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# HANDS-ON LEARNING: EXPLORING PROJECT-BASED TEACHING IN CONCRETE STRUCTURE COURSES

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**Abstract**

Project-based teaching is an innovative pedagogical approach that immerses students in practical projects to enhance their knowledge and skills. This method offers diverse project options tailored to the specific course requirements, such as architectural design, translation projects, and more, to optimize the learning outcomes. This paper illustrates the effectiveness of project-based teaching through architectural design projects. By engaging students in hands-on design and construction tasks in real building projects, they gain in-depth knowledge and practical skills in concrete structure development. Additionally, students have the opportunity to explore and tackle real-world challenges, promoting active and experiential learning.

## Introduction

## 1. Characteristics of project-based teaching method

### 1.1 Taking the project as the main line

The project-based teaching method focuses on practical projects, immersing students in them and emphasizing the acquisition of knowledge and skills through practice. According to the characteristics of different courses, different types of projects can be adopted, such as architectural design, translation projects, etc., to achieve the best teaching effect. Taking architectural design as an example, by involving students in the design and construction of concrete structures in an actual building project, students can learn concrete structure knowledge and skills in a "real" construction site, and explore and solve problems in practice.

### 1.2 Problem oriented

The project-based teaching method emphasizes problem oriented approach and achieves teaching objectives by solving practical problems. This teaching method can stimulate students' interest in learning and improve their ability to learn independently and solve problems. Taking translation projects as an example, students need to face various language difficulties and cultural differences in actual translation projects. By seeking information, accumulating extracurricular reading, and practicing cultural decoding, they can improve translation skills and solve practical problems[1].

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### 1.3 Emphasize the cultivation of practical abilities

The project-based teaching method emphasizes students' practical abilities, liberating them from traditional classroom teaching, allowing them to acquire knowledge and skills in practice and apply them to practical life and work. Taking engineering projects as an example, students need to participate in the actual construction and management of engineering projects, understand engineering processes and standards, gain professional skills and experience through practice, and enhance practical abilities.

### 1.4 Interactivity in the teaching process

The project-based teaching method emphasizes the interaction between students and between students and teachers, which can promote cooperation and communication between students and build a dynamic learning atmosphere. At the same time, teachers can also understand students' learning situation and existing problems in real-time, and provide on-site guidance and feedback, making the teaching effect more accurate. Taking the implementation of educational planning projects as an example, students need to collaborate in groups to complete educational planning projects, exchange opinions, coordinate division of labor, and through communication and feedback with teachers, gain a deeper understanding of needs and goals, thereby improving students' cooperation and problem-solving abilities[2].

## 2. Application of project-based teaching mode in concrete structure courses

In the course of concrete structures, a project-based teaching method can be adopted. In this mode, actual engineering projects can be used as teaching carriers, allowing students to participate and deepen their understanding and mastery of course content by solving practical problems. At the same time, it also enhances their ability to solve practical problems and self-directed learning. Specifically, the following steps can be taken:

### 2.1 Select appropriate engineering projects

Before designing a teaching plan, it is necessary to first select the appropriate engineering project[3]. Concrete structure is a relatively broad category, including various types of engineering projects such as bridges, buildings, reservoirs, tunnels, etc. In order to ensure teaching effectiveness and quality, it is very important to choose engineering cases that are suitable for this course. The selected project should have a certain level of visibility and influence. This is beneficial for improving students' participation and enthusiasm, while also attracting more attention and attention. The selected project needs to have sufficient practical opportunities. A good teaching project should have a certain scale, involving different links and technical difficulties, in order to provide students with sufficient practical opportunities and opportunities to respond to challenges. There are many knowledge points that need to be mastered in the concrete structure course, and the selected project should be able to cover these knowledge points, so that students can have a more comprehensive grasp of the theoretical knowledge and practical skills they have learned[4].

### 2.2 Design a teaching plan

After selecting a suitable engineering project, it is necessary to design the corresponding teaching plan based on this project. The teaching plan should include various aspects such as teaching objectives, tasks, methods, and evaluation standards. The teaching objectives are the core of the teaching plan. In the concrete structure course, the teaching objectives can be divided into three levels: basic knowledge level, ability development level, and practical problem-solving level. The teaching objectives should be clear, specific, and quantifiable, which can guide students' learning and practical activities in the teaching process. Teaching tasks should be closely integrated with the selected project, and different tasks should be formulated according to different stages and stages. For example, in the design stage, students can be involved in the design and planning of bridges, thinking about the bearing capacity, design standards, and other issues of the bridge; During the construction phase, students can be involved in the preparation, pouring, and maintenance of concrete to enhance their operational and team collaboration abilities; During the acceptance and maintenance stages,

students can be involved in the development of safety monitoring and maintenance plans for bridges, improving their practical application and self-learning abilities.

