Construction and exploration of practical education system of applied chemistry under the background of new engineering

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Abstract. Chemistry is an experimental science. Practical teaching is a significant link in the cultivation of students majoring in chemistry to foster students' practical, professional application, and innovation abilities. Based on the investigation and analysis of the problems existing in the cultivation of the practical ability of applied chemistry major, take specific measures, such as constructing the practical teaching system of applied chemistry major, explored a better practical teaching system for students of applied chemistry major; applied to the reform and innovation of training mode of students majoring in applied chemistry and achieved good results.

1 Introduction

Since February 2017, the Ministry of Education has actively promoted the construction of new projects, and has successively formulated the "Fudan Consensus", "Tianda Action" and "Beijing Guidelines" to adapt to a new scientific and technological revolution and industrial change, and support a series of national strategies such as scientific and technological innovation-driven development and "Made in China 2025". The "Notice on Carrying out Research and Practice of New Engineering" and the "Notice on Promoting Research and Practice Projects of New Engineering" were announced to explore the Chinese model and experience of engineering education to assist build higher education in a powerful country. It is also announced in the "Notice on Carrying out Research and Practice of New Engineering" and the "Notice on Promoting Research and Practice Projects of New Engineering" that the Chinese model and experience in engineering education should be explored with all efforts to assist to establish higher education of a strong country. To break through key technologies, build first-mover advantage and occupy the strategic commanding position in the approaching global innovation system. There is an urgent need for emerging engineering talents with scientific knowledge structure, comprehensive practical ability, strong sense of innovation, broad international vision, positive teamwork spirit and communication ability [1]. The new engineering major is a transformation and upgrading of traditional engineering majors such as chemical engineering, civil engineering,

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materials, electrical appliances and machinery in an intelligent and controllable way. Different from conventional engineering fields, the development of emerging industries needs high-quality interdisciplinary talents with strong engineering practice ability and strong innovation consciousness and capability [2].

2 Existing situation of practical teaching system

The major of Applied Chemistry at Xi 'an University of Technology aims to cultivate talents with high-quality for the society based in northwest China and facing the whole country. Therefore, the training of innovation awareness and burgeon practical ability of undergraduates has always been the focus of our attention. After revising the talent training program for many times, the experiment content has been integrated and optimized, the proportion of comprehensive experiments has been increased, and the organization and implementation of professional skills competitions have been increased, which has aroused the enthusiasm and initiative of students to participate in scientific research practice and innovation activities to a large extent. However, with the popularity of emerging industries and the upgrading of traditional industries, the current engineering practice education system and platform, such as practice teaching, can no longer meet the requirements of the development of "new engineering" in terms of teaching objectives, system design, practice content, teaching methods, teaching quality evaluation and comprehensive practice platform. The existing problems are mainly reflected in the following aspects.

The teaching objectives of various practical teaching in the current training programs cannot accurately connect with the needs of emerging industries and a new economy, which is not conducive to the cultivation of students' engineering literacy and innovative thinking.

The current practical teaching system has strengthened the cultivation of students' engineering practical ability, but there are deficiencies in the cultivation of students' interdisciplinary ability, innovative consciousness and comprehensive ability.

The number of design experiments, school practical teaching funds and the relevant equipment matching with new technologies and new industries in the professional basic experiment, which is insufficient. Thus, the practical teaching content is slightly traditional and outdated, and relatively lagging behind compared with the development of the industry.

The practical teaching method and method are single, which cannot fully mobilize the enthusiasm and participation of students. It is not conducive to the improvement of students' practical operation and problem-solving abilities. Besides, This does not conform to the training goal of cultivating high-quality "new engineering" talents.

The promotion of students' engineering practice ability and the formation of innovation consciousness cannot be separated from the construction of perfect construction of practical teaching base inside and outside the school and the scientific management, assessment and evaluation mechanism. However, the current situation of practical teaching is worrying. For enterprises, economic benefits are the first demand. Their normal production order and economic benefits will be disrupted and affected for students' internship. Thus, universities and practice base cooperation level is relatively low. Moreover, student practice gave priority to visit and view are not conducive to the practical and innovative capability of students. In addition, the lack of practical ability of practical teaching teachers in colleges and universities also leads to the absence of guidance, assessment and evaluation of students 'practical links. And this also limits the cultivation of students' practical ability and innovative consciousness to a certain extent.

Based on the above analysis, it is urgent and important work to meet the needs of cultivating new engineering talents and emerging industries and new economy by exploring the engineering practice education system and the construction of platform for new engineering, which also has important theoretical research and practical significance.

3 Goal and building of practical teaching system

3.1 Reform the traditional practical teaching system and build a multi-level practical teaching system to meet the needs of professional development

With new engineering education put forward the practice ability training goal as the guidance, to integrate and design applied chemical professional practice ability training system, build to adapt to the development of new engineering "thick basic experiment, wide caliber of technical experiment, teaching and research combination of professional experiment and personalized innovation experiment" practice teaching system. The main purpose of the solid basic experiment is to cultivate the practical ability of applied chemistry students related to basic subjects, organically integrate basic disciplines with engineering technology, so that students can have solid professional basic practical skills, and lay a foundation for the subsequent study of professional courses. The broad caliber technical basic experiment is to strengthen students' professional engineering background and cultivate engineering awareness and engineering literacy through the cultivation of professional practical ability. It mainly includes the basic experiment of the applied chemistry major, the specialty direction characteristic experiment, and the applied chemistry comprehensive experiment courses. The professional experiment combining teaching and scientific research aims to sublimate students from textbook knowledge to practical application through the real scientific research and practice environment. Personalized innovation experiment is composed of various practical links, such as quality development practice, applied chemical innovation experiment, graduation thesis, national college student chemical skills competition, college student chemical experiment competition and other professional competitions, and innovation and entrepreneurship training projects approval. By building a new practice teaching system and earnestly implement it in the practice process of practice, strengthen the students 'cognitive ability, improve students' ability to analyze and solve problems, cultivate students 'innovation consciousness, and in the comprehensive practice activities to cultivate students' interdisciplinary learning ability, communication and coordination ability and teamwork ability, so as to realize the engineering practice ability and humanistic accomplishment.

