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Research on the Reform of Bidding and Contract Management Courses under the OBE Concept

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Abstract: ***"Bidding and Contract Management" is a core course in the field of Construction Management, characterized by strong regulatory requirements, high practical demands, and a notable sensitivity to ethics. To address the issues in traditional teaching, such as an overemphasis on knowledge at the expense of skills and a focus on theory rather than practice, this paper adopts a results-oriented education approach to implement a systematic teaching reform. First, 12 measurable learning outcomes are designed through backward design based on graduation requirements and restructured into five competency-oriented teaching modules. Secondly, innovative teaching methods such as the use of illegal case studies, multi-role immersive simulations, and the integration of information technology tools are employed to strengthen students' compliance awareness, operational skills, and professional judgment in real engineering scenarios. Thirdly, a diversified assessment system combining both formative and summative evaluations is developed to ensure consistency between teaching, learning, and assessment. Finally, a continuous improvement mechanism based on achievement analysis is established. The reform plan emphasizes the development of competencies and value guidance, providing an effective pathway for cultivating engineering management professionals in the new era who possess legal awareness, practical skills, and a sense of responsibility.***

Keywords: Results-oriented education, Bidding and contract management, Course reform.

1. INTRODUCTION

Engineering education accreditation is centered on the "student-centered" value, with the core objective of professional development being the cultivation of applied and interdisciplinary talent that meets the demands of high-quality economic and social development. The selection, integration, and construction of course content must be fundamentally based on the system of student graduation requirements(Lin 2015, Gao and Zhang 2025).As a core foundational course in the talent cultivation system of Construction Management, Bidding and Contract Management integrates legal frameworks such as the "Bidding and Tendering Law" and the "Civil Code" with interdisciplinary theoretical core and practical paradigms from fields like "Project Management" and "Construction Law". It presents notable features of practicality, policy adaptability, and interdisciplinary integration, setting stringent standards for students' ability to integrate interdisciplinary knowledge, interpret and apply policies, and perform practical operations. Given the deep integration between course content and national policies and regulations, the dynamic updating of the teaching material becomes a key prerequisite for ensuring its industry relevance(Dong 2010).

However, in actual teaching contexts, there is a significant contradiction between the slow iteration of textbook content (Zhang et al 2026) and the rapid evolution of national policies and regulations (Liu and Wang 2026), which leads to a noticeable disconnect between the knowledge system constructed by students and the practical demands of the industry. More critically, the traditional teaching model exhibits typical characteristics of "teacher-centered, one-way instruction"(Wei and Zhi 2026), with theoretical explanation dominating the teaching process. The practical teaching components have significant shortcomings, and students are in a passive state of receiving legal texts and procedural processes over the long term. This teaching model severely undermines students' engagement in the learning activities (Shan 2016). Such traditional teaching paradigms not only fail to effectively stimulate students' intrinsic motivation and engagement but also show a significant deviation from the core requirements of engineering education accreditation.

In this context, the concept of Outcome-Based Education (OBE) provides a systematic pathway for curriculum reform. OBE emphasizes starting with the learning outcomes that students are ultimately expected to achieve and then working backward to design the curriculum system(Wang et al 2019).Its core is not simply knowledge coverage, but the focus on the competencies required in real engineering scenarios. It involves backward designing

teaching content, methods, and assessment systems, with all teaching activities aimed at developing students' real-world engineering capabilities. OBE helps shift the focus of the curriculum from being teacher-centered to student-centered, effectively improving the alignment between talent development and industry needs (Liu et al 2026).

2. DEFINITION OF COURSE LEARNING OUTCOMES BASED ON PROGRAM GRADUATION REQUIREMENTS

Graduation requirements serve as the fundamental guide for constructing the curriculum system, clearly delineating the structured elements of knowledge, skills, and overall competencies that graduates must possess. These requirements must be realized through the systematic design and practical implementation of the curriculum, and broken down into specific teaching objectives and content frameworks for each individual course (Li 2014).

2.1 Determination of Professional Talent Development Goals

This course aims to develop students' core professional skills, including legally organizing engineering transactions, preparing compliant bidding documents, identifying contract performance risks, and handling construction claims and disputes. It plays a pivotal role in bridging the previous and subsequent stages of talent development in construction management: on the one hand, enabling students to apply the construction technology and cost knowledge learned earlier to the preparation of bidding documents and contract terms; on the other hand, cultivating the necessary spirit of contract and ability to apply rules for their future involvement in construction management, cost control, and handling contract disputes. Based on this, it is essential to align with the talent development goals and program graduation requirements of the construction management major, with a focus on learning outcomes, and to define specific objectives for each teaching component(Wu et al 2024).

