Training of outstanding and innovative talents in the whole chain of research universities under the background of new engineering

—Taking the new specialty of new energy materials and devices as an example

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Abstract: Under the guidance of the national 2035 strategic goal, research universities that shoulder the important task of national development need to quickly complete the engineering education reform from "engineering technology" to "engineering science" + "excellent leadership", in order to meet national needs and fulfill the responsibility of cultivating innovative talents. The specialty of new energy materials and devices is a multidisciplinary interdisciplinary specialty developed to meet the major needs of the country. It has the characteristics of typicality and urgency in the reform of engineering education. Aimed at the school's characteristics of "based on aerospace and serving national defense", the new energy materials and devices specialty of Harbin Institute of Technology proposes and implements a whole-chain innovative talent training mode of "quasi-positioning - wide foundation - re-integration - seeking innovation", in combination with the national strategy and taking aerospace and civil new energy as the specific training premise. The characteristic direction of aerospace and civil new energy reflects the "quasi-positioning", coordinates the rationality of knowledge structure and cross-border knowledge with "wide foundation", ensures the cultivation and improvement of students' innovative ability with "re-integration" + "seeking innovation", and ensures the all-around cultivation of excellent innovative talents.

1. Introduction

The traditional engineering education adopting the engineering technology education mode mainly pursues "pragmatism" and aims to serve industrialization. By using the basic principles of science, it invents and manufactures practical products. The combination of technology and scientific frontier is not very close, resulting in the lack of talent innovation [1]. Only the engineering education with the close combination of science and technology can help cultivate innovative and outstanding engineering science and technology talents leading a new round of scientific and technological revolution and industrial reform, and achieve China's 2035 strategic goal [2]. Therefore, in terms of strategic needs, engineering education has changed from traditional "engineering technology" to "Engineering Science" + "excellent leadership".

The first mock exam of Engineering Education in China is the former Soviet Union mode. Under the premise of the past national demand, the main mode is single mode and knowledge imparting, emphasizing the cultivation of engineering technology. The future model of higher engineering education can be summarized as "unitary (higher engineering education must serve the needs of national development strategy), two-sided (higher engineering education is divided into scientific and engineering type) and multi-level (different levels of Education)". Therefore, under the guidance of the national 2035 strategic goal, research universities shouldering the important task of national development need to quickly complete the engineering education reform from "engineering

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technology" to "Engineering Science" + "excellent leadership" to meet the national requirements. Research universities must serve the national strategic needs, that is, cultivating innovative talents is the bounden responsibility of research universities. The engineering science education mode requires students to have a solid scientific foundation, with more emphasis on design ability, creativity and coordination ability, and the ability to find problems, analyze problems and act quickly. Engineering Education under the mode of "Engineering Science + excellent guidance" requires students not only to have scientific and technological knowledge and ability, but also to have a deeper foundation of Humanities and Social Sciences, to be able to find new opportunities with critical and innovative vision, but also to have strong leadership and management ability, to organize teams and strive for common goals. Therefore, China's engineering education reform should not only reform the engineering technology education, emphasize the cultivation of students' basic engineering knowledge, personal ability, team cooperation ability and engineering system integration ability, and improve the quality and level of engineering and technical talents, but also pay attention to the cultivation of engineering scientific talents and engineering leading talents. Therefore, exploring a talent training mode that can not only meet the needs of talent training objectives, but also meet the reality of running a school is the key to solve the problem of innovative talent training.

At present, the cultivation of engineering talents in China still faces the following problems: (1) the school running concept, professional orientation and setting are divorced from the actual needs of the society; (2) The talent training plan, curriculum system and teaching interaction are unreasonable, which is difficult to cultivate high-quality talents; (3) Without "innovation" throughout the whole process of talent training, classroom teaching not only focuses on the cultivation of innovative thinking, but also does not form a perfect platform to meet the needs of students from the spark of innovative thinking - formulation of innovative scheme - overcoming difficulties in the process of innovation - refining and sublimation of innovative achievements - continuous secondary innovation [3].

The whole chain scientific and technological innovation and Entrepreneurship Talent training system has the advantages of systematic system design and arrangement, diversified talent training mode selection, effective project guidance and support, and can build a diversified innovation and Entrepreneurship Talent Training Mode from the overall situation and the whole. At present, in the "whole chain" talent training mode, colleges and universities generally adopt the parallel training mode of finding the right problem - mapping foundation + finding the right problem - ability target training. The corresponding relationship between foundation and ability training is not close, focusing on solving problems with problems and lacking top-level design. For the development of the industry, the demand for undergraduate talents' innovation ability is urgently put forward. Most domestic universities basically follow the similar practices of traditional engineering majors to cultivate students' innovation ability, and solve problems or needs according to the "broad and broad" education concept. For example, set up internship practice, experimental class and second course, or comply with the reform trend of the concept of innovative talent training in Colleges and universities, and then add additional courses related to the cultivation of undergraduate students' innovative ability and various elective and minor courses. The result of this educational idea of making up for what students lack is to continuously increase students' learning burden, which is contrary to the current undergraduate education concept of "less but better" in the new era.

