

# Construction and Implementation of The Characteristic Practice Education and Training System with The Biopharmaceutical Process Design as The Core Under the New Engineering Background

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**Abstract:** Sichuan University of Science & Engineering is one of the first universities to set up biopharmaceutical major in China. "Biopharmaceutical Equipment and Process Design" is a core course with strong characteristics of biopharmaceutical majors. In recent years, with the background of engineering certification in the biopharmaceutical field, the teaching team has built a three-dimensional practical teaching and training system that integrates ideological and political courses, school enterprise cooperation, subject competitions, and online and offline based on "Biopharmaceutical Equipment and Process Design", and has achieved gratifying teaching results.

**Keywords:** Biopharmaceutical process design, Practice, A three-dimensional teaching and training system.

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## 1. Introduction

In recent years, the Biological Pharmaceutical industry has developed rapidly, especially after the outbreak of the COVID-19, the Biological Pharmaceutical industry presents a new atmosphere of changing with each passing day. Biopharmaceuticals are a strategic emerging industry in China. According to statistics, there have been lots of higher education institutions in China such as Dalian Medical University, Shenyang Pharmaceutical University, Shanxi Medical University, Jilin Institute of Chemical Technology, Tianjin Agricultural University, etc., that have newly opened biopharmaceutical majors since 2022.

Sichuan University of Science and Engineering is located in the Chengdu-Chongqing economic circle. Based in Sichuan, it provides a large number of talents for regional economic development, radiating to the southwest of China. Our school is one of the first universities in China to offer a biopharmaceutical major. The biopharmaceutical specialty is committed to cultivating high-quality, morally, intellectually, physically and aesthetically comprehensive talents who can engage in design, production, management, new technology research and product development in the biopharmaceutical field. At the beginning of the construction of the biopharmaceutical major, "Biopharmaceutical Equipment and Process Design" was a compulsory course.

"Biopharmaceutical Equipment and Process Design" is a core course with strong biopharmaceutical professional characteristics, which integrates multidisciplinary knowledge such as bioengineering technology, Chemical engineering technology and Pharmaceutical engineering technology and equipment. "Biopharmaceutical Equipment and Process Design" teaches the main equipments for biopharmaceutical production, as well as the production process, calculation and design of biopharmaceutical products such as antibiotics. Given the close connection between the theory and application of "Biopharmaceutical Equipment and Process Design" and its highly practical characteristics, various universities have carried out considerable practical teaching

reforms. For example, Tianjin University of Science and Technology carried out online and offline hybrid teaching method, combining "rain classroom", "Tencent meeting", virtual simulation teaching, etc., to increase interaction between teachers and students, strengthen students' participation in teaching, and enhance students' enthusiasm for learning[1]. Huaibei Normal University has built a "trinity" teaching system based on "pre class factory field learning, classroom classic main line guidance, after class virtual simulation consolidation and assessment", so that students can consolidate what they have learned in practice[2]. Chongqing Technology and Business University has cooperated with Chongqing Kerui Pharmaceutical (Group) Co., Ltd. to set up a "Kerui Class", which enables enterprise instructors to enter the classroom and impart first-line experience to students[3].

## 2. Construction and Implementation of The Characteristic Practice Education and Training System

In recent years, the teaching team has built a three-dimensional practical teaching and training system centered on "Biopharmaceutical Equipment and Process Design" with the background of engineering certification in the biopharmaceutical field, integrating course ideological and political education, school enterprise cooperation, subject competitions, and online and offline teaching.

### 2.1. Theoretical teaching reform

The teaching team adhere to ideological and political education, learn knowledge and morality, and solve the problem of weak classroom ideological and political education in professional courses. Since the outbreak of COVID-19, biopharmaceuticals have played a pivotal role in virus detection, vaccine research and development, etc. The teaching team actively explores the ideological and political elements in the curriculum, and strengthens education in areas such as love for the Party and Patriotism, national industrial policies, environmental protection, technological innovation,

bioethics, laws and regulations on biopharmaceutical production and management, and professional ethics.

The teaching team continuously improve teaching and learning methods to address the issue of insufficient cultivation of students' autonomous learning abilities. The teaching team is positioned according to the talent cultivation goals, student-centered, and result oriented. Combining the characteristics of multiple basic knowledge points involved in biopharmaceutical process design and the complexity of biopharmaceutical processing technology, it constructs a diversified teaching model that combines case-based teaching, project-teaching, micro lectures, and online-offline integrated teaching. The teaching team requires full-time teachers to do three things in theoretical class teaching: ① stimulate students' learning interest through micro lectures and other methods before class, and encourage students to actively preview; ② Classroom assignments are released in class, the flipped classroom and other methods are used to detect students' mastery of knowledge points online, and adjust the teaching methods of key-points and significant parts in class in real time; ③ Encourage students to review after class through homework, quizzes, and other methods. This diversified teaching mode increases the interaction between teachers and students, stimulates students' learning potential, cultivates students' independent learning and Lifelong learning ability, and also facilitates teachers to adjust teaching methods according to students' mastery of knowledge points in time.

