Education Reform and Development, 2024, Volume 6, Issue 4
https://ojs.bbwpublisher.com/index.php/ERD
Online ISSN: 2652-5372
Print ISSN: 2652-5364

# Exploration and Research on the Project-Driven Teaching Mode of Building Materials and Testing Experimental Course

**Jun Zhou*, Qingyun Zeng, Dan Huang**

Jiangxi Industrial Polytechnic College, Nanchang 330096, Jiangxi Province, China

***Corresponding author:*** Jun Zhou, zhoujunjxnc@163.com



**Abstract:** The project-driven experimental course teaching model focuses on the cultivation of students' practical and innovative abilities, with projects as the core. This study takes the course "Building Materials and Testing" as an example to explore and evaluate the effectiveness of specific implementation methods of the project-driven experimental course teaching model. Through practical case analysis, it was found that this teaching model effectively enhanced the student's practical hands-on abilities, innovative thinking abilities, and teamwork abilities. In this teaching model, students are not just passive recipients of knowledge, but actively learn by participating in project practice. They need to apply the knowledge they have learned to solve practical problems and cooperate with team members to complete project tasks. This learning approach makes students more proactive and positive, cultivating their practical hands-on abilities and teamwork abilities. With this, the teaching of experimental courses in architectural majors can refer to and draw lessons from the project-driven experimental course teaching model. However, teachers need to pay attention to solving potential problems when implementing this teaching model to ensure optimal teaching outcomes.

**Keywords:** Project-driven experimental teaching mode; Building materials and testing; Practical ability; Innovative ability; Teamwork

**Online publication:** May 20, 2024

## 1. Introduction

With the development of society and the continuous progress of educational reform, the teaching mode of higher education is constantly innovating and reforming [1]. The traditional classroom teaching mode has been unable to meet the needs of students, and the project-driven experimental teaching mode has emerged. This teaching mode takes projects as the core, focuses on the cultivation of practical and innovative abilities, and enables students to better cope with real-life challenges [2]. In the traditional classroom teaching mode, students mainly receive knowledge and theoretical indoctrination, lacking practical and application opportunities. In the project-driven experimental teaching mode, students will participate in real or simulated projects, engage in practical and innovative activities, and thus improve their practical abilities, innovative thinking abilities,

and teamwork abilities [3]. This teaching mode can better cultivate the student's comprehensive and application abilities, enabling them to better solve practical problems [4].

This paper takes the "Building Materials and Testing" course as an example to explore the specific implementation methods and effects of the project-driven experimental teaching mode. Through practical case analysis, we will discuss the impact of this teaching mode on students' practical abilities, innovative thinking abilities, and teamwork abilities [5]. At the same time, this paper also analyzes the problems encountered in the teaching practice of this teaching mode and proposes corresponding solution strategies, providing beneficial references for the experimental teaching of construction-related majors [6]. In this study, a combination of qualitative and quantitative research methods will be adopted to evaluate the effectiveness of the project-driven experimental teaching mode through practical investigation and data analysis. We will also compare it with the traditional classroom teaching mode to identify the advantages and value of the project-driven experimental teaching mode.

### 1.1. The concept and characteristics of the project-driven teaching model

The project-driven teaching mode is a teaching method that takes projects as the core and enables students to master knowledge and skills through participating in real or simulated project activities [7,8]. Compared with traditional classroom teaching, the project-driven teaching mode pays more attention to students' active learning and the cultivation of practical abilities. It emphasizes student participation and cooperation. In projects, students need to form teams to solve problems and complete tasks. Through teamwork, students can cultivate team spirit and collaboration abilities. This teaching mode fully utilizes practical environments and resources. The project-driven teaching mode focuses on practical operations and applications, allowing students to conduct practical operations and experiments in real or simulated situations, thus improving their practical abilities. Furthermore, this teaching mode encourages students' innovation and exploratory spirit. In projects, students need to think and solve practical problems, which stimulates their innovative thinking and problem-solving abilities. As students need to learn and think independently in projects, this cultivates their learning abilities and critical thinking through independent exploration. The project-driven teaching mode emphasizes interdisciplinary integration and comprehensive abilities. This is because students may need to integrate knowledge and skills from different disciplines and solve complex problems through the integration of various disciplines.

