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Theory and Practice of Teaching Reform of Bioengineering Equipment Course

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Abstract: Bioengineering equipment course is one of the main core courses of bioengineering specialty. Because there are many problems in the traditional classroom teaching, according to the characteristics of bioengineering equipment course, this paper puts forward a teaching mode reform scheme adopting the concept of OBE-CDIO education. Through the implementation of the program, the teaching quality of the course can be effectively improved, the interest in autonomous learning can be stimulated, and the practical ability and innovation ability of students can be improved.

Keywords: OBE-CDIO concept; Interactive three-dimensional mixed teaching; Bioengineering equipment

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1. Introduction

Under the background of new engineering construction and engineering education certification, engineering education needs to combine the requirements of industry development to cultivate high-quality engineering talents [1]. Bioengineering equipment course is the core course of bioengineering specialty. Through the study of the course, students need to master various types of bioreactors, product extraction equipment and equipment selection and other systematic knowledge. The traditional teaching methods are mainly based on theory, which leads to the lack of students' practical ability and innovation ability, which can not meet the needs of modern industrial production. Outcome-oriented education (OBE) takes learning outcomes as the core of teaching, emphasizes the goals and abilities that students should achieve in the learning process, and pays attention to the cultivation of students' ability to use knowledge [2]. Process-oriented education (CDIO) pays more attention to the results achieved by students after learning [3]. It is an important way to cultivate students' practical ability and innovative spirit to explore how to carry out the teaching reform of bioengineering equipment course based on OBE-CDIO concept [4-5].

2. Problems Existing in the Teaching of Bioengineering Equipment

Bioengineering equipment mainly includes four aspects: bioreactor, biomass raw material processing equipment, product separation equipment and auxiliary system equipment. Not only involves a wide variety of equipment types, but also the teaching content is empty and boring, and students are not interested in learning. Although pictures, animation, video and other forms are used to help students understand in the teaching process, learning is still difficult. Although students have the opportunity to recognize equipment during the internship, they cannot conduct practical operation and disassembly of all equipment. The cultivation of students' hands-on analysis ability, problem-solving ability, and exploration and innovation ability is restricted [6-7]. In addition, the traditional teaching mode is mainly based on teacher teaching, lack of teacher-student interaction, and low student participation, which is far from the OBE-CDIO educational philosophy.

3. The specific content of teaching reform

3.1 Curriculum Goal Design Based on OBE-CDIO Concept

One of the objectives of biological engineering talents training is to train students to use the theoretical knowledge to solve the complex process problems encountered in the process of biological fermentation, so that students can meet the needs of the development of modern biological industry. Based on the concept of OBE-CDIO education, starting from the training goal of professional talents, taking the ability of graduation requirement index points as the guide, adopting the method of reverse thinking in teaching design, setting reasonable curriculum objectives, the corresponding relationship between them and graduation requirement index points is as follows:

Course Objective 1: Have the ability to analyze and optimize the practical problems of the microbial fermentation process, and be able to analyze the engineering problems of material transportation, medium preparation and sterile air preparation according to its production purpose. Corresponding graduation requirements index point 2-2 can accurately express complex biological engineering problems based on the theoretical knowledge of the specialized courses learned.

Course Goal 2: Be able to master and operate all kinds of equipment, equipment selection and technological process needed in production, and also have scientific spirit, craftsman spirit, safety production consciousness and professional responsibility. Corresponding to the graduation requirement index point 3-2, the design of the unit (component) can be completed according to the needs of the production process of bioengineering products.

Course objective 3: in the process of bioengineering product design and production, we should be able to design and develop engineering projects and make economic decisions, taking into account many factors, such as health, safety, environmental protection, economic and social sustainable development and so on. Corresponding to the graduation requirement index point 11-3, the process scheme of different fermentation scenarios and scales can be designed in a multidisciplinary environment.

3.2 Design of Curriculum Teaching Mode Based on OBE-CDIO Concept

Based on the concept of OBE-CDIO education, this course introduces problem-driven teaching method, adopts online and offline hybrid teaching method to guide students' autonomous learning, cooperative learning and independent inquiry, and transforms the traditional teaching mode with teachers as the main teaching mode and low students' participation into "student-centered" interactive three-dimensional teaching.

3.2.1 Release of pre-class learning resources

The results of the questionnaire on learning situation show that 87.12 percent of the students hope to teach themselves online through a combination of online and offline classes, with simple content and difficult teaching. Teachers set up an online teaching platform to publish teaching resources, including courseware, videos, chapter tests, seminars, subjective topics and case introductions, so that students can fully understand the content of the new lesson, summarize the difficulties in advance and feed them back to the teacher. The realization of class students with questions to listen to the teacher's targeted explanation.

3.2.2 Under-line teaching in class

While teachers teach knowledge, they can introduce cutting-edge progress and industry trends at any time so that students can apply what they have learned. Teachers and students can show their learning results on the spot through classroom interaction such as in-class exercises, special discussions and case studies. It really allows students to apply knowledge to practice, truly target students' learning results, and improve students' innovative and practical ability.

3.2.3 Online after-school tutoring

Teachers can follow up and solve the problems encountered by students in time through online comments. Through a series of teaching activities such as roll call in class, in-class exercises, actual combat exercises, classroom reports, and after-class comprehensive tests, students can truly find the course useful and the classroom interesting, thus stimulating students' initiative in autonomous learning and turning passive acceptance into active learning.

3.3 All-round Diversified Evaluation Reform Based on OBE-CDIO Concept

Based on the concept of OBE-CDIO, establish diversified curriculum assessment content and evaluation methods, comprehensively examine students' ability to analyze and use knowledge points at different stages, and comprehensively evaluate and understand students' learning situation at different stages. The assessment contents and evaluation methods of diversified courses are as follows:

Process assessment (50%): before class (10%), release learning materials, assign preview tasks and conduct chapter tests through online platforms; In class (20%), questions, in-class tests accounted for 10%, classroom interactive discussions and case analysis accounted for 10%; After class (10%), comprehensive homework was evaluated through team cooperation. Mid-term examination (10%).

Final examination (50%): the examination topics mainly involve the mastery of basic theoretical knowledge of the course and its

engineering application.

4. Conclusions and Prospects

Based on the OBE-CDIO concept, this paper puts forward the practical methods of teaching reform of bioengineering equipment, including resource release, exchange and interaction, case analysis, mixed teaching and so on. The boring theoretical knowledge is taught to students in a more vivid and vivid way, which increases the interaction between teachers and students, enhances the positive initiative of students' autonomous learning, and improves students' high-level innovative thinking ability and comprehensive inquiry ability.

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