Global Research in Higher Education
ISSN 2576-196X (Print) ISSN 2576-1951 (Online)
Vol. 9, No. 1, 2026
www.scholink.org/ojs/index.php/grhe

Original Paper

Reform and Practice of Engineering Cost Software Application Course under OBE Concept

Hongyu Chen[1], Xiaoyi Liu[1] & Hui Wang[1*]

[1] Qingdao City University, Qingdao, China

[*] Corresponding author: Hui Wang, E-mail: hui.wang@qdc.edu.cn

Received: March 10, 2026 Accepted: March 26, 2026 Online Published: March 29, 2026

doi:10.22158/grhe.v9n1p148 URL:http://dx.doi.org/10.22158/grhe.v9n1p148

Abstract

In response to the development trend of digital transformation in the construction industry, the curriculum reform of engineering cost major has shifted from “knowledge imparting orientation” to “outcome orientation (OBE)”. Under the promotion of the “1+X” certificate system and the policy of integrating industry and education, the reform ideas of curriculum teaching, skills competitions, certificate acquisition, and job practice (referred to as “course competition certificate job”) collaborative education have gradually reached a consensus. This article takes the engineering cost software application course group as the object, systematically sorts out the relevant policy backgrounds such as OBE and engineering education certification framework, “1+X” and excellent engineer training reform, and analyzes the problems of “fragmented software training, disconnection between competitions and courses, and fracture between certificates and job abilities” in current teaching; Based on this, a goal matrix and outcome oriented curriculum map of the “Course Competition Certificate Post” four element isomorphism were proposed, and a teaching mode supported by BIM cost and quantity valuation platform was constructed. The contribution of this article lies in: taking the OBE concept as the main line, upgrading the “course competition certification post” from “stacked combination” to “isomorphic integrated design”, providing a scalable system, curriculum, and evaluation integrated solution for the engineering cost software application course group.

Keywords

OBE, Construction Cost, Course-Competition-Certificate-Post Integration, Curriculum Reform

1. Background and Theoretical Framework

With the development of digitalization and intelligence in the construction industry, the trend of integrated engineering management is becoming increasingly evident. The demand for engineering cost positions presents three obvious changes: first, from single tool operation to comprehensive ability of whole process, data-driven and cross role collaboration; The second is to move from static list pricing to dynamic control that integrates models, lists, quotas, schedules, and costs; The third is to move from in class exercises to external consistency with comparable evidence and standards. The OBE philosophy emphasizes learning outcomes as the starting point, evidence as the basis, and continuous improvement as the guarantee. This is highly consistent with the focus of engineering education certification on student outcomes, continuous improvement, and industry demand alignment, providing a feasible quality assurance framework for the engineering cost software application course group. At the same time, the “1+X” certificate system has established a parallel support system of “academic education + vocational skills” at the level of standards, assessment, and service platforms; The Excellent Engineer Program will integrate the guidance of “joint enrollment, joint training, joint topic selection, and shared achievements” and “standards and certification” throughout the entire process of talent cultivation. At the technical level, BIM is expanding towards 5D (cost dimension), expanding cost management from “quantity based pricing” to “data-driven full process cost control and collaborative management”, providing a unified language and data foundation for the integrated design of courses, competitions, certificates, and positions.

Based on the above theoretical and policy background, this article proposes to use the four element isomorphism of “course competition certificate post” as the framework to bridge the structural gaps in the three levels of goals, tasks, and evaluation.

2. Current Diagnosis

2.1 Current Situation and Pain Points

(1) Separation between course teaching tasks and competitions

At present, the teaching tasks set in the classroom mainly focus on single skill training, emphasizing students’ mastery of a specific knowledge point. And various competition projects usually require the comprehensive use of multiple software tools to complete the entire process tasks from modeling, quantity calculation, pricing to achievement reporting. The lack of effective connection between the two in terms of data structure, outcome form, evaluation criteria, etc. results in students being able to complete individual exercises well in the classroom, but facing competition, it is difficult to organize scattered skills systematically and lacks overall coping ability. In addition, the commonly used real project data and cross role collaboration methods in competitions are rarely involved in regular teaching, and students need a long time to readjust when entering competitions.

(2) Certificate disconnected from course content

The training of certificate related content is often conducted independently of the course, in the form of centralized training or “additional courses”, which increases students’ learning burden and also easily leads to problems such as asynchronous learning with the course progress, repeated learning, or content disconnection. Due to the lack of unified design between certificate training and course tasks, students are unable to naturally accumulate the abilities and achievements required for certificates in the classroom, resulting in the need for a large amount of additional practice during preparation, which affects the integration effect of course learning and certificate acquisition.

