

Study on the “New Engineering” Talent Cultivation Pathway of Traditional Engineering Majors for Applied Universities in China: A Case Study of Environmental Engineering at Yancheng Institute of Technology

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Abstract. In the new era, the Ministry of Education is actively promoting the construction of "new engineering" to meet the unprecedented changes of the century. However, the talent cultivation pathway for traditional engineering majors under this construction goal has not been clearly analyzed, which cannot provide clear guidance for the reform and development of higher engineering education in China. Therefore, this paper takes the environmental engineering at Yancheng Institute of Technology as an example, and uses the case study method to explore the talent cultivation pathway of applied universities, aiming to provide feasible ideas for the upgrading and transformation of traditional engineering majors.

Keywords: New Engineering; Applied Universities; Talent Cultivation; Environmental Engineering.

1. Introduction

Currently, China has emerged as the world's largest manufacturing country, boasting a complete industrial system and integrated industrial chain. Nevertheless, against the backdrop of the new era, China's industry is confronted with immense challenges posed by globalization and technological transformation. Industrial transformation is not only an inevitable choice to address the current challenges but also a necessary requirement to adapt to the unprecedented changes in a century. To achieve high-quality industrial transformation, it is necessary for various science and engineering universities to cultivate high-quality application-oriented talents who can meet the needs of future economic and social development. It is imperative to enhance the quality of application-oriented talent cultivation and the national innovation ability and core competitiveness in China by strengthening the construction of emerging engineering education based on traditional engineering disciplines. This can not only promote the adjustment and optimization of the educational structure in universities but also facilitate the in-depth integration of industry, academia, and research, and enhance the pertinence and practicality of talent cultivation. Therefore, strengthening the construction of emerging engineering education in traditional engineering majors in application-oriented universities holds significant contemporary significance [1].

The main task of the new engineering construction is to strengthen education in the engineering field and train talents that meet the needs of economic and social development. Among them, application-oriented universities are an important base for providing applied talent training. In order to effectively leverage the advantages of applied universities, a series of universities have carried out new engineering construction in an orderly manner based on their own situations [2]. Although a large number of application-oriented universities have been approved for construction, there is no clear sorting and analysis of the traditional engineering majors in application-oriented universities under the goal of new engineering construction, which cannot provide clear guidance for Chinese application-oriented universities to stand firm in new engineering construction. Therefore, this paper selects Yancheng Institute of Technology, a first-round top-level application-oriented bachelor's degree university construction unit in Jiangsu Province, and its traditional engineering majors - environmental engineering as an example, to systematically study its talent training path, which is

expected to provide guidance and reference for China's new engineering construction in the new era background of application-oriented universities.

2. Current Problems in Environmental Engineering Talent Cultivation

Environmental engineering is a typical traditional engineering discipline, and since the establishment of China's first environmental engineering major at Tsinghua University in 1977, more than 380 universities have set up environmental engineering majors. The goal is to cultivate engineering technicians who can design and construct environmental protection projects, operate and manage pollution control facilities, and monitor and evaluate environmental pollution. Over the years, environmental engineering has trained a large number of talents to protect and rationally utilize natural resources, prevent and control environmental pollution, improve environmental quality, promote environmental protection and social development, and provided a large number of advanced technologies to meet the people's living needs and fulfill the traditional engineering duty. The diversity and complexity of environmental problems also pose increasing challenges to traditional environmental engineering professional education and training models. Under the background of new engineering, traditional universities, influenced by the inertia of the traditional model, generally face problems in cultivating environmental engineering talents in the process of building applied universities.

(1) Mismatch between specialized needs and training objectives in environmental engineering.

