



The Typical Model of Foreign Engineer Training and Its Enlightenment

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Abstract. Outstanding engineers are a national strategic talent force and an important talent support to support high-level science and technology to stand on its own feet and achieve Chinese modernization. Strengthening the construction of engineers in the new era is an important measure for China to implement the strategy of strengthening the country with talents in the new era and build a national strategic talent force. The training system of engineers abroad is sound and has achieved remarkable results, and the training mode and typical practice of engineers are worth learning from. Based on the demand of the construction of engineers in China, this paper combs the latest research progress of engineering training abroad, summarizes the training modes of engineers in France, Germany and the United States, and analyzes the similarities and differences of the training of engineers at home and abroad, which provides an important reference for strengthening the construction of engineers in the new period.

Keywords: Engineer Team, Training Mode, Typical Experience.

1 Introduction

Engineers are not only the driver of scientific and technological innovation, the key to industrial upgrading, but also the support of economic development and an important embodiment of national competitiveness. The training of engineers in the new era is of great significance for realizing self-reliance and self-improvement in science and technology and promoting Chinese modernization. Engineers are an important force in scientific and technological innovation and transformation into actual productive forces. With the adjustment and upgrading of industrial structure, the demand for engineers is also changing. A team of high-quality engineers is the key to promote industrial transformation and upgrading. With the rapid development of science and technology in the new era, the training of engineers is directly related to the improvement of national innovation ability. Their professional knowledge and skills directly affect the quality and efficiency of engineering projects and play an important role in promoting economic growth. The overall quality of engineers is an important index to measure a country's comprehensive national strength and international competitiveness. A strong team of engineers helps to enhance the country's international status. Therefore, strengthening the training of engineers in the new era is not only a

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task in the field of education, but also an important part of the national development strategy [1].

2 Research Progress of Engineer Training Abroad

Foreign scholars have conducted in-depth research on the engineer training system from various angles, including engineer training mode, school-enterprise cooperation mode, enterprise role and so on, and accumulated rich research results [2].

2.1 Research on the training of engineers

The international training modes of engineers are mainly divided into two types: registered engineers represented by the United States and diploma engineers represented by Germany. In the developed countries of engineering education, such as the United States and Germany, the research on engineering education and engineer training has a long history, and the research system of engineering education has been relatively mature and perfect.

Regarding the training of engineers, Charles M. Vest, president of the National Academy of Engineering, believes that the biggest change brought about by globalization and international competition in the knowledge age is a brand-new engineering frontier and a major challenge. The diversity, complexity and importance of the engineering environment will continue to increase in the 21st century, which requires engineers to seize the opportunity and solve the worldwide problems with unprecedented scope and scale. To this end, he also pointed out that "engineering skills and leadership are crucial to solving the great challenges facing human society. Therefore, it is necessary to discover a group of young backbones who not only have the necessary process skills, but also have interdisciplinary knowledge, global vision and a sense of mission necessary to contribute to society and lead the country. In the face of social changes, the reform direction of American engineering education is to make the current engineering education based on disciplines return to its original meaning, and pay more attention to the engineering practice and the systematicness and integrity of the project itself. Some people call this idea the concept of big engineering education. All kinds of engineering colleges in the United States are actively exploring the curriculum reform model suitable for their mission and characteristics, that is, on the premise of ensuring a solid foundation in mathematics and science, reforming the existing curriculum system, making it face engineering practice as soon as possible, and better facing curriculum intersection, hands-on experiments, engineering practice, team work, systematic thinking and innovative design. In the reform of teaching methods, from the traditional concept of "teacher-centered, let students know what" to the new concept of "student-centered, let students use how", many schools try their best to create conditions for students to "actively learn". On the issue of teaching staff, we should employ more flexible and diverse methods to hire engineers with rich practical engineering experience to teach in our school, guide students, establish a lasting and effective cooperation mechanism with enterprises, and create conditions to

encourage engineering teachers to actively strengthen cooperation and exchanges with enterprises [3].