Because the close combination of science and engineering in engineering education is very important to the national competitive advantage. Therefore, while rapidly completing the transformation from "engineering technology" to "Engineering Science" + "excellence leading" engineering education, research universities can explore and form a world-class engineering education system with Chinese characteristics only by carrying out top-level design from three aspects: training objectives, training programs and students' innovative ability, Help cultivate innovative and outstanding engineering and technological talents leading a new round of scientific and technological revolution and industrial reform, and build a world engineering innovation center and talent highland.

2. Objective orientation and concept of talent training

The goal and concept of talent training is the core of "top-level design" and the wind vane of talent training. As the industrial development is diversified, the orientation of talent training objectives should be refined and distinguished according to different industrial development. The talent training objectives and ideas of research universities shouldering strategic needs should be consistent with the national talent needs. The determination of the talent training objectives of this major in specific colleges and universities not only needs to be consistent with the country, but also needs to take into account the professional characteristics and international vision. Therefore, before formulating the talent training objectives, it is necessary to carry out the research on the talent training objectives in combination with the national needs, research social needs and the research direction of characteristic majors.

Change the concept of engineering education to meet the needs of engineering education reform from "engineering technology" to "Engineering Science" + "excellence leading" [4-5]. "Based on aerospace and serving national defense" is the school running orientation and school running characteristics of Harbin Institute of technology. After conducting thorough research on various scientific research institutes and universities, including Shanghai 811 Institute, East China University of Technology, Beijing University of Technology, Tianke Heda, Semiconductor Institute of Chinese Academy of Sciences, and Harbin Institute of technology's new energy materials and devices specialty, our program has been designed to focus on battery materials and functional devices. This specialization is in line with the current industry demands and academic advancements, particularly in the field of aerospace and civil new energy. Our goal is to cultivate individuals who are passionate about their country, possess unwavering beliefs, and are able to integrate theoretical knowledge with practical application. We aim to instill a sense of realism a sense of realism and pragmatism, as well as a drive for innovation, social responsibility, and international perspective. Our curriculum will provide students with a strong foundation in mathematics, physics, chemistry, chemical engineering, and materials science, as well as the necessary skills to analyze and solve complex problems related to new energy materials and devices. Graduates will also possess the ability to conduct research and development in new materials, devices, and energy systems, as well as the skills to manage and lead teams. "Strive for the" quasi positioning "of talent training for the goal of talent training.

3. Training scheme and curriculum system design

Engineering problems generally involve complex engineering and technical problems, basic scientific problems, technical approaches and Humanities and social sciences. The traditional engineering technology education model overemphasizes the professional theory teaching, and the unreasonable knowledge structure leads to the lack of cross-border knowledge, which makes students unable to solve engineering problems. Curriculum is the basic element of talent training. A good curriculum framework provides a solid theoretical and practical basis for talent training. Therefore, how to design the curriculum system through the training scheme to realize the cross-border knowledge under the condition of reasonable knowledge structure and reflect Chinese characteristics is the difficulty in the formulation of talent training scheme in the transformation of engineering education.

By studying the curriculum system of Engineering Education in American research universities [6-7], researchers believe that engineering education should develop a curriculum system of "problem or project centered" and integrate "theory and research teaching" to cultivate students' creativity and engineering design ability; Carry out interdisciplinary and multidisciplinary engineering research and design to provide students with comprehensive and cutting-edge course content; Relying on the advantages of rich scientific research projects of research universities, we should provide students with comprehensive research courses as much as possible, so that students can realize "learning in research" and "research in learning". Therefore, under the guidance of "quasi positioning" talent training objectives, China's research universities highlight the close

relationship between science and engineering, emphasize the application of basic scientific knowledge in engineering problems, pay attention to the foundation of Humanities and Social Sciences, critical and innovative thinking, leadership and management ability, and highlight professional and Chinese characteristics in talent training programs and curriculum systems.

4. Conclusions

The close combination of science and Engineering in engineering education is very important to the national competitive advantage. In order to better serve the national 2035 strategy, research universities must quickly complete the transformation from "engineering technology" to "Engineering Science" + "excellence leading" engineering education, explore and form a world-class engineering education system with Chinese characteristics, and help cultivate innovative and outstanding engineering science and technology talents leading a new round of scientific and technological revolution and industrial reform, Build a world engineering innovation center and talent highland. The specialty of new energy materials and devices is a multi-disciplinary interdisciplinary specialty bred for the major needs of the country. Taking the strategic new specialty as an example, the top-level design is carried out from three aspects: training objectives, training programs and students' innovative ability training. Through the whole chain innovative talent training practice of "quasi positioning - wide foundation - re integration - seeking innovation", It provides a reference for the construction of new majors and other majors to carry out engineering education reform, teaching and curriculum reform.

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