With the continuous industrial transformation, there are significant differences in the demand for environmental engineering professionals among different industries and regions. For example, in Jiangsu Province, the industrial areas in southern cities are relatively developed, and the demand for environmental engineering talents is more focused on the application of gas, liquid, and solid treatment technologies. In contrast, the northern region places more emphasis on ecological protection, and soil remediation and ecological regulation are more useful. In the face of these differentiated needs, traditional universities often adopt a uniform training model. This single "one-size-fits-all" training approach cannot meet the special needs of different industries and regions. Traditional educational thinking has limited the traditional training model, which overemphasizes theoretical knowledge learning and neglects the combination with actual application scenarios. This inherent thinking also makes it difficult to flexibly adjust the talent training plan to meet the needs of different industries and regions. In addition, there are differences in resource allocation among different regions and industries, such as faculty strength, experimental equipment, local support, and student quality. These resource differences make it difficult for talent to achieve a unified training goal in different regions and industries.

(2) Bloated curriculum, high levels of overlap and low levels of specialization.

Environmental engineering is a cross-disciplinary major that involves multiple subjects (chemistry, physics, biology, geography, etc.) [3]. In the traditional talent training model, the course setting of environmental engineering majors is often broad, lacking fine-tuned settings that cater to different industry and regional needs, and lacking in-depth exploration of fundamental principles. Additionally, due to the lack of effective integration and coordination, there is often overlap in knowledge. Currently, the course content of many colleges environmental engineering majors is extensive but not in-depth, lacking in targeted and practical applications, which not only wastes teaching resources but also increases the students' learning burden.

With the development of science and technology and the constant changes in environmental protection needs, the knowledge and technologies of environmental engineering are also constantly being updated. However, the course setting under the traditional talent training model is often lagging behind these changes and unable to reflect the latest research findings and technological applications in a timely manner. The disconnection between practical teaching and theoretical teaching leads to students being unable to apply what they have learned in practice and unable to deepen their

principled understanding of theoretical knowledge through the combination of theory and practice, further leading to a decline in the specialization of environmental engineering talents.

(3) Out of sync with the new requirements of the times.

With the change of new technologies, policies and market demand, the new requirements of environmental protection in the era mainly involve higher standards of pollution prevention and control, protection and restoration of the ecological environment, green and low-carbon development, strengthening environmental risk management, environmental protection publicity and improving the level of environmental protection science and technology. These new requirements are not only a new challenge to environmental protection work, but also a new opportunity to promote sustainable social development. However, in the process of the development of environmental engineering discipline, it fails to adapt to the new changes in time, resulting in a certain lag between the curriculum of personnel training and the new requirements of The Times. The allocation and investment of educational resources are also relatively limited, which cannot meet the needs of the rapidly developing industry, especially the lack of sufficient investment and attention in the construction of the curriculum system and the reform of teaching methods. In addition, the evaluation and feedback mechanism of the talent training effect is not perfect, and the talent training program is not adjusted according to the new needs of the industry and region in a timely manner, resulting in the mismatch between talent training and the new requirements of The Times.

3. Talent Cultivation Objectives of the Environmental Engineering Major at Yancheng Institute of Technology

In recent years, the School of Environmental Science and Engineering at Yancheng Institute of Technology has systematically promoted the construction of new engineering education, innovatively developed a talent cultivation feature of "three levels, three orientations, and three combinations," and continuously built a local polytechnic college talent cultivation model based on the OBE concept. Among them, the Environmental Engineering major, as a pilot program for the "Excellent Engineer Training Plan" of the Ministry of Education, has a leading role in talent cultivation. The Environmental Engineering major at Yancheng Institute of Technology has developed to this day, with provincial teaching platforms such as the "Jiangsu Provincial Colleges and Universities Environmental Protection Equipment and Advanced Manufacturing Engineering Practice Education Center" and the "Jiangsu Provincial Colleges and Universities Coastal Land Reclamation Ecological Environment Monitoring and Pollution Control Engineering Practice Education Center" as well as a national-level student practice education base. The major has passed two rounds of engineering education accreditation and has been selected as a national-level excellent undergraduate major construction point [3].