## 2. Design and implementation of project-driven experimental teaching in the course

### 2.1. Design of course objectives and content

In the Building Materials and Testing experimental course, clear course objectives and scientific design of teaching content are the keys to ensuring the effectiveness of teaching [9,10].

(1) Setting of course objectives

The main objectives of the Building Materials and Testing experimental course are to cultivate students' comprehensive understanding of the performance and characteristics of common building materials and to master relevant experimental testing methods and skills. The specific objectives include understanding the basic performance and characteristics of common building materials, including concrete, steel, etc.; mastering the experimental testing methods of common building materials, including compressive strength, tensile strength, bending, etc.; learning the methods of data collection, analysis, and processing, cultivating experimental design and data analysis abilities; cultivating teamwork awareness and communication skills, and completing experimental project tasks through

collaboration.

(2) Design of teaching content

A series of scientific and systematic teaching contents was designed. The classification, properties, and applications of common building materials, including concrete, steel, bricks, etc., were introduced so that students have a basic understanding of various building materials. The experimental testing methods of common building materials, including the principles, steps, and operational skills of performance tests such as compressive strength, tensile strength, and bending were also explained. A series of experimental projects were designed, taking the compressive strength testing of concrete as an example, to enable students to master experimental design and operational skills through practice. Guidance was provided for students' experimental operations in the experimental class, allowing them to personally conduct experimental operations and master experimental skills. They were also guided to analyze and process experimental data and present experimental results through charts, curves, etc. Students were required to write experimental reports based on experimental data, including experimental purposes, methods, results, conclusions, etc., to enhance their writing skills and scientific literacy.

The above design of teaching content aims to help students have a comprehensive understanding of the performance characteristics of building materials, master experimental testing methods, and skills, and cultivate experimental design and data analysis abilities, thereby achieving the course objectives.

## 2.2. Preparation of experimental environment and equipment

In the Building Materials and Testing experimental course, to effectively carry out project-driven teaching activities, it is necessary to ensure the preparation of the experimental environment and equipment [11,12].

(1) Layout of the experimental environment

To ensure the safety of students' experimental operations and the effectiveness of the experiments, the experimental environment should be arranged reasonably to ensure that the laboratory facilities are complete and the environment is clean. In this study, we selected a building materials laboratory with necessary experimental equipment and safety measures as the venue for experimental teaching. Sufficient experimental benches were also set up in the laboratory to ensure that students had enough space for experimental operations. Since dust, odors, and other harmful substances may be generated during the experiment, the laboratory, an exhaust system was installed to ensure fresh air and constant ventilation. The laboratory was also equipped with emergency facilities, including fire extinguishers, emergency exits, first aid kits, etc., to deal with emergencies.

(2) Preparation of experimental equipment

To carry out experimental projects on building materials and testing, a series of experimental equipment was prepared to support students in completing experimental tasks, including testing machines, concrete preparation equipment, safety protection equipment, data recording, and analysis equipment. The experimental measurement equipment was also equipped with a series of experimental measurement equipment, such as measuring rulers, pressure gauges, thermometers, etc., for measuring various parameters during the experimental process.

(3) Preparation of experimental materials

Various experimental materials were prepared to support the experimental operations. In the compressive strength testing project of concrete, raw materials such as cement, sand, aggregate, etc.,

were prepared, and concrete samples were mixed and prepared according to a certain mix ratio.

(4) Experimental operation procedures

To ensure the standardization and safety of experimental operations, detailed experimental operation procedures were formulated, including the preparatory work before the experiment, the operation steps during the experiment, and the equipment cleaning and storage after the experiment. Students were required to carefully read and comply with the experimental procedures before conducting experimental operations to ensure the smooth progress of the experiment and accurate data recording.

