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Practice of Undergraduate "Practical Training Program" Project in the Background of "Excellent Engineer Education and Training Program"

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Abstract—The Excellence Engineers Program is a major education program for the implementation of the National Medium and Long-Term Education Reform and Development Plan (2010-2020). At the same time, in order to comprehensively promote the comprehensive reform of education in Beijing's colleges and universities, a high-level talents training in Beijing's higher education institutions was carried out among universities and colleges in Beijing. This is the Practical Training Program. Under this two aspects background, the energy and power major of one university in Beijing has carried out the practice of "Practical Training Program". The practical topics of the project are all relevant about engineering thermophysics and other disciplines. The implementation of the practical training project provides students with an opportunity to expand their research horizons, and promotes the exchange and communication of front-line teachers in research institutes and colleges, while it also reveals that some students' basic knowledge is not strong, the work ability is weak, and the funding is delayed, all above is waiting for improvement.

Keywords—Excellent engineer, practical training Program, graduation design, undergraduate

I. INTRODUCTION

The Excellent Engineer Education and Training Program (hereinafter referred to as the "Excellence Plan") is a strategic plan for implementing the new industrialization road with Chinese characteristics, building an innovative country, building human resources of a strong country. The Excellence Plan also is a major plan for higher education implemented to implement the National Medium- and Long-Term Education Reform and Development Plan (2010-2020) [1].

In 2013, the energy and power engineering major of one university entered the Ministry of Education's list of outstanding engineers' education and training programs. And since then, the university began to enroll students with the "Engineering Excellence Program" and in 2017 cultivated the first batch of engineers with outstanding engineers as target graduates.

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The Education Ministry also has clear guidance on the training objectives of excellent engineers. Taking undergraduates as an example, undergraduate training has put forward requirements from the aspects of professional ethics, natural sciences and humanities knowledge reserves, professionalism, innovation consciousness, team spirit and international vision[2].

In 2015, the Beijing Municipal Education Commission began to implement the "High-level Talents Cross-training Program for Beijing Higher Education Institutions" among universities and colleges in Beijing, this move will strengthen the training of practical and innovative abilities of college students, promote the comprehensive reform of education in Beijing's higher education institutions, and carry out high-level Beijing higher education institutions.

The following cross-training and training program is called the "Practical Training Program". The implement of this project has expanded the training form of the "Excellent Engineer Training Program" of the Energy and Power Engineering Department of our school. At the same time, participation in the "Practical Training Program" project is in line with the Education Ministry's principle of cultivation: "Engineering Guidance, School-Enterprise Cooperation, Classification Implementation, variation of forms".

II. THE PRACTICAL TRAINING PROJECT OF ENERGY AND POWER ENGINEERING IN ONE UNIVERSITY IN BEIJING

Before the implementation of the "Practical Training Program" training program, our school has been able to try and cooperate with the school-enterprise related enterprises in the industry, and there is a certain progress. School-enterprise cooperation can make the professional training target face the talent demand of enterprises directly. On the other hand, by the limitation of the level of technological development of Chinese enterprises, the current demand for innovative talents is weaker than the demand for skilled engineering and technical personnel. If talents are cultivated in full accordance with the needs of enterprises, it will weaken the foundation for the

cultivation of high-end technical talents to a certain extent. However, high-level technical talents face a large talent gap in China, and the cultivation of high-level technical talents is also an aspect that must be strengthened in the professional training of colleges and universities. The incident of ZTE's sanctions in the United States in 2018 shows that we must master core technologies, which is the only way to have the right to speak of technology and trade in the international market.

To a certain extent, the implementation of the "Practical Training Program" has strengthened the cultivation of scientific research ability in the training of engineers, and consolidated the scientific thinking of the students involved. Let's take the energy and power engineering major of one university in Beijing as an example to introduce the practice of the undergraduate "Practical Training Program" under the background of "Excellent Engineer Education and Training Program".

In 2015, after the Beijing Municipal Education Commission approved the implementation of the "Practical Training Program", it has been carried out twice since then. The participants selected in 2016 will graduate in the summer of 2017, and the participants selected in 2017 are graduates in 2018. The practical training projects are divided into three categories: college graduate design (research) projects, university student research training program deepening projects, and college graduate design (entrepreneurial) support programs. The undergraduates of the Department of Thermal engineer of one university in Beijing are all engaged in graduation design (scientific research) projects. The graduates of 2016 and 2017 were jointly trained with the Institute of Engineering Thermophysics of the Chinese Academy of Sciences and the Institute of Physics and Chemistry of the Chinese Academy of Sciences.

