration, primarily aiming for students to “passively complete credits”. Disciplines remain compartmentalized with insufficient cross-disciplinary fusion, failing to meet the demands of solving complex problems in engineering practice (Xi et al., 2022). Third, support measures lack specificity, often focusing on procedural compliance rather than effectively bridging campus teaching with real-world industry challenges. This results in practical teaching becoming “armchair theorizing”, struggling to support the cultivation of digital and intelligent capabilities (Liu et al., 2025b). Against this backdrop, exploring an engineering management practice-based education model aligned with new engineering discipline requirements has become a core task for university program development.

Existing research shows scholars have pursued multiple approaches to reforming practice-based education models: some universities attempt to address physical resource limitations through virtual simulation platforms, yet fail to systematically integrate these with competency development objectives (Kang, 2023); other studies propose single-path reforms like “industry-education integration” (Xu et al., 2025) or “competition-driven learning” (Li et al., 2024), yet these isolated approaches have not formed an integrated system encompassing processes, methods, and safeguards, resulting in fragmented reform outcomes. Building upon its foundation of “engineering discipline heritage + engineering degree conferral”, the Engineering Management program at Jiangxi Normal University has established a practice-based education model characterized by “three-tier progression,

three-dimensional integration, and four-pronged measures”, guided by the principles of “prioritizing practice, emphasizing capability, and valuing innovation”. This model achieves seamless competency development through process reengineering, stimulates student initiative via innovative approaches, and ensures teaching quality through enhanced safeguards—effectively overcoming traditional practical teaching challenges. This paper systematically outlines the model’s design logic, implementation pathways, and application outcomes, providing a practical reference for engineering management programs seeking to reform practical teaching under the New Engineering framework.

2. Problem-Solving Process and Methods

2.1. Problem-Solving Process

The Engineering Management program at Jiangxi Normal University traces its origins to the Civil Engineering program established during the National Chung Cheng University era. Since 2013, it has conferred degrees in engineering. To meet the requirements of “New Engineering” development and the emerging demands for digitalization and intelligentization in the engineering construction industry, we have proposed the “Triple Emphasis Philosophy” —prioritizing practice, capability, and innovation—during the construction of our national-level engineering practice base. Addressing the new demands for talent cultivation in engineering management under the New Engineering framework, we have initiated a series of explorations starting with practical teaching reform. Since 2017, we have implemented the “Virtual Simulation Practice Base Construction Based on ‘Disciplinary Integration’,” undertaking a series of explorations and practices such as the “Research on Course-Based Ideological and Political Education Reform Using Simulation Experiment Teaching Methods” and the “Research on the Construction and Application of an Engineering Management Self-Learning Platform Based on MR Technology.” Through process reengineering, method innovation, and enhanced support systems, we have established a practice-oriented talent development model for the Engineering Management program within the context of New Engineering.

2.2. Problem-Solving Approach and Innovation Points

1) Process reengineering: establishing a “three-tier progressive” practical teaching process with “full-chain integration”.

Centered on Competency-Based Education (CBE) theory and following the logical framework of “competency identification - competency development - competency assessment,” this approach integrates digital competency requirements for engineering management (such as BIM technology application and smart construction site management). It establishes a tiered competency framework of “foundational competencies - integrated application competencies - innovation competencies” with “end-to-end integration” as the core principle. This systematically designs practical teaching across three layers: knowledge comprehension,

application training, and innovation enhancement. It creates a progression from “foundational competencies” to “integrated application” and ultimately to — “innovation capabilities” gradient objectives. Centered on a “full-chain integration” approach, it systematically designs practical teaching across three tiers: knowledge comprehension, application training, and innovation enhancement. This forms a cultivation pathway progressing from “foundational capabilities” to “integrated application” and ultimately to “innovative breakthroughs,” addressing the “fragmented” shortcomings of traditional processes. It achieves deep alignment between competency-based education (CBE) and the competency requirements of new engineering disciplines.

a) Strengthen the foundation of knowledge comprehension and enhance the cultivation of fundamental practical skills. Using “Project Immersion, Enterprise Engagement, and Urban Exploration” as platforms, we conduct professional orientation internships centered on understanding disciplines, industries, and careers. Our initial achievements earned the First Prize for Teaching Accomplishments at Jiangxi Normal University. Employing a “unified blueprint” approach, we systematically design practical teaching for courses like Engineering Graphics and Structural Mechanics, optimizing verification experiments (training) to comprehensively enhance students’ ability to solve deterministic problems in idealized environments.