The goal of engineering education in Germany is to train engineers, while the German engineering education circle thinks that engineers are people who solve practical problems, and engineering education in Germany is carried out around "problem-solvers". Engineering education in Germany gives students a rigorous and rational mode of thinking, which is the premise of becoming an excellent engineer and what China's higher engineering education just lacks. The German University of Applied Sciences, as a training mode of advanced applied talents, mainly trains engineers and engineering application talents for industry, and has delivered a large number of qualified talents to the society, making important contributions to German industry and service industry. In the professional teaching arrangement, experimental classes and short-term internships occupy more than half of the time. It is necessary to practice in the enterprise for about 3 months, learning both technology and professional knowledge; It is necessary to complete the graduation project in the enterprise, and more than 70% of the topics are related to the enterprise. In the internship stage, there are teachers who give special guidance, participate in classroom research and take charge of the internship work, and enterprise tutors will also give evaluation and appraisal opinions according to the students' internship situation.

Higher engineering education in France also adopts the training of diploma engineers, and is unique in the world because of its distinctive characteristics, among which the most representative institution is the higher professional college. The French Institute of Advanced Professional Engineers aims to enable students to find jobs in specific industrial sectors after graduation, and takes the basic guiding principles of "learning how to learn" and cultivating the ability of creativity, independent analysis and problem solving. It attaches importance to both learning the scientific foundation and engineering and technical training, maintains long-term close cooperation with industrial enterprises, and closely links the theory and practice of teaching process. These include working out a training plan with business people, adjusting the teaching content of the course together as needed, hiring enterprise engineers as teaching teachers, allowing students to participate in the research of practical projects from enterprise engineering, and arranging students to participate in professional internships. Some schools also have professional workshops and laboratories for students to design and make their own products.

2.2 Research on School-enterprise Cooperation

Foreign research on school-enterprise cooperation in running schools has been very common since 1950s, including Germany's "dual system", America's "cooperative education", Britain's "sandwich" and Japan's "cooperation between production and learning", and has formed different school-enterprise cooperation modes suitable for China.

School-enterprise cooperation in the United States was first put forward at the University of Cincinnati, that is, let students take part in practical work before returning to class. Through the combination of study and work, the combination of theory and

practice, school and society can be realized, so as to cultivate talents needed by employers. In the United States, in addition to the teaching methods of engineering colleges, enterprises play an important role in the training process of engineers. American enterprises have formed alliances with some engineering universities, and most engineering universities have industrial advisory committees, with strong support from government departments. From its successful experience, we can see that the introduction of the legal system of school-enterprise cooperation in the United States is an important guarantee for the orderly, standardized and efficient school-enterprise cooperation in the United States. Li Manli analyzed the "Ou Lin Triangle" curriculum concept of Ou Lin Institute of Technology in the United States and the characteristics of integrating interdisciplinary teaching design and project-based teaching into the whole course, and thought that these concepts and training modes had certain reference significance for the improvement of higher engineering education in China [4].

The most typical school-enterprise cooperation in Germany is the "dual system" model, which is a vocational education model that closely combines schools and enterprises, theoretical knowledge and practice, and institutionalizes it through national legislation. At the end of the last century, this model was also introduced into German regular higher education, in which the dual system of applied science and technology university is mainly manifested in the close combination of college students' curriculum teaching and practice; Students obtain various vocational qualification certificates through training and study during their schooling; Social workers study career-related courses or majors at the University of Applied Science and Technology, and finally obtain academic qualifications or degrees. Personnel training is jointly undertaken by schools and enterprises. Schools are responsible for theoretical teaching, while enterprises are responsible for practical teaching, and provide jobs for graduates.