(5) Management of the experimental environment

To ensure the cleanliness and safety of the experimental environment, regulations for the management of the experimental environment were formulated, including daily cleaning and disinfection of the laboratory, regular inspection, and maintenance of experimental equipment. Teachers and laboratory administrators were responsible for supervising and managing the experimental environment.

Through the preparation of the experimental environment and equipment mentioned above, we provide necessary support and guarantee for the project-driven teaching activities in the Building Materials and Testing experimental course, and provide students with a good experimental learning condition.

### 2.3. Experimental process and result analysis

In the implementation of project-driven experimental teaching, experimental operations, and result analysis are very important. In the "Building Materials and Testing" course, ensuring the standardization of the experimental process and the accuracy of results is crucial [13,14]. Teachers should provide guidance and explanations for students' experimental operations and ensure that students can conduct experimental operations correctly and master relevant practical skills. Students should collect relevant data during the experiment and analyze and interpret the experimental results. Teachers can guide students in result analysis through explanations and discussions to help them understand the meaning of the experimental results.

### 2.4. Teacher's role and student evaluation

In project-driven experimental teaching, the role of the teacher and the evaluation of students are key factors in promoting teaching effectiveness. In the "Building Materials and Testing" course, teachers should play the roles of guide, facilitator, and evaluator [11]. Teachers should provide guidance, explanations, and necessary help and support. Through this, teachers can ensure the correctness of students' experimental operations and the accuracy of results. By acting as a facilitator, teachers can guide students in independent learning and thinking, and stimulate their innovative abilities and problem-solving abilities. Student evaluation is important feedback on the effectiveness of project-driven experimental teaching. Teachers can collect students' opinions through questionnaires, group discussions, etc., to improve teaching effectiveness based on the student's feedback.

## 3. Evaluation of effects and problem analysis

### 3.1 Selection of evaluation methods

When evaluating the effectiveness of a project-driven experimental teaching mode, multiple evaluation methods can be implemented to obtain comprehensive evaluation results. Questionnaires can be designed to collect students' opinions and feedback on the project-driven experimental teaching mode. The questionnaire can include the student's evaluation of the achievement of course objectives, practical abilities, innovative abilities, and teamwork abilities. By evaluating the submitted experimental reports, we can understand the student's operational and result analysis abilities during the experiment. The teacher can then evaluate the

student's practical operation abilities, data analysis abilities, and result interpretation abilities. By observing students' performances in group discussions and presentations, teachers can evaluate their teamwork abilities, communication and expression abilities, and innovative abilities. Teachers can evaluate and then provide feedback based on students' performances. Students should be encouraged to self-evaluate and reflect on their performances, summarize their experiences and lessons in the projects, and propose suggestions for improvement.

### 3.2. Analysis of evaluation results

According to the selected evaluation methods, the effectiveness of the project-driven experimental teaching mode was analyzed and evaluated. It can be concluded that the students' practical abilities, innovative abilities, and teamwork abilities improved. Furthermore, the student's feedback and self-evaluation helped teachers to understand the teaching effectiveness, identify problems, and make improvements.

### 3.3. Problem analysis and solution strategies

In the project-driven experimental teaching mode, some problems and challenges may be encountered. In the process of teamwork, there may be communication barriers and ineffective collaboration between team members. Solution strategies can include clarifying division of labor, strengthening communication and coordination, and cultivating teamwork awareness. During experimental teaching, there may be problems with insufficient or unsuitable experimental equipment. Solution strategies can include reasonable arrangement of experimental time and resources, and finding alternative experimental equipment or methods. Some students may lack interest or enthusiasm in project activities. Solution strategies can include increasing the interest and practicality of projects and providing personalized support and guidance. Lastly, the guidance and instruction of teachers play an important role in project-driven experimental teaching, but there may be problems of improper guidance or insufficient instruction. Solution strategies can include adequate preparation and planning of teaching content, and providing timely guidance and feedback.