### 2.3 Student participation

The active participation of students is one of the core links of project-based teaching methods. Students experience and master practical operations by participating in practical projects, and combine the theoretical knowledge they have learned with practical operations. In the concrete structure course, student participation can be divided into three stages: preliminary design and planning, mid-term construction and monitoring, and later acceptance and maintenance. Different skills and qualities are required at different stages, requiring corresponding guidance and guidance. In the early stage of design and planning, students need to master knowledge and skills such as the bearing capacity and design standards of bridges, participate in the design and planning of bridges, think about different solutions and possible problems, and provide solutions. In the mid-term construction and monitoring phase, students need to master practical skills in concrete preparation, pouring, and maintenance, participate in practical operations, and collaborate with team members to complete work tasks[5].In the later acceptance and maintenance stages, students need to master knowledge and skills in bridge safety monitoring and maintenance plan formulation, and participate in bridge safety monitoring and maintenance.

### 2.4 Coaching and evaluation

In the process of student participation, teachers need to act as mentors, providing guidance, guidance, and guidance to students. Teachers need to understand the specific problems and difficulties faced by students and provide timely help and advice. Meanwhile, evaluation is an indispensable part of the teaching process, and teachers need to evaluate and provide feedback on students' practical projects. In concrete structure courses, various evaluation methods can be used, such as oral reports, written reports, practical operations, and summary reports. Teachers can also record and provide feedback on students' participation in actual projects, promptly identify students' problems and difficulties, and solve them. In addition, teachers should also create a good academic atmosphere, encourage students to actively participate in practical projects, and enhance students' enthusiasm and motivation through various means. For example, competitions and sharing activities can be organized to encourage students to showcase their talents in fierce competition, thereby promoting their growth and development.

## 3. The significance of project-based teaching method in the construction of concrete structure courses

The teaching mode based on project-based teaching method is of great significance in the construction of concrete structure courses. This teaching method combines theoretical knowledge with practical projects, exercises students' practical abilities by participating in practical projects, promotes the integration of knowledge, cultivates students' comprehensive qualities, and improves the practicality of the course. The specific significance will be analyzed in detail below.

### 3.1 Enhance students' practical abilities

The course of concrete structure is an interdisciplinary course that combines theory with practice. Traditional classroom teaching often only emphasizes the explanation and mastery of theoretical knowledge, lacking practical support, making it difficult to truly improve students' practical abilities. Adopting a project-based teaching model that combines actual projects with course content, allowing students to personally participate in the project, effectively improving their practical abilities. In the concrete structure course, students can master practical skills and improve operational abilities by participating in the preparation, pouring, and maintenance of concrete. At the same time, in the design and planning of bridges or buildings, students need to consider various issues such as load-bearing capacity and design standards, thereby exercising their ability to solve practical problems. Through project-based teaching, students can master more practical skills and combine theoretical knowledge with practical operations to improve their practical abilities.

### 3.2 Promote the integration and integration of knowledge

Traditional classroom teaching often faces problems of isolated knowledge points and a lack of overall grasp, making it difficult for students to truly grasp and understand the knowledge they have learned. The project-based teaching model enables students to better grasp and understand the knowledge learned through the participation of actual projects. In the course of concrete structure, students need to master the evaluation methods of concrete strength and durability, seismic foundation design principles, and other knowledge from a theoretical level. At the same time, they also need to learn practical skills such as how to adjust the concrete mix ratio, inspect the concrete site during construction, and analyze possible problems that may occur during the concrete pouring process during construction. By participating in projects, students can not only apply theoretical knowledge to practical operations, but also gain a deeper understanding of relevant knowledge points through practical problems. Thus promoting the integration of knowledge and improving students' learning outcomes.

### 3.3 Cultivate students' comprehensive qualities

The project-based teaching model can effectively promote the cultivation of students' comprehensive qualities, including innovation ability, teamwork ability, etc. In the concrete structure course, students need to face various problems and challenges in practical projects and solve problems through innovative thinking. Meanwhile, due to the fact that practical operations often require multiple people to collaborate, students also need to possess strong teamwork skills. Through project-based teaching, students can better exercise their innovation and teamwork abilities, thereby comprehensively cultivating their comprehensive qualities.

### 3.4 Improve the practicality of the course

Traditional teaching often only focuses on imparting theoretical knowledge and lacks practical support, making it difficult to truly cultivate students' application abilities. Adopting a project-based teaching model that combines actual projects with course content, allowing students to personally participate in the project, greatly improving the practicality of the course. In the course of concrete structures, students need to master practical skills such as the preparation and pouring techniques of concrete, as well as solutions to potential problems that may arise during construction. By participating in practical projects, students can not only master more practical skills, but also apply the knowledge they have learned to practical situations. This not only improves students' application abilities, but also lays the foundation for their future related work.

In summary, the teaching mode based on project-based teaching method is of great significance in the construction of concrete structure courses. By participating in practical projects, students' practical abilities can be enhanced, knowledge integration can be promoted, students' comprehensive qualities can be cultivated, and the practicality of the curriculum can be improved. In future teaching practices, more attention should be paid to the application of project-based teaching methods to achieve better teaching effectiveness and quality.