Since the launch of the new engineering education, Yancheng Institute of Technology's Environmental Engineering program has combined the school's position as a regional applied-type university with the local needs and the transformation requirements of the area's special industries. The program has developed an applied talent cultivation strategy, avoided the pursuit of grandiose and unnecessary courses, and focussed on meeting the practical engineering needs of the local region. The program aims to respond to the new era of ecological civilization construction and the national strategy of coastal development, and to meet the needs of ecological environmental protection and the green and low-carbon development of the environmental protection industry in Jiangsu Province. The program aims to cultivate comprehensively developed talents with firm ideal beliefs, patriotic sentiments, and humanistic etiquette, as well as good professional ethics and physical and mental health, for the environmental field. At the same time, the program emphasizes the training of students' team coordination ability, communication and exchange ability, and project management ability, focusing on the professional skills and practical abilities in the field of environmental engineering, and expecting that after the program's training, students will be able to skillfully apply environmental engineering knowledge to solve complex problems and have the ability to independently engage in

environmental engineering design and construction, pollution facility operation and management, and environmental pollution monitoring and evaluation. The program is expected to adapt to the changing domestic and international environmental protection and modern environmental engineering technology development needs.

4. Talent Cultivation Analysis of Environmental Engineering Major at Yancheng Institute of Technology

Based on the existing problems and professional talent cultivation goals of environmental engineering, local applied-type universities need to "focus on practical applications and serve regional economy" in new engineering talent cultivation. Yancheng Institute of Technology's environmental engineering major has adopted the following approaches to cultivate engineering technology application-type talents.

(1) Based on the needs of the industry and the region, carried out specialized talent cultivation.

Students of Environmental Engineering at Yancheng Institute of Technology have a strong employment focus in the Yangtze River Delta region, which is one of China's most economically active areas. The demand for environmental governance industries in the region is increasingly strong. On the one hand, as the country's emphasis on environmental protection continues to increase, the environmental governance industry is more focused on technological innovation and industrial upgrading, driving green and low-carbon development. On the other hand, the environmental governance industry demand in the Yangtze River Delta region is mainly concentrated in the fields of industrial wastewater, waste gas, solid waste treatment, and ecological restoration. At the same time, with the acceleration of urbanization, urban environmental comprehensive treatment, garbage classification and disposal have become important demand directions. Yancheng Institute of Technology's Environmental Engineering program has developed a specialized talent training model based on the characteristics of the environmental governance industry and the regional industrial demand in the Yangtze River Delta. First, the program continuously conducts surveys on students' understanding of Yangtze River Delta-related environmental industries throughout the entire training period, and continuously invites relevant professionals to give lectures on related information, liaise with enterprises in the Yangtze River Delta that have talent needs in environmental-related fields, arrange students to visit in person, and learn about the regional industrial and market demand in the Yangtze River Delta industry. Second, the program sets mandatory courses and elective courses for environmental engineering based on different industry scenarios and regional clusters in the Yangtze River Delta, and guides students to consciously choose course clusters based on their future planning for different industry application scenarios, fully ensuring that students have targeted reserve of basic knowledge for entering the corresponding regional environmental industry. Finally, the program leverages the "mentor system" to guide students to think about their own professional and employment prospects, drive students to enhance their own capabilities and supplement their knowledge, and ultimately achieve specialized talent training that is in line with industry and regional needs.

(2) Focusing on engineering applications, strengthening the integration of education, research, and industry

Environmental engineering, as an engineering discipline that involves environmental protection, pollution control, and resource utilization, its core lies in solving practical problems and improving environmental quality. In the context of the new engineering education reform, it is particularly important to strengthen the application-oriented environmental engineering majors at universities of applied sciences with an emphasis on engineering application-oriented integration of teaching, research, and production. Yancheng Institute of Technology's environmental engineering major has actively cooperated with environmental-related enterprises to establish a cooperative model of teaching, research, and production. The enterprises mainly provide practice bases, technical guidance, and market guidance, while the major provides teaching resources and intellectual support. In addition,

the major has established production and learning bases with enterprises, such as laboratories and internship bases, to provide students with more practical opportunities. In terms of curriculum design, the major has added a variety of more practical courses, such as "Operation and Management of Wastewater Treatment Facilities," "Operation and Management of Gas Treatment Facilities," and "Environmental Engineering Instrumentation and Automation," to lay a foundation for students to better participate in teaching, research, and production cooperation, thereby contributing to the cultivation of new engineering application-oriented talents.