b) Strengthen the application training layer to ensure the cultivation of engineering practice capabilities. Using “a single project” as the vehicle, we systematically designed practical teaching for course clusters like Engineering Estimation and Engineering Economics. With a focus on virtual simulation experiments, we enriched comprehensive experiments (training) and innovative exploratory experiments (training), comprehensively enhancing students’ ability to solve uncertain problems in real environments within digital and intelligent fields.

c) Emphasize the innovation enhancement layer to strengthen the cultivation of innovative practice capabilities. Using “multiple real-world projects” as carriers, we integrate “projects + social service,” “projects + graduation (internship) design,” and “projects + competition-driven initiatives” to seamlessly connect “on-campus courses - off-campus practice - graduation design.” This multi-stage approach facilitates industry-education resource interaction, delivers advanced practical instruction, and focuses on digital architecture and smart construction. It comprehensively enhances students’ abilities to explore and resolve unknown problems.

2) Methodological innovation: establish a “Triple-Integration” Practical Education Model to Achieve “Three Integrations and Three Promotions”.

Addressing the shortcomings of traditional teaching’s “passive training,” this framework adopts the cyclical model of experiential learning theory— “Situation-Participation-Reflection-Application” —combined with the characteristics of project-based learning (PBL), which emphasizes “real-world problem - Application” cycle model as its framework. Integrating the characteristics of Project-Based Learning (PBL) —real-world problem orientation and interdisciplinary collaboration—it achieves “learning through application, learning through competi-

tion, and learning through research” by integrating learning with practice, competition, and research. This approach stimulates students’ proactive engagement in practice and innovation, demonstrating its innovative value in overcoming the limitations of “single-dimensional” education and establishing a multi-dimensional, interconnected mechanism.

a) Emphasizing the integration of learning and application, with practice driving learning: Leveraging the Jiangxi Normal University Real Estate Research Institute and Jiangxi Normal University Urban Planning and Design Research Co., Ltd. (including engineering cost qualification), and guided by societal demand, we optimize practical teaching content. Through a dual-track project-based teaching approach integrating classroom instruction with hands-on practice, we innovate a “bringing projects in” model that integrates learning with application, achieving “learning through application.” Over the past three years, annual revenue from social service projects has exceeded 10 million yuan.

b) Strengthening the integration of learning and competitions to promote learning through competitions: Through student clubs like the “Real Estate Wealth Society” and “Shijie Architecture Society,” we foster a culture of practical innovation by combining “courses + club activities + scientific innovation competitions.” We organize debate tournaments, architectural model competitions, BIM graduation design contests, and on-campus selection rounds for real estate appraisal competitions, achieving “learning through competitions.” Each student participates in an average of 4 on-campus competitions and 2 provincial-level or higher competitions annually.

c) Emphasizing Research-Learning Integration to Drive Learning Through Research: Through social surveys, revolutionary heritage tours, rural outreach programs, and volunteer activities, we combine classroom learning with social practice to foster curiosity-driven research innovation. Surveys and investigations focus on issues like elderly-friendly projects, revolutionary architecture, urban renewal, and revitalizing historic buildings, achieving “research-driven learning.” This approach has secured 36 provincial-level or higher innovation and entrepreneurship projects for students.

3) Upgrading Educational Safeguards: Establishing a “Four-Pronged Approach” to Ensure Quality and Quantity in Practice-Based Education

Guided by the resolution of “real-world problems” in practical teaching, and drawing on the “resource support - process control - outcome evaluation” framework of Project-Based Learning (PBL) and the “dynamic assessment” mechanism of Competency-Based Education (CBE), we have upgraded— “outcome evaluation” assurance system and the competency-based education (CBE) “dynamic assessment” mechanism as references. It upgrades the four safeguarding measures— “value-driven, platform-based, competition-driven, and project-led” —to ensure the effective implementation of the “three-tier progression” and “three-dimensional integration” approaches. Its innovation lies in overcoming the bottleneck of traditional safeguarding becoming “formalistic,” thereby establishing a “full-

chain, multi-dimensional” quality control system.

