

Thinking on Improving the Teaching Quality of “Chemical Engineering Specialty Experiment Course” in Xinjiang Universities in the New Era

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Abstract: This paper focuses on the practical teaching of the traditional engineering major-chemical engineering and technology major. And taking the construction of the new engineering discipline as an opportunity, with the goal of cultivating applied talents, combined with the characteristics of chemical engineering and technology majors and students in Xinjiang universities, this paper put forward some thoughts on the improvement of experimental teaching quality of chemical engineering specialty. By introducing Ideological and Political Theories teaching in All Courses, strictly controlling experimental teaching and assessment processes, and appropriately combining computer operations in the three aspects of teaching content, teaching process and assessment process, we can further consolidate teaching achievements, improve teaching quality, and cultivate applied talents with more Xinjiang characteristics.

Keywords: Chemical engineering and technology; Professional experiment; Teaching quality; Ponder

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In order to cope with the new round of technological and industrial revolution, the Ministry of Education began to actively promote the construction of new engineering in 2017 and encouraged the construction of a number of new engineering majors such as the Internet of Things Engineering Specialty and Bio-pharmaceutical Specialty^[1-2]. The rapid development of new engineering specialty also challenges the construction of traditional engineering specialty in our country. How to give full play to the advantages of traditional engineering, consolidate teaching results and strengthen the effect of education is an important issue faced by the development of traditional engineering major. Training applied talents and compound talents is not only an important deployment of the Party Central Committee and The State Council^[3], but also the main direction of talent training for ordinary colleges and universities in the future, and it is also an important development direction for traditional engineering majors such as chemical engineering and technology.

Tarim University, as an ordinary undergraduate institution, has long been mainly cultivating applied and innovative talents who are “of going down, retainable, useable and of doing well” in higher professional fields for society. The training of applied talents and the development of engineering majors cannot be separated from practice teaching, the quality of practice teaching seriously affects the training quality of talents and the employment reputation of graduates. In order to consolidate and improve the quality of talent training, the engineering majors of ordinary undergraduate colleges should take the initiative to timely regulate the practice teaching links. As a general engineering major in Tarim University, the Chemical Engineering and Technology major (Chemical Engineering Major for short) is forced by the situation and the trend of The Times to strengthen and improve the teaching quality of professional experiment (Chemical engineering experiment for short). To this end, I put forward some personal thoughts and suggestions:

1. Strengthen the Course Theory Explanation Process, Properly Introduce the Content of Ideological and Political Theories teaching in All Courses, Enhance Moral Education and Enhance Learning Enthusiasm

Experiment for chemical engineering is a practical course for chemical engineering major, which involves physical chemistry, chemical thermodynamics, chemical reaction engineering, separation engineering, chemical technology and other relevant courses. It is highly professional and requires students to complete the experiment process by synthesizing what they have learned, so as to improve their professional hands-on practice ability^[4-5]. However, as a comprehensive experimental course, teacher explanations followed by student grouping operations are still mainly used during the teaching process. The content is too rigid. Currently, students have poor subjective initiative and lack the ability to think independently and discover problems. And students are eager to complete experimental tasks. Some students cannot even fully participate in it, who seriously lack teamwork and exploration spirit and also cannot experience the joy of verifying practical teaching and theoretical content with each other^[6-7].

At the 2016 National Conference on Ideological and Political Work of Colleges and universities, Secretary-General Xi Jinping has repeatedly emphasized that ideological and political education is the foundation of "Nurture Morality and Foster Talent". Ideological and political education should run through the whole process of education and teaching. Resources of Ideological and Political Theories teaching in All Courses related to the curriculum should be deeply explored to fully realize all-round education and realize three-in-one education^[8]. Chemical engineering specialty experiments are highly specialized. In the course of classroom teaching, especially in the course of theoretical explanation, ideological and political resources such as the development history of experimental projects and classic virtue stories of relevant experts can be appropriately cited to actively inculcate moral knowledge in students and popularize ideological and political education. By selecting suitable ideological and political contents and introducing them into the curriculum appropriately, students can rekindle their hopes for learning, re-establish the learning interest of professional experiment and establish excellent professional quality, which are conducive to strengthening the construction of the study style of this major.

