

Research on the Five-Dimension Cooperative Education Mode of Local Universities in the Concept of Production-Education Integration —A Case Study of Applied Chemistry Major of Yancheng Teachers University

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Abstract

Under the background of production-education integration, cooperation between school and government, school and industry, school and enterprises, and school and research institutes, the construction of five-dimensional collaborative education mode needs to be oriented to serve the regional chemical industry. The five parties, such as schools, local governments, enterprises, industries and research institutes, participated in the construction of five-dimensional collaborative education mode, focusing on the construction of collaborative education platform, talent training objectives, curriculum system, teaching staff, practical teaching system and institutional mechanism in order to promote the integration of the curriculum chain, the talent chain and the industrial chain. The construction of this mode has an important reference value for realizing the scientific development of applied chemistry talent training in China.

Keywords: local colleges; integration of production and education; school-enterprise cooperation; five-dimensional force drive collaborative education mode

1. Introduction

The chemical industry is a pillar industry that is related to the economic lifeline and safety of the country. There is a strong demand for applied high-level professionals engaged in production, R&D working and management in chemical industry, environmental, materials and related disciplines, who has strong

engineering practice ability, research ability, innovation consciousness, a sound personality, ideals, beliefs and social responsibility, and international vision. However, there is still a certain gap between the quality and quantity of talents cultivated by universities and the needs of the industry, which cannot meet the needs of the society ^[1-3]. Aim at the actuality, the local application-oriented undergraduate colleges should strengthen cooperation with local governments, industries, enterprises and research institutes to promote the integration of curriculum chain, talent chain and industrial chain, realizing the scientific development of personnel training, and continuously improving the training quality of applied talents. As an applied local undergraduate college, Yancheng Teachers University explored and constructed the five-dimensional collaborative education mode of applied chemistry major under the concept of integration of production and education, and obtained some achievements.

2. Analysis of the demand of applied chemistry professionals

The chemical industry is an important pillar industry of China and plays a pivotal role in the development of the national economy. The chemical industry, as the basic engineering technology of material and energy production, determines its important position in the unshakable basic industry in the future society. Green chemical industry and ecological chemical industry are the future development direction of China's chemical industry. With the transformation and development of China's economy, the demand for talents has shifted from the traditional single professional talent to the demand for high-skilled and interdisciplinary talents. With the development of coastal development in Jiangsu as a national strategy, key bases such as petrochemical industry, fine chemicals and new materials have been settled in Yancheng, and the chemical industry has been become the second pillar industry of Yancheng. Therefore, the Yancheng area has a very high demand for high-quality chemical talents. As a local college in Yancheng, how Yancheng Teachers University adapts to Yancheng's development strategy and cultivates a large number of high-quality chemical professionals has become the research focus of education and teaching reform.

3. The construction of five-dimensional force drive collaborative education mode under the concept of integration of production and education

The construction of the five-dimensional force drive collaborative education mode under the concept of integration of production and education is to stimulate the vitality of each subject and to cooperate closely, so that the supply side and the demand side of the talent cultivation can be fully matched in the quantity, quality and structure.

3.1 The goals of construction

The goal of integration of production and education is to achieve "four dockings". Firstly, specialty development and industrial demand docking are achieved to enhance the ability to cultivate talents that meet the needs of industrial development. Secondly, graduation requirements and professional qualification certificate docking are achieved to make professional qualification standards, industry technology

specification as the basis for the formulation of talent training specifications, constructing the professional qualification certificate and the academic certificate "Communication between Double Certifications" system. Thirdly, the curriculum setting and the professional standards docking are achieved to optimize and rebuild the curriculum construction based on the target requirements. Fourthly, the teaching process and the production practice docking are achieved to strengthen practical training, and continuously improve students' ability to solve practical engineering problems based on production practice.

3.2 The content and approaches of construction

3.2.1 With the integration of production and education as the starting point, build a five-dimensional force drive collaborative education platform.

The applied chemistry major of Yancheng Teachers University was established in 1999. It was selected as a specialty construction center for colleges and universities in Jiangsu Province in 2010. In 2012, it was awarded the key specialty of the "12th Five-Year" Provincial Higher Education Institutions in Jiangsu Province. In the same year, it was awarded the "12th five-year" pilot project of comprehensive professional reform by the Ministry of Education. The applied chemistry major of Yancheng Teachers University is now a brand specialty in Jiangsu Province. It signed a strategic cooperation agreement with Jiangsu Huifeng Agrochemical Co., Ltd., Jiangsu Dahua Chemical Industry Co., Ltd., Yancheng Yueda Dongfang Automobile Industry Development and Investment Co., Ltd., Nanjing University Yancheng Environmental Protection Technology and Engineering Research Institute. The mode of running a school in which the government, chemical industry, related chemical enterprises, scientific research institutes and universities participate in the whole process of talent training has been opened up. The collaborative innovation and education platform for the participation of the five parties has been established in this mode, including the five parties joint setting up training objectives, revision of personnel training programs to meet the social demand of talent training. The five parties jointly built practical teaching environment and practice bases, designed practice-oriented curriculum system and innovated practice training methods. The five parties jointly built "double-quality teacher" teaching body to conduct teaching research and optimize the structure of the teaching staff. The five parties co-constructed curriculum resources, updated teaching resources, and optimized course content. Multi-dimensional coordinated quality system was adopted to evaluate and ensure the sustainable development of cooperative education, so as to jointly improve the quality of applied talents and meet the talent demand for the development of the chemical industry of Yancheng City.

