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Progress in Marine Engineering and Technology, 2026, 1(1), 25-28
https://www.hillpublisher.com/Journals/pmet/
ISSN Online:

Research on the Practical Teaching System of "Production, Learning, Innovation and Application" in Shipbuilding and Marine Engineering Major

Aixia Cao[1,*], Youwei Du[1], Ruiying Shao[1], Hongyuan Sun[2], Xinyuan Zhou[1]

[1]Qingdao Huanghai University, Qingdao 266427, Shandong, China.
[2]Shandong University of Transportation, Jinan 250000, Shandong, China.

How to cite this paper: Aixia Cao, Youwei Du, Ruiying Shao, Hongyuan Sun, Xinyuan Zhou. (2026). Research on the Practical Teaching System of "Production, Learning, Innovation and Application" in Shipbuilding and Marine Engineering Major. *Progress in Marine Engineering and Technology*, 1(1), 25-28.
DOI: 10.26855/pmet.2026.06.005

Received: November 22, 2025
Accepted: December 16, 2025
Published: January 8, 2026

[*]**Corresponding author:** Aixia Cao, Qingdao Huanghai University, Qingdao 266427, Shandong, China.

Abstract

Under the background of the continuous improvement of China's economic development level, China's navigation industry has also shown a rapid development trend, and the modern Marine engineering has put forward high requirements for the professional level of engineering and technical personnel. For the majors of shipbuilding and Marine engineering, in order to strengthen the quality of professional teaching, it is necessary to implement the integrated practical teaching of "production, learning, innovation and application", so as to cultivate more high-quality applied technical talents. Based on this, this paper mainly analyzes the integrated practical teaching of "production, learning, innovation, application" in shipbuilding and Marine engineering majors, and hopes to provide reference for relevant people.

Keywords

Marine and ocean engineering; "Production; learning, innovation and use"; Integration; Practical teaching

In the new era of development, actively developing and utilizing the ocean is a key aspect of current progress. Under the new normal of the economy, leveraging the advantages of the ocean and transforming them into a goal of modern economic development is crucial. However, it is important to note the current shortage of marine talent in China's job market. Based on this, China has paid close attention to the cultivation of marine talent, establishing numerous specialized universities, such as Ocean University of China, Zhejiang Ocean University, and Dalian Ocean University, which have cultivated a large number of professionals, providing significant support for strengthening marine science and technology innovation and serving the development and utilization of marine resources. Currently, the opening and utilization of marine resources has entered a new stage of development. Although there are many ocean universities, there is a shortage of application-oriented talent in naval architecture and ocean engineering. Therefore, effective measures are needed to enhance the effectiveness of naval architecture and ocean engineering education. An integrated teaching model of "production, learning, innovation, and application" can be implemented to cultivate more talent to support the industry's development.

1. Current Status of Practical Teaching in Naval Architecture and Ocean Engineering

1.1 Lack of emphasis on practical teaching

Firstly, there is a lack of understanding regarding practical teaching, with a persistent preference for traditional

Note: The article was originally published in *Journal of Engineering Research*, and this is an authorized translation of it.

methods that emphasize theory over practice and classroom learning over extracurricular activities. For example, talent development programs often lack sufficient internships and practical training, and there are no comprehensive internship guidance plans or assessment models. This hinders the improvement of students' learning efficiency and effectiveness. Secondly, insufficient funding for internships leads to a lack of guaranteed quality. In naval architecture and ocean engineering internships, transportation and accommodation costs are generally high. Instructors often prioritize funding when planning internships. For instance, some naval architecture schools tend to concentrate internships at local or nearby shipyards, while other universities with sufficient funding arrange internships elsewhere. This results in students having weaker professional skills.

1.2 Insufficient teaching staff for practical teaching

Currently, practical teaching in naval architecture and ocean engineering is primarily conducted by young teachers. While these teachers possess high academic qualifications and professional foundations, their lack of practical training and experience makes them ill-equipped to effectively guide professional practical work. Furthermore, compared to classroom theoretical teaching, off-