

Exploration of Education Reform for Port, Harbour and Coastal Engineering under the Background of New Engineering

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Keywords: Port waterway, coastal engineering, education reform, practical ability, high-quality talent

Abstract: With the continuous development of global trade and ocean economy, the importance of the field of port, harbour and coastal engineering is increasingly highlighted. However, traditional educational models for these fields can no longer meet the rapidly changing industry demands and technological developments. New challenges and opportunities require reforms in the education of port, harbour and coastal engineering to cultivate high-quality talents that can adapt to future needs. This paper aims to explore the reform of port, harbour and coastal engineering education, and proposes feasible reform plans. Firstly, it is necessary to re-evaluate and update the curriculum to ensure that the teaching content is consistent with the industry development trends and latest technologies. Secondly, teaching methods and tools need to be reformed, with the introduction of more practical and interdisciplinary teaching activities. At the same time, close ties need to be established with the industry and enterprises to promote education and practical needs matching, and to carry out cooperative research and practical projects. Finally, evaluation and feedback mechanisms need to be established to understand the effects of education reform and student learning achievements, and to adjust and improve based on feedback results. Through these reform plans, port, harbour and coastal engineering education can better adapt to industry demands and technological developments, cultivate high-quality talents with comprehensive, practical and innovative abilities, and contribute to the sustained development of the field of port, harbour and coastal engineering.

1. Introduction

The field of port waterway and coastal engineering involves multiple professional areas, including port construction, waterway planning, coastal protection, and shoreline management. Traditional education models often focus on imparting theoretical knowledge but overlook the cultivation of practical skills and understanding of industry development trends [1]. However, with the rapid development of technology and the emergence of new issues, the demand for professional talents with comprehensive abilities in the field of port waterway and coastal engineering is increasing.

Firstly, the application of emerging technologies in the field of port waterway and coastal engineering is increasing, such as smart port technologies, unmanned vessels, and remote sensing technologies. Therefore, education reform needs to focus on cultivating students' technical abilities, including proficiency in relevant software and tools, understanding the principles and applications of emerging technologies, and possessing the ability to innovate and solve problems. [2]

Secondly, sustainable development and environmental protection have become important focal points in the field of port waterway and coastal engineering. Education reform should emphasize students' understanding of environmental protection and sustainable development concepts, and cultivate their ability to consider environmental impacts and ecological protection in port and coastal engineering design [3]. Students should also be aware of issues such as coastal erosion, sea level rise, and climate change, and be able to propose corresponding solutions.

Furthermore, interdisciplinary skills have also become increasingly important in the field of port waterway and coastal engineering. Port waterway and coastal engineering involve multiple fields such as engineering, management, environment, and law [4]. Therefore, education reform should encourage students to develop interdisciplinary thinking and comprehensive abilities, enabling them to engage in cross-domain cooperation and solve complex problems.

Lastly, practical education should be the focus of education reform. Students should receive more practical opportunities, such as field trips, laboratory practice, and engineering project practice, to enhance their practical skills and problem-solving abilities. Cooperation with the industry and internship experiences should also be included in the education plan to help students obtain industry-related experience and skills [5].

In summary, education reform in the field of port waterway and coastal engineering needs to focus on the cultivation of practical skills, pay attention to industry development trends and the application of emerging technologies, emphasize the importance of sustainable development and environmental protection, and develop students' interdisciplinary abilities. Only by doing so can high-quality talents be cultivated to meet industry needs and possess comprehensive abilities.

2. Analysis of Educational Needs in Port Waterway and Coastal Engineering

(1) In-depth research on industry development trends and real requirements, understanding the changing demands for skills and knowledge.

The teaching content should be closely related to industry demands, integrating theoretical knowledge with practical skills. Through practical projects, experiments, and case analyses, students can develop their ability to solve real-world problems [6]. Practical teaching activities allow students to better understand and apply what they have learned.

(2) Conduct research on the expectations of industry-related companies and organizations for talents, and clarify the training objectives.

Port Waterway and Coastal Engineering Education should engage in dialogue with industry companies, organizations and associations in the port, channel, and coastal engineering fields to understand their expectations and demands for professional talents, including requirements for technical skills, interdisciplinary abilities, innovation, practical experience, and teamwork. Through close cooperation with industry partners, the training objectives can be made clear, ensuring education matches industry demands.

Through in-depth needs analysis, universities can understand the latest trends and demands in the industry, provide guidance for educational reform, and adjust curriculum design, teaching methods, and faculty development to cultivate high-quality talent that meets industry demands.

3. Means to Enhance Talent Development Capabilities

3.1. Enriching Teaching Content and Curriculum Design

(1) Re-examining the curriculum design, increasing practical and innovative content to improve students' practical abilities.

Teaching content should be closely related to industry demands, combining theoretical knowledge with practical skills, and educating students on problem-solving abilities through practical projects, experiments, case studies, and other forms. Through practical teaching activities, students can better understand and apply the knowledge they have learned.

