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Original Paper

Research on Teaching Reform and Innovation in the Project Management Course Based on "Case+"

Wang Chunxiao[1], Bu Chengguang[1] & Zhang Kefei[1]

[1] Qingdao City University, Qingdao, Shandong, China

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Abstract

Engineering project management is a course that intricately integrates theoretical knowledge with engineering practice, technology, and management. This paper provides an in-depth analysis of the characteristics of the engineering project management course as well as the current state of traditional teaching methods. It systematically constructs a "case+" teaching model for this course, encompassing key components such as precise case selection, engaging class interpretation, structured implementation processes, and dynamic case compilation. The proposed model aims to render the engineering project management course not only useful but also interesting, organized, and effective. Practical applications have demonstrated that the "case+" teaching mode can significantly enhance students' knowledge levels, skill sets, and learning attitudes. Furthermore, it offers robust support for innovative curriculum development while fostering new approaches to training engineering talents that align with societal needs.

Keywords

Engineering Project Management, Case+, Curriculum Reform, Practical Teaching

1. Introduction

As a highly practical course, the teaching objective of engineering project management extends beyond enabling students to master comprehensive and systematic scientific management and effective coordination. It also aims to cultivate their ability to apply management knowledge in addressing real-world problems. Traditional teaching methods often emphasize theoretical instruction, which can lead to the neglect of active student participation and the development of practical skills. This study focuses on a "case+" teaching model for the engineering project management course, highlighting the integration of actual engineering cases throughout the entire instructional process. This approach allows students to deepen their understanding and application of knowledge through case analysis,

discussion, and practice. On one hand, this model enhances teaching quality by stimulating students' interest in learning and encouraging initiative while fostering critical thinking and innovative capabilities. On the other hand, it injects new vitality into the development of the engineering management discipline by promoting a closer alignment between curriculum instruction and industry practice. Ultimately, this approach aims to produce more high-quality engineering management professionals for society.

2. Characteristics and Teaching Status of Engineering Project Management Courses

2.1 Characteristics of Engineering Project Management Courses

The engineering project management course encompasses a wide range of multidisciplinary knowledge, including engineering technology, economics, and management, making it significantly comprehensive. Throughout the entire life cycle of an engineering project—spanning from project planning and design to construction and operation—each phase necessitates the cross-application of knowledge across various fields. This integration demands that students possess strong abilities in knowledge synthesis and application, enabling them to analyze and address complex problems in engineering projects from multiple perspectives.

Engineering projects are inherently unique and one-off; each project encounters distinct environments, requirements, and challenges. Consequently, it is challenging for students to fully grasp the essence of engineering project management solely through theoretical instruction in the classroom. To bridge this gap, students must engage with actual engineering projects—from initial planning and bidding to contract signing as well as on-site management during construction processes up until completion acceptance—to gain a comprehensive understanding of the project's operational continuum while mastering practical skills necessary for real-world problem-solving.

The engineering industry is characterized by continuous development and transformation; new technologies, innovative ideas, and emerging models proliferate ceaselessly. In recent years, the adoption of Building Information Modeling (BIM) has facilitated digital integration within building information systems. This advancement provides a collaborative platform for all stakeholders involved in a project while significantly enhancing overall efficiency in project management practices. Furthermore, with the increasing emphasis on green building concepts, contemporary engineering projects prioritize resource conservation and environmental protection throughout all stages—including planning, design, construction—and operation. These emerging trends in the industry necessitate the timely integration of relevant content into engineering project management courses. This approach enables students to grasp cutting-edge developments, master new technologies and concepts, and adequately prepare for their future career trajectories.

2.2 Teaching Status of Engineering Project Management Courses

Currently, traditional lecture-based teaching methods continue to dominate the instruction of engineering project management. In these classes, educators primarily rely on textbooks and course materials, systematically delivering knowledge through PowerPoint presentations that outline basic concepts and principles related to engineering projects as well as various processes and methodologies in project management. However, without incorporating real-world engineering case studies, students often struggle to connect theoretical knowledge with practical applications. Furthermore, this method neglects the development and enhancement of students' practical application skills within the realm of engineering project management.

