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Reform Research of Environmental Engineering Major under the Background of New Engineering Discipline

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Abstract

Under the background of the construction of new engineering disciplines, the exploration of reform in the Environmental Engineering major is particularly important. The reform exploration of the Environmental Engineering major focuses on the strength of the faculty, the interconnection between courses, and the development of theory and practice. It pays attention to the foundational knowledge and professional skills of traditional disciplines, while emphasizing the enhancement of comprehensive qualities and the cultivation of innovative thinking. In line with the context of the new engineering construction, we explore the reform direction and practice of the Environmental Engineering major.

Keywords: Environmental engineering, New engineering discipline, Educational reform

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1. Introduction

With the continuous development of a new round of technological revolution and industrial transformation, the new economy characterized by new technologies, industries, business models, and modes of operation is calling for "new engineering disciplines". Therefore, the construction of new engineering disciplines has become an inevitable requirement for the upgrading and development of China's industries and a new initiative in the reform of engineering education in universities [1-3]. The proposal of new engineering disciplines also demonstrates the strong determination to reform higher engineering education. The concept of constructing new engineering disciplines is based on the future demand for talent cultivation, focusing on talent quality, innovation-oriented, and grounded in the integration of industry and education [4]. It aims to accelerate the construction of a talent training system that meets the needs of future social and economic development. As the construction of new engineering disciplines progresses, the education and cultivation of the Environmental Engineering major face new challenges and opportunities. Environmental Engineering is a comprehensive discipline involving chemistry, engineering design, water, atmospheric, and solid waste treatment, among other fields [5]. In the context of new engineering construction, the Environmental Engineering major needs to emphasize the integrated cultivation of classroom learning and practical experience. Students should learn through practical projects and course design to understand the needs of the actual application fields of environmental engineering and possess the ability to solve practical problems [6, 7]. Moreover, with the continuous development of new engineering practices, the professional education in environmental engineering also requires ongoing reform and innovation. Traditional environmental engineering education focuses on the mastery of theoretical knowledge and skill training, but under the background of new engineering construction, there is a need to cultivate senior environmental engineering talents with innovative consciousness and practical abilities [8].

To better respond to the call of new engineering construction and create high-quality professionals in the Environmental Engineering field, this paper will explore reform schemes for the major. Through the discussion and implementation of these reform schemes, the Environmental Engineering major can better adapt to the future development needs of the economy and society, cultivate more high-quality environmental engineering professionals, and make greater contributions to the sustainable development of society and the construction of a green China.

2. The current status analysis of the Environmental Engineering major

The Environmental Engineering major is at the core of sustainable development in modern society and is also related to the fate of future generations. With the continuous advancement of technology and the industry's demand for professional talents, the talent cultivation plan for the Environmental Engineering major is constantly being optimized and adjusted. As a major with strong practicality and a wide range of applications, Environmental Engineering has always been a focus in terms of talent cultivation and educational teaching. Under the background of the construction of new engineering disciplines, the current situation and development of the Environmental Engineering major have also received widespread attention. With the ever-changing demands of the environmental protection and sustainable resource utilization industries, relying solely on traditional curriculum settings and teaching models is no longer sufficient to meet the needs of talent cultivation.

Therefore, the Environmental Engineering major needs to comprehensively adjust and reform its curriculum, strengthen practical teaching, and enhance the updating of professional knowledge. At the same time, there is a need to emphasize practical education, not only in traditional experimental courses and graduation internships but also in innovative practice, experimentation, and the application of new technologies. Enhancing the experiential nature of practical education will improve students' practical operation and application abilities. Additionally, the faculty and teaching facilities also need enhancement. The teaching of Environmental Engineering requires professionals with practical experience and innovative consciousness, and the construction of teaching facilities and resources, especially the development of virtual simulation resources, is crucial to improving teaching quality and effectiveness.

To adapt to the development of new environmental protection technologies, deepening the reform of talent cultivation is an inevitable choice for the Environmental Engineering major. It is necessary to strengthen the design of standardized talent cultivation plans, integrate practical and theoretical course arrangements, and establish a high-quality practical education system.