By analyzing the problems and adopting corresponding solution strategies, continuous improvement and enhancement of the effectiveness of project-driven experimental teaching can be achieved. The active participation and cooperation of teachers and students are the key to solving these problems.

## 4. Conclusion

The project-driven experimental teaching mode can effectively enhance students' practical abilities, innovative abilities, and teamwork abilities. The project-driven experimental teaching mode also contributes to students' comprehensive qualities and career development. Through participating in project activities, students can cultivate comprehensive qualities such as independent learning, communication and expression, and problem-solving, improving their comprehensive abilities and competitiveness. The project-driven experimental teaching mode may encounter problems such as poor teamwork, insufficient resources and equipment, poor student engagement, and teacher guidance. Through reasonable solution strategies, these problems can be overcome, and teaching effectiveness can be continuously improved and enhanced.

## Funding

Exploration and Research on Project-Driven Experimental Course Teaching Mode - Taking the Course "Building Materials and Testing" as an Example (Project Number: XJKT-2312), a Campus-Level Project of Jiangxi

Industrial Vocational and Technical College for the Year 2023.

## Disclosure statement

The authors declare no conflict of interest.

## References

[1] Zhang B, 2021, Exploration of Project-Driven Flipped Classroom Teaching Mode. Educational Informationization Forum, 2021(10): 13–14.

[2] Yang Z, Shao K, 2023, Exploration and Practice of Project-Driven Pulsating Teaching Mode in Software Engineering Major. Computer Education, 2023(7): 166–170.

[3] Lan Y, Li D, 2024, Exploration and Practice of Project-Driven Teaching Mode Based on Real Projects. Die and Mould Making, 24(1): 107–109.

[4] Li X, 2019, Research on Teaching Reform of Project-Driven Method in Architecture Materials Course in The New Era. Occupation, 2019(16): 62–63.

[5] Li C, 2023, Research on the Application of Virtual Simulation Technology in Architectural Training. Jiangsu Building Materials, 2023(2): 129–130.

[6] Hou Y, 2018, Project-Driven Experimental Teaching Mode: Taking "Civil Engineering Materials" as an Example. Education and Teaching Forum, 2018(46): 265–266.

[7] Shan S, 2018, Teaching Reform of Project-Driven Method in Construction Technology Course. Jushuo, 2018(18): 176.

[8] Cao X, 2019, Research on the Application of Project-Driven Method in The Teaching of "Construction Engineering Budget." Industry and Technology Forum, 18(16): 187–188.

[9] Li Z, Chen W, Liu Y, 2020, Practice of Teaching Reform Based on Project-Based Task-Driven Method-Taking "Construction Engineering Measurement and Pricing" as an Example. Journal of Zhejiang Water Conservancy and Hydropower College, 32(5): 92–96.

[10] Qin A, 2020, Preliminary Exploration of Application-Oriented Undergraduate Course "Engineering Cost Budget" Based on Project-Driven Method. Curriculum Education Research, 2020(12): 232.

[11] Cai H, 2015, Reform Exploration of Project-Driven Method in The Practice Teaching of Architectural Design Major. Sichuan Cement, 2015(10): 30.

[12] Chen W, Xu Y, 2015, Teaching Reform of Building Materials Course Based on Project-Driven Method. Higher Architectural Education, 24(3): 103–105.

[13] Zhang D, Peng H, 2014, Teaching Reform of "Construction Engineering Measurement" Project-Based Course. Journal of Jiamusi Education Institute, 2014(1): 210–211.

[14] Wang P, Yi H, 2023, Discussion on the Reform of Construction Engineering Surveying Curriculum Based on the 1+X Certificate Perspective 7. Shaanxi Education: Higher Education Edition, 2023(6): 42–44.