

Construction of the Teaching Mode of Chemical Engineering Experiment Courses Based on Discipline Competition

Lushan Yu¹, Ping Wang^{2*}, Haofei Huang³, Xiuxia Meng⁴, Jinjin Zhang⁵

Shandong University of Technology, Shandong 255000, China

College of Chemistry and Chemical Engineering, Shandong University of Technology

*Corresponding Author

ABSTRACT. *Discipline competitions have a positive effect on improving the quality of engineering education in colleges and universities, advancing the reform of practical models, and cultivating students' engineering ability. This article will analyze the status quo of current subject competitions in universities, and take chemical engineering experimental courses as an example to propose effective and reasonable teaching schemes, build the content and specific content of chemical engineering experimental courses, and construct subject-oriented chemical engineering experimental course teaching mode.*

KEYWORDS: *Subject competition, Chemical engineering specialty, Experimental course*

1. Existing problems in subject competition

During the pre-disciplinary training and competition of the subject competition, the participating students had some deficiencies in the areas of chemical professional knowledge reserve, engineering practice ability, teamwork, innovation and development awareness, and comprehensive quality, as shown in the following:

1.1 Knowledge Composition and Lack of Theory

Participants are mainly students in the second and third year of university. Some chemical engineering courses are not reasonably set, professional courses are relatively lagging behind, and students' professional knowledge is not comprehensive enough [1]. Many participating students can not correctly understand the requirements of the competition topics, can not design the correct implementation plan according to the requirements, but just piece together the reference experiments that are consulted, which is lack of systematicness and the argument is not detailed.

1.2 The Theoretical Knowledge Cannot Be Learned

Many participating students do not know how to get started with many practical problems in the competition. They cannot use their theoretical knowledge to analyze and think about the problems that arise in the competition. They are not skilled enough in the use of basic commonly used instruments, resulting in poor engineering practice.

1.3 Poor Engineering Ability and Comprehensive Literacy

Mainly manifested in the irregular writing of design reports, grammatical errors and typos, and lack of systematic analysis and logic for the demonstration of chemical engineering experimental schemes. At the test site, due to the poor psychological quality, the performance was too tense, the questions asked by the experts were not answered [2], or the busy process caused some errors that should not occur during the test. Competition is not only a competition of skills, but also a competition of good mentality. During the competition, there will be various problems. Some students lack the determination to persevere, and it is difficult to reach the end of the competition.

2. Reform and Practice of Experimental Teaching System for Chemical Engineering Specialty

The specialty of chemical engineering is a typical engineering specialty, which has the characteristics of strong practicality and high basic theoretical requirements. Giving play to the important role of subject competition in the training of students is of vital importance to improving the comprehensive quality of professional talents. However, there are certain disadvantages to subject competition: for example, the original innovation is not strong. Some subjects are proposed by teachers, and students only act as operators in this process; students have limited energy and do not have a deep understanding of the subject [3]. The large number of undergraduate courses restricts the students' actual involvement in scientific research. However, undergraduate foundation courses are knowledge that students must master and cannot be reduced. This person restricts the students' enthusiasm for participating in the topic, the limitation of topic selection, and affects the effectiveness of the discipline competition in the student training.

The specialty of chemical engineering implements the training idea of "equal theoretical foundation and experimental skills, basic skills training equals original research, and knowledge accumulation equals thinking training." Training features are applied and innovative. At the same time, we attach importance to cutting-edge curriculum systems. Since 2017, he has participated in the National University Students Chemical Experiment Competition every year. According to the requirements of the competition, he reformed the experimental teaching content and increased the experimental equipment. And won the first prize. Participation in national experimental competitions has promoted experimental teaching.

Among them, basic experiments are cultivating students' basic experimental skills and related basic knowledge construction; professional experiments are more closely related to professional courses due to differences in professional backgrounds, focusing more on the cultivation of practical ability and innovative ability, so that students can better enter Professional role. For undergraduates majoring in chemical engineering, they have been exposed to experimental courses from the beginning of their enrollment, such as admission to chemistry experiments, physical chemistry experiments, organic chemistry experiments, and analytical chemistry experiments. These experiments have provided students with a solid experimental foundation. In order to meet the concept of talent training[4], a series of professional experimental courses have been set up for materials-related professional courses, teacher research directions, and scientific research equipment characteristics, including: professional basic experiments (polymer chemistry experiments, polymer physics experiments) and professional direction experiments (Polymer synthesis process experiment, polymer material test analysis experiment, metal organic catalyst experiment, material mechanics experiment, material molding experiment, etc.). How to better design the teaching content of the professional direction experiment and let it play a more useful role in teaching is a proposition worth exploring.