Before the implementation of the "Practical Training Program", the university and the cooperation organization of the practical training plan signed a cooperation agreement to clarify the cooperation methods and each responsibilities, and set clear requirements for the training of the practical training program, including the project content, project management methods, project conclusions, etc. At the same time, the instructor of the university is required to sign the letter of commitment, in accordance with the requirements of the school and the college, to complete the work related to the specific project of the actual training program in quality and quantity. During the implementation of the practical training program, college are required to further promote the practice teaching reform [3].

There are 10% of the students graduated in 2018 that participated in the actual training program (Graduation Design). The instructor of the Department of Thermal engineer and the instructor of institute jointly guided the graduation design of the students. Graduation design scores of the graduates participating in the practical training program were excellent or good. Among them, two students graduated as excellent graduate, and one student's graduation design was rated as a school-level excellent paper.

III. Analysis of the Implementation Process of the Practical Training Program

In the initial period of the practical training project, work should focus on propaganda work to students, and on the full communication with student and institute， which would be an established foundation of project. During the implementation of the project, the school and the corresponding scientific research units jointly trained the students. The student should complete the experimental and theoretical analysis and other relevant scientific research under the dual guidance of the instructor and the external tutor.

A. Students

For the students participating in the project, the practical training program provides an opportunity to expand the scope of scientific research, and the chance to complete the graduation design on a high-level scientific research platform, which is of great benefit to improve students' scientific literacy. In the previous training process, students are aiming to become excellent engineers, whose thinking system is different from the training objectives of scientific research personnel. In the joint training process of scientific research institutes, it is very helpful to train students' scientific thinking. And the ability to solve scientific problems is also a necessary quality for high-level engineers. From this aspect, the project implementation of the practical training program strengthens the training effect of the "Excellent Engineer Program", enhances the students' professional quality and scientific research, and lays a solid foundation for further study.

B. Teachers

On the other hand, the joint training of the practical training project has promoted the cooperation between the front-line teachers of the research institutes and the university departments, enhanced communication and contact at the unit level, and laid a solid foundation for further joint research work. At the beginning of project establishing process, the project instructors will fully communicate with each other. All the projects established are the main research directions of the institutions. The direction selected also has great cooperation potential.

C. Process

The implementation of the practical training project has promoted the development of interdisciplinary subjects, conformed to the trend of the development of science and technology in the times, and also met the training requirements of the "Excellent Engineers Program" for compound talents. Take the three practical projects that the author participated in as an example. All three projects belong to the topic of engineering thermophysics and cross-integration of other disciplines:

- Construction of a droplet microfluidic system - Engineering Thermophysics & Cell Biology.
- Paper-based flexible circuit design based on liquid metal-Engineering Thermophysics & Materials Science.
- Living biological cryopreservation technology based on green non-toxic cryoprotectant - cryogenic biology.

D. Discussion and Reflection

However, during the implementation of the project, some problems have also been exposed, it is worth reflected:

- The basic knowledge of students is not strong. Graduation design is essentially a summary and comprehensive application of the professional knowledge of the university for four years, but the students have weak basic knowledge and unclear concepts in details.
- Hands-on ability needs to be strengthened. Although in the professional training process, the active major has strengthened the training of practical courses such as experimental courses, students have exposed the weak hands-on ability in the actual experimental design. In contrast, it is necessary to reflect on the cultivation of students' practical ability in the previous practical courses, whether there are problems such as insufficient difficulty in the course and the need for student participation to be improved. The project execution process need to be optimized.
- In the process of project implementation, there is a problem that funding was delayed. The project was due to begin in the winter of 2017, but the funds come in the July of 2018 period, when the students were almost on the stage of Graduation thesis defense process. The fund came too late.

IV. Conclusions

Under the background of the "Excellent Engineer Education and Training Program", the development of the "Practical Training Project" will help the graduates further meet the training objectives of the Excellent Engineer, strengthen the scientific thinking of the graduates, and enhance the scientific literacy of the students. Whether the students in the program would continue to pursue further studies after graduation or direct employment, they will be able to adapt well, thus enhancing the choice of graduates. On the other hand, from the perspective of talent training, the implementation of the project will help promote communication and cooperation between research institutes and universities. The joint training of universities and research institutes is expected to become a new cradle for high-level talent training in China.

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