(3) Build a new curriculum system to reduce knowledge duplication.

Environmental engineering involves multiple disciplines and knowledge sources from various aspects, but lacks effective integration. There is often repetitive teaching in the teaching process, which increases the students' learning burden, including background, technology, and principle application. Yancheng Institute of Technology's Environmental Engineering major has systematically integrated and optimized the existing curriculum system, organically combining various courses (basic theory, engineering applications, and tool skills) into a comprehensive knowledge system. The course coordinators have continuously discussed the course content design to optimize the course structure, reduce redundant content, and enhance the targeted and effective teaching. Additionally, the major emphasizes guiding teachers to introduce innovative elements and cultivating students' innovative thinking and practical abilities. Through the use of innovative teaching methods and case teaching, the major guides students to think independently, explore, and innovate. At the same time, the major encourages students to put forward their own insights and suggestions during the learning process, cultivating their ability to learn independently and innovate[4]

(4) Conduct curriculum and teaching reform in the new era to highlight the needs of the times

The Environmental Engineering major at Yancheng Institute of Technology has carried out curriculum reform in environmental engineering education by combining the new era background of carbon neutrality goals and ecological civilization construction, from the perspectives of talent cultivation objectives, course content updates, teaching method innovations, and faculty team building. In terms of talent cultivation objectives, it is clearly stated that the cultivation of environmental engineering talents is aimed at responding to the new era of ecological civilization construction and the national coastal development strategy, and meeting the needs of ecological environmental protection and regional environmental industry green and low-carbon development in Jiangsu Province. In terms of course content updates, new era-oriented environmental engineering professional courses such as "Energy Saving and Emission Reduction and Green Low-carbon", "Environmental Pollution Control Technology under the Perspective of Carbon Neutrality", and "Clean Production and Circular Economy" have been added. In terms of teaching method innovation, modern information technology is used to adopt a combined online and offline teaching mode, establish an online course platform, and combine traditional classroom teaching with online learning. By leveraging online resources, more new era environmental engineering application cases and actual projects are introduced to enrich teaching content, allowing students to understand the current problems and challenges in actual engineering, and cultivating their ability to adapt to the times. At the same time, experts currently working in the industry can be invited for face-to-face lectures to enable students to better understand the current industry situation and future development trends under the new era background. In terms of faculty team building, domestic and foreign outstanding environmental engineering talents, especially those in line with the development direction of the new era environmental profession, are actively introduced to join the faculty team to improve the overall level of the faculty team. At the same time, through lectures, training, and academic conferences, the faculty's awareness of the times and teaching ability are improved.

(5) Establish a multi-dimensional collaborative innovation and entrepreneurship mechanism involving school, enterprise, and teachers and students

The Environmental Engineering major at Yancheng Institute of Technology has established a unique partnership with relevant enterprises in the environmental industry, focusing on the goal of joint innovation and entrepreneurship between the school and the enterprises. Based on the target

market and the special features of the partnership, the major has determined the research direction and projects for innovation and entrepreneurship, and established a platform for cooperation between the school and the enterprises. Regular multi-party seminars, technical exchanges, and other activities are held to promote interactive and collaborative innovation and entrepreneurship among various parties. A joint mentorship system has been established, with industry experts and engineers serving as corporate mentors, participating in the planning, implementation, and summary of the joint innovation and entrepreneurship projects, providing guidance and support to students and faculty within the major. The major also establishes a resource-sharing and communication platform to enable faculty and students, as well as enterprises, to complement each other's strengths, share laboratory, equipment, and talent resources, and jointly carry out innovation and entrepreneurship projects and activities. Leveraging the talent advantages of both the school and the enterprises, personnel are exchanged to provide innovation and entrepreneurship training, raising the innovation and entrepreneurship awareness of both school and enterprise faculty and students. The major also actively establishes an incentive mechanism to encourage faculty and students to actively participate in innovation and entrepreneurship projects. School and enterprise faculty and students work together to research and develop new products and processes, achieving the goal of innovation and entrepreneurship.