3. The challenges in teaching

3.1 Faculty with a limited engineering background

Currently, the Environmental Engineering major at the School of Chemistry and Environmental Engineering of Yancheng Teachers University has 16 full-time faculty members, including 3 professors, 13 associate professors and lecturers. Among the 16 faculty members in the school, only 1 has an engineering background. In addition, the major faces a relative lack of high-level international talent, especially in the number of teachers holding doctoral degrees from foreign universities, which is seriously insufficient. In teaching, it is difficult to fully carry out curriculum content related to engineering practice, resulting in graduates, both undergraduates and postgraduates, finding it hard to possess adequate abilities to solve practical engineering problems. Moreover, some faculty members have relatively weak engineering practical skills, leading to an imbalance between theory and practice in teaching.

3.2 The connections between courses are weakly coordinated

3.2.1 The knowledge structure is scattered and lacks logical connections.

The knowledge points among different courses have not been effectively integrated and structured. The sequence, structure, and hierarchy of learning knowledge points are not clear, which easily leads to complex and repetitive learning content. This makes it difficult to construct a complete knowledge system.

3.2.2 The teaching content of the courses is too narrow

The new engineering discipline requires the Environmental Engineering major to deeply integrate with other subjects such as information technology, biotechnology, and materials science. For instance, utilizing big data and artificial intelligence technology for environmental monitoring and prediction, and developing new environmentally friendly materials. Currently, the curriculum for the Environmental Engineering major mainly includes courses like Environmental Chemistry, Environmental Monitoring, Water Pollution Control Engineering, and Air Pollution Control Engineering. The content is relatively traditional and lacks interdisciplinary courses related to the new engineering disciplines. Some courses are more theoretical, with a relatively weak practical teaching component, resulting in insufficient hands-on skills for students.

3.2.3 Teaching methods are monotonous

The teaching methods primarily rely on classroom lectures, lacking interactivity and innovation. Students passively receive knowledge, which hinders their ability to engage in active learning and critical thinking. Experimental teaching mostly consists of confirmatory experiments, lacking comprehensive and design-oriented experiments, which makes it challenging to cultivate students' innovative and practical abilities.

3.3 There is an imbalance between theory and practice in development

With the development of the times and the continuous progress of science and technology, the theoretical knowledge in the field of environmental engineering is constantly being updated and improved. However, some teaching materials or curriculum systems often exhibit a certain degree of lag, with outdated theoretical knowledge that does not promptly reflect the latest industry trends and cutting-edge technologies, especially in environmental protection. This leads to a disconnect between theoretical learning and practical application. In the Environmental Engineering major, practical training is often limited to experiments, where students have a very limited knowledge structure and find it difficult to gain direct insights into industry dynamics during the experimental process. Moreover, the practical components offered by schools are relatively monotonous, such as simple principle-based experiments, engineering practice, and competitions, which are unable to meet the complex demands of the industry.

Yancheng Teachers University's Environmental Engineering major has a considerable number of laboratories, such as water treatment, atmospheric, environmental chemistry, and solid waste treatment laboratories. Although the variety and number of laboratories meet the students' theoretical understanding, they do not facilitate the integration of knowledge learned in the laboratory with actual industry practice, preventing students from truly understanding industry dynamics in their learning.

3.4 The scoring system for assessments is unreasonable

In terms of assessment, the final exams often carry a significant weight in the overall scoring, while the contribution of regular grades to the student's final score is relatively small, which is quite unreasonable. Focusing solely on final exams and neglecting the importance of regular grades in course design and teaching may compromise the fairness of student grades, reduce educational quality, and hinder the cultivation of talents with innovative capabilities. This approach also does not align with the educational standards under the new engineering discipline background. Regular grades, especially those related to participation in course practice, production internships, and probationary performance, are crucial in reflecting students' practical abilities. Therefore, it is important to appropriately incorporate regular grades to encourage students to place more emphasis on practical hands-on experiences, which is vital for their balanced development.

