



Exploration of New Teaching Methods for Undergraduate Engineering Students

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Abstract: In order to cultivate engineering high-quality talents with innovative ability and practical ability, this study explores a new approach to the teaching mode of engineering undergraduates in combination with theoretical practice, aiming to improve students' learning effect and comprehensive ability. Firstly, the problems of the traditional teaching mode are analyzed, based on which the framework of project-oriented learning teaching mode is constructed. The implementation effect of the method in enhancing students' innovation ability, problem-solving ability and teamwork spirit is further explored, and the effect of the teaching mode is evaluated. The teaching mode is of great significance for cultivating high-quality talents and improving the comprehensive ability of engineering undergraduates.

Keywords: Undergraduate education; Engineering education; Project oriented teaching mode; Impact assessment

1. Introduction

Undergraduate education occupies a dominant position in the higher education system. In today's fast-developing science, technology and engineering fields, practical teaching and learning in China's undergraduate engineering education is particularly critical. However, at present, the main teaching methods for Chinese engineering undergraduates are still based on the traditional "teacher-centered" teaching methods, This method has various problems, such as the lack of innovation, insufficient teaching resources, and the disconnection with the actual needs of the industry [1]. These challenges not only affect students' mastery of professional knowledge, but also restrict their development of practical application ability in their future career.

With the continuous progress of society and technology, cultivating engineering talents with innovative and practical abilities has become one of the main goals of current engineering education. In October 2019, the Ministry of Education issued the "Opinions on Deepening the Reform of Undergraduate Education and comprehensively Improving the Quality of Talent Cultivation". The Opinion proposes to comprehensively deepen the reform of undergraduate education and build an education system that comprehensively cultivates morality, intelligence, physical fitness, aesthetics, and labor skills. Therefore, there is an urgent need to explore and introduce new teaching methods to meet these challenges and enhance the quality and effectiveness of practical teaching. The purpose of this study is to explore an innovative practical teaching method for undergraduate engineering, combining theory and practice, with a view to providing reference and reference for the improvement and innovation of the current practical teaching mode.



2. Current Status of Research on New Approaches to Project-Orientated Learning

The traditional teaching mode for engineering undergraduates is usually teacher-centered, with students passively accepting knowledge and lacking active participation and the cultivation of innovative thinking. Modern engineering education, on the other hand, stresses the concept of student-centered learning and focuses on cultivating students' independent learning ability and teamwork spirit. Therefore, many universities and educational institutions have actively explored and innovated in laboratory and practical teaching, and proposed a series of new teaching methods and strategies. Wang applies the project-led learning method in the design of GIS principles and applications course, selects a practical project related to GIS, and organizes the course with the project as the core, which promotes students' in-depth understanding of the course and the cultivation of their practical skills [2]. Luo et al. used the project-guided learning method in the land resources investigation and evaluation course, and tested the learning effect, and found that the method can not only effectively improve students' practical skills, but also promote students' mastery of theoretical knowledge [3]. Liu et al. used the output-oriented project-driven blended teaching mode in the educational software and development course to assess and improve for the course content [4]. It can be seen that constructing an innovative education model with project-oriented learning for engineering undergraduates plays an important role in cultivating high-quality talents. This paper proposes an innovative new method of project-oriented teaching using virtual collaboration tools as a means and project results as an orientation.

3. Project-Oriented Teaching Model Design

Project-oriented learning is a project-centered learning method, which aims to organically combine theoretical and practical teaching in classroom teaching, fully explore the potential of students, and improve their comprehensive ability to solve practical problems [5]. This study uses virtual collaboration tools and data analysis tools to establish a "student-centered" teaching model. The framework is shown in Figure 1 below:

