

Research on Teaching Reform of Applied Chemical Technology Major for Engineering Practice Ability Training

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Abstract

Under the framework of vocational undergraduate education, the applied chemical technology program aims to cultivate high-level technical professionals, with engineering practice capabilities occupying a central position in the talent development system. However, practical teaching processes still face challenges, including insufficient integration between theoretical instruction and engineering practice, mismatched practical content with job requirements, and inadequate evaluation systems for practical competencies. Addressing these issues, this study proposes teaching reform strategies and implementation pathways through curriculum goal restructuring, content optimization, theory-practice integration with project-based teaching, enhanced practical teaching facilities, and improved evaluation mechanisms. The research demonstrates that practice-oriented teaching reforms can effectively enhance students' operational skills and engineering problem-solving abilities, holding significant practical value for improving the quality of applied chemical technology talent cultivation.

Keywords

Applied chemical technology; Engineering practice competence; Teaching reform; Vocational undergraduate education; Applied talent cultivation

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1. Research background and significance

1.1. The key role of engineering practice ability in the training of applied chemical technology talents

The applied chemical technology program is characterized by strong engineering attributes and job-oriented features. Its talent development objectives require students not only to master essential chemical engineering theories

but also to demonstrate practical application skills in real production processes. Chemical production involves multiple critical aspects, including material conversion, equipment operation, process control, and safety management, which demand high standards of operational precision and engineering judgment. This inherent complexity establishes engineering practice as the cornerstone of the program's talent development

framework.

With the development of the chemical industry towards scale, automation and safety, the employers pay more attention to the adaptability of graduates in the real engineering environment, especially the practical operation ability, safety awareness and the understanding of the process and equipment operation. Engineering practice ability has become an important index to measure the quality of applied chemical technology talent training.

1.2. New requirements for teaching applied chemical technology in the context of vocational undergraduate education

Vocational undergraduate education focuses on cultivating highly skilled technical professionals. Distinct from both the skill-oriented vocational education and the theory-driven general undergraduate education, it emphasizes the integrated development of knowledge, technical competencies, and engineering practice. In this context, the teaching of applied chemical technology must strengthen theoretical foundations while prioritizing engineering practice, thereby enhancing students' ability to solve real-world engineering problems.

The vocational undergraduate program demands talents who can work, operate and solve engineering problems, which requires the teaching process to be closer to the actual industry, and the curriculum content and teaching methods to be connected with the chemical engineering job ability standard, so as to avoid the disconnection between teaching and engineering practice.

1.3. The practical significance of teaching reform research

Research on teaching reform in applied chemical technology programs, aimed at cultivating engineering practice competencies, enhances the alignment between talent development and industry demands while fostering students' holistic growth in engineering literacy and practical skills. By systematically addressing pedagogical challenges and exploring reform pathways, this initiative provides actionable insights for optimizing curriculum frameworks, innovating teaching methodologies, and strengthening practical training. These efforts significantly contribute to advancing the high-quality development of applied chemical technology disciplines ^[1].

2. Current teaching status and existing problems of applied chemical technology specialty

2.1. Theoretical teaching and engineering practice are not closely connected

In the current teaching of applied chemical engineering technology, theoretical instruction still dominates the curriculum. Course content primarily focuses on fundamental concepts, principle derivations, and knowledge frameworks, emphasizing systematic and comprehensive knowledge while lacking sufficient integration with engineering practice scenarios. Some courses predominantly rely on classroom lectures, with limited coverage of specific production processes, equipment operational status, and field operation procedures in chemical production. This results in students' inadequate understanding of the engineering applications of theoretical knowledge ^[1].

Due to the lack of engineering application scenarios, students often have difficulty to establish an effective connection between abstract theoretical knowledge and the actual production process in the learning process, which affects the formation of engineering thinking and practical consciousness.

2.2. Discrepancy between practical teaching content and real engineering requirements

Practical training is a crucial component in developing engineering competencies for applied chemical technology majors. However, current teaching practices reveal a disconnect between certain training modules and real-world industry demands. Many hands-on projects focus narrowly on single-step operations or verification experiments, failing to adequately reflect the comprehensive skill requirements of chemical engineering positions. Furthermore, the pace of updating practical training content remains relatively slow.

In addition, the practical teaching is mainly based on decentralized training, and the comprehensive and systematic practical links are relatively insufficient. Students are less involved in the analysis and implementation process of complete engineering tasks, which makes it difficult to form an overall understanding of chemical production systems. To some extent, this restricts the improvement of students' engineering

practice abilities and job adaptability.

2.3. The cultivation methods for students' engineering practice abilities are relatively monotonous.

In terms of teaching methodology, the applied chemical technology program still predominantly relies on teacher-led lectures, with students engaging in passive participation during classroom sessions. Practical instruction is largely conducted according to predetermined procedures, where students primarily complete operational tasks, with limited involvement in the analysis, discussion, and decision-making of engineering problems.

3. Teaching reform ideas and implementation paths for engineering practice ability cultivation

3.1. Reconstructing course teaching objectives oriented by engineering practice ability

To cultivate engineering practice competencies, the teaching objectives of applied chemical technology courses should shift from mere knowledge transmission to competency-oriented approaches, with the core position of engineering practice capabilities clearly defined in the goal system. Course instruction must not only assess students' grasp of fundamental chemical theories but also emphasize their ability to apply knowledge in solving real-world engineering problems^[2].

In the course design, the teaching objectives should be combined with the job ability requirements of chemical industry, and the contents of production operation, process analysis, equipment cognition, safety standard and engineering consciousness should be integrated into the teaching objectives system, so that the course objectives can be connected with the job ability standards, and the teaching activities can be guided to focus on the cultivation of engineering practice ability, and the practice orientation can be strengthened from the source.

3.2. Optimize the course content and strengthen the engineering case and practice

In the curriculum design, emphasis should be placed on the organic integration of theoretical knowledge

and engineering practice to avoid the disconnection between theoretical instruction and practical application. By introducing typical chemical production processes, technological flows, and engineering accident cases, abstract theoretical knowledge can be contextualized within specific engineering backgrounds for explanation, thereby enhancing the practicality and relevance of the teaching content^[3].

At the same time, the teaching can be organized around the engineering problems in the course implementation, and the students can be guided to use the learned theories to analyze the process parameters, the equipment running state and the safety risks, so that the students can deepen the understanding of the theoretical knowledge and gradually form the engineering thinking mode in the process of solving the engineering problems.

3.3. Promoting the integration of theory and practice and project-based teaching model

The integration of theory and practice, along with project-based teaching models, serves as a crucial approach to enhance engineering practical skills. In the teaching process, instructional projects can be designed around typical engineering tasks, seamlessly combining theoretical learning, hands-on practice, and problem analysis. By driving students to complete learning processes through project tasks, this method ensures effective knowledge acquisition.

3.4. Strengthening practical teaching facilities and school-enterprise collaborative education

The cultivation of engineering practice competence requires well-equipped practical teaching facilities. On one hand, we should fully utilize on-campus training bases and virtual simulation resources to diversify teaching methods, providing students with varied hands-on training environments. The application of virtual simulation technology can partially compensate for the limitations of real-world engineering practice conditions^[2].

4. Conclusion

The teaching reform of applied chemical technology major, which is aimed at cultivating engineering practice ability, is an important measure to improve the quality

of talent training under the background of vocational undergraduate education. By reconstructing the course objectives, optimizing the teaching content, innovating the teaching mode and perfecting the evaluation system, it is helpful to enhance the engineering consciousness and practical ability of students. Practice shows that the teaching reform guided by engineering practice ability

has a positive effect on promoting the development of students' comprehensive ability. In the future, on the basis of summarizing the existing reform experience, the teaching reform should be continuously deepened to promote the continuous improvement of the quality of applied chemical technology professional personnel training.

Disclosure statement

The author declares no conflict of interest.

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