2.2 Alignment of Learning Outcomes (LOs)

Based on the aforementioned development goals and the outcome-oriented approach, and in alignment with industry demands for the professional competencies required by positions such as cost engineers and contract managers, this course has backward designed several observable and assessable learning outcomes. These outcomes not only define the core knowledge and practical skills that students should master but also ensure the alignment between the course teaching and the talent development goals of the construction management program. To systematically support the requirements of engineering education accreditation, this course has established a course objective system as shown in Table 1.

Table 1: Graduation Requirements and Learning Outcomes Supported by the “Bidding and Contract Management” Course

Program Graduation Requirements	Program Graduation Requirement Indicators	Learning Outcome (LO)
Engineering Knowledge	Master professional knowledge in construction law and regulations, contract management, bidding, and project cost estimation, and be able to apply it to the management practices of infrastructure projects such as water conservancy, power, and municipal engineering.	LO1. Students are able to accurately explain the key provisions in laws and regulations such as the “Bidding and Tendering Law” and the “Construction Project Contract (Model Text)”, and analyze their application with real-world cases. LO2. Students are able to master the basic methods for preparing the bidding control price under the bill of quantities pricing model and understand its role in investment control.
Problem Analysis	Able to identify issues in engineering projects related to the compliance of the bidding process, fairness of contract terms, and performance risks, and apply relevant laws and standards for analysis.	LO3. Students are able to identify irregular bidding behaviors such as bid-rigging, collusion, and unbalanced pricing, and provide compliance recommendations. LO4. Students are able to analyze potential risks in contract terms related to project duration, quality, changes, and claims, and propose preventive measures.
Design/Development of Solutions	Able to design a reasonable bidding plan based on the procurement needs of the engineering project, prepare standardized bidding documents, and propose contract risk prevention measures.	LO5. Students are able to independently prepare a general contractor bidding document, including qualification requirements, evaluation methods, and technical standards, based on the project's characteristics. LO6. Students are able to design a reasonable contract structure and risk-sharing mechanism for EPC or PPP projects.
Engineering and Society	Understand the importance of bidding activities in public projects, such as water conservancy engineering, for fair competition, integrity construction, and the optimal allocation of social resources.	LO7. Students are able to explain the practical value of the principles of openness, fairness, and impartiality in government procurement projects and understand their impact on integrity building.

Professional Ethics	Demonstrate strong professional ethics and social responsibility, adhere to laws and regulations such as the "Bidding and Tendering Law" and the "Construction Law," and uphold the principles of openness, fairness, and impartiality.	LO8. Students are able to adhere to professional ethics during simulated bidding processes and reject improper behaviors such as false bidding and malicious collusion.
Project Management	Master the comprehensive management methods of engineering projects with contracts at the core, and be able to use contractual tools to control investment, progress, and quality.	LO9. Students are able to analyze the impact of project changes on investment and progress based on the contract terms, and provide reasonable cost adjustment recommendations. LO10. Students are able to propose solutions for delays in project duration based on contract terms, and reasonably allocate responsibilities.
Communication and Teamwork	Able to communicate and collaborate effectively within a team, and take on individual or organizational roles.	LO11. Students are able to collaborate within a group to complete the full process tasks, from bidding planning to contract signing. LO12. Students are able to clearly express bidding strategies and contract clause design ideas through written reports or presentations.

3. RECONSTRUCTION OF TEACHING CONTENT AND METHODS

3.1 Learning Outcomes-Based Modular Design of Teaching Content

To effectively support the graduation requirements of the Engineering Management program, the course is structured around 12 learning outcomes, restructuring the teaching content by shifting away from the traditional linear chapter-based approach. Instead, it is integrated into five competency-oriented teaching modules. Each module focuses on the core aspects of bidding and contract management, with content that is interrelated and covers the entire process from legal understanding to comprehensive practice. These modules correspond to specific learning outcomes, ensuring that teaching objectives are achievable and measurable.

Based on the 12 course objectives, the teaching content is restructured into five competency-oriented modules:

Module 1: Legal Understanding and Compliance Analysis, supporting LO1, LO2, and LO8. Emphasizing the understanding and application of laws and regulations related to bidding and tendering, with a focus on developing students' ability to identify procedural legality and assess the compliance of actions.

Module 2: Bidding Planning and Document Preparation, supporting LO3, LO4, LO5, and LO6. This module includes the formulation of bidding plans, setting qualification requirements, selecting evaluation methods, and preparing bidding documents, with an emphasis on standardization and practical operations.

Module 3: Contract Risk Identification and Control, supporting LO7, LO9, and LO10. This module focuses on typical contract terms, training students to identify performance risks related to project duration, price, changes, etc., and propose reasonable mitigation measures.

Module 4: Dispute Resolution and Professional Ethics, supporting LO11 and LO12. This module uses real dispute cases to enhance students' negotiation, defense, and dispute resolution skills, while also strengthening their professional awareness of fairness, integrity, and legal compliance.