a) Emphasizing Ideological and Political Guidance to Enhance Educational Outcomes: With “cultivating virtue through education” as the foundation, we will establish six model courses for ideological and political education through university-level demonstration programs. This initiative will foster teaching teams and distinguished educators specializing in ideological and political education, deeply integrating such principles into professional practice syllabi and all aspects of student competency development. This approach ensures ideological and political guidance leads professional practice instruction.

b) Strengthening platform development to enhance educational conditions: Leveraging the Ministry of Education’s Industry-Academia Collaborative Education Program, we have intensified partnerships with companies including Regezi, Ke.com, and Suiwei to establish six Ministry of Education Industry-Academia Collaborative Education Bases. Establish four alumni platforms: the Jiangxi Normal University Urban Construction Alumni Website, the Jiangxi Normal University Urban Construction Alumni Management System, the Jiangxi Normal University Urban Construction Alumni Group, and the Jiangxi Normal University Urban Construction Alumni Association. Create 43 off-campus enterprise practice bases. By “bringing bases on campus” and “bringing enterprises on campus,” form an integrated practice platform, laying a solid foundation for various academic competitions and “bringing projects on campus.”

c) Introducing Competition-Driven Innovation in Education Methods: By developing university-level innovation and entrepreneurship demonstration courses, we incentivize student participation in science and technology competitions through measures like course-based excellence awards and comprehensive assessment bonuses. Utilizing virtual simulation technology, we transform award-winning projects from competitions like “Internet Plus” and “Challenge Cup” into teaching cases, achieving learning and teaching enhancement through competitions. Through team coaching and club-based mentorship programs, we guide students to achieve high-quality results in various science and technology competitions.

d) Strengthen project-based initiatives to implement educational drivers: Focus on engineering cost estimation, real estate market monitoring, and community housing planning to consolidate the campus social service platform, implementing “Project + Social Service”; prioritize actual projects from off-campus enterprise practice bases to enhance the quality of graduation internships, implementing “Project + Graduation Design”; leverage practical projects to guide students in achieving high-quality results in academic competitions, implementing “Project + Competition-Driven Approach”.

3. The Promotion and Application Effect of the Achievements

3.1. Process Reengineering: Energizing Operations and Achieving Remarkable Educational Outcomes

1) Students have demonstrated remarkable growth in digital and intelligent

engineering practice and innovation capabilities. Since 2019, they have consistently achieved outstanding results in competitions such as “Internet Plus” and the “Challenge Cup,” with the number of award recipients increasing annually. On average, each student has received 1.5 provincial-level or higher academic competition awards, contributing to the university’s first-place finish in the 2024 Jiangxi Provincial College Student Innovation and Technology Competition (BIM Graduation Design Innovation). In 2023 alone, over 100 students secured more than 30 awards across various competitions. Since 2020, they have earned 11 provincial-level or higher honors in major contests, including “Internet Plus” and “Challenge Cup,” along with two national gold awards. In recent years, students have obtained 23 patents and published 38 academic papers in journals such as *Acta Ecologica Sinica* and *Journal of Public Administration*.

2) Significant Enhancement in Students’ Comprehensive Competencies. Over the past five years, four students were honored as the university’s “Top Ten Undergraduates,” and two received the Outstanding Graduate Award from the Chinese Society of Civil Engineering. Since 2019, the initial employment rate of graduates has steadily risen in the university’s internal rankings. The program has consecutively won the university’s employment achievement award for five years, ranking first in 2023 (excluding state-funded normal students).

3) Graduates’ engineering practice capabilities are widely recognized. In recent years, alumni have achieved remarkable success in engineering management. Notable alumni include Yang Luxing, selected as a 2022 Outstanding Young Entrepreneur of Jiangxi Province; Yao Zhide, recipient of the Third Innovation and Entrepreneurship Talent Award; and Liu Lidong, whose Madagascar Egg Road Project was featured in a special report by Xinhua News Agency.

