

Innovative Teaching Practices based on Project-Oriented Approach

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Abstract: This paper focuses on the core principles of "theory, practice, and innovation" and explores innovative teaching methods in the educational process. Under a new teaching model, a series of experimental teaching projects are designed based on the project-oriented approach. Through teamwork, students' communication skills and collaborative spirit are enhanced, and ideological education is emphasized during the teaching process. The proposed innovative teaching model provides new ideas and methods for teaching reform. This paper details the implementation process of the project-oriented approach, the redesign of teaching content, the diversification of teaching methods, and the evaluation of teaching effectiveness, aiming to provide a reference for the reform of engineering education in universities.

Keywords: Project-Oriented Approach, Teaching Innovation, Practical Teaching, Ideological Education, Teamwork.

1. Background Introduction

With the advancement of new engineering education, university teaching has gradually shifted from traditional theoretical instruction to the cultivation of practical abilities. The new engineering education emphasizes the use of experiments, training, and projects to allow students to learn and master engineering skills through practice, thereby improving their ability to solve real-world problems. However, current teaching models still face several issues. Firstly, theoretical and practical courses are often offered separately, with practical courses typically lagging behind theoretical ones, preventing students from applying theoretical knowledge to practice in a timely manner. Secondly, some experimental equipment is unstable and prone to malfunctions, which limits the updating and expansion of experimental content. These issues may cause students to lose interest and enthusiasm for experiments due to poor equipment performance or inconvenient operations.

Additionally, traditional classroom teaching primarily relies on teacher lectures and student listening, making it difficult to stimulate students' interest and motivation. The teaching methods are too monotonous and fail to meet the diverse learning needs and styles of different students, which is inconsistent with the "student-centered" concept of new engineering education. Therefore, how to enhance students' practical abilities, innovative thinking, and teamwork skills through teaching innovation has become a critical issue in current teaching reform.

2. Exploration and Practice of Teaching Innovation

2.1. Exploration of Teaching Innovation

The project-oriented approach is a teaching method centered around "projects," where students complete the entire process of a project under the guidance of teachers[1]. This method emphasizes the student's leading role in the project, encouraging them to solve problems through discussion, negotiation, and collaboration, and to apply multidisciplinary skills to complete the project. The project-oriented approach not only enhances students' practical

abilities but also cultivates their innovative thinking and teamwork spirit.

Taking the undergraduate course "Computer Networks" as an example, the project-oriented approach drives student learning through practical projects, helping them master theoretical knowledge in practice and improve their problem-solving abilities. As shown in Figure 1, the teaching philosophy of the project-oriented approach is to closely integrate theoretical knowledge with practical operations through projects, forming an organic whole.

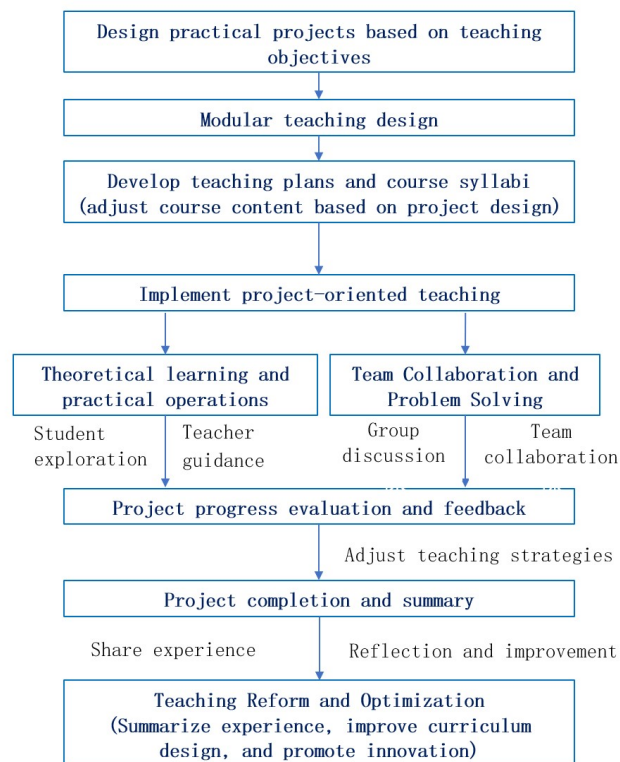


Figure 1. Teaching Philosophy of the Project-Oriented Approach

2.2. Practice of Teaching Innovation

2.2.1. Integration of Theory and Practice

The new engineering education emphasizes the importance

of practical teaching, allowing students to learn and master theoretical knowledge through experiments, training, and projects. The project-oriented approach is based on this concept, closely integrating theoretical knowledge with practical operations to build a unified curriculum system[2]. While explaining theoretical concepts, relevant practical projects are introduced, enabling students to engage in practical operations while learning theoretical knowledge, thereby deepening their understanding of the subject. Taking the computer networks course as an example, Table 1 shows the restructured teaching content based on the project-oriented approach, with each experimental project corresponding to an ideological point, ensuring that knowledge transmission and ideological education proceed simultaneously.