This pedagogical approach diverges from a student-centered educational philosophy prevalent in engineering education; consequently, students find themselves passively receiving information rather than actively engaging in critical thinking or exploration. Educators frequently concentrate on imparting knowledge while failing to stimulate student participation effectively; thus, classroom engagement tends to diminish over time. As a result, feedback from students is often unenthusiastic or negative—making it challenging for instructors to accurately gauge their learning progress promptly.

In this prolonged state of passive learning, students' comprehension remains superficial; they are unable to cultivate essential problem-solving abilities or innovative thinking skills necessary for addressing real-world challenges. The disconnect between theoretical understanding and practical application hinders effective achievement of training objectives within the curriculum.

3. Construction of the "Case+" Teaching Model for Engineering Project Management Course

This study proposes a comprehensive teaching model termed "Case+", grounded in the case teaching method, aimed at developing an engaging, structured, and effective engineering project management course. As illustrated in Figure 1, this model encompasses all stages from case preparation and classroom implementation to post-class summary feedback, thereby forming a complete closed loop. During the case preparation phase, emphasis is placed not only on the authenticity and representativeness of cases but also on ensuring that core knowledge points are accurately aligned with these cases. This alignment guarantees that the selected cases effectively convey the intended teaching content. In the classroom implementation stage, diverse instructional methods are employed—such as role-playing by project participants and group discussions—to stimulate student engagement and facilitate experiential learning. In the subsequent feedback phase, summarization efforts assist students in constructing a cohesive knowledge system while enhancing their awareness of management principles. Additionally, timely collection of student feedback allows for ongoing optimization and enhancement of case materials, resulting in a dynamically updated repository that continuously improves educational outcomes.

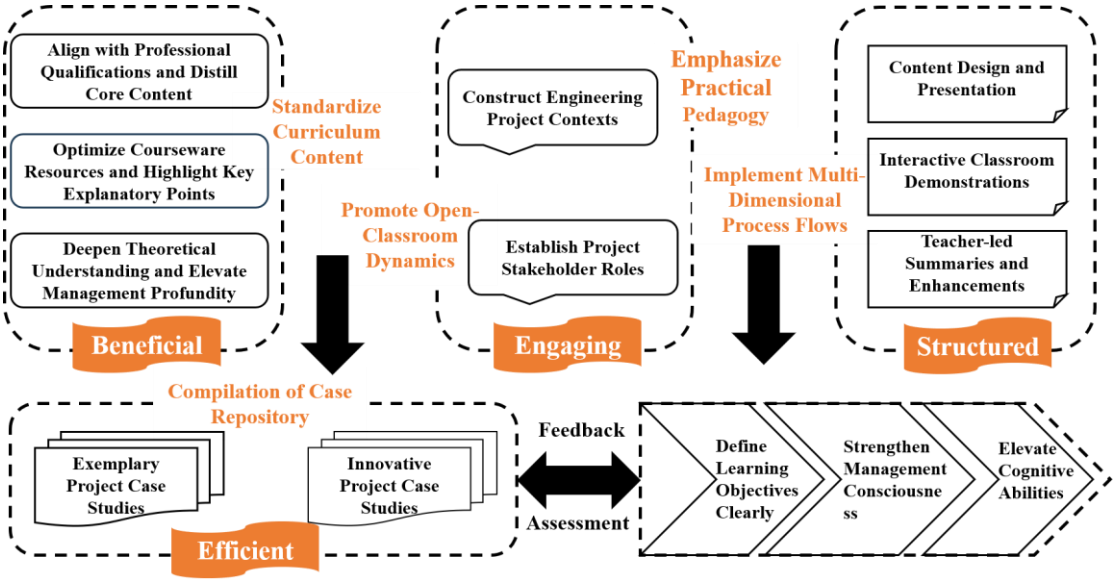

Figure 1. "Case+" Comprehensive Teaching Model

3.1 Extracting Useful Content and Screening Cases

In the "case+" teaching model for the engineering project management course, case selection is the initial and crucial step, directly impacting the effectiveness of the teaching. Selecting cases that align with the core content of the course ensures that the cases are closely integrated with the teaching objectives.