## 4. Exploration on the construction of concrete structure curriculum

### 4.1 Course objectives

Concrete structure is one of the important courses in the field of construction engineering. Its main goal is to cultivate students' knowledge and skills in the design, construction, supervision, and other aspects of concrete structures, as well as the ability to independently complete tasks such as concrete structure design, construction, management, and technical services. It should be noted that in practical work, architects and engineers have different roles and responsibilities in the design and construction of concrete structures, so the goals of concrete structure courses should vary according to different types of students.

For architects, the main goal of the concrete structure course should be their understanding of the design and architectural form of concrete structures. Architects need to understand the properties and characteristics of concrete materials, and understand how to use concrete materials to achieve architectural design. At the same time, architects also need to understand the basic knowledge of the construction process and supervision

standards of concrete structures. Therefore, concrete structure courses for architects should pay more attention to the cultivation of architectural design and aesthetic awareness, emphasize the correlation between concrete structure and architectural design, and focus on cultivating students' practical and innovative abilities.

For engineers, the main goal of the concrete structure course should be to master the design, construction, management, and technical services of concrete structures. Engineers need to master the relevant theories and methods of concrete structure design, and be able to design and calculate reasonably according to the needs of different projects. At the same time, engineers also need to possess the construction management ability of concrete structures, be able to provide on-site guidance and management for the construction of concrete structures, and solve problems encountered during the construction process. Therefore, concrete structure courses for engineers should pay more attention to the combination of theoretical knowledge and practical operation skills, emphasizing students' practical ability and problem-solving ability.

**4.2 Course content**

The content of the concrete structure course mainly includes concrete materials and properties, concrete structure design and calculation, concrete structure construction, concrete structure inspection and evaluation, and other aspects. Specifically, concrete materials and properties include the basic composition, strength, durability, deformation, and other basic properties of concrete materials; Concrete structure design and calculation include the principles of concrete structure design, load calculation, structural layout and structural design, etc; Concrete structure construction includes concrete pouring construction, support structure construction, and concrete waterproofing construction; Concrete structure inspection and evaluation include concrete structure safety inspection, damage assessment, and repair/building reinforcement. For the study of concrete materials and properties, students need to understand the composition, characteristics, and performance indicators of concrete materials, and be familiar with the uses and properties of different types of concrete materials. Understanding the basic properties of concrete such as strength, durability, and deformation can provide scientific basis for the design and construction of concrete structures.

In the design and calculation of concrete structures, students need to learn the relevant theories and methods of concrete structure design, and be able to design and calculate reasonably according to the needs of different projects. At the same time, students also need to understand the structural layout and design of concrete structures, in order to lay a solid foundation for the practical application of concrete structures. In the construction of concrete structures, students need to learn knowledge and skills in the construction process of concrete support structures, methods and processes of concrete pouring construction, and concrete waterproofing construction. These knowledge not only help students to have a deep understanding of the structure and construction technology of concrete structures, but also enhance their practical and innovative abilities. In terms of concrete structure detection and evaluation, students need to understand the relevant theories and methods of concrete structure damage assessment and repair/building reinforcement, be able to conduct on-site safety inspections and damage evaluations of concrete structures, and propose corresponding repair and reinforcement measures.

**4.3 Teaching methods**

This article proposes a project-based teaching model. This model uses actual projects as a carrier, allowing students to deeply understand the course content through participation in actual projects, while also enhancing their ability to solve practical problems and self-learning ability. The teaching mode based on project-based teaching mainly includes the following aspects: project-based approach, problem-oriented approach, emphasis on cultivating practical abilities, and interactivity in the teaching process. In this mode, students can actively participate in the project practice process, deepen their understanding and mastery of the course content through practical operations, and also enhance their self-learning and innovation abilities. In the course of concrete structures, project-based teaching methods can be adopted. For example, students can be involved in the design

and construction of concrete structures in an actual construction project, allowing them to learn concrete structure knowledge and skills in a "real" construction site, and explore and solve problems in practice. In project-based teaching, teachers should play the roles of mentors and mentors, providing necessary technical support and guidance to students, while also providing ample room for students to think independently and solve problems independently.

### 4.4 Evaluation of teaching effectiveness

The evaluation of teaching effectiveness is an important link in the construction of concrete structure courses, mainly including the evaluation of students' comprehensive quality and the evaluation of relevant practical achievements. Among them, the evaluation of students' comprehensive quality mainly considers students' teamwork ability, Critical thinking and innovation ability. These evaluation standards can not only improve the participation of course teaching, but also promote the comprehensive and diversified development of students. In addition to the comprehensive quality evaluation of students, the evaluation of teaching effectiveness should also include the evaluation of relevant practical achievements. In the concrete structure course, relevant practical achievements include the performance of students in the design, construction, management, and technical services of actual projects, such as the rationality of design schemes and the standardization of practical operations. These evaluation standards can truly reflect students' practical and innovative abilities, providing reference for teachers to further improve curriculum construction.

## 5. Conclusion

In summary, this article proposes a project-based teaching model through the exploration of the construction of concrete structure courses. This model not only effectively improves students' practical abilities and comprehensive qualities, but also promotes the integration of knowledge and enhances the practicality of the curriculum. I believe that adopting project-based teaching methods will be more widely applied in future teaching.

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