Table 1. Restructured Teaching Content Based on the Project-Oriented Approach

Experimental Project	Ideological Point
VLAN Division and Single-Arm Routing	VLAN division is like different roles and responsibilities within a team. Each VLAN has its specific functions and goals, collectively forming an efficient and secure network environment.
NAT Comprehensive Experiment	Encourage students to think innovatively, propose new solutions, and validate them through practice.
Capturing and Analyzing Data Packets Using Wireshark	When using tools like Wireshark to capture data packets, ensure that your actions comply with laws, regulations, and ethical standards.
Installing FTP Server Software	Guide students to think about how to use network technologies like FTP to serve society, such as participating in resource sharing and spreading positive energy.

This innovative teaching model breaks the limitations of traditional course sequences, flexibly arranging the order of theoretical and practical courses based on the actual needs of the projects[3]. Practical sessions are interspersed before or during theoretical learning, allowing students to apply their knowledge in practice promptly.

Implementation process is as follows:

(1) Project determination: Based on the syllabus of the computer networks course and actual needs, determine projects with clear goals and practical application value.

(2) Group collaboration: Divide students into several groups (3-4 students per group) and encourage them to complete the tasks required for the project through classroom lectures, self-study, and collaborative learning.

(3) Teacher guidance: During the project implementation, teachers provide necessary guidance and supervision to ensure that students follow the project requirements.

(4) Outcome presentation: After completing the project, organize students to present and evaluate their results.

(5) Feedback and improvement: Through evaluation, understand students' performance and shortcomings in practice, providing feedback for subsequent teaching.

2.2.2. Diversification of Teaching Methods

Enriching teaching methods is crucial for improving students' interest in learning, deepening their understanding of course content, and cultivating their practical application abilities[4]. In the implementation of the project-oriented approach, the following teaching innovations have been made:

(1) Interactive teaching: Use interactive methods such as classroom discussions, group collaboration, and role-playing to encourage active student participation in class. Through communication and cooperation, students deepen their understanding of computer network concepts. Design interactive Q&A sessions to encourage students to ask and answer questions, increasing classroom engagement[5].

(2) Decentralized teaching: Experimental projects adopt a decentralized teaching approach, allowing students to freely choose to conduct experiments in the computer lab or on their own computers. Decentralized teaching encourages students to arrange their own learning plans and solve problems independently, thereby cultivating their self-learning and problem-solving abilities. By installing and configuring the experimental environment themselves, students can gain a deeper understanding of the configuration and management processes of network devices. Students can plan their experiments according to their own schedules and learning progress, without being limited by fixed class times and locations.

2.2.3. Introduction of Cutting-Edge Technologies

With the rapid development of information technology, new technologies and ideas are constantly emerging. To keep students up-to-date with the latest trends in network technology, the course actively introduces cutting-edge technologies through special lectures and case studies, allowing students to understand the principles, application scenarios, and future development trends of these new technologies. For example, the course introduces emerging technologies such as cloud computing, the Internet of Things, and blockchain, helping students broaden their horizons and stimulate their innovative thinking.

3. Effects of Teaching Innovation

Through the implementation of the project-oriented approach, teaching effectiveness has been significantly improved. Firstly, theoretical knowledge provides students with a framework and foundation, while practical operations are the concrete application and validation of this theoretical knowledge. Through practice, students can more intuitively understand complex concepts, thereby deepening their grasp of theoretical knowledge.

Secondly, during the practical process, students need to collaborate with team members to complete tasks, effectively enhancing their teamwork skills and teaching them to communicate, coordinate, and divide tasks with others. Teamwork not only improves students' communication skills but also strengthens their sense of responsibility and collective honor.

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4. Challenges and Solutions in Teaching Innovation

Although the project-oriented approach has achieved significant results in teaching innovation, it also faces some

challenges during implementation. Firstly, the project-oriented approach places high demands on teachers, who need not only solid theoretical knowledge but also rich practical experience. To address this, schools should strengthen teacher training to improve their practical abilities and project management skills.

Secondly, the project-oriented approach requires a large amount of experimental equipment and resources. To solve this problem, schools can collaborate with enterprises to introduce real-world projects and technical resources, providing students with more practical opportunities. At the same time, schools can use virtual simulation technology to compensate for the lack of experimental equipment, allowing students to conduct experiments in a virtual environment.

Finally, the implementation of the project-oriented approach requires students to have strong self-learning abilities and teamwork spirit. To cultivate these abilities in students, teachers should provide necessary guidance and training at the beginning of the course to help students adapt to the new teaching model.

5. Conclusion and Future Prospects

The innovative teaching practices based on the project-oriented approach have not only improved students' practical abilities and problem-solving skills but also cultivated their teamwork spirit and innovative thinking. Through the integration of theory and practice, students can better master professional knowledge and apply what they have learned to solve real-world problems. At the same time, the integration of ideological education ensures that students develop correct values and a sense of social responsibility while learning professional knowledge.

In the future, we will continue to deepen teaching reform, further optimize the implementation process of the project-oriented approach, and explore more teaching methods suitable for new engineering education. At the same time, we

will strengthen cooperation with enterprises, introduce more real-world projects, and allow students to grow and develop in authentic engineering environments. We believe that through continuous teaching innovation, we can cultivate more high-quality engineering talents with innovative spirit and practical abilities.

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