In 2013, Secretary-General Xi Jinping put forward important ideas such as "clear water and green mountains are gold and silver mountains" and "a Community with a Shared Future for Mankind". In the report of the 20th National Congress of the Communist Party of China in 2022, the above two concepts were reiterated, which emphasize that there is only one earth for human beings, people and nature should live in harmony, ecological environmental protection should be carried out in an all-round way and carbon peaking and carbon neutrality should be promoted. The talents trained by the chemical industry, as the reserve force of the future chemical industry practitioners, should practice the concept of "green water and green mountains are gold mountains and silver mountains" from the perspective of professional and technical personnel, deeply understand the consciousness of "a Community with a Shared Future for Mankind", promote the green and sustainable development of the chemical industry and achieve the goal of carbon peaking and carbon neutrality. The main lecturer of Chemical Engineering Specialty Experiment infiltrates important ideas such as "green mountains and clear waters are golden mountains and silver mountains", "a Community with a Shared Future for Mankind", and "carbon peak and carbon neutrality" into students from the aspects of experimental principles and objectives. The concept of green and sustainable development in chemical engineering is introduced, which combines with ideological and political education in the curriculum to deepen students' understanding of the importance of this major. For example, when teaching "extractive distillation", the selection of extractants and their separation and recycling not only reflect the concept of green development, but also achieve the recycling and reuse of resources. The improvement of product purity has also implemented the idea of "atomic economy" and achieved the goal of carbon reduction in chemical production processes.

2. Strengthen the Experimental Teaching Process of Chemical Engineering Specialty, Strictly Manage the Teaching Links and Enhance the Hands-on Ability

Practice teaching focuses on cultivating students' hands-on ability. As an important professional practice course of chemical engineering major, chemical engineering specialty experiment plays an important role in improving students' hands-on ability and practical level. Therefore, more attention should be paid to experiment teaching and classroom teaching process should be strictly managed.

At present, in the teaching process, students preview before class, teachers ask questions during class, the main lecturer explains, theory is combined with practice, then experimental operations are carried out, and finally experimental reports are submitted^[5]. In order to

further improve students' hands-on ability, exercise students' ability to independently analyze and solve problems, consolidate the quality of student training, gain leverage for students' employment in the later stage, and accumulate a good corporate reputation for professional development, combined with the actual situation of the university, it is suggested that the experimental teaching team of the chemical engineering specialty reform the experiment of the chemical engineering specialty experiment, and unify and strictly control the course teaching links, especially the student operation process. The team teachers divided the whole teaching process into preview, classroom operation and questions, experimental products and records, experimental hygiene, experimental report, experimental operation examination and other links. During the classroom teaching process, the main lecturer will rate each student's preview, classroom operations and questions, experimental products and records, and experimental hygiene. Each item will be scored at 10 points, and will be included in the usual grades at a ratio of 20%, 50%, 20%, and 10%. The total score obtained will be converted into the usual grades at a ratio of 30% according to the assessment standard.

After the grading of the teaching process is implemented, students not only pay attention to their personal scores, but also pay more attention to the teaching process in their thought and attach greater importance to all aspects of the experimental process. Not only did it supervise students' learning, but it also effectively improved their learning effectiveness. This scoring system not only achieves full process education, but also enriches the assessment basis and further unifies the teaching standards of teachers in the teaching process, which makes it easier to achieve overall control of the quality of teaching in multiple classes.

3. Strengthen the Assessment Link, Strictly Control the Scoring Link

Assessment is a necessary part of every course, which can further restrict students' learning attitude and discipline and improve learning effect. Therefore, the teaching team further standardizes the assessment process. Firstly, a unified experimental report paper is implemented, and the report format is standardized through prefabricated modules such as experimental purpose, experimental principle, experimental operation, experimental data, data processing, results and discussion, and questions. Students write the experimental report by hand according to the requirements and submit it to the lecturer. Teachers rate the report based on criteria such as whether students have completed the experimental requirements, obtained the correct experimental results, formatted correctly, described the steps clearly, analyzed the experimental data correctly and selected solutions from a technical perspective to obtain effective conclusions. These criteria are recorded in the actual report score. Secondly, conducting operational exams, focusing on operational operations and classroom questioning, assessing students' mastery of the basic principles of the experiment, evaluating their ability to process experimental data, examining whether the operations are standardized, and whether students can think independently and solve problems, and scoring based on this standard. Such scoring method not only improves students' attention to and quality of experimental reports, but also cultivates and standardizes students' professional quality, greatly stimulates students' enthusiasm for hands-on operation, further eliminates some students' thinking of fish in troubled waters and consolidates, strengthens students' understanding and mastery of relevant theoretical knowledge and enhances the students' hands-on ability. In the end, the final score of the experiment is calculated according to 30% of the usual score, 40% of the experimental operation exam and 30% of the experimental report.