3. Constructing a Teaching Model of Chemical Engineering Experiment Course

3.1 Teaching Objectives

The construction of experimental courses with a professional orientation oriented by discipline competition is very important for integrating resources, mobilizing students' enthusiasm, and training professional talents with innovation and practical ability. A few days ago, the subject competitions that students majoring in chemical engineering mainly participated in included the Big and Small Challenge Cups, the Chemistry Competition, the National Polymer Innovation and Entrepreneur Competition, and the Zhejiang Province (National) Chemical Competition. Different competitions have different characteristics, but they have common requirements for students' basic qualities: innovative thinking, logical thinking, language expression ability, and teamwork ability. How to select talents and form a team that can go further is very important. Students design a large-scale chemical factory based on their own knowledge [5]. Students' own abilities can be effectively distinguished in this competition mode. In the professional direction experimental class, unified experimental questions can ensure that all students get the same experimental training, but the analysis and expression of experimental results will replace the previous experimental reports and become the main assessment form of the course. The results will be used as a reference for screening. Students, and then form a balanced competition team to continue in-depth research, so as to participate in various competitions.

3.2 Teaching Process

Take the experimental course of polymer processing engineering for chemical engineering as an example. In this course, students master the basic processing methods and performance testing methods, combined with the

performance testing of polymer processing engineering courses. If these experiments are performed on the same sample, this is a complete development process for the product. Therefore, before the start of the experimental course, make a detailed feasibility study of the teaching content, take full account of the grouping of students, refine the variables examined in advance, and send them to each group as their experimental tasks, so that students have targeted Sexually complete a set of experiments. After the experiment, combine the teaching content of the professional course, analyze the experimental data, and finally display it in the form of a group PPT report. In this way, on the premise of completing the basic purpose of teaching, the comprehensive ability of students can be exercised, and the enthusiasm of students to participate can be mobilized [6]. The specific operation process of cultivating entries for subsequent competitions is as follows:

(1) Feasibility study of setting the title

The setting of question days is the same as the scientific research topic selection. The experimental topic selection session needs to be determined by the teacher for each competition's work, combined with scientific research characteristics, or product market requirements on the premise that the basic teaching day is completed, and the feasibility is fully verified before it can be established as the curriculum topic day. This part requires a large amount of funding to allow graduate teaching assistants to participate throughout the process. Not only can it ensure the effective progress of the course, but it can also effectively train the graduate teaching assistant ability.

(2) Grouping and operation

After the feasibility study, the tasks were broken down and decentralized to each group to start the experimental course. During the period, due to the characteristics of each experiment, experiments were arranged in a crossover manner to properly determine the order of experiments.

(3) Analysis of experimental results

Under the guidance of teachers and teaching assistants, students learn to use simple scientific research software, organize experimental data, combine professional knowledge, analyze the data, form an experimental summary report, make a PPT statement, and complete the teaching link.

(4) Talent selection and training

According to the comprehensive quality of students, form a team. On the basis of existing research, continue to conduct in-depth research to form entries and participate in corresponding subject competitions. Some outstanding work can be published as a first author and a patent application for students.

(5) Model promotion

Summarize experience, and moderately popularize this model in experiments in other professional directions, such as polymer synthesis process experiments, polymer analysis and test experiments. Combining the characteristics of the topic selection, to ensure the class hours, even consider opening up several experimental courses offered by the classmates, such as polymer synthesis process experiments and polymer analysis and testing experiments, so that students have sufficient experience to complete a targeted The entire process of polymer products from synthesis to analysis and testing.

4. Conclusion

The construction of professional experimental courses is a systems engineering. Taking discipline competition as a guide can point the way to professional construction, but to truly achieve the overall goal of reform, we need to continue to revise, improve, and develop in future practice.

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The combination of discipline competition and specialty construction improves the exploration and practice of chemical talents quality training.

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