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Exploration of the Collaborative Education Model of Production-University-research: A Case Study of Material Science and Engineering Major

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Abstract

Collaborative education model of production, study and research is an effective way to improve the engineering practice ability and innovation ability of application-oriented undergraduates. The necessity and the existing problems of the collaborative education model of production, study and research were summarized. And then, the construction of the collaborative education model of production, study and research in the materials science and engineering of our school, including the construction of the industry-university-research platform production, the construction of the virtual simulation center and the revision of the talent training scheme, are briefly introduced. Finally, two suggestions on deepening of subsequent construction were proposed. Hoping this paper can provide a useful reference for the collaborative education model of the same type of institutions.

Keywords

Industry-university-research collaboration; Application-oriented talents; Cultivation mode; Materials Science and Engineering.

1. Introduction

Driven by the "dual carbon" goal, the new energy industry has developed rapidly in recent years, and the demand for professionals in this area has continued to rise. Based on the development needs of the new energy industry in northern Jiangsu, our school opened the major of materials science and engineering in 2018. This major is a discipline that studies the composition, structure, processing technology, performance and application of materials. The traditional material science and engineering majors emphasize knowledge transfer and ignore practical training. The courses offered are based on the needs of traditional industries and mainly teach theoretical knowledge. Students learn passively and lack practical experience. The process of development has encountered great challenges, and the disconnection between theory and practice cannot meet the needs of today's society for advanced applied technical talents [1-3]. Our school is an application-oriented undergraduate institution, which should serve the local area and cultivate application-oriented technical talents to meet the needs of regional economic and social coordinated development. Graduates should not only master theoretical knowledge, but also have the ability to use knowledge to solve problems. Therefore, while imparting knowledge, we should strengthen the cultivation of students' practical ability and innovation ability.

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2. Necessity of Industry-university-Research Collaboration to Educate People

Industry-university-research collaboration is an effective combination of production, teaching and scientific research, which can promote the mutual sharing of scientific and technological education resources between applied undergraduate colleges and local enterprises, and promote the innovation of talent training models in local applied undergraduate colleges and the transformation of scientific and technological achievements. The industry-university-research collaborative education model is based on the needs of social and industrial development, and the tripartite cooperation between enterprises, scientific research and universities, combining school teaching activities with production and scientific research practice, and comprehensively improving students' practical innovation ability. Talent training model [4], can be effectively solve the problem of "learning not for use, use not based on research", that is, the problem of two layers of scientific and educational achievements in colleges and universities and industry needs. Strengthening the construction of industry-university-research institutes and promoting talent training in local application-oriented undergraduate colleges with industry-university-research collaboration is more conducive to cultivating talents that meet the needs of the industry and the market.

3. Problems Existing in Industry-University-Research Collaboration

Local applied undergraduate colleges are not only important training bases for high-level innovative talents and the main force of innovation in the field of applied research, but also important promoters of solving local economic and technological problems, and realizing technology transfer and achievement transformation. Although most domestic colleges and universities have established different forms of industry-university-research cooperation, there are some problems and deficiencies, which can be summarized as the following [5, 6]:

3.1. School-enterprise Cooperation Is Not Deep Enough

Most of the enterprises that are willing to carry out school-enterprise cooperation with local undergraduate colleges are small and medium-sized enterprises. Their production scale is small, the job demand is small, and they are willing to invest less financial support. At present, there are two forms of school-enterprise cooperation. One is that the school sets up an internship base in the company. Every year, it only takes students to visit for 1-2 days to complete the internship. Students cannot participate in the production process, and there is no in-depth relationship between teachers and companies. The second is that the company sets up scholarships in the school and goes to the school to conduct recruitment presentations every year. The company does not know the talent training process of the school, and the school does not know the talent demand specifications of the company. This kind of simple school-enterprise cooperation is only at the primary stage. The production-university-research base has failed to act as a bridge between efficient communication and the market, and production, teaching and scientific research have not been effectively integrated.

