

# Research on Teaching Innovation Reform of Engineering Project

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## Abstract

The course design of engineering project management is a course that emphasizes the combination of theory and practice. In order to make the course teaching closely related to engineering practice, enable students to flexibly use the methods and theories of engineering project management in engineering practice, and cultivate students' ability to solve practical engineering problems, the paper put forward some suggestions: firstly, the management of a complete "engineering project" is implemented on the basis of integrating the strengths of "practical teaching", "simulation teaching" and "project teaching method". Secondly, the course design is based on the carrier of "sand table" and adopts the method of "simulation" to fully experience the whole process practice of engineering project management. Thirdly, the curriculum design adopts the "sandwich" model simulation process design and the comprehensive teaching innovation idea of integrating diversified ideology and politics into the teaching reform, so as to effectively realize the combination of courses and competitions, form the practical training curriculum system with the unique style of engineering cost major, effectively improve students' innovative thinking ability, and achieve the purpose of cultivating students' comprehensive quality and ability.

## Keywords

Teaching innovation reform; Engineering project management curriculum design; BOPPPS

## Cite This Article

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## Introduction

Engineering project management curriculum design is a course that emphasizes the combination of theory and practice. When teaching this course, teachers should closely relate to practical engineering projects, so that students can deeply understand the theories and methods of project management through specific engineering projects, so as to cultivate students' ability to analyze and solve practical engineering problems. "Sandwich" teaching method is a training mode of "Theoretical learning-Practical training-Re-theoretical learning", which can achieve the purpose of cultivating students' practical ability and professional skill through practical training outside classroom teaching. At present, engineering project management curriculum design teaching is usually concentrated in one semester, while the actual project implementation cycle is generally 2-3 years, or even longer. High variation in time cause a result that most schools do not offer enough practising opportunities for students. Therefore, it is necessary to introduce sand table simulation into the teaching of course design of engineering project management. With sand table as the carrier, simulation method is adopted to simulate the whole process of engineering project management, so as to make up for the deficiencies in practice.

## Curriculum design teaching objectives and ability cultivation

Since the sand table simulation is a practical training part of engineering project management course design teaching, the simulation content should be closely related to course teaching. The content of course design includes five stages: project approval, design, bidding, construction and completion acceptance. From the perspective of teaching objectives, the simulation of each stage involves the cultivation of knowledge, ability and quality, and the results of each stage reflect the planning and results. Students in sand table simulation need to consider how to control the project quality and schedule, cost targets, and how to coordinate the relationship among owners, contractors, design units, supervision units, material suppliers, etc. Teachers should guide students to solve these frequently encountered problems in the real work situation, and finally deepen students' understanding of how to apply theoretical knowledge in practice, to achieve the purpose of cultivating students' comprehensive quality and ability.[1]

## Sand Table Simulation Process Design of Project Management

In the sand table simulation teaching of project management, students need to set up a project management team by themselves, and completing the management tasks by simulating various roles, practising in specific engineering cases and applying the theoretical knowledge they have learned. In this way, they can experience the whole process of project implementation in the simulation process, master and deeply comprehend the basic theory of project management, improve the ability of engineering practice. Sand table simulation teaching of engineering project management can be divided into the following four stages:

### Project start-up stage

In the simulation process of the project start-up stage, all the students should be divided into multiple collaboration groups, and a project team -- engineering project department should be set up, with about 5 people in each group acting as project manager, budget director, technical director, procurement director and financial director respectively, according to the characteristics of the specific engineering project. On this basis, the division of labor should be carried out to clarify their respective responsibilities.

## **Project Planning and Decision Stage**

The main tasks to be completed in this stage are as follows: (1) Analyze the basic data in the start-up stage and decompose the project WBS; (2) To formulate the implementation plan of the project; (3) Prepare the project schedule according to the requirements of the contract; (4) Prepare and optimize the project resource plan according to the schedule; (5) Prepare construction drawing budget documents based on construction drawings and bill of quantities; (6) Complete cost planning and analysis, and preliminary determine expected cost and profit; (7) Prepare the fund plan and finalize the financing plan.