The important feature of French universities' research activities is that they cooperate with industrial enterprises and scientific research institutions, and in line with the principle of mutual participation, common benefit and common development, they mobilize the enthusiasm of both production and learning. Enterprises provide funds for higher engineering education and provide basic theoretical research topics for schools; Professors of the school, together with engineers and researchers of enterprises, conduct research in the laboratory jointly organized by industrial enterprises and French national scientific research center; Schools and enterprises have adopted two-way interactive cooperation in personnel exchange and training. Teachers and students go to enterprises for internships, and enterprise personnel come to schools to participate in research work. School-enterprise leaders enter the leading bodies of both sides and participate in the decision-making and management of major issues; Senior management cadres and engineers of enterprises go to schools as teachers, and school teachers go to enterprises to give lectures and hold lectures, and provide continuing education and training for enterprises.

2.3 Research on the Role of Enterprises

In the research of school-enterprise cooperation abroad, there is no direct discussion about the role of enterprises, but from the perspective of French enterprises participat-

ing in engineer education, enterprises directly participate in education and undertake teaching tasks; Accept students' internships, participate in school committees, directly participate in determining teaching content, discussing the development direction of the school and formulating student training and research policies. In addition, in the process of school-enterprise cooperation, because the government has fully played its role, enterprises attach great importance to school-enterprise cooperation and participate in it. Some scholars have proposed that the governments of developed countries should play the roles of the makers of relevant laws and regulations, the regulators, supervisors and guarantors of the development of vocational education in school-enterprise cooperation [5].

3 Typical Training Mode of Foreign Engineers

The training modes of foreign engineers are diverse and distinctive, among which the training practices in the United States, France, Germany and Europe have achieved remarkable results and are worth learning from.

3.1 French Engineer Training Model

French engineer education has a long history, distinctive features and outstanding achievements. French engineer education system emphasizes history, characteristics, achievements and elite education, and focuses on the origin, development process and characteristics of French engineer education. The French Institute of Engineers has trained a large number of leading figures who have played a great role in modern French history, such as several French presidents and prime ministers, many Nobel Prize winners, and the founders and heads of world-renowned enterprises.

3.2 German Engineer Training Mode

The German University of Applied Sciences (FH) is an important institution for training engineers. Students usually have practical experience before entering school, and the educational goal is to cultivate engineering and technical professionals who are good at solving practical problems. The academic system is four years, including two semesters of internship. The curriculum and teaching mode are oriented to occupation and practice, and attach importance to the combination of theoretical courses and exercise courses, emphasizing practical application ability.

3.3 American Engineer Training Model

Engineering education in the United States is represented by the registered engineer model. This model emphasizes the teaching of basic knowledge and the guidance of skills. In addition to the traditional classroom teaching, American engineering undergraduate education also adopts cooperative learning, project learning, experimental design, online learning and other ways. American engineering colleges and universi-

ties are mainly responsible for cultivating students into the basic form of engineers, and further skills upgrading is completed by enterprises, engineer qualification certification and continuing engineering education. The training of engineering talents in the United States emphasizes multi-party cooperation and common development under the standardization system.

3.4 European Engineer Training System

The FEANI model has been put forward by the European Association of Engineers, that is, three years of college engineering education, one year of supervised engineering training and two years of professional practice training. This model promotes the free flow and exchange of engineers from European member countries and improves the technical level of European engineers. The European engineer training model pays attention to the combination of university education and enterprise practice, and constructs a complete system for the growth of engineering talents in higher engineering education.

4 Conclusion

The concept and typical practice of training engineers abroad have important reference significance for strengthening the training of engineers in China. It also enlightens our country to pay attention to strengthening the combination of theory and practice in the process of promoting the training of engineers, to ensure that the educational content conforms to the actual needs of enterprises and to enhance students' practical ability. Pay attention to interdisciplinary cooperation and comprehensive training, adapt to the needs of the development of modern engineering technology, and train engineers with diverse knowledge and skills. Promote multi-party participation in training, and the government, universities, enterprises and other multi-party entities will participate together to form a joint force to provide all-round support for engineer training. In the new era, China can learn from foreign experience in the training of engineers, combine its own national conditions, reform and improve the engineering education system, and cultivate more high-quality engineering and technical talents.

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