3.2. The Teaching System Needs to Be Reformed

In recent years, with the rapid expansion of local undergraduate colleges and universities, most young teachers start teaching as soon as they graduate and do not go deep into enterprises. Therefore, teachers' awareness of serving enterprises is not strong, and they cannot be related to production practice in the process of theoretical teaching. Moreover, due to the lack of cooperation and exchanges with enterprises, it is impossible to update the talent training plan in a timely manner according to the needs of enterprises, and the new trends and achievements of the industry cannot be reflected in the teaching process. In addition, although the practical

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teaching process has attracted the attention of major universities, due to factors such as equipment, venues, and hazards, most of the current experimental teaching is still a verification experiment, and the comprehensive and designed experiments are limited. The training process is also carried out by students in groups of five or six under the guidance of teachers. Therefore, students' practical ability cannot be fully exercised, and students' innovative ability has not been effectively cultivated.

4. Strengthen School-enterprise Cooperation and Optimize Talent Training Programs

The material science and engineering major of our school is characterized by "new energy materials", focusing on the development and application of key materials in the process of new energy conversion and storage. Based on teachers' scientific research projects, this major has built a collaborative education model of production, education and research, integrating practical teaching, innovation and entrepreneurship, and technology research and development. Team building.

4.1. Connect with Local Enterprises and Establish A Collaborative Innovation Platform for Production, Education and Research

This major is based in northern Jiangsu and faces Huaihai Economic Zone, serving "one core and three bases", namely the core area of comprehensive development of new energy industry, Peixian photovoltaic leader base, Pizhou smart grid industry base and Fengxian electric vehicle industry base. Focusing on the needs of the industry, jointly apply with enterprises for 3 provincial engineering centers, 7 municipal engineering technology centers, 1 municipal engineering research center, and 1 municipal key laboratory. These experimental centers are all open centers. Some of the practical training and experiments, subject competitions, and teachers' scientific research can be applied for and used, which can satisfy the cultivation of students' practical innovation ability.

4.2. Make up for the Shortage of Internship and Build A Large-scale Virtual Simulation Center

In order to solve the problem that students can't really participate in the production process because they can't really participate in the production process, the college has built a 1,600-square-meter virtual simulation center. The "Simulation Experiment" project has been approved by the provincial first-class undergraduate virtual simulation experiment project. Based on the virtual simulation project, by flexibly setting various parameters and simulating various experimental conditions in the virtual simulation experiment software, it can freely simulate various real-world situations. condition. Through the combination of theory and experiment, the combination of virtual and real, the combination of online and offline learning, the combination of experimental operation and principle animation display, and the combination of practice mode and assessment mode, problems such as conditional limitations and safety hazards in the real operation process can be overcome.

4.3. Strengthen School-enterprise Cooperation and Optimize Talent Training Programs

The major has built 6 off-campus practice bases, and sends 2 teachers to the practice base for practical training every year, participating in the daily production and management process of the enterprise, laying the foundation for the follow-up in-depth cooperation, and continuously promoting the construction of "double-qualified" teaching staff. At the same time, teachers are encouraged to form scientific research teams according to the needs of enterprises, to solve technical problems for enterprises, to meet the needs of enterprise R&D and management, and

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to obtain support funds from enterprises to further improve the platform required for the growth of R&D teams. In addition, corporate leaders are invited to participate in the dynamic adjustment of the talent training program every year, and fine-tune relevant courses and their key points. For example, increase the professional experimental hours, add "Energy Storage Science and Engineering", "New Energy Materials and Devices", "Hydrogen Energy Science and Technology", "Electrocatalytic Nanomaterials" and other courses to meet the training needs of the industry and society for talents.

5. Summary

Meeting the needs of enterprises and achieving a win-win situation for both parties is the foundation of local application-oriented undergraduate colleges. The collaborative education of production, education and research is an effective way to improve the quality of talent training in local application-oriented undergraduate colleges. After years of construction, the material science and engineering major of our school has achieved certain achievements, but it still needs further improvement. First, it should be market-oriented, actively connect with the industry, and be oriented by innovation and entrepreneurship. The model and talent training model based on industry-university-research cooperation are further improved, so that the students trained are more in line with the actual needs of the industry and market needs. The second is to combine the basic knowledge of the course with the scientific research results, and introduce the scientific research results transformed in the industry into the talent training of colleges and universities to guide students to apply the knowledge they have learned to solve the problems encountered in the actual production process.

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