## **Project implementation and control stage**

In the implementation and control stage of the project, each project management team should complete the following tasks :(1) The financing work of the project should be completed according to the financing plan formulated in the planning and decision-making stage, and appropriate adjustments should be made according to the actual situation; (2) The corresponding construction subcontract and labor subcontract should be signed, in order to control and manage the subcontractors according to the requirements of the contract; (3) Purchasing materials, receiving and inspecting goods, managing inventory and delivering goods according to resource plan; (4) Lease, use management and entry and exit control of construction machinery; (5) Division of labor and allocation of construction personnel; (6) Timely control and dynamic adjustment of project schedule, cost, quality and safety; (7) Project settlement and final accounts for completion.

## **Project closure and Evaluation Stage**

Project closure and evaluation stage mainly include project closure, project summary and evaluation. The project closure work mainly covers project acceptance, engineering handover and data handover. Project summary and evaluation include project team and project members assessment, project summary and project evaluation. The project closure work mainly requires the project team members to complete the simulation of the engineering handover process in accordance with the completion and acceptance procedures, while the project summary and evaluation is mainly based on the simulation process and results of the whole project, to assess the project team members and the project team, and to summarize and evaluate the project.

## **Improvement Ideas and Measures on Multiple Teaching**

### **BOPPPS Teaching Model**

BOPPPS teaching model is to divide the teaching process into 6 parts: leading-in, purpose, pretesting, interactive learning, posttesting and summing-up. The leading-in part includes two sections: physical sand table operation in the training room and electronic sand table operation. The teaching objective is to cultivate students' ability of independent thinking, knowledge integration and comprehensive application, and to clarify the post level responsibility objectives of the five roles. Guiding the students to master the rules of the sand table and review the basic management theory to complete the pretesting part. Interactive learning requires each student to complete at least two projects in different roles in order to achieve rotating participation in process management. Multidimensional posttesting, in the evaluation of group base score and individual score, considering the project complexity and role task difficulty, group and individual activity and other factors were weighted. The course ends with a summing-up meeting: each group explains what they learned and the improvement goals in the first place, and then the teacher points out the common problems and explains the ideal plan.[2]

## Information Tool Support

Introducing information teaching mode into PMST can bring a lot of convenience, for example, labor team entry and exit application form, project dispatch order and other manual documents can be submitted by electronic version to realize paperless office. The project management analysis tool software can be used to input the data of engineering quantity statistics table and cash flow record table, and the software can help in-depth mining and analysis of the operating data of each team. Teachers can supervise group status and check system rating through project management assessment system. BIM project management electronic sand table can be well connected with PMST, realize BIM virtual-real integration training, and solve the problem that the number of team members exceeds the number of roles, as well as the lack of physical teaching AIDS. Electronic sand table built-in project model is rich, students can also log in the electronic sand table at any time to practice, to achieve mobile learning.

## Competition Training Connection and Differentiated Teaching

The training goal of students majoring in project cost is to improve their innovative thinking ability and work creativity for the long run. PMST is an excellent diversified and comprehensive practical teaching platform, and there are relevant competitions to connect with it. Every year in the training course, we can find the outstanding students for candidates to participate in the competition. The electronic sand table allows students to practice anytime and anywhere using smart mobile terminals. The teachers are both young and middle-aged teachers with extensive experience in enterprise practice and competition guidance. These favorable conditions make it possible to integrate courses with competition training. Implementing differentiated teaching, students with strong interest and ability can increase project constraints, such as the constraint relationship between arrears and bank loans, the constraint relationship between main material field processing and finished main material, the constraint relationship between labor entry and exit and waiting expenses, etc., to improve the complexity of market environment, such as material increase, equipment shortage, labor rate increase and so on. For the rest of the students, they can complete the basic requirements of the course so as not to be pushed too hard.

