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Exploring the Practice of "College, Government, Association, Research and Enterprise" Collaborative Education Mode from the Perspective of Supply Side Reform - A Case Study of the Applied Chemistry Major of Yancheng Teachers University

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Abstract

At present, the training of engineering talents in higher education needs to carry out supply-side reform to solve the disconnection between the demand for social talents and the cultivation of talents in universities, and the phenomenon that there is a mismatch between the students' employment needs and the curriculum system of colleges and universities. The "College, Government, Association, Research and Enterprise" (CGARE) Collaborative Education Mode has been built to improve the quality of applied talents in the applied chemistry major of Yancheng Teachers University for nearly 10 years. Based on the "student-oriented" education concept, the collaboration of college, government, association, research and enterprise was taken as a breakthrough and the enterprise technology demand was taken as the carrier to improve the engineering practice ability and innovation and entrepreneurship ability of college students, and fully meet the needs of society and enterprises for high-quality talents in the CGARE collaborative education mode. The quality of applied talents has been improved significantly through the CGARE collaborative education mode. High-level achievements of the students of the applied chemistry major of Yancheng Teachers University are fruitful. The innovative and entrepreneurial ability and their professional self-confidence of the students have been greatly enhanced. Thus, the quality of student employments is high, and given high marks by the internship unit and employer.

Keywords: Supply-side reform; College, Government, Association, Research and Enterprise; Collaborative education; Applied chemistry major

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1. Introduction

Since the implementation of the higher education enrollment plan in 1999, the development path of demand-side reform, that is, by increasing investment, expanding the number of enrollment to realize the rapid expansion of the scale of colleges and universities has been taken in the China's higher education. As the means of stimulating domestic demand and consumption, the means of promoting economic growth and relieving employment pressure, the China's higher education has obtained great leap forward development in a relatively short period of time. In 2015, the number of the college students in China reached 37 million, ranking the first in the world, the number of the colleges and universities is 2,852, second only to the United States and the gross enrollment rate is 40 %, higher than the global average. Thus, the China's higher education is at a stage of popularization now. On the other hand, from the perspective of the “supply side” of higher education, the improvement of the faculty and the conditions of running colleges and universities lag behind the expansion of the enrollment scale. The adjustment and setting of disciplines and majors cannot adapt to the changes in the demand for talent brought about by the economic and social transformation and development, which have led to a series of structural contradictions between the cultivation and supply of talents in universities and social needs [1-3]. There is a structural contradiction between supply and demand. It is difficult for college students to find suitable positions, and to find suitable talents for employers. The main reasons for this phenomenon are the disconnect between the demand for social talents and the cultivation of talents in colleges and universities and the lack of connection between the employment needs of students and the curriculum system of colleges and universities. In view of the mismatch between supply and demand in the cultivation of talents in colleges and universities, the reform of higher education should turn from the original demand side to the supply side. The foothold of the supply-side reform lies in improving the quality of personnel. The applied chemistry major of Yancheng Teachers University is taken as an example to explore the cooperative education mode of "College, Government, Association, Research and Enterprise" (CGARE) from the perspective of supply-side reform in this paper.

2. The necessity of the CGARE collaborative education mode

In the reform of the supply-side of higher education, the reform of the talent training mode should been carried out and implemented at the macro, middle and micro levels. At the macro level, the national education department should adjust and optimize the development layout of higher education and increase the proportion of the schools that cultivate applied technology and innovative entrepreneurial talents. At the same time, the reforms of evaluation system should been deepen and the indicator weight of the quality of personnel training in the evaluation of colleges and universities should been increased to solve the problem of the "skilled workers shortage" of enterprises and the "employment difficult" of a large number of graduates. On the middle level, the professional settings should been adjusted in real time and the connotation of the discipline construction should been paid attention to solve the problem that the discipline professional structure of talent cultivation cannot adapt to the industrial transformation and upgrading and the market demand of professional enterprises in emerging industries. At the micro level, the college (department) should fully consider the needs of the “demand side” of society, enterprises and markets in formulating talent training programs, curriculum systems, teaching content, teaching methods, etc., to solve the problem of the students' lack of active learning, independent thinking, knowledge, ability and the mismatch between quality structure and industry job requirements.

Bachelor of the applied chemistry in Yancheng Teachers University was established in 1999. In 2010, it was selected as a specialty construction center for colleges and universities in Jiangsu Province. 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 awarded the pilot project of comprehensive professional reform during the “12th five-year” by the Ministry of Education. The applied chemistry major is now a brand specialty in Jiangsu Province. In order to solve the contradiction between supply and demand in the cultivation of talents, the CGARE collaborative education mode has been taken as a breakthrough to fully stimulate the enthusiasm of each education link for more than 10 years in the applied chemistry major. The remarkable results have been achieved in the training of engineering professionals.

3. The practice of the CGARE collaborative education mode

The path of the CGARE collaborative education mode to improve the quality of applied innovative talents is summarized as follows. Based on the "student-oriented" education concept, the collaboration of "College, Government, Association, Research and Enterprise" has been taken as a breakthrough and the establishment of the platform for CGARE collaborative education has been focused on. On the same time, the enterprise technology demand project has been taken as the carrier to improve the engineering practice ability and innovation and entrepreneurship ability of the college students, fully meeting the needs of society and enterprises for high-quality talents.

Based on the "student-centered" concept, the CGARE collaborative education mode has been established in the applied chemistry major of Yancheng Teachers University. In the CGARE collaborative education mode, the synergy of the past two entities has been broken through, the enthusiasm of more subjects has been brought out and more resources on talent cultivation has been concentrated on the talent training. The CGARE collaborative education mode is an innovation in the traditional collaborative education model.