(2) Introducing knowledge from emerging fields, such as intelligent port technology, digital channel planning, marine ecological conservation, etc., to keep up with the technological development and changes in the industry.

Universities should cooperate with industry experts, research institutions, and related companies to obtain the latest information on industry trends and cutting-edge technology, and incorporate it into curriculum design [7]. This allows students to be exposed to the latest industry trends and technology during the learning process, preparing them for their future career development.

(3) Strengthening interdisciplinary collaboration and cross-training students with other related majors to cultivate multi-disciplinary talents.

The port, channel, and coastal engineering fields require comprehensive professionals who possess expertise in engineering, environmental science, information technology, and other interdisciplinary knowledge and skills. Therefore, universities should cooperate with other majors to carry out interdisciplinary teaching and research activities, helping students to broaden their breadth of knowledge, cultivate comprehensive abilities, and develop innovative thinking. Such cross-training can provide broader career development opportunities and promote cooperation and communication between different fields.

3.2. Improving Teaching Methods and Techniques

(1) Introducing case-based teaching and practical projects to educate students on solutions by learning from actual problems.

Through analyzing real-world cases, students can cultivate problem analysis and resolution abilities, elevating their application abilities in practice. Such students can learn through case analysis, gain knowledge of challenges and solutions in the industry, combine theoretical knowledge with practical experience, develop comprehensive qualities, and innovate capabilities.

(2) Leveraging virtual simulation technology and experimental equipment to provide training and practical opportunities in real-life scenarios.

Virtual simulation technology can simulate actual scenarios of port channels and coastal engineering, allowing students to operate and practice in a virtual environment, enhancing their skill level. Additionally, universities should equip themselves with advanced experimental equipment, allowing students with opportunities for training and experiments in real-life scenarios, strengthening their practical and technical application abilities.

(3) Encouraging students to participate in industry internships, practical activities, and competitions to enhance their practical experience and teamwork abilities.

By participating in internships, practical activities, and competitions, students can communicate and cooperate with industry professionals and peers, expand their social networks, and increase their practical experience. Such practical opportunities can provide students with opportunities to engage with real-work environments, developing their team collaboration, communication, and problem-solving abilities.

By adopting these teaching methods and resources, students can acquire deeper learning and practical experiences in the field of port channels and coastal engineering, developing their overall abilities, innovative thinking, and practical capacities, to adapt to industry needs and challenges.

3.3. Strengthening the Construction of Teaching Staff

To provide students with an education that is closely integrated with the industry, it is necessary to focus on cultivating teaching staff with practical experience and industry backgrounds. Schools should recruit teachers with practical experience and industry backgrounds who can incorporate the latest industry dynamics and practical experiences into teaching, allowing students to understand the actual situation of the industry.

Universities should provide teachers with training and professional development opportunities to continuously enhance their teaching level and professional quality. Through organizing teacher training and academic exchanges, teachers can update their teaching concepts and education skills to stay in sync with the industry. This can improve teachers' teaching ability and better meet students' needs.

Additionally, encouraging teachers to participate in industry research projects and collaborations can promote the integration of teaching and research. Teachers can collaborate with industry enterprises and organizations to carry out research projects, applying research results to teaching, and enhancing the practicality and cutting-edge nature of teaching [8]. Such collaborations can enable teachers to gain a deeper understanding of industry development trends and demands, providing students with updated knowledge and practical opportunities.

Through the above measures of teaching staff construction, teachers can be equipped with practical experience and knowledge backgrounds that match the industry, providing education closely integrated with the industry. The continuous improvement of teachers' professional abilities and teaching levels will help to cultivate students' abilities and qualities that adapt to industry development.

3.4. Increase Teaching Facilities and Resources

To support students' practical training and research projects, universities should provide advanced laboratory equipment and technological tools. Investing in updated laboratory equipment ensures that students have access to the latest technology and tools, improving their practical abilities. By using advanced equipment and tools, students can conduct practical operations and experiments to deepen their understanding of port and coastal engineering, enhancing their skill level [9].

In addition, it is also vital to establish practical training bases suitable for port and coastal engineering. Collaborating with the industry to build practical training bases provides students with practical opportunities and allows them to participate in actual work. Practical training enables students to understand the real working environment and process, enhancing their practical abilities and problem-solving skills.

Furthermore, establishing industry partnerships is also an important task for universities. Building close relationships with ports, shipping companies, and coastal engineering related organizations provides students with internship and job opportunities. Through collaboration with industry partners, students can participate in actual project cooperation, accumulate practical experience, and prepare for future employment.

By cultivating innovation and entrepreneurship, students will have the ability to face challenges and changes, and bring new thinking and innovative solutions to the port, navigation, and coastal engineering industry. This will help to promote the industry's development and innovation and

provide broader opportunities for students' career development.

3.5. Developing Innovation and Entrepreneurship Mindset

Developing students' innovative thinking and problem-solving abilities is crucial in the education of ports, navigation, and coastal engineering. Students should be encouraged to think and propose new solutions to cultivate their innovative abilities. Universities can stimulate students' creativity by offering innovation projects and courses, enabling them to come up with new ideas and innovative approaches to solving practical problems.