## Diversified Ideological and Political Integration Into Teaching

In the reform of ideological and political teaching in the curriculum, the team teachers first strengthened the ideological and political education and the cognition of the curriculum ideological and political education, changed the teaching concept of the team from "teaching" to "education", and organically integrated the ideological and political content such as patriotism, craftsman spirit of a great country and socialist values with Chinese characteristics into the curriculum. In addition to enhancing the moral education consciousness of professional course team teachers, the curriculum ideology and politics can be deeply rooted in teachers' "heart". Secondly, the team implemented ideological and political teaching reform by digging deep ideological and political elements and revising the teaching syllabus. For example, ideological and political elements such as system engineering thought, cost control thought, patriotism, craftsman spirit, teamwork spirit and innovation spirit were integrated into the teaching syllabus. On the basis of realizing the basic functions of the course such as knowledge impartation and ability cultivation of students, Let ideological and political elements with the cultivation of socialist successors, practice the basic purpose of "moral cultivation". Thirdly, the teacher team achieves the teaching effect of "moistening things silently" by elaborately designing the teaching implementation process, that is, the curriculum ideology and politics into the classroom implementation, and then into the "brain (heart)" of students. For example, in the introduction of the initial project, brilliant and outstanding ancient architecture can be integrated into the teaching content as an example, and gradually guide students to form the habit of systematic thinking and

comprehensive consideration of problems; In the assignment of leading-in tasks, the achievements in the construction of project management design since the reform and opening up, the great achievements of "the devil of construction" and the ideological and political elements in the work run through the teaching process to gradually form students' professional quality, guide students to understand and think about their future career, and establish a sense of professional honor and mission. When it comes to cost control, BIM technology project management can be compared with traditional project management, emphasizing the opportunities and challenges brought by the major reform of Chinese science and technology for the vigorous development of the construction industry, so as to stimulate students' innovation consciousness and cultivate students' spirit of constantly pursuing new science. When emphasizing risk management, in addition to combining actual safety case accidents, it is more important to emphasize and strengthen the process of safety constraint objectives in the sand table, guide students to cultivate career sensitivity based on risk management, and then strengthen students' awareness of safety production and management, and guide students to firmly establish the people-oriented concept in the process of project management. Implement related laws and regulations on construction site quality and safety management. Finally, by studying and formulating the quality evaluation standard of ideological and political teaching reform in the curriculum, the teachers' team expands the evaluation perspective from the single evaluation dimension of professional knowledge and skills to students' ideological and political quality, humanistic quality, professional quality and attitude, professional sensitivity, social responsibility and sense of mission, teamwork, craftsman spirit, etc., that is, the evaluation system of ideological and political teaching in the curriculum. For example, the assessment should be carried out by means of professional literacy knowledge question and answer, group theme discussion and report, comprehensive practice, etc., in the process of assessment, students' mastery of curriculum knowledge and understanding of ideological and political literacy should be reflected, so as to achieve the purpose of professional curriculum learning and ideological quality education sharing the same direction and synergistic effect. And finally to achieve a full range of multi-angle diversified curriculum ideological and political.

## **Evaluation of Curriculum Innovation and Implementation**

Compared with traditional theory inducing deductive method and single traditional teaching method, the above teaching innovation is more obvious, practical, effective, flexible, autonomous, interesting and open while practicing the process of moral education. It can fully mobilize the enthusiasm, consciousness, creativity, interactivity and competitiveness of students' subjective learning. It can maximize the mobilization of students' interest in learning and stay in a excitatory state during the learning experience. In the sand table simulation training program, which integrates ideological and political processes, students can no longer get empty and boring concepts and theories, but acquiring valuable practical experience and deep understanding and perception. Meanwhile, students can exercise and improve their comprehensive quality and various abilities in the course teaching. Besides, it can be influenced and infiltrated in ideological and political quality, humanistic quality, professional quality and attitude, professional sensitivity, social responsibility and sense of mission, teamwork and craftsman spirit. According to the excellent students selected in the course teaching process of Wuhan University of Engineering Science, they have won the first prize of the Challenge Cup Extracurricular Academic Science and Technology Works Competition of Hubei University Students for many times, the first prize of the 10th National College Building Software Skill Certification Competition, the third prize of the "Huazhong Cup" Mathematical Modeling Challenge Competition of College Students, and the first prize of the undergraduate group of the 2022 National Digital Architecture Innovation Application Competition. At the same time, relying on the achievements of teaching innovation and talent training reform, the team also won the first prize of school-level teaching achievement Award. The main teacher has been awarded "Outstanding Individual", "Famous Young Teaching Teacher", "Model of teacher ethics and style" for many years.

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## Conflicts of Interest

There is no conflict of interest.

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