(3) Job requirements and teaching gap

In practical work, the engineering cost position not only requires students to master software operations, but also emphasizes comprehensive abilities such as full process cost planning, dynamic cost control, contract and procurement linkage, settlement, and change claim processing. However, current curriculum teaching still focuses more on software operation itself, lacking the design to translate the above job skills into specific teaching tasks. There is a significant gap between the exercises completed by students in the classroom and the actual work situation of the position, and the course results are difficult to reflect the composite abilities required for the position. There is also no evidence material that can be retained and displayed, which leads to graduates still needing a long time to adapt and relearn after entering the position.

(4) The closed loop of achievement degree is not sound

At present, course evaluation is still mainly based on final assessment, and formative evaluation is relatively weak. The lack of systematic recording and feedback on students’ stage achievements, completion of project tasks, and team collaboration performance during the learning process makes it difficult for teachers to timely grasp students’ learning progress and make precise adjustments to teaching content and methods based on evidence. Due to the ineffective accumulation and utilization of evaluation data, it is difficult to form a closed loop for the analysis of achievement at the curriculum level, and there is a lack of clear direction and basis for continuous improvement.

2.2 Target System and Indicator Mapping

Taking industry job competency as the top-level goal, including full process cost capability, BIM-5D data governance and collaboration, compliance and risk control, communication and ethics, etc., it is decomposed into four levels of indicators: graduation requirements, course objectives, module output, and evidence, forming outcome oriented indicators. Embedding general abilities such as problem analysis, scheme design, experimentation and data interpretation, team collaboration, effective communication, professional ethics, and lifelong learning into the task chain, and corresponding them to competition modules and certificate elements one by one, on this basis, establishing a data governance mechanism for achievement, key evidence, and improvement triggers, so as to effectively link course level evaluation with project level certification.

3. Target System and Overall Framework

3.1 Goal Decomposition and Alignment

Taking industry job competency as the top level, it is decomposed into four levels of indicators: graduation requirements, course objectives, module output, and evidence, forming a result oriented indicator cluster. Each indicator corresponds to the competition module and certificate elements one by one to ensure consistency. At the same time, team collaboration, problem analysis, solution design, effective communication, professional ethics, lifelong learning and other dimensions are embedded into the task chain of cost software applications, achieving the integrated cultivation of professional abilities and general literacy. Based on this analysis, it can be concluded that as long as the mapping is clear, the evaluation data can achieve a closed loop and serve continuous improvement at the course and project levels.

3.2 Course Map and Hierarchical Structure

Build a four layer course map from basic tools to comprehensive applications. The A layer serves as the foundation for tools and data, covering cost data structures, lists and quotas, quantity and pricing platforms, with a focus on consistency in caliber and data quality. The B-layer is a linkage between BIM and cost, including cost modeling, list and price mapping, progress and pricing, model consistency verification, and other related content. The C-layer covers the entire process, including bidding procurement and contracts, dynamic cost control during the construction phase, completion settlement and change claims, risk and compliance, etc. The D-layer is designed for comprehensive project and competition certification integration, driven by real project data for cross role collaborative projects. It introduces enterprise mentors for joint evaluation and benchmarks with job training and internship requirements.

4. Teaching Design

4.1 Task Oriented and Contextualized

Using performance tasks driven by real project data as the backbone of the course. Each class revolves around a deliverable, such as “Monthly Report on Dynamic Cost Control during Construction Phase”, “List and Pricing Mapping Report”, “Bid List and BIM Model Consistency Verification Script”, etc. In classroom guidance, a short process of problem definition, statement of caliber, and tool selection can be used as the starting point, followed by evidence production, peer evaluation, reflection and improvement to form a closed loop within a short period of time.

4.2 Evidence Chain and Evaluation Design

4.2.1 Formative Evaluation

Formative assessment runs through the entire process of course learning, mainly covering the following aspects: first, attendance and classroom participation, focusing on students’ performance in classroom discussions, task advancement, and team collaboration; The second is the process oriented results, including the task output of each lesson, stage reports, model files, etc., which form a complete learning trajectory through continuous accumulation; The third is peer evaluation, which guides students to examine the achievements of others from the perspective of evaluators, learn from each other, discover problems, and improve their own judgment during the peer evaluation process; The fourth is learning reflection, encouraging students to regularly review their learning progress, difficulties, and improvement measures, and cultivating the ability of self-monitoring and adjustment. Through the various forms mentioned above, formative assessment not only provides teachers with a basis for teaching adjustments, but also helps students establish a sense of continuous improvement.

4.2.2 Summative Evaluation

Summative evaluation focuses on the overall assessment of students' comprehensive abilities, which can be conducted in the form of a competition based comprehensive assessment, simulating real competition or job task scenarios, and requiring students to complete the complete process from modeling, pricing to achievement reporting within a specified time. Simultaneously introducing situational oral exams, such as simulated job interviews, setting questions related to actual work in engineering cost positions, and testing students' abilities to analyze problems, express ideas, and respond to doubts. Through multidimensional and multi-party comprehensive evaluation, summative assessment can comprehensively reflect the overall level of students' knowledge, skills, and literacy.