The engineering project management course is part of the content for numerous registered vocational qualification examinations in China's construction industry, such as those for construction engineers, cost engineers, supervisory engineers, and more. By following the selection and integration of teaching content based on standard vocational qualification examinations, the entire course can be broadly summarized as "three controls, three managements, and one coordination", as depicted in Figure 2. On one hand, utilizing vocational qualification examination content for extraction and case screening can deepen theoretical understanding, enhance management depth, better fit engineering practice, and achieve curriculum standardization. On the other hand, it can boost students' interest and enthusiasm for learning, laying a solid foundation for their future careers and acquisition of relevant vocational qualifications. Rich and high-quality case resources are the cornerstone of the "case+" teaching model, continuously invigorating the course through the mining of cases from multiple channels such as enterprise projects, industry reports, academic literature, and news media.

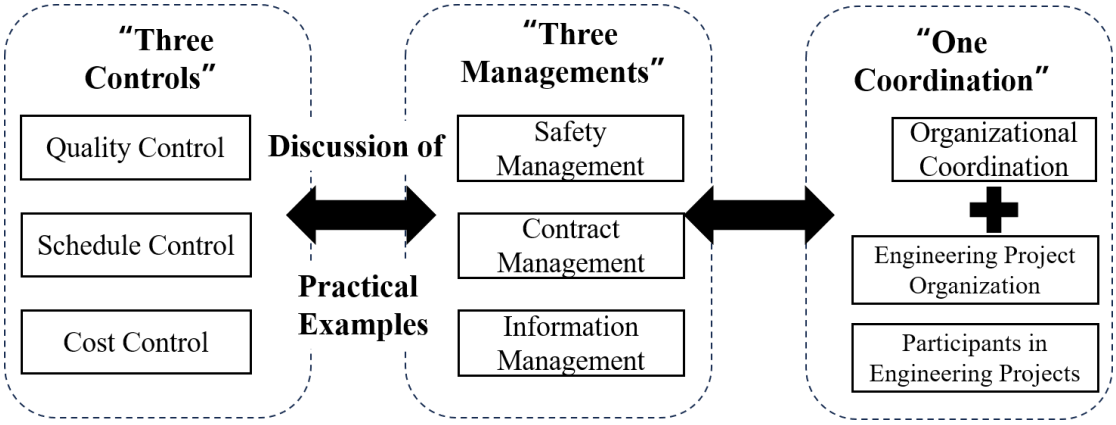

Figure 2. Core Content of the Engineering Project Management Course

3.2 Creating Engaging Classes and Implementing Cases

To better immerse students in case scenarios, multimedia can be fully utilized to play documentary footage of the construction process of building projects. Through the striking visual and auditory effects, students' attention can be instantly captured, making them feel as if they are on an actual construction site. Role-playing is also an effective method for creating scenarios. Within the context of real project cases, students are organized to play different project participants, such as construction units, building units, design units, consulting units, supervisory units, suppliers, etc., allowing them to deeply understand the responsibilities, tasks, and goals of each participant. For instance, students playing the role of a construction unit will focus on practical aspects like construction schedules, quality control, and cost management. During role-playing, students gain a deep understanding of the responsibilities and concerns of different roles in a project, significantly enhancing the fun and participation in learning, successfully stimulating students' interest in learning, and laying a good foundation for subsequent case analysis.

Moreover, in role-playing activities, students need to communicate and collaborate with other participants, just as they would in a real project environment. Through this interaction, students learn how to express their views clearly, understand the needs of others, and effectively resolve disagreements that arise in communication. At the same time, various problems will inevitably arise in projects, such as schedule delays, quality defects, cost overruns, and so on. During role-playing, students can experience these problems and attempt to solve them from the perspective of their role, thereby cultivating students' problem-solving thinking and abilities. In this process, students experience different professional roles in engineering projects and understand their positions and requirements, which helps students develop a sense of professional responsibility and professionalism.

3.3 Planning Orderly Processes and Summarizing Cases

During the case analysis phase, a three-dimensional classroom process is realized, and knowledge understanding is deepened through communication and collision. Firstly, student discussion groups are established, and each group is arranged to report and present, which is a concentrated display of students' learning outcomes and an important opportunity to exercise their expression and communication skills. After the presentation, a Q&A and interaction session is set up, allowing other team members to ask questions, express different opinions, or provide supplements on the content of the report. This process encourages students to further contemplate the details of the case, expand the boundaries of their thinking, cultivate critical thinking, and achieve the transfer and expansion of knowledge. Finally, after the students' presentation, the teacher provides a comprehensive and in-depth summary of the case. Starting from the specific details of the case, the teacher extracts the core points, connects scattered knowledge points into a complete knowledge system, helps students build a systematic cognitive framework, and enables them to deeply understand the flexible application of theoretical knowledge in practical projects.