5. Talent Cultivation Analysis of Environmental Engineering Major at Yancheng Institute of Technology

(1) Shoulder social responsibility

In this new era, environmental engineering profession faces both opportunities and challenges, and bears the great responsibility and mission of realizing the great rejuvenation of the Chinese nation. In order to meet the challenges of the new economy, from the perspective of serving national strategies, meeting industrial needs, and looking towards the future, during the process of building new engineering, the environmental engineering profession should always bear in mind its initial heart of serving and supporting the national development strategy [5]. As a local applied-type university, Yancheng Institute of Technology, which is one of the construction units of the local government, is dedicated to providing advice and guidance for environmental impact assessment and regulation to administrative decision-makers in Yancheng City and its surrounding areas. It helps to understand and evaluate the potential impacts of environmental engineering projects. It participates in the formulation and implementation of local environmental standards to ensure the compliance and sustainability of environmental engineering projects. It engages in research and innovation of environmental protection technologies, promotes the research and application of environmental protection technologies, and enhances the level of environmental protection. It participates in the popularization of environmental education to raise public awareness and consciousness of environmental protection. It also participates in the planning and development of environmental protection industry to promote the healthy development of the environmental protection industry.

(2) Stick to the school's unique style of education

The functions, divisions, levels of education, and social positions of various colleges and universities are not the same, and Yancheng Institute of Technology's Environmental Science and Engineering program is committed to differentiated and specialized development in the construction of new engineering. It fully considers factors such as the school's social and historical positioning, its own educational conditions, and emphasizes "practical application-oriented education" to serve the regional economy. It adheres to a unique path of specialized education with a focus on differentiated development, aiming to cultivate regional applied engineering talents for the great rejuvenation of the Chinese nation.

(3) Keep up with the times

In the new era, there are new requirements. With the development of the economy and industrial upgrading, Yancheng Institute of Technology's Environmental Engineering program has been

constantly focusing on the match between students' employment and industry needs in the new era, optimizing and adjusting the training process, and building a talent cultivation model for environmentally-smart and innovative professionals [6]. Therefore, in the construction of new engineering in Xinjiang University, the environmental engineering major has not only achieved good results, but also laid a solid foundation for sustainable development. The major aligns with national policies and continuously cultivates innovative and practical new engineering talents to inject fresh blood into the country's new era development.

References

- [1] Li Weiguang, Jiang Zhuwu, Liang Heng, et al. A Comparative Study on the Construction of Emerging Engineering Education of Traditional Engineering Majors in Research-oriented and Application-oriented Universities-A Case Study of Water Supply and Drainage Science and Engineering, Higher Engineering Education Research. Vol. 1 (2023) p. 27-32.
- [2] Tan Xiaofei, Xiong Weiping, Zhou Chengyun, et al. Research on the Cultivation of Carbon Neutralization Innovative Talents in Environmental Engineering Specialty under the Construction of New Engineering, China Modern Educational Equipment. Vol.11 (2024) p. 75-78.
- [3] Lü Huihua, Yan Jinlong, Zhou Feng, et al. Personalized Talent Cultivation Model and Approaches for Environmental Engineering Profession-oriented - A Case Study of Yancheng Institute of Technology, Education Modernization. Vol. 5 (2018) p. 5-7.
- [4] Yang Jia, Application of Activity Teaching Model with "Situation" as the Mainline in Teaching, Read Write Calculate. Vol. 20 (2024) p. 95-97.
- [5] Jiang Yuyan, Yin Li, Tao Chengfeng, On the Cultivation of Young College Teachers' Engineering Practice Ability under the Background of New Engineering, Foreign Economic and Trade. Vol. 11 (2021) p. 136-139.
- [6] Wang Wen, Yang Ziqi, Zhang Hui, Lin Aijun, Training Mode Exploration of Interdisciplinary Talent Oriented towards Solving Practical Problems-The Teaching Practice of "Environmental Engineering Foundation" Course in Information Subject, Higher Engineering Education Research. Vol. 4 (2023) p. 165-170.