4.2.3 Gauge Design

Around the seven dimensions of problem definition, solution design, tool application, data quality, communication and collaboration, professional ethics, and improvement suggestions. Pay attention to the rationality of the solution ideas, the efficiency of internal communication within the team, the division of labor and cooperation, and the integration of results. Encourage students to reflect on their existing achievements and propose targeted optimization ideas. The seven dimensions balance technical ability and general literacy, which is suitable for classroom task evaluation and can also be integrated with competition and certificate standards to achieve unified and reusable evaluation frameworks.

4.2.4 Achievement Calculation

The course objectives and graduation requirements are calculated through dual channels, and archived evidence is included in the CIP report. Based on this, it can be inferred that if the gauge is reusable and the evidence is standardized, the interannual fluctuations in achievement can be effectively controlled within an interpretable range.

The achievement measurement adopts a dual channel calculation method of course objectives and graduation requirements. On the one hand, based on the achievement of course objectives, analyze students' performance in various dimensions of measurement item by item, and form achievement data at the course level; On the other hand, aligning the course evaluation results with the graduation requirement indicators and reflecting the degree of support of the course for graduation requirements through an evidence chain.

4.3 Competition Certificate Integration and Resource Linkage

In terms of the connection between competitions and courses, with the relevant modules of the National BIM Graduation Design Competition for universities as the main docking point, the core tasks of the course are transformed into "campus competitions" according to the competition standards, designed as a graded challenge mode. Students gradually accumulate the abilities and achievements required for the competition while completing the course tasks. Introduce corporate mentors to participate in the evaluation process, making the evaluation criteria more closely aligned with industry reality. In terms of certificate docking, around the "1+X" related cost and digital building certificates, the knowledge points and skill requirements covered in their standards are decomposed and integrated into classroom tasks and gauges to ensure that students naturally meet the training needs of certificate assessment while completing course learning.

5. Implementation Path and Supporting Conditions

5.1 Integration of Industry and Education and Collaboration of "Dual Mentors"

Based on the experience of cultivating outstanding engineers through reform, schools and enterprises jointly build a management platform. Enterprise mentors intervene in course design, teaching, and evaluation in advance, forming a joint training and review mechanism, and creating a collaborative system of teacher exchange, curriculum integration, platform integration, and policy smoothness. Practice has shown that with the deep participation of enterprise mentors, course tasks are more closely aligned with the actual job requirements, and students' growth rate is significantly accelerated.

5.2 Software and Data Infrastructure Construction

Centered around mainstream cost software and BIM platforms, configure unified teaching images and standardized data dictionaries to ensure consistency and reproducibility in classroom, competition, and certification environments. To reduce the deviation caused by environmental differences, the course uniformly adopts containerized images, and key scripts and templates are centrally managed and published in a rolling manner.

5.3 Integration of Competition and Certificate Resources

Integrate industry competition ecology and training resources, establish a progressive training channel for school competitions, provincial competitions, and national competitions, and streamline the entire process of registration, training, submission of works, and feedback from judges. The competition question bank and course task bank are updated annually in both directions to ensure stable standards, updated scenarios, and consistent approaches.

5.4 Quality Assurance and Continuous Improvement

Conduct a lightweight review every semester and an in-depth evaluation every academic year to form a public record of “problems, measures, evidence, and review”. Based on fine-grained diagnosis of data, improvement measures can be focused on key areas.

6. Conclusion

This article proposes and verifies a reform plan for the isomorphic integration of “course competition certificate post” from the perspective of OBE: with the four layer course map and the three ring teaching mode as the main body, and the seven dimensional gauge and continuous improvement mechanism as the starting point, the course objectives, competition elements, certificate standards, and job requirements are structurally mapped onto observable and verifiable evidence.

(1) Software applications have shifted from simple tool training to comprehensive capability construction that integrates the entire process cost and engineering context.

(2) Competitions and certificates have become dual engines for advanced tasks and comparable evidence, and after students internalize the curriculum, the transfer cost is significantly reduced.

(3) The job standards have achieved a paradigm shift from “what to teach, how to teach” to “what to learn, and what to use as evidence” through the implementation of objective matrices and gauges as observable evidence.

References

Chen, M. K. (2024). *Research on the Reform of Talent Training Mode for Engineering Cost Major Facing High-Quality Development of Construction Industry*.

General Office of the Ministry of Education, et al. (2019). *Guiding opinions on promoting the pilot work of the 1+X certificate system** (Policy remains effective, with multiple work notifications and standard improvements from 2022 to 2025).

Ministry of Education. (2025, July 16). *Work report on the reform of industry-education integration for outstanding engineers*.

Yun, L. (2025). Research on teaching reform of construction cost management professional courses based on OBE education concept. *China Management Informationization*.