3.2. Innovate Approaches, Expand Functionality, and Empower Professional Development

1) Continuous Enhancement of Professional Standards. The Engineering Management program rose from fourth place in the first round to first place (1/14) in the second round of Jiangxi Province’s comprehensive undergraduate program evaluation, earning a five-star rating (the only program in the province to achieve this distinction). In 2023, it received an A rating from ShanghaiRanking Consultancy, ranking 45th out of 462 programs nationwide. It was also approved as a Jiangxi Province Characteristic Program for the 14th Five-Year Plan period (the only program in the province designated as such).

2) Significant achievements in teaching research and curriculum development. Six courses, including Engineering Cost Estimation and Real Estate Development and Management, were designated as provincial-level first-class courses. Faculty members co-authored four volumes of the Course-based Ideological and Political Education Teaching Case Collection and published six textbooks. Twelve provincial-level teaching reform projects were completed, with 24 teaching reform pa-

pers published. Six Ministry of Education Industry-Academia Collaborative Education projects were approved, and the program received the 2021 Ministry of Education Industry-Academia Collaborative Education “Outstanding Project Case” award.

3.3. Strong Support, Substantial Achievements, and Positive Social Response

1) The practice-based education model has garnered significant social recognition. Over the past five years, practical teaching activities have been featured in over 80 reports by official media outlets, including Xinhua News Agency (Xinhuanet), People’s Daily (People’s Daily Online), and China Youth Network. The Party-building and business integration model was selected for the “2023 Jiangxi Normal University College-Level Party Organization Case Exhibition on Strengthening Faculty Ideological and Political Education and Professional Ethics Development.” It has received one national award for outstanding ideological and political education work, one provincial award for outstanding ideological and political work papers in Jiangxi higher education institutions, and five other provincial-level awards.

2) The practical outcomes have generated significant social benefits. Over the past five years, the team has received more than 10 industry awards; annually completes over 30 social service projects generating over 10 million yuan in revenue; selected outcomes were featured on Jiangxi Satellite TV’s “Social Fax” program; theoretical findings derived from team members’ practical work have been incorporated into the national real estate appraiser qualification exam syllabus and textbooks, becoming mandatory assessment criteria for industry entry and guiding sector development.

3) Teaching achievements have been widely disseminated and applied. Firstly, select practice-based educational outcomes have garnered high recognition from peers, with renowned scholars such as Professor Feng Changchun from Peking University and Professor Liu Guiwen from Chongqing University deeming them worthy of broader adoption. Secondly, certain achievements have been promoted nationwide, with online resources benefiting 29 provinces (municipalities and autonomous regions) and exceeding one million views. Third, by hosting two provincial-level academic competitions, the practical teaching model has been promoted across the province. This has supported the advancement of new engineering education reforms in related disciplines such as architecture and urban planning at our university, while also aiding five sister institutions in the province with their new engineering initiatives in fields like engineering management, engineering cost, and civil engineering, yielding significant results.

4. Discussion on the Universality of Models and Addressing Challenges

As a case study of a single institution, this model requires adaptation during im-

plementation to align with the resource endowments of different universities and regional industry characteristics. Key challenges and corresponding strategies are outlined below:

1) Resource Endowment Disparities Challenge. Some local universities face insufficient practical platforms and limited funding. Recommendations include establishing “lightweight practice bases through university-enterprise collaboration” and “sharing regional industry resources” to reduce construction costs. For instance, partnering with local housing authorities and small-to-medium construction firms to conduct short-term project training can replace high-investment physical platform development.

2) Regional Industry Demand Disparities. Construction sectors exhibit varying levels of digitalization and intelligence across regions (e.g., eastern coastal areas vs. central and western regions). Practical content should be tailored to regional industrial characteristics. For instance, institutions in central and western regions may focus on “traditional construction + digital retrofitting,” while eastern institutions could emphasize “end-to-end smart construction training” to ensure alignment between practical education and local demands.

3) Challenges from disparities in faculty capabilities. Some university instructors lack digital technology application skills and industry experience. Enhance faculty capabilities through “mutual faculty appointments between universities and enterprises” and “short-term specialized training.” Examples include sending faculty to partner companies for BIM project participation and inviting industry experts as adjunct mentors to co-supervise student projects.