4. Specific reform measures for the Environmental Engineering major

4.1 Reform of Faculty Strengths

Introduce teachers with interdisciplinary backgrounds to optimize the structure of the faculty. Encourage teachers to participate in interdisciplinary training and academic exchanges to enhance their interdisciplinary teaching capabilities. Strengthen the cultivation of teachers' engineering practice abilities by involving them in actual enterprise projects, thereby improving their practical teaching level. Establish a cooperative mechanism between teachers and enterprises, inviting industry experts to teach courses or guide student practice, which enhances the practicality and relevance of teaching. Hire key technical and management personnel from enterprises as part-time teachers, and encourage full-time teachers to step out of the school and into enterprise facilities for on-site observations. Regularly arrange for teachers to delve into enterprises for professional learning, where they can discuss curriculum design, educational programs, teaching content, and teaching method reforms with enterprise experts and technicians. Keep abreast of modern enterprise talent needs and explore new initiatives for the effective integration of corporate culture with campus culture. Ultimately, promote the flow and sharing of talent between schools and enterprises, accelerating the enhancement of teachers' capabilities in engineering practice, scientific research, and social services.

4.2 Reform of Inter-Course Relationships

4.2.1 Increasing the Intersection of Course Content

Add interdisciplinary courses such as Environmental Big Data Analysis, Environmental Biotechnology, and Environmental Materials. These courses can expand students' knowledge base and develop their ability to work across disciplines. Enhance the practical teaching aspect by increasing the focus on internships, course design, and graduation projects. The content of practical teaching should be closely linked to real-world environmental engineering projects to improve students' practical skills. Incorporate courses on innovation and entrepreneurship to cultivate students' innovative thinking and entrepreneurial skills.

4.2.2 Design course projects

The college encourages teachers to actively lead undergraduate innovation projects, utilizing these projects for the design of water treatment, atmospheric treatment, and other similar projects. This method can improve students' practical abilities while also reinforcing the interdisciplinary links between courses.

4.2.3 Engage in practical teaching

Utilize diverse teaching methods, such as case-based teaching, project-driven learning, and group discussions. These methods can enhance students' learning enthusiasm and initiative, as well as cultivate their spirit of teamwork and problem-solving skills. Employ modern information technology, such as online courses and virtual simulation experiments, to enrich teaching resources and improve teaching effectiveness. Strengthen the reform of experimental teaching by increasing the proportion of comprehensive and design-oriented experiments, thereby fostering students' innovative and practical abilities.

4.3 Reform of Theory and Practice

Intensify partnerships with enterprises and create a robust industry-academia-research collaboration platform. Collaboratively conduct scientific research, talent development, and technological innovation to foster resource sharing and complementary advantages. Motivate students to participate in industry-academia-research projects to strengthen their practical and creative skills. Provide students with access to internships and job opportunities to boost their employability and competitive edge in the job market.

4.4 Reform of the assessment and scoring system

Employ a variety of assessment methods, including exams, experiments, essays, design work, and projects, and assign different weights to ensure a comprehensive evaluation. Furthermore, increase the proportion of regular assessments by adding daily homework, attendance, classroom engagement, participation in competitions, and research projects. Teachers can also use field inspections to test students' professional competence and practical abilities, thereby assessing their overall qualities.

5. Conclusion

Under the background of the new engineering discipline construction, this paper discusses the exploration of reforms in the Environmental Engineering major, focusing on the issues, reform directions, and practices of the major. Research findings indicate that the education of the Environmental Engineering major needs to adapt to the needs of the times and industrial development, explore new educational teaching models and methods, and strengthen reforms in talent cultivation, practical education, and curriculum development. In the context of the new engineering discipline, the Environmental Engineering major should focus on cultivating students' abilities and keep pace with the times. Schools should update relevant teaching content, emphasize the learning of the latest technologies, and improve students' practical skills. Increased investment in equipment updates can help students better understand and master subject knowledge with modern laboratories and equipment. Strengthening cooperation with enterprises and research institutes, and carrying out project collaborations, can improve students' practical application level. To keep up with the pace of development of the current era and cultivate more environmental talents, the Environmental Engineering major needs to further improve the talent cultivation system, promote reforms in practical education and curriculum design, and align with industrial and technological innovations. This will enable the cultivation of high-quality innovative talents and contribute to the construction of a green China.

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