In addition, providing entrepreneurship education and support is also an important means of developing innovative mindset. Students should be encouraged to apply their knowledge to entrepreneurial and innovative projects. Universities can offer entrepreneurship guidance and training to help students understand the entrepreneurial process and management skills, enabling them to realize their entrepreneurial dreams in the industry. By establishing connections with industry partners and the entrepreneurial ecosystem, students can access entrepreneurial resources and support and drive their entrepreneurial plans.

By cultivating innovative and entrepreneurship mindset, students will have the ability to face challenges and changes, and bring new thinking and innovative solutions to the field of ports, navigation, and coastal engineering [10]. This will contribute to promoting the industry's development and innovation and provide students with broader opportunities for their career development.

3.6. Developing Internationalized Education

In the education of ports, navigation, and coastal engineering, strengthening international exchanges and cooperation is essential. Students should have the opportunity to exchange and study with overseas institutions to broaden their international horizons [11]. To achieve this, international cooperation projects can be established, students can be organized to visit and cooperate academically with foreign institutions, promoting cross-cultural exchange and learning.

Introducing internationalized teaching materials and cases is also an effective way to develop students' global perspectives and cross-cultural communication abilities. Universities can choose internationalized teaching materials and cases to expose students to practical cases of ports, navigation, and coastal engineering in different countries and regions, cultivating their communication abilities in cross-cultural environments and global awareness.

In addition, offering internationalized courses and programs, providing international internships, and exchange plans are also important ways to promote internationalization. Students can participate in international internship projects to experience the practical aspects of ports, navigation, and coastal engineering in different countries, expanding their international horizons and career development opportunities.

Through the implementation of internationalization education, students will be able to exchange and cooperate with international counterparts, understand the latest developments and practical experiences in the global ports, navigation, and coastal engineering field, improving their cross-cultural communication abilities and global competitiveness. This will provide them with broader opportunities and challenges for their future career development.

3.7. Other Recommendations

To adapt to the constantly changing field of ports, navigation, and coastal engineering, schools should provide opportunities for continuous learning and encourage students and professionals to

pursue further education and professional development. The establishment of a continuing education system provides opportunities for graduates and professionals to continuously update their knowledge and skills.

Schools can establish school-industry collaboration projects with industry companies to provide students with practical opportunities and employment consulting services. Through industry collaboration, students can participate in actual projects, gain practical experience, and collaborate and communicate with industry professionals [12]. In addition, schools can also provide employment guidance and career counseling services to help students find employment and achieve their career development goals.

Furthermore, schools should also pay attention to industry development trends and technological changes, updating course content and teaching methods in a timely manner to ensure that the knowledge and skills taught remain consistent with industry demands. Schools can establish cooperative relationships with industry professional institutions, industry associations, and other organizations to obtain the latest industry information and trends, providing students with cutting-edge educational resources.

Continuous learning and career development are key elements of the field of ports, navigation, and coastal engineering. Schools should actively provide support and opportunities for students and professionals, enabling them to continuously learn, adapt to industry developments, and achieve personal career goals.

4. Conclusions

The goal of the reform in the education of ports, navigation, and coastal engineering is to cultivate high-quality talents that meet the industry's demands. To achieve this goal, comprehensive reforms are needed, including demand analysis, curriculum design, teaching method improvement, and faculty development.

Firstly, in-depth demand analysis is necessary to understand the industry's talent requirements and future development trends. This can be accomplished through cooperation with industry-related organizations and companies, as well as researching industry hotspots and innovative areas. The results of the demand analysis should guide the direction of educational reform and ensure close alignment between education and industry needs.

Secondly, curriculum design reform should be based on the results of demand analysis. This includes updating the curriculum content, introducing emerging technologies and cutting-edge industry knowledge, strengthening practical activities and case-based teaching, and cultivating student's practical abilities and problem solving skills. Curriculum design should focus on cultivating students' innovation awareness and team collaboration abilities to enable them to adapt to the rapidly changing industry environment. Teaching methods also need to be improved, focusing on student-centredness and practicality. Project-based learning, experimental practice, and simulation teaching methods should be introduced to allow students to learn and practice in real-life situations, enhancing their comprehensive skills and problem-solving abilities.

Faculty development is a critical aspect of educational reform. Teachers' industry experience and practice abilities should be nurtured, and continuous teacher training and professional development opportunities should be provided to ensure that they keep up with industry trends and new technologies. Teachers should have strong practical experience and innovative awareness, capable of guiding students in practical exploration and team collaboration. Through comprehensive reforms such as demand analysis, curriculum design, teaching method improvement, and faculty development, the education of ports, navigation, and coastal engineering will be more closely aligned with actual needs, enhancing students' practical skills and comprehensive abilities. This will

contribute to the sustainable development of the industry and make a significant contribution to the future development of the ocean economy.

Acknowledgement

This work was supported by Key Project of Undergraduate Teaching Reform in Shandong Province (Z2022254, Z2022091).

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