5. Conclusion

The core of new engineering education lies in cultivating innovative engineering talents capable of adapting to industrial transformation, with practice-based education serving as the key vehicle for achieving this goal. Jiangxi Normal University’s exploration and implementation of the “Three-Tier Progression, Three-Dimensional Integration, Four-Pronged Measures” practice-based education model for its Engineering Management program has not only effectively addressed the challenges of traditional practice-based teaching but also established replicable and scalable reform experiences. From process reengineering to achieve “end-to-end integration” in competency progression, to method innovation for “triple integration and triple promotion” in proactive practice, and finally to enhanced safeguards ensuring “quality and quantity” in teaching effectiveness, this model consistently aligns with the digital and intelligent transformation demands of the construction industry. It integrates real-world industry challenges, authentic enterprise projects, and genuine societal needs throughout the entire teaching process. Ultimately, it has significantly enhanced students’ practical innovation capabilities, elevated the overall level of program development, and effectively demonstrated its value in serving society.

From students’ repeated successes in national competitions to the program’s

recognition as a Five-Star Characteristic Major in Jiangxi Province; from practical achievements being incorporated into the national real estate appraiser qualification exam standards to the model's adoption across multiple peer institutions—these outcomes demonstrate that only by grounding education in industry needs, prioritizing competency development, and innovating pedagogical mechanisms can we cultivate high-caliber engineering management talent truly suited to China's modernization drive. Looking ahead, as the construction industry deepens its intelligent transformation, the practice-based education model for engineering management must continue to evolve. This involves strengthening interdisciplinary integration, deepening industry-education collaboration, and expanding digital teaching resources. These efforts will ensure a steady supply of versatile professionals—equipped with both practical skills and innovative thinking—to support the nation's high-quality engineering projects.

Acknowledgements

This work was supported by the Project of Jiangxi Province's Education Science "14th Five-Year Plan" (Project No. 23YB016). This work is also supported by the Key Project of Teaching Reform in Degree and Graduate Education in Jiangxi Province (Project No. JXYJG-2022-042).

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- Jin J. (2025). Research on the Training Path of BIM Application and Innovation Ability of Civil Engineering Specialty under the Background of New Engineering-Taking Engineering Management Specialty as an Example. *The Theory and Practice of Innovation and Entrepreneurship*, 8, 84-87.
- Kang, L. (2023). Exploration and Practice of Ideological and Political Education in Engineering Courses Based on the Obe Concept-Taking the 3D Modeling Course as an Example. *Frontiers in Educational Research*, 6, Article ID: 23.
- Lee, S., Lee, J., & Ahn, Y. (2019). Sustainable BIM-Based Construction Engineering Education Curriculum for Practice-Oriented Training. *Sustainability*, 11, Article 6120. <https://doi.org/10.3390/su11216120>
- Li, N., Han, Y., & Gao, F. (2024). Theory and Practice of BIM Skills of Construction Management Professional Based on Conceive-Design-Implement-Operate Engineering Teaching Mode. *Computer Applications in Engineering Education*, 32, e22719. <https://doi.org/10.1002/cae.22719>
- Liu, D., Lei, X., Huang, Y., Liu, W., & Zhang, J. (2025a). Competency Requirements for Engineering Management Undergraduates in the Era of Intelligent Construction. *Journal of Asian Architecture and Building Engineering*, 24, 3916-3939. <https://doi.org/10.1080/13467581.2024.2402771>
- Liu, X., Zhang, L., Gong, L. et al. (2025b). Exploring the Industry-Education Integrated Talent Cultivation Model for Engineering Management Majors in Application-Oriented Universities under the Digital-Intelligent Context. *Project Management Technology*, 23,

95-102.

- Xi, Y., Shen, H., & Chen, X. (2022). Bridging the Gap between University Engineering Education and Enterprise Requirements. *Mobile Networks and Applications*, 27, 1209-1217. <https://doi.org/10.1007/s11036-022-01947-1>
- Xu, Q., Hong, B., Lan, T., Shi, X., & He, H. (2025). Exploration of Ideological and Political Teaching Reform in the “Project Management of Engineering” Course Based on the OBE Concept. *Journal of Politics and Law*, 18, Article 12. <https://doi.org/10.5539/jpl.v18n3p12>
- Zhong, D. (2017). Connotations and Actions for Establishing the Emerging Engineering Education. *Research in Higher Education of Engineering*, No. 3, 1-6.