## 2.2. Practice teaching reform

The teaching team establish a training system for academic tutors and enterprise tutors, and build a multi-dimensional training system integrating scientific research practice such as discipline competition, college students' innovation and entrepreneurship, and "Internet plus". By allowing corporate mentors to enter the campus and selecting students to participate in in-depth learning at the "Yingde Biology" and "Sichuan Bohaoda" practical bases. Chengdu Yingde Biomedical Equipment Co., Ltd. is a company under Xinhua Pharmaceutical that manufactures, designs, installs, repairs, and transforms biopharmaceutical specialized equipment. Its core business is the professional design and manufacturing of high-end biopharmaceutical equipment, which is highly compatible with the teaching content of "Biopharmaceutical Equipment and Process Design". This major has established a good cooperative relationship with Chengdu Yingde, which officially became one of the practical bases for the biopharmaceutical profession in 2021. By hiring engineers of Chengdu Yingde to join the teaching team and become corporate mentors for students, and selecting students to go to Chengdu Yingde for graduation project practice, the students' level of biopharmaceutical equipment and production process design has greatly improved. Specialized teachers and corporate mentors in the team also actively guide students to participate in various professional competitions. At the same time, students deeply participate in the research projects of full-time teachers, strengthening the integration of theory with practice, and also cultivating students' innovative design abilities from multiple perspectives.

## 3. Teaching Achievements in Recent Years

By continuously improving the curriculum ideological and

political education, school enterprise cooperation, subject competitions, and online-offline teaching training system, the teaching reform of the teaching team has achieved initial results.

(1) The current teaching achievements achieved by the teaching team include: (1) a significant improvement in students' innovation and entrepreneurship abilities. In recent years, the students have won 3 national second prizes, 3 national third prizes, 1 national excellent prize and 1 best defense prize in the National Undergraduate Pharmaceutical engineering Design Competition. The students have also 1 national third prizes, 1 national winning prize, 2 provincial second prizes, and 2 provincial third prizes in the National College Student Life Science Competition, and 1 second prize of the "Internet plus" College Students Innovation and Entrepreneurship Competition. Teachers and students jointly published 4 papers and granted 8 patents.

(2) The reform of teacher curriculum and teaching has achieved initial results. The teaching course scores scored by students have been increasing year by year, and students' satisfaction with course teaching has steadily increased. At the same time, in the past five years, members of the teaching team have repeatedly commended by demonstrated courses, educational reform projects, and participated in the compilation of textbooks. One teacher won the third prize in the school classroom teaching competition and got title "My Good Teacher in my mind's eye". One teacher won the school level demonstration course project. Three teachers won the school level educational reform project. And the teaching team participated in the compilation of two textbooks.

(3) The quality of student employment has improved. By building a practical base that integrates industry and education, hiring corporate mentors, strengthening practical teaching, bridging the gap between university education and the actual needs of enterprises, promotes high-quality employment for students. In 2021 alone, 20 students from our school interned and found employment in Chengdu Yingde Biomedical Equipment Co., Ltd.

## 4. Summary

Education needs to be based on educating people, and higher education is even more so. To become a good teacher and friend for students, it is necessary for every teacher in the teaching team to constantly strive to improve their teaching level and deepen teaching reform. We share this with all of you.

## Acknowledgment

This work is financially supported by the teaching reform research projects of SUSE of "Construction and Implementation of Characteristic Practical Education Training System with High end Biomedical Equipment Design as the Core in the New Engineering Background (JG-2017)", and "Exploration and Research of Online and Offline Hybrid Teaching of Cell Biology (JG-2016)" and "Teaching Reform of Biomedical Courses in the Background of Engineering Education Professional certification (CJRH-JG2309)", and "Exploration of Biopharmaceutical Cognitive Practice Teaching Model under the Background of Innovation and Innovation+New Engineering".

## References

- [1] Yujie Dai, Xuegang Luo, Shiru Jia, et al. Cultivation of innovative ability of Pharmaceutical engineering students under the background of new engineering. China Education of Light Industry. Vol. 21(2020) No. 5, p. 16-20.
- [2] Xin Zeng, Dayong Xu, Huawei Zeng, et al. Teaching Reform and Practice of Bioengineering Equipment and Design Course. Science Press, 2010, p. 5.
- [3] Lixia Guo, Gang Chen, Zhongyi Yin, et al. Teaching Reform and Practice of Pharmaceutical Equipment and Workshop Process Design Guided by Engineering Practice Education. Education and Teaching Forum. Vol. 12(2019) No. 12, p. 2.