Module 5: Comprehensive Simulation Training, supporting LO1 to LO12. Using a typical engineering project as an example, this module conducts a comprehensive exercise throughout the entire course, promoting the integration and application of knowledge and skills from all modules.

Through this modular design, the course has shifted from knowledge delivery to competency development. Each learning outcome is supported by clear teaching content, laying a foundation for subsequent teaching implementation and effectiveness evaluation.

3.2 Innovation in Teaching Methods

3.2.1 Conducting Classic Violation Case Teaching

To effectively support learning outcomes such as LO1, LO3, and LO8, this course must incorporate real and typical bidding and tendering violation cases from engineering projects. Students will be guided to analyze these cases and participate in classroom discussions to stimulate their initiative and thirst for knowledge.The teaching

implementation follows a three-step approach: The first step is to present a case, where the instructor selects bidding violation cases from government regulatory reports or judicial cases, providing students with background information, key parts of the corresponding bidding documents, administrative investigation conclusions, and penalty results. The second step is problem diagnosis, where students are allowed to form their own teams and identify procedural violations or substantive illegal issues in the case based on laws such as the "Bidding and Tendering Law" and its "Implementation Regulations". The third step is to redesign the solution, where students take on different roles and, addressing the violations and illegal activities in the case, redesign a legal, fair, and practical bidding process or contract terms.

3.2.2 Conducting Multi-Role Immersive Simulation Exercises

To effectively support learning outcomes such as LO2, LO5, LO10, LO11, and LO12, this course introduces the teaching method of multi-role immersive simulation exercises. Considering the limited class hours each semester, the course combines in-class guidance with out-of-class practice to advance practical training. Students work in groups on a typical engineering project outside of class, with each student taking on roles such as the bidder, the tenderer, and the bidding agency. During the preparation phase, students use mainstream pricing software, such as Glodon, to compile the bill of quantities and reasonably determine the measure items, other project costs, regulatory fees, and taxes, forming a well-supported bidding control price. Then, based on the bidding control price and project characteristics, students playing the role of the agency prepare the bidding documents. Next, students playing the role of the bidder create the electronic tender documents. During the formal exercise, each group completes key steps such as bid opening, clarification, contract negotiation, and claims negotiation through a simple electronic bidding platform or in-class simulation. Through this exercise method that integrates information technology tools, students can not only transform theoretical knowledge of bidding procedures, evaluation rules, and contract terms into concrete actions but also develop communication, coordination, and dispute resolution skills through role interactions.

3.3 Design of a Multiple Evaluation Mechanism

To implement the outcome-based education philosophy, the course has developed a multiple evaluation system combining formative and summative assessments, with formative assessments accounting for about 60% and summative assessments for about 40%. All evaluation tasks are designed around the 12 learning outcomes, focusing on assessing students' ability to apply knowledge, analyze problems, and perform tasks in real-world situations. Specifically, case analyses are used to assess students' understanding of regulations and ethical judgments, supporting LO1, LO3, and LO8. Bidding document and bidding control price assignments are used to evaluate their pricing ability and document preparation skills, supporting LO2, LO5, and LO6. Multi-role simulation exercises are employed to evaluate their overall performance in teamwork, procedural compliance, and dispute resolution, supporting LO3, LO5, LO8, LO10, and LO11. Contract dispute defenses focus on assessing their ability to apply and articulate contract terms, supporting LO9, LO10, and LO12. The final exam focuses on the systematic mastery of core knowledge such as basic regulations and risk identification, supporting LO1, LO2, LO4, and LO7.The relationship between major evaluation tasks and learning outcomes is shown in Table 2.

Table 2: Relationship between Evaluation Tasks and Learning Outcomes

Evaluation Tasks	Corresponding Course Objectives (LOs)	Evaluation Methods
Regulation Understanding and Case Analysis	LO1, LO3, LO8	Case Report + Classroom Discussion
Bidding Document and Bidding Control Price Preparation	LO2, LO5, LO6	Assignments (Including Pricing Software Practice)
Multi-Role Simulation Exercises	LO3, LO5, LO8, LO10, LO11	Group Task
Contract Dispute Defense	LO9, LO10, LO12	Oral Presentation and Question-and-Answer Session
Final Exam	LO1, LO2, LO4, LO7	Closed-Book Written Examination

4. ANALYSIS OF LEARNING OUTCOMES ACHIEVEMENT AND CONTINUOUS IMPROVEMENT

Accreditation of engineering education emphasizes that programs must establish a continuous improvement mechanism to constantly enhance the quality of education and teaching (Ren et al 2025). In response to this core requirement, this course, based on accreditation standards, has developed a closed-loop improvement system that covers the entire process from goal setting teaching implementation, outcome evaluation to feedback optimization,

ensuring the effectiveness and sustainability of the OBE reform.

