

Research on the Curriculum Reform of Process Equipment and Control Engineering Based on the Specialized Programmatic Accreditation of Engineering

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Abstract. Specialized Programmatic Accreditation of Engineering (SPAE) is not only required for social development of talent, but also necessary for international exchange and mutual recognition to China's engineering education. In this paper, taking the major of Process Equipment and Control Engineering of Qingdao University of Science and Technology as an example on the basis of the analysis of the connotation of Specialized Programmatic Accreditation of Engineering, the specialty characteristics and advantages were summarized, and the teaching resources were integrated. Through the curriculum, which meets the requirements of Specialized Programmatic Accreditation of Engineering, the orientation of the university and the major characteristics was reformed.

Keywords: Accreditation, Control, Curriculum, Engineering, Equipment.

INTRODUCTION

China became the 21th member of "Washington Accord" on June 19, 2013 with a unanimous pass. It means that the quality and security of engineering education in China had been recognized by the international engineering education community. Meanwhile, it marked that the internationalization of Chinese engineering education had taken significant steps, and the students of engineering education were provided "pass" with the recognition of international quality standard (Yu et al., 2015)

The curriculum system which plays as a connecting link role, is an important element in the Specialized Programmatic Accreditation of Engineering (SPAE) (2012). This paper was based on the professional certification standard of SPAE, and followed training requirements of Educational Ministry for control professional as well as training scheme of Qingdao University of Science and Technology (QUST). Besides the characteristics of university and subject, the high quality teaching resources are considered

simultaneously. Firstly, training objectives requirements and plans are renewed. Secondly, the curriculum system of PECE is analyzed from the mathematics and science courses, engineering courses, professional courses, humanities and social science courses and practice courses. Thirdly, the curriculum system is reformed on the basis of general education, professional basis, professional characteristics and practice. Therefore, the curriculum system based on professional certification standards of SPAE was conformed to engineering education accreditation standard and reflected training requirements of chemical machinery industry. Meanwhile, it can also improve organization and management ability and international perspective of student.

SUBJECT CHARACTERISTICS AND RESOURCES

The PECE (Formerly known as Chemical Equipment and

Machinery, CEM) of QUST which was established in 1958, is one of the first subjects set up in Shandong Province. In 1981, PECE became the first bachelor's degrees awarded subject of QUST. Then, the subject got the master's degree granting right in 1993 and subsequently, it grew into the first-class discipline in Power Engineering and Engineering Thermophysics (PEET) in 2005, and got the authority to launch Ph.D program in the same year. A "Taishan scholar" position was set up which was approved by Shandong province at the same time. In 2010, PEET (including PECE) had the authority to launch Ph.D program of first-class discipline. Moreover, PECE is the key construction disciplines during "Tenth Five Year Plan", the strengthen construction discipline during "Eleventh Five Year Plan" and the key characteristics construction discipline during "Twelfth Five Year Plan" of Shandong Province. In 2010, PECE was approved by the State Ministry of education as a specialty construction point (Qian et al., 2012)

In terms of hardware, the subject has a national virtual simulation experiment teaching center, provincial level process equipment, oil & gas storage and transportation teaching demonstration center.

In terms of software, a long-term, stable and close communication channel has been established between PECE and German universities, which not only offers the students opportunities to communicate with foreign teachers, but also provide a chance to get employment or further education in Germany for outstanding graduates. In addition, Qingdao Mesnac Heavy Industry Co., Ltd., Sinopec Qilu Petrochemical and other large pressure vessel manufacturing enterprises or chemical enterprises had established a long-term stable relationship with PECE of QUST as practice teaching bases. Through the organic combination of learning and practice, the quality of practice teaching need to be further improved.

Undergraduates who were employed throughout the machinery and chemical industry, are well received by their employers. In recent years, the employment rate of undergraduates reached 95%, and graduate enrollment rate is about 25%.

The guiding ideology and goal of curriculum reform

The guiding ideology

Based on school characteristics, focused on the professional advantages, combined theory with practice, established open and research-based teaching model. Implement the education idea of "characteristic and high quality". Cultivate students with "good moral character, solid foundation, broad domain, international vision". Reflect the interdisciplinary fusion, knowledge updating, employment field expanding (Yan et al., 2012)

Based on the requirement of SPAE, combined with the current PECE curriculum system of QUST to find out the

problems and deficiencies, the reform direction of curriculum system has been established to:

- (1) Strengthen the humanities and social science literacy, social responsibility and engineering ethics education.
- (2) Understand the current situation and trend to the development of the PECE systematically.
- (3) Develop students' organization management ability, expression ability, interpersonal communication ability and the ability to play the appropriate role in the team.
- (4) Broaden international perspective and improve the ability of cross-cultural communication, competition and cooperation.

Reform goal

The curriculum reform goal of PECE is that: Rely on the advantage of discipline, pay more attention to undertake sexual, systematic and the holistic optimization design of curriculum system. Around the objectives and requirements of SPAE. Based on its own benefits. Integrate excellent resources, highlight characteristic of PECE. Set targets of profession fostering and cultivate the professional and humanistic quality of students. Lay the foundation for the engineering education professional certification pilot work.

The content of curriculum reform

Clear talent market needs and training objectives, optimize the teaching plan and system, strengthens the basic skills training, update the optimization courses' teaching content and training system, enhance the students' ability in solving practical engineering problems and broaden their horizons at the same time. It also establish an accessible and research-based teaching mode in order to cultivate students' engineering awareness and communication management ability (Zheng et al., 2011).