4. The construction of supporting curriculum system

The five parties of the CGARE collaborative education mode work together to develop training objectives and reconstruct the advanced curriculum system centered on the training of the critical thinking, engineering practice ability and innovation and entrepreneurship. The applied chemistry major has taken the comprehensive revision of the 2015 undergraduate professional training program as the starting point, and established a new program for talent training in “General Studies Course + Subject Course + Subject Professional Course + Innovation and Entrepreneurship Course + Cross and Personality Development Course + Concentrated Practice Link”. In principle, the first- and second-grade students will be trained in a large category. That is to say, in the first grade, general studies courses and subject courses are set according to the subject categories. In the second grade, subject professional courses are set according to the professional direction. The third and fourth grades are divided into trains according to the individual needs of the students. The total credits for graduation was reduced to 160 in the revised training program. In order to cultivate students' effective expression and the ability to communicate, strengthen the critical thinking training and the guidance for students' academic career planning, ideological and political theory, university physical education, college English, safety education, reading and

writing, college students' mental health education, humanities and arts and sports were set in the general studies curriculum. The subject curriculum covers the basic knowledge, basic theories, basic qualities, and basic abilities of the chemical industry. Science, engineering, and other disciplines, including advanced mathematics, university physics, high-level language programming, inorganic chemistry, and organic courses were set in the subject curriculum. The subject professional curriculum platform consists of the professional compulsory and professional elective courses, 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 to cultivate students' entrepreneurial awareness, innovative spirit and innovative entrepreneurship. The compulsory courses of the innovation and entrepreneurship curriculum platform mainly included entrepreneurial foundation and innovative entrepreneurial thinking training. The elective courses mainly consisted of innovation and entrepreneurial activities, professional skills training, innovative entrepreneurial practice and training and professional science leadership guidance and training. The cross-discipline and personality development curriculum was set to make up for the lack of courses in the traditional Chinese culture and humanities development of the engineering major and to meet the individualized and diversified needs of students. Based on the actual case of the enterprise and guided by industry standards, professional apprenticeships, professional internships, metalworking internships and graduation design and course design were carried out in the centralized practice link to improve the students' engineering practice ability and meet the needs of employers.

5. The construction of supporting teachers

The "double-quality" teacherteam were jointly established by the applied chemistry major of Yancheng Teachers University and the enterprise to promote the interactive sharing of high-quality teachers of both schools and enterprises, and the accelerated flow of technology, information and resources between schools and enterprises [4-5]. On the one hand, the part-time teachers from the front line of enterprises were selected to take practical skills courses, hold seminars for undergraduates, and introduce new development trends and highlights of the industry to strengthen the students' industry awareness. On the other hand, in order to promote the development of the cooperative enterprise, some professors and experts were assigned to act as the general manager and vice president of the company by the school, participating in the business decision-making and technology research and development of the cooperative enterprise.

6. Construction of supporting guarantee mechanism

In order to make fully use of the professional knowledge and rich practical experience of enterprise technicians to jointly guide students to practice teaching [6], the school-enterprise joint training mechanism based on the sharing of results sharing was built in the applied chemistry major of Yancheng teacher university. The dynamic driving mechanism based on real needs and the mechanism of mutual benefit and sharing between different cooperative entities were established to make such above cooperation institutionalized, scientific, standardized, and long-term in the applied chemistry major. The multi-interaction mechanism with clear rights and responsibilities and the feedback and the consultation mechanism between the applied chemistry major, industry, enterprises and research institutes were constructed to make the government, association and enterprises deeply involved in the personnel training mechanism.

7. The effect of the CGARE collaborative education mode

In the past ten years, the applied chemistry major have closely coordinated with government, association, research and enterprise through the CGARE collaborative education mode and achieved fruitful results. The satisfaction of the employers was greatly improved. Yancheng Environmental Protection Technology and Engineering Research Institute of Nanjing University is a joint construction unit of the applied chemistry major of Yancheng Teachers University. The training center was jointly built by the school and above mentioned joint construction unit. A lot of enterprise experts and technical backbones were regularly invited to provide special lectures to introduce the latest technological developments of the company. Based on the process of the National University Student Chemical Design Competition, the Yancheng District Chemical Design Competition has been held for four consecutive years in the Yancheng teacher university. The on-campus micro-factory (ethyl acetate production training device) was built through the school-enterprise cooperation to develop the "four-in-one" practical training technology which set practical teaching for business, make the instrument operation visible,

make the operating control diversified and make the training project comprehensive. The seamless integration between on-campus training and off-campus internships was finally achieved through the on-campus micro-factory to effectively solve the problem of lack of systematic and complete on-site internships. In the past 4 years, the students of applied chemistry major of Yancheng Teachers University have all participated in the competition, which won one gold medal in the National Competition of the 10th College Student Entrepreneurship Competition, one gold medal in 2016 and 2018 “Creating Youth” National Undergraduate Entrepreneurship Competition, the first prize of the 9th, 10th, 11th, and 12th National Undergraduate Chemical Design Competitions, the first prize of the 4th Jiangsu University Student Chemistry and Chemical Experiment Competition. In 2016 and 2017, the students of applied chemistry major won the first prize of the outstanding undergraduate thesis of the provincial colleges and universities. The average acceptance rate of the four-year postgraduate entrance examination was 35.8 %. Through many years of practical exploration in the application of applied chemistry, the students' engineering practice ability, scientific research ability, innovation and entrepreneurial ability have been greatly improved, and thus the coordination and balance between the supply side of the talent cultivation and the demand side of the industry has been realized in the applied chemistry major in Yancheng Teachers University.

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