3.2.2 Guided by the demand of chemical industry in Yancheng, clarify the target of talent training.

According to the demand of applied chemistry professionals in the development of chemical industry in Yancheng City, the goal of cultivation is applied and inter-disciplinary talents with innovative spirit and practical ability, who have the basic theories, basic knowledge and basic skills of chemistry and chemical engineering and related disciplines, strong engineering practice ability, research ability and innovation consciousness, sound personality, ideals and beliefs, social responsibility and international vision. Graduates of this major are expected to engage in applied research, teaching, production and management in research institutions, higher education institutions, enterprises and companies.

3.2.3 Based on the standard of the chemical industry, build a curriculum system.

Based on the goal of talent training, the education and teaching concepts of four new (new ideas, new models, new content, new technologies) and the industry standards and norms of the chemical industry, the “5+1” (ie, five platforms and a link) curriculum system which is coordinated with the required capabilities and quality of the industry has been built through cooperating with Jiangsu Huifeng Agrochemical Co., Ltd., Nanjing University Yancheng Environmental Protection Technology and Engineering Research Institute and surrounding chemical companies. Among them, the “five platforms” included the general education curriculum platform, the subject curriculum platform, the professional curriculum platform, the innovation and entrepreneurship curriculum platform, and the cross-over and personality development curriculum platform; the “one link” refers to the centralized practice.

The "5+1" curriculum system fully reflected the high degree of unity of theory and practice, positions and skills, industry standards and training specifications. At the same time, in order to meet the demand of the college students' individualization development, innovative entrepreneurship courses and special courses on student crossover and personality development have been set up.

The general education curriculum platform is the basic part of the students' knowledge structure and ability accomplishment training. It is divided into two parts: compulsory and elective courses, including ideological and political theory, university sports, college English, safety education, reading and writing, college students' mental health education and courses of humanities and arts. The subject curriculum platform covers the basic knowledge, basic theory, basic quality and basic ability of the chemical industry. The curriculum system of the subject curriculum platform covers science, engineering and other disciplines, including advanced mathematics, university physics, high-level language programming, inorganic chemistry, and organic course. The professional curriculum platform consists of professional essential courses and professional elective courses. The curriculum of the professional curriculum platform is time-sensitive and should be revised with the adjustment of industrial structure and industry development requirements, mainly including analytical chemistry, physical chemistry, chemical engineering principles, chemical reaction engineering, chemical thermodynamics, polymer chemistry, basic chemistry experiments and other courses. The innovation and entrepreneurship curriculum platform is a curriculum for cultivating students' entrepreneurial awareness, innovative spirit, and innovative entrepreneurship. It is divided into two parts: compulsory and elective. Its compulsory courses mainly included entrepreneurial foundation and innovative entrepreneurial thinking training. The elective courses mainly included innovation and entrepreneurship activities, professional skills training, innovation and entrepreneurship practice training and professional science and technology guidance and training. The cross-discipline and personality development curriculum is to make up for the lack of curriculum for the discipline of Chinese traditional culture and humanities, which fully reflected the integration of arts and sciences and included cross-curricular and self-learning courses. The concentrated practice link is to improve students' practical ability, better connect with industry and industry standards, and better integrate school learning with corporate work, including professional trainee, professional internship, metalworking internship, graduation design, and curriculum design.

3.2.4. Based on the new teaching ideas and methods, establish a double-quality-teacher teaching team.

In the five-dimension cooperative education mode, the applied chemistry major of Yancheng Teachers University implemented the teaching concept and method of "synchronization of teaching and industry development", and employed industry or enterprise experts to join the teaching team to form a double-quality-teacher teaching team^[4-6]. The main role of industry or enterprise experts is to integrate industry development trends, real business cases, and enterprise actual R&D and other projects into the curriculum, to improve students' ability to solve specific engineering problems. In the teaching method, the existing teaching modes were reformed by making full use of the existing MOOC resources, and the teaching center was turned from the teacher to the student. The student is no longer the passive recipient of knowledge, but the active constructor of knowledge. Using the platform of the MOOC, many study groups were established to enable teachers and students to communicate freely to improve teaching efficiency, and service the cultivation of innovative talents.

3.2.5. Based on the actual R&D project, construct a practical teaching system of deep integration of production and education and deep cooperation between schools and enterprises.