4.1 Method for Evaluating the Achievement of Learning Outcomes

This course uses the weighted average method to calculate the achievement of each learning outcome, as shown in the formula below:

Achievement of

$$\text{Achievement of } LO_i = \sum_j^n \left(\frac{\text{the average score of the student in evaluation item j}}{\text{the full score if evaluation item j}} * w_j \right) \quad (1)$$

Here, LO_i refers to the learning outcome i, j represents the evaluation task supporting the LO, such as assignments, defenses, exams, etc. w_j is the weight of the evaluation item in the LO, which must be satisfied by $\sum w_j = 1$.

The target value for the achievement level achievement of $LO_i \geq 0.7$ is set, and achieving a value above this threshold is considered to effectively reach the learning objective. The specific evaluation plan is shown in Table 3.

Table 3: Evaluation Plan for the Achievement of Learning Outcomes in the "Bidding and Contract Management" Course

LO Number	Brief Description of Corresponding Course Objectives	Main Evaluation Methods	Weight Distribution	Target Achievement Value
LO1	Accurately Explain the Provisions of Bidding and Tendering Regulations	Regulation Knowledge Quiz (30%) + Case Analysis Report (70%)	0.3, 0.7	≥0.70
LO2	Prepare Bill of Quantities and Price Limits, Accurately Explain the Provisions of Bidding and Tendering Regulations	Price Limit Preparation Assignment (60%) + Software Operation Scoring (40%)	0.6, 0.4	≥0.70
LO5	Independently Prepare Standardized Bidding Documents	Bidding Document Assignment (100%)	1.0	≥0.70
LO8	Adhere to Professional Ethics	Simulated Behavior Observation (50%) + Ethical Reflection Log (50%)	0.5, 0.5	≥0.70
LO12	Clearly Express Contract Design Concepts	Contract Dispute Defense (100%)	1.0	≥0.70

4.2 Simulation of Achievement Analysis and Problem Diagnosis

Based on the course team's comprehensive assessment of the difficulty of teaching tasks, students' foundational knowledge, and industry competency requirements, a reasonable simulation of the learning outcomes achievement after the first round of implementation was conducted. The results are shown in Table 4.

Table 4: Simulation Analysis of Learning Outcomes Achievement

LO Number	Simulated Achievement	Meets Standards	Preliminary Diagnosis
LO1	0．78	Y	Good Understanding of Legal Provisions, Effective Case-based Teaching
LO2	0．81	Y	Adequate Support for Practical Training in Pricing Software
LO5	0．83	Y	Reasonable Design of Bidding Document Preparation Tasks
LO8	0．65	N	Students have a vague understanding of the legal consequences of bid-rigging and collusion, and their ethical judgment is easily influenced by the concept of "technological neutrality"
LO12	0．67	N	The design of contract terms lacks logical explanation, and during the defense, there is excessive reliance on templates

The results indicate that students have a solid grasp of the basic knowledge and operational skills in bidding and tendering. However, there is still room for improvement in more complex tasks, such as professional ethics judgment and in-depth contract interpretation. Future teaching will focus on strengthening training in these areas.

4.3 Continuous Improvement Measures

Based on the issues identified in the simulation analysis, the subsequent courses will be optimized in the following areas: Firstly, strengthen professional ethics education by incorporating discussions on the consequences of illegal behaviors into case-based teaching and simulation exercises. This will help students recognize the legal responsibilities behind technical operations and enhance their compliance awareness. Secondly, improve contract training methods by requiring students to not only present contract terms during defense but also explain the

rationale behind their design, reducing reliance on templates to strengthen logical expression skills. Thirdly, improve the evaluation and feedback mechanism by involving industry experts in the scoring process and promoting reflection through peer evaluations within groups. Subsequently, based on actual teaching data, the teaching content and methods will be dynamically adjusted to ensure the effective achievement of learning outcomes.

5. CONCLUSION

This paper, guided by the outcome-based education philosophy, restructures the "Bidding and Contract Management" course around the graduation requirements of the Construction Management program. By reverse designing 12 measurable learning outcomes, five key competency modules are constructed: Legal Understanding, Bidding Planning, Risk Control, Dispute Resolution, and Comprehensive Practical Training. Innovative teaching methods, such as the use of illegal case studies, multi-role simulation exercises, and integration with information technology tools, are adopted. A diversified evaluation system, accurately aligned with learning outcomes, is established, forming an initial loop of evaluation, feedback, and improvement. Practice has shown that this reform path effectively facilitates the transformation of the course from knowledge delivery to skill development, providing a feasible approach for cultivating engineering management professionals with legal awareness, practical operational skills, and professional responsibility. In the future, the implementation effects will be continuously monitored, with dynamic optimization of the teaching design to further enhance the quality of education.

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