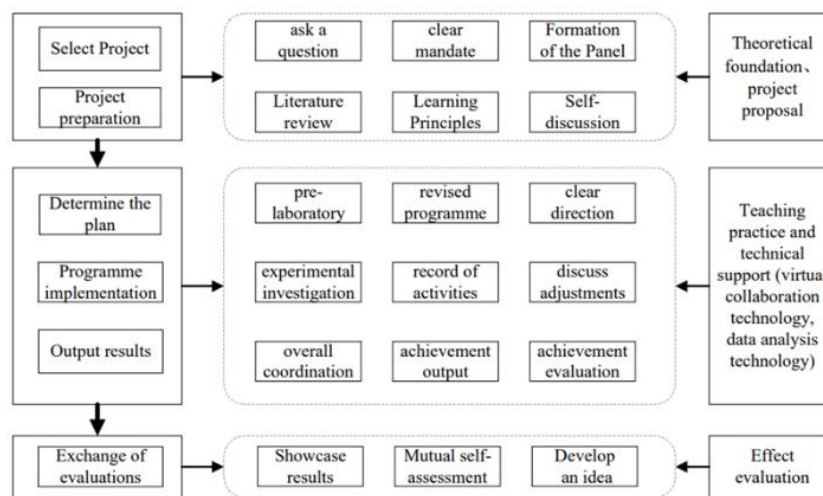


Fig.1 Framework for a project-oriented teaching model

This teaching model is a new teaching model that focuses on engineering practice projects, with teachers as guides and students as the main body. It combines online and offline teaching, with Tencent Meeting live streaming as the main method. The teaching process is managed through a cloud platform, which contains rich course resources.

4. Evaluation of Teaching Mode Effectiveness

When evaluating the effectiveness of the project-oriented teaching model, the evaluation index is no longer the time spent on teaching and learning, but the extent to which the students have achieved the teaching objectives as the evaluation index [7]. This evaluation method is committed to in-depth assessment of whether students are able to effectively apply the knowledge and skills they have learnt to solve real-world problems, as well as the creativity and teamwork they have demonstrated in the process of project implementation.



Prior to evaluation, it is important to first define the learning objectives and assessment criteria of the project to ensure that they are closely aligned with the expected outcomes of the project implementation. Examples include identifying the specific knowledge and skills that students are expected to acquire as well as defining the criteria for project success, including problem-solving skills, innovativeness and the practical value of project outcomes.

In assessing the effectiveness of project-oriented teaching, the focus is on analyzing the performance and outcomes of students in real-life projects, and checking whether students are able to effectively apply what they have learnt to the implementation of projects to solve real problems or needs. The quality and creativity of the projects or works completed by the students are assessed against pre-determined criteria and objectives. In addition to the final outcome, students are assessed for their performance and growth in the learning process, observing their participation and contribution to teamwork, problem solving, and decision-making processes. Students are asked to document and reflect on the challenges they encountered during the project, the lessons they learnt and their responses.

Observation and feedback from teachers throughout the entire project process are important components of evaluation. Teachers should record the performance and reactions of students during the project execution process. Regularly hold individual meetings with students to provide targeted feedback and suggestions, helping them improve and grow.

Finally, the results of the above assessments will be combined to provide a comprehensive assessment of the objectives and competencies that students have achieved and demonstrated in project-based teaching. Suggestions for improvement are made based on the results of the assessment to further optimize the effectiveness of project-based teaching in the future.

Through this type of evaluation, the impact of the project-oriented teaching mode on students' learning outcomes can be more accurately assessed, and the teaching design and methodology can be improved in a more targeted way.

5. Conclusion

The talents cultivated in Chinese engineering undergraduate colleges should be high-quality applied talents. This requires that the training objectives should be in line with the market demand, aiming at employment, and designing the classroom content according to the market demand and cutting-edge information. This paper establishes a "student-centered" project-led learning teaching method, adopts a blended teaching mode combining online teaching and offline teaching, which is of great significance for enhancing students' comprehensive ability and improving the quality of talent cultivation by incorporating diversified teaching elements and insisting on project outcome orientation. As an innovative learning method, the project-oriented learning method has significant advantages in promoting students' practical ability, teamwork ability and problem resolution ability. With the progress of educational technology and the deepening of learning theory, it is expected to continue to play an important role in the future and to promote the development of educational innovation.

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