Based on the actual development project of cooperative enterprises, the practical teaching system that realized the deep integration of the production practice and the teaching process was constructed in the applied chemistry major of Yancheng Teachers University. In the above practical teaching system, university teachers and students are the main body, and the teaching process is arranged with reference to the actual production operation process.

The deep cooperation between the school and the enterprise is mainly to jointly build the internal and external training bases to provide students with practical teaching scenarios that are consistent with the actual positions of enterprises and industries. At the same time, the real training environments were provided for students to deeply understand the production environment, corporate culture and job requirements. In this way, the experiential cultivation of students is realized, and the platform for assessing students is provided for the enterprise, which narrows the distance between the learning process and the work position, and truly realizes the seamless connection between the talent cultivation and the social needs. The practical teaching mode of multi-dimensional collaborative education under the concept of integration of production and education mainly included the following categories: Firstly, the practical teaching mode of teaching-learning-doing integration. Based on the actual project of the enterprise, the teaching mode of teaching-learning-doing integration was constructed. In such teaching mode, the teaching was carried out around the completed project and the content of theoretical courses could be applied to practice in a timely manner to improve students' ability to solve practical problems. Secondly, the practice teaching mode guided by science and technology competition. Students' innovative and practical ability could be promoted through science and technology competition as the carrier. By encouraging students to participate in the national college students' "Challenge Cup" contest, the National College Student Chemical Design Competition, the Jiangsu University Student Chemistry and Chemical Experiment Competition and other important competitions, the competition rules and contents are integrated into the practice teaching process to cultivate students' collaborative ability and innovative thinking.

3.2.6. To ensure efficient and sustainable development, improve the mechanism of integration of production and education.

The five-dimensional collaborative education mode under the concept of integration of production and education required a sound and integrated multi-cooperative education mechanism, including school-enterprise cooperation management methods, school-enterprise collaborative education evaluation and evaluation system, talent introduction work management methods, and fund use methods^[7-8]. The incentive mechanism for mutual benefit and mutual benefit, the operational mechanism for cooperation, the comprehensive scientific guarantee mechanism, and the reasonable and reasonable evaluation mechanism could be constructed through clarify the responsibilities, rights and obligations of the corresponding personnel of the school-enterprise cooperation.

4. Conclusion

Under the background of the production-education integration, the school-government cooperation, the school-industry cooperation, the school-enterprises cooperation, and the school-research institutes cooperation, the construction of the five-dimension cooperative education mode needs to be oriented by serving the regional chemical industry, with the participation of the government, relevant industries, enterprises, research institutes and schools, with the emphasis on such six aspects as multi-dimension cooperative education platform, talent training objectives, curriculum system, teaching staff, practical teaching system and institutional mechanism. The construction of this mode has an important reference value for promoting the integration of curriculum chain, the talent chain and the industrial chain, and realizing the scientific development of applied chemistry talent training in China.

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6. References

- [1] Chen Yan-Liang, and Li De-Li, "Practice and Model Construction of Collaborative Education by Government, Industry and Higher Education Institutions from Perspective of Triple Helix Theory", Heilongjiang Researches on Higher Education, 2018, 292, pp.87-90.
- [2] Guo Yanfeng, Jiang Feng, and Chen Xiaoyang, "Innovating Cooperation Mechanism, Improving the Quality of College Students' Education: Taking South China Agricultural University as an Example", Science and Technology Management Research, 2018, 22, pp.105-110.
- [3] Zhao Hui-Qin, and Chen Xiao-Hui, "Research on the Multi-Dimension Cooperative Education Mode of Applied Universities in the Concept of Production-Education Integration-A Case Study of Digital Media Technology Specialty of Datong University of Shanxi", Theory and Practice of Education, 2018, 38(36): pp.6-8.

- [4] Hen De-Yi, Li Jun-Hong, Zhang Lei, and Xu Xi-Yan, “New Mode of Cooperation Education between School-Enterprise-Association in Construction Cost Specialty”, *Education Teaching Forum*, 2019, 12: pp.32-33.
- [5] Chen Xiao-Chun, and Xu Hong-Long, “Research and Practice of “Studio” Operation Mechanism Based on School-enterprise Collaboration”, *Education Teaching Forum*, 2019, 12: pp.32-33.
- [6] Bao Fang-Yin, Dou Peng, Wu Jie, Xu Jing, Xia Chun-Xiao, Yu Zhen-Zhen, and Cheng Jia-Yan, “Research on the Cooperative Education Mechanism between Schools and Enterprises”, *Journal of Bengbu University*, 2019, 8: pp.86-88.
- [7] Zhang Jia Chi, “Exploration and Practice of Reforming Innovation and Entrepreneurship Education in Comprehensive Universities-Taking the School of Physics of Lanzhou University as an example”, *University Education*, 2019, 4: pp.28-31.
- [8] Liu Limei, Ma Jingxiang, and Zhang Yingliang, “Exploring on the Mode of Internal Collaborative Education System in Newly-built Universities-A Case Study of Handan University”, *Education Research*, 2017, 6: pp.151-156.

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