3.2 Reform the traditional practical teaching content, and compile the practical teaching syllabus and practical teaching materials with professional characteristics and advantages

With the development of science and technology, new testing instruments, testing technologies and methods are constantly emerging, representing the future development direction of science and technology. And the current advanced science and technology and testing methods are constantly introduced into students 'practice teaching, expand students' knowledge and horizon, improve their practical ability and innovation ability. Through transformation, update will be relatively backward practice teaching platform, establish advanced, with high technical level, represents the development direction of practice teaching platform and practice teaching content, the practice teaching can coordinate with the progress of science and technology, can adapt to the development of the current society, can meet the needs of the enterprise, improve students' practical ability.

3.3 Reform experimental teaching method, and build a virtual practice teaching platform system and online and offline sharing practice platform

Virtual experiment teaching is a modern teaching method, which is a supplement to physical experiments and which is a popular experimental teaching method in the world [3, 4]. By connecting the network with the virtual experiment centre, the remote teaching experiment combining virtual and real can be realized, and it is established to overcome the teaching experiment which is difficult to be implemented due to the restrictions of investment, environment, equipment, consumption, safety and operation difficulty under normal circumstances. It integrates real equipment, virtual technology, simulation technology and remote technology. It can realize the plasticity, diversity, comprehensiveness and openness of practical teaching. According to the teaching requirements, students can not only carry out their own field experiments on the relevant experimental platform, but also improve the number of students, experimental technology level and experimental effect, and enhance the autonomy and openness of the experiment. Through a variety of teaching means, broaden students' vision and improve students' interest in learning.

3.4 Deepen school-enterprise cooperation and build a platform for school-enterprise cooperation

Actively carry out the construction of the school-enterprise cooperation platform, based on the construction and planning of the professional practice and training base, including the existing engineering practice education system and practice platform, increase the construction of school-enterprise cooperation platform, make full use of enterprise conditions, and carry out all-round practical training. The practical problems encountered in enterprises are provided to the major in the form of horizontal projects or graduation papers, so that students can practice in enterprises in a wide range of high-class hours. So that professional and enterprises can achieve collaborative education and collaborative innovation. Create real or simulated professional atmosphere from the aspects of production training environment, production training project design, enterprise culture atmosphere, enterprise management mode and so on, simulate the production process, and build a number of comprehensive training rooms and production practice workshops. It provides opportunities and conditions for students to participate in production, learning and research activities through the joint construction of high-level, sharing and open practice teaching platforms between the school and enterprise.

3.5 Build a team of high-level practical teaching teachers

The construction of a high-level practical teaching platform and teaching staff is the basis of achieving teaching objectives [5]. Through the joint construction of a high-level, sharing and open practice teaching platform between the school and the university and enterprise, establish a "school-enterprise joint" instructing teacher team, build a stable "combination of professional and professional" high-level practical teaching teacher team, truly establish a "double-qualified" teaching team, achieve the improvement of software and hardware conditions, improve the overall teaching and research level of regional teachers, and guarantee resources of teaching materials and teachers.

4 Implementation effect

In recent years, through continuous reform, the experimental teaching demonstration center has completed more than 100 open experimental projects and more than 2000 people in open experiments every year. The opening of various forms of laboratory has effectively improved the practical ability of students majoring in applied chemistry. A large number of "national and provincial college student innovation and entrepreneurship plan" projects, internet plus, challenge cup and discipline competition award-winning works have been cultivated. All kinds of internships, professional practice and comprehensive practice education platforms are conducive to the expansion of students' professional quality. Taking chemical experiment and chemical design competition as an example, the entries and awards in recent three years are shown in Figure 1. As can be seen from Figure 1, the number of participants in the competition and the number of winners has increased year by year, and there will be a great increase in 2022.The construction and promotion of the extra-curricular practice system have greatly improved the practical education level of our school and achieved good results.

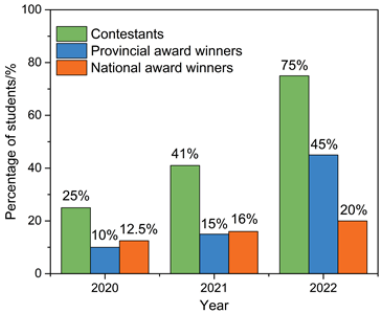

Fig. 1. Percentage of participants and winners in recent three years.

5 Conclusion

In recent years, aiming at the traditional practical teaching mode, we have actively carried out the construction of an innovative practical teaching platform, focused on promoting the reform of experimental course teaching content and method, strengthened the construction of comprehensive, designed and open experimental projects, and focused on strengthening the construction of practice base with the mode of school-enterprise cooperation education and school-enterprise professional construction as the starting point. Through continuous exploration and practice, the practical teaching system of "solid basic experiment, wide aperture technical basic experiment, professional experiment combined with teaching and research, personalized innovative experiment" has been formed. The implementation results are remarkable, and can provide useful reference for the practical teaching of applied chemistry major.

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