3.4 Accumulating Effective Feedback and Compiling Cases

As direct participants in teaching activities, students' feedback is crucial for the optimization of the "case+" teaching model. After each round of case teaching, a questionnaire survey is designed to collect students' opinions. The contents of the questionnaire cover multiple dimensions, such as the perception of the difficulty of the case, asking students whether they thought the case was too complicated to understand or too simple to be challenging; the degree of interest stimulation, to understand whether the case theme and the setting successfully attracted students to study; and the auxiliary effect on knowledge mastery, exploring whether students' grasp of the core knowledge and skills of engineering project management has been significantly improved through case analysis, with questions set for students to answer from options like "very effective", "relatively effective", "average", "not very effective", "completely ineffective", and so on.

As the organizer and guide of teaching activities, self-reflection is the inner motivation to promote the continuous improvement of the "case+" teaching model. Reflect on whether the selected cases accurately correspond to the course teaching objectives and students' knowledge level, and consider whether the group discussion and case analysis guide successfully stimulated students' thinking vitality and prompted them to deeply explore the management logic behind the cases.

As the core resource support of the "case+" teaching model, the case base should be dynamically updated to adapt to teaching demands and industry development. Based on student feedback and teacher reflection, the case base is reviewed and optimized on a regular basis. At the same time, teachers are encouraged to transform the engineering projects and scientific research projects they participate in into teaching cases, integrating the latest technology applications and management innovation experiences, so that the case base remains vibrant, providing a steady stream of high-quality

materials for the "case+" teaching model, and ensuring that the teaching content keeps pace with the times and conforms to the development trend of the industry.

4. Evaluation of the "Case+" Teaching Model's Effectiveness

After implementing the innovative "case+" teaching model for the engineering project management course over one academic year, from the perspective of knowledge mastery, the pass rate of most students in core knowledge areas such as project schedule management and cost management has significantly improved in the final assessment compared to the traditional teaching model, with an increase in the average score. In terms of ability enhancement, based on the analysis of real projects, students exhibit clear division of labor and tacit cooperation, efficiently completing tasks with a notable improvement in problem-solving abilities. Regarding learning attitudes, class participation has greatly increased, with the majority of students actively engaging in case discussions and sharing their insights, significantly boosting their learning initiative—a stark contrast to the dull atmosphere in traditional classrooms.

Moreover, students' satisfaction with the "case+" teaching model is quite high; 85% of students believe that the cases are rich and closely aligned with reality, effectively aiding in knowledge comprehension. Compared to the traditional, monotonous theoretical teaching, the new model skillfully integrates knowledge into real engineering cases, making it more engaging and practical. Students also prefer the multiple integration methods such as case study, project-driven learning, group cooperation, and role-playing. They have a strong sense of class participation, high learning enthusiasm, and the teaching atmosphere is well-recognized by students. Overall, the "case+" teaching model for the engineering project management course has significantly enhanced students' interest and initiative in learning, making them more willing to deeply explore the knowledge and skills in the field of engineering management, injecting a strong impetus for them to join the engineering industry in the future.

5. Concluding Remarks

The "case+" teaching model strongly promotes the construction of the engineering project management curriculum and injects new vitality into the training of engineering management talents. Through the continuous optimization of case selection, classroom implementation, summary feedback processes, and the constant updating of the case base, it is expected to further improve the quality of teaching, providing society with more high-quality engineering management talents who possess solid theory, strong practical abilities, and an innovative spirit, thereby aiding the prosperity of the engineering industry.

With the rapid development of information technology, technologies such as Virtual Reality (VR) can be utilized in the future, allowing students to experience the project process in a comprehensive and immersive way, as if they could visit the project site in person. At the same time, deepening school-enterprise cooperation is a key path to the continuous optimization of teaching. Through the deep integration of enterprise project case resources with engineering project management courses, innovative practical cases can be realized to ensure that teaching is more in line with the actual needs of the industry.

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