Strict control and grading of the assessment process will further constrain and deter students to shed their confused and careless thinking. At the same time, it will further constrain the teaching staff. After several years of student practice, not only can the teaching quality be improved, but it also helps to improve the teaching level of the teaching staff.

4. Appropriate Computer Operation, Further Strengthen the Experimental Teaching Process and Consolidate the Teaching Results

Computer simulation operation is a teaching method strongly encouraged by the state in recent years. Especially for chemical engineering and pharmaceutical majors, the combination of theoretical explanation and computer operation can greatly improve the learning effect and quality of courses. For this reason, when introducing relevant experimental instruments, chemical professional laboratories should purchase supporting computer operating software in time to realize the control and simulation of experiments. In teaching courses, the teacher should effectively combine theoretical explanation, practical operation demonstration and computer software operation simulation, which greatly improves students' learning interest and enthusiasm, enhances students' understanding of chemical automation control, further consolidates and improves students' grasp of basic knowledge, improves teaching quality and consolidates teaching results.

5. Conclusion

As a traditional engineering major, chemical engineering and technology emphasizes the cultivation of applied or com-

posite talents with strong practical ability. And practical teaching plays an important role in the cultivation. As a core practice course of the major, chemical engineering experiment should follow the characteristics of students constantly, adjust and improve the teaching process timely and consolidate and strengthen the teaching quality. In order to enhance students' learning interest, the theoretical explanation should be strengthened and Ideological and Political Theories teaching in All Courses should be appropriately introduced. In order to consolidate teaching quality and enhance students' hands-on ability, teaching process should be strictly controlled and experimental teaching links should be strictly managed. In order to further constrain students and teachers and improve the teaching quality and level, the assessment link should be strengthened and the scoring link should be strictly controlled. Proper computer operation should be introduced to further strengthen the experimental teaching process and consolidate the teaching results. Based on the teaching experience of our university, the above four methods and means can not only fully meet the teaching objectives and teaching requirements of chemical engineering specialty experiment, further consolidate the experimental teaching results and improve the teaching quality, but also provide teaching reference for the experimental teaching of relevant majors of colleges and universities and provide reference for colleges and universities to train talents with local characteristics.

References:

- [1] Hua Li, Na Hu & Zhenshen You. New Engineering: Form, Connotation and Direction [J]. Research in Higher Education of Engineering, 2017(04): 21-24+62.
- [2] Denghua Zhong. Connotation and Action of New Engineering Construction [J]. Research in Higher Education of Engineering, 2017(03): 1-6.
- [3] Xi Yang. The Three Departments Jointly Issued the "Guiding Opinions on Guiding Some Local Ordinary Undergraduate Universities to Transform into Application Oriented Universities" [J]. Shaanxi Education (Higher Education), 2015(12): 33-33
- [4] Xiaobing Liu, Runlin Han, Shujun Peng, Baogeng Xie & Wenming Liao. Teaching Reform and Practice of Chemical Engineering Specialty Experiment under the Background of Application Transformation of Local Universities [J]. Shandong Chemical Industry, 2021, 50(15): 188-189.
- [5] Jincheng Mu, Yuefeng Zhang, Su Liu, Xiumin Li, Weiliang Tian & Haifeng Yu. Exploration and Reflection on the Course of Chemical Engineering Specialty Experiment in Xinjiang Universities [J]. Guangzhou Chemical Industry, 2017, 45(19): 180-181.
- [6] Lianjun Lin. Research on Comprehensive Experimental Teaching Reform of Chemical Engineering Specialty in Universities [J]. Chemical Engineering Design Communications, 2020, 46(08): 139+162.
- [7] Zhanjun Zhang, Liyuan Wen & Shikui Wu. Research on the Integration of New Carrier "Ideological and Political Theories teaching in All Courses" into the Teaching of Chemical Engineering Specialty Experiment [J]. Chemical Engineering Design Communication, 2021, 47(7): 131-133.
- [8] Zhanjun Zhang, Liyuan Wen & Shikui Wu. Research on the Integration of New Carrier "Ideological and Political Theories teaching in All Courses" into the Teaching of Chemical Engineering Specialty Experiment [J]. Chemical Engineering Design Communication, 2021, 47(7): 131-133.