Strengthen students' sense of discipline identity

A new course named "Conspectu of Process Equipment and Control Engineering" has been added in the first semester, which costs every student 32 class hours. In this course, students will be systematically taught the professional background, subject basis, knowledge system, employment and frontier of the PECE discipline by all PECE teachers at the beginning of their university lives. On one hand, it can enhance students' professional knowledge and professional sense of belonging, and avoids their specialization lost and problem of poor learning consequently as freshmen. On the other hand, it provides a chance for students and teachers to be familiar and communicate with each other for better

understanding, and avoids the phenomenon of "soldiers do not know their general, general does not know his soldiers". Through this kind of communication, students who encounter confusion in learning can ask professional teachers for answers in time, and the teachers can also know well of the characteristics of students and their studies. It also helps to teach students in accordance with their aptitude (Xu et al., 2015).

Strengthen English skills

Additional English courses are set up in every semester and students can choose free courses on their own accord. These courses include two parts: the first is to strengthen the students' communication ability and improve students' listening and speaking ability. The second is the professional English part which do not only help students understand more about PECE, but can also improve their professional literature in foreign language reading and writing ability, which lays the foundation for the students to learn at graduation stage.

It should be noted that part of the course is on a voluntary basis but elimination mechanism is also introduced, because English learning is not the core part of professional training. The level of English depends on each student's foundation and gift, there is no need to demand everyone reaches a certain standard and make it a burden to part students.

The establishment of open, research-based teaching model

First of all, teaching activities is based on teaching material but not tied to the textbook. They came from textbooks but above them. The most vivid information would be collected from the internet on engineering which can be added to the teaching resources. This method respects the classics and authority of the books, and breaks through the limitation of the books. Secondly, further strengthens the use of computer media in teaching demonstrations such as dynamic animation and film to display the formation of knowledge and the proportion of scene. However, it does not mean to deny or abandon the role of the blackboard and chalk in teaching. Thirdly, "Internet plus" teaching, where teachers are required to be familiar with the relevant websites, can be linked to the appropriate time in teaching.

Research-based teaching is a teaching method which emphasizes the forming process of scientific principle. The presentation of teaching content should be process oriented, which can cause and generate knowledge points, guide students' divergent thinking, inspire the students' autonomous learning and inquiry of motivation, and actively and consciously enhancing students' participation in knowledge construction.

Opening laboratory

Open laboratory encourage students to design experiments, reform and even invent experimental equipment with the teachers' guidance or help, which improves students' hands on ability and innovative ability.

It guide students to participate in all kinds of innovation contests. Through the contests, impel students to understand the profession, broaden their horizons, enhance communication and further stimulate the students' creative desire.

Project management ability

Whether students are going to be employed or admitted as graduate students, they often not just play a performer's role but sometimes manager role, which requires the students not only to have excellent professional skills, but also possess a certain communication skills and management capabilities. For this reason, a new course named "Project Management" is offered to the students. In this course, students can contact management knowledge, understand the connotation of management, learn management skills and promote management ability. Further, how to manage should also be well learned. Because of the aim of learning, the management is not simply to allow students to "yell" others and more importantly, they ought to have a sense of ownership and more understanding of the management attitude and the way of thinking, clear their right position in the team, and know how to reflect their values through servicing the team.

Strengthen off-campus training

Except the completion training plan set in the practice teaching and production practice, additional practice opportunities for students are provided in off-campus practice bases established by enterprises or scientific research institutes cooperated with QUST. Cooperate with enterprises and research institutes to establish off-campus internship and practice base for students with the chance to participate in the engineering practice. Develop open and comprehensive designing experiments and explore comprehensive practice ability and innovative spirit. Combine theory teaching and production teaching, adopt diversified teaching methods, and establish evaluation system of teaching quality evaluation to improve the quality of practice teaching.

Advocate the combination of theory teaching and practice teaching, adopt diversified practice methods, establish the evaluation system of practice teaching quality assessment, and ensure the improvement of

practical teaching quality.

Interaction between practice training, employment and dissertation

Dissertation is the most important practice segment, which undertakes the task to guide the undergraduates to employment or graduate study. The dissertation should be closely combined with the engineering or preceding issue, and it leads students to solve practical problems by the integration and application of professional knowledge, cultivating project consciousness, ability of solving problem independently, cooperation spirit. By means of optimization of the experiments, practice, course thesis and dissertation, scientific and reasonable teaching practice evaluation system is established to evaluate the graduates' abilities.

Based on the above principles, the graduation dissertation topics is no longer decided by the tutors, but mainly chosen by the students' on demand. It needs the tutors to understand and respect each student's interest demand, employment demand, and research demand. Firstly, the dissertation topics needs be proposed by the students, and then they choose tutors according to the topic and the tutors' specialty. After the two-way election of students and tutors, the tutors help students determine dissertation topics and the research directions.

CONCLUSION

With the arrival of the "new normal" of china, the pace of economic and industrial restructuring is accelerating, and the undergraduates of PECE show a trend of diversification.

Survey results show that the main fields of undergraduates of PECE that obtain employment are petroleum chemical industry, food processing, pharmaceutical production, machinery manufacturing jobs. Both of them are front-line staffs of technology, technic, design and operation, management. Through the reform of the curriculum system, students have laid a solid foundation of professional knowledge, mastered the basic professional skills, know well of analyzing and solving practical problems, had teamwork skills and methods, broadened international vision and ability to communicate, and enhanced the ability to adapt to the employment. So, the field of employment of graduates are greatly expanded.

In conclusion, exploring the potentialities of students, acquainting the employment demands, optimizing teaching system, establishing teaching process control and feedback mechanism, the curriculum system of PECE had been perfected well. Moreover, the students'

comprehensive professional quality had been improved, and the reform of curriculum system has very important theoretical guidance and practical significance in cultivating PECE students.

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