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Teaching Innovation Design and Practice Analysis in Chemical Engineering Principal Course

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Abstract: The Principle of Chemical Engineering is the core course of chemical engineering and technology, pharmaceutical engineering and other related majors, which occupies an important position in the engineering discipline. However, the complexity of the Principle of Chemical Engineering course itself and the tedious teaching content led to the problems of single teaching method, disconnection between theory and practice in the course teaching, which led to low interest of students and difficulty in effectively improving the teaching quality of the course. Starting from the existing problems in the teaching of the Principle of Chemical Engineering, this paper discusses the innovative design and practical countermeasures of the Principle of Chemical Engineering course from the aspects of transforming, adjusting and improving the teaching content, innovating the teaching methods, and improving the assessment and evaluation system, so as to provide references for the further development of the principles of chemical engineering course.

Keywords: Principles of chemical engineering; Teaching innovation; Practical countermeasure

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1. Introduction

In the background of the in-depth development of education in China, higher requirements and standards are put forward for current education, which no longer only pays attention to teaching results, teaching process and cultivation of ability, to cultivate students' innovative consciousness and problem-solving ability. The Principle of Chemical Engineering course has the basic characteristics of practicality and theory, the course content involves a lot of knowledge content, complex abstract structure and various types of equipment, which is often the focus and difficulty of students' learning. Therefore, teachers should take innovation consciousness and problem-solving ability as the focus in the actual teaching, only in this way can it meet the needs and standards for talents in the field of modern chemical industry. Conform to the development of the era, it can improve the overall quality of chemical principles course teaching.

2. The present situation of the Principle of Chemical Engineering course teaching

The course of Principles of Chemical Engineering is highly theoretical and practical. The teaching goal of this course is to make students master the basic concepts, theories and methods of chemical engineering through systematic and in-depth analysis and research on the basic principle of chemical engineering, and cultivate students' ability to solve practical problems, to lay a good foundation for the study of subsequent professional courses and engineering practice. However, there are still many problems in the teaching of chemical engineering principles, which affect the teaching effect of the course. However, there are still many teaching problems in the teaching the Principle of Chemical Engineering course, which lead to the teaching effect and quality of chemical engineering principles are not ideal. The current problems in the teaching of the Principle of Chemical Engineering course are mainly reflected in the following aspects.

2.1. The teaching content of the course is too simple

The teaching content of Principles of Chemical Engineering is mainly designed and selected by teachers, while most teachers' teaching content is the traditional unit operation process of "momentum transfer, heat transfer and mass transfer," for example, ordinary absorption, rectification process and corresponding chemical equipment. However, the new chemical process and new chemical equipment are not introduced, which makes it difficult for students to receive the latest knowledge and information, so the students' innovation consciousness is relatively lacking, which affects the overall quality of the Principle of Chemical Engineering course teaching. In addition, the knowledge points in many professional courses learned by a major are also repeated many times. For example, unit operation in the course of chemical principles is also introduced in detail in pharmaceutical separation engineering. As a result, the teaching content design of the course is too simple and fixed, and it is not keeping pace with this era and it is difficult to meet the needs of the development of the era. This also makes the teaching effect of the Principle of Chemical Engineering course unsatisfactory.

2.2. Neglect to train students' engineering consciousness

The course of Principles of Chemical Engineering is an introductory course from the basic course in the field of natural science to the specialized course of engineering science. It plays an important role in "bridging" between the basic courses (mathematics, physics, chemistry) and the specialized courses (chemical technology, chemical process design and equipment design, etc.). In the course of classroom teaching, due to the influence of traditional education concepts and teaching modes, teachers pay more attention to the teaching of basic theoretical knowledge of each unit operation and lack the introduction and application of unit operation and equipment in actual industrial production, thus neglecting to cultivate students' engineering consciousness.

2.3. Weak young teachers' teaching ability

As the base and cradle of personnel training, the fundamental task of colleges and universities is to train high-quality qualified personnel, the quality of personnel training is related to the survival and development of colleges and universities. At present, the total number of young teachers in China's colleges and universities is more than 1.12 million, and they are the backbone of the development of higher education. Therefore, improving the teaching ability of young teachers in colleges and universities can fundamentally improve the teaching quality.

Most of the young teachers in colleges and universities have just graduated. They are active in thinking, strong in receiving information, and have a certain professional foundation and innovation abilities. Due to

the small age gap between students, the generation gap between teachers and students is small, and they can establish a harmonious, harmonious and democratic teacher-student relationship [1]. There are still some problems in the teaching of young teachers in colleges and universities. Li J *et al.* (2021) pointed out in their analysis of the countermeasures to improve the teaching ability of young teachers in colleges and universities that there are still some shortcomings in the teaching work of young teachers in colleges and universities, which mainly include unfamiliar teaching content, single teaching method, insufficient and poor teaching manners, lack of passion in lectures, lack of attention to teaching reflection and lack of personal prestige [2]. Therefore, in the actual teaching of chemical principles, teachers lack certain practical teaching abilities, and their teaching guidance to students is also a little insufficient, which seriously affects the overall quality of the teaching of chemical principles.

3. The new measure of innovation education of the Principle of Chemical Engineering course

With the development of the country's economy, people have increasingly high requirements for higher education. University education should not only exert importance on the impartment of students' knowledge but also focus on the cultivation of students' practical ability and innovation ability. Principle of Chemical Engineering course is a comprehensive course, including chemical engineering and technology, chemical technology, chemical equipment and other aspects of knowledge. To improve the learning effect of students in this course, innovative educational ideas must be actively integrated into the teaching to improve students' professional ability and quality goals.

3.1. Innovation of teaching content

The course content of chemical engineering principles is closely related to actual production, and theory is connected with practice. It plays an important role in guiding production practice. In the teaching process, it is necessary to combine the production reality and the needs of students' learning, and constantly update the teaching content to reflect the new development of chemical engineering in time. With the emergence of new technologies, new processes and new equipment, the course content of chemical engineering principles should also be adjusted in time to reflect the latest progress and latest achievements in time. For example, in the application of chemical process simulation technology in chemical principle teaching, computer simulation technology is introduced into classroom teaching, so that students can master the use of computer simulation software in the learning process. Another example, the emergence of new separation equipment and the application of new chemical equipment can also be introduced as teaching content [3].

3.2. Innovation of teaching methods

The Principle of Chemical Engineering course has the characteristics of strong theory, abstract concepts, many formulas, complex mathematical derivation, etc. It is a course that requires teachers to constantly update knowledge and accumulate experience, and the main content is to combine theory with practice. Therefore, the innovation of teaching methods has become an important measure to improve teaching quality. In the teaching process, the combination of a variety of teaching methods can make students deepen their understanding and mastery of the classroom content, and enhance the learning effect. For example, students are assigned preview tasks before class and enter the class of famous teachers through platforms such as "Love Course" and "China University MOOC" to preview the new course knowledge points. In the course, case analysis, problem

discussion, project teaching, and other methods are integrated into the teaching of chemical engineering principles, to stimulate students' interest in learning the course and make students actively participate in the course learning. After class, the chemical principles class communication group is established, which is convenient for teachers and students to communicate at any time, for teachers to answer questions, assign tasks, etc. Teachers should also make full use of multimedia courseware and videos to enhance the interest and vividness of class, introduce a hybrid teaching mode combining online and offline, and use flipped classrooms, micro-classrooms and other means to enhance students' independent learning and interactive learning [5–7].

3.3. Innovation of teaching evaluation

Curriculum assessment is an important link in the course teaching process and an important means to measure students' mastery of knowledge. It plays a vital role in cultivating students' innovative spirit and ability. In the previous evaluation process, the evaluation method is simple and depends a lot on the scores of students' final exams. Through continuous learning and changes, this course adopts a diversified evaluation method, combining the process evaluation with the final evaluation, and paying attention to the assessment of students' comprehensive quality and innovation ability. There are various forms of assessment for the course of chemical engineering principles, including ordinary scores, experimental scores, course papers, course design, etc. The usual results include class attendance, class speech and homework. Experimental results mainly test students' grasp of basic concepts, basic theories and practical application ability, through the combination of experimental lessons and theoretical knowledge, improving students' hands-on ability. Course thesis (or course design) is a comprehensive test of students' independent learning ability and practical ability and comprehensively examines students' theoretical mastery and practical application ability [8–11].

4. Implementation process and effect

4.1. Clarify the teaching objectives and revise the syllabus

In combination with the school's mode of running a school, according to the professional personnel training program, clear the teaching objectives of chemical engineering principles, including the mastery of knowledge, the combination of theory and practice, and the ability to solve practical problems. By setting clear teaching objectives, revising the teaching syllabus, and supporting the teaching objectives and graduation requirements with the course content, teachers can better help the design of teaching courses, and students can better understand and apply the course content.

4.2. Optimize the teaching content and design the ideological and political classroom

Combined with the latest domestic and foreign chemical production new technology, new technology, new equipment and the actual unit operation of the factory, the course research the internal law of chemical principle teaching content, optimize and update the teaching content to determine the teaching key and difficult points of each chapter. The analysis and explanation of the actual complex project in the factory can effectively improve students' interest and attention in class and activate the classroom teaching atmosphere. This can cultivate students' engineering perspective and the ability to solve the practical problems of complex engineering in factories.

The ideological and political elements related to the course of principles of chemical engineering are deeply and comprehensively explored, and the course ideological and political elements are organically integrated into classroom teaching, strengthening the role of teachers in moral education, and effectively

guiding students to establish a correct life values, moral values and worldviews. Through the combination of classroom teaching and ideological and political education, students can improve their social responsibility, humanistic quality, patriotism, moral quality, teamwork, family and country feelings and science and technology to serve the country spirit [4].

4.3. Combine theory and practice to strengthen engineering literacy

In order to improve students' learning interest and enhance their learning enthusiasm, the course content is adjusted, and the links of course design, engineering examples, on-site teaching and simulation experiments are added to build a complete course system of Principle of Chemical Engineering. This can encourage and help students to participate in chemical engineering discipline competitions, such as the National College Students Chemical Experiment competition, the National College Students Chemical Design competition, curriculum teaching to promote discipline competition to promote learning and improve students' ability to solve complex problems. Relying on various discipline competitions and taking engineering applications as the orientation, it cultivates students' engineering literacy and cultivates students' ability to analyze and solve engineering practical problems by using the knowledge they have learned [12–14].

4.4. Focus on process learning and build an evaluation system

Different from middle and high schools, students no longer pay attention to the final exam results but pay more attention to the process of learning and comprehensive application of chemical principle knowledge. Teachers can formulate a rigorous and scientific calculation method for course scores, and comprehensively calculate students' total course scores based on online pre-class review, class attendance, class discussion, online classroom testing, online homework, unit tests, final exam scores, etc. to overcome students' bad habits of "relaxing and surprise at the end of the semester" and "cramming at the last minute" [15].

5. Conclusion

The course of Principle of Chemical Engineering is an important basic course for chemical engineering and technology, pharmaceutical engineering and other related majors, which plays a role in the learning process of students. Therefore, ways to improve the student's interest in learning this course through the innovation of teaching methods and improve the teaching quality and effect is an important task for teachers at present. Teachers should change their teaching concept and take the course of chemical engineering principle as a science to study. The teaching content should be adjusted and perfected, and the content of Principle of Chemical Engineering course should be combined with practical application. The teaching method and means should be innovated, and the teaching process should be optimized by using modern technology. At the same time, it is important to improve the assessment system and adopt diversified assessment methods. With this, teachers can better improve the teaching quality of Principle of Chemical Engineering course and cultivate outstanding talents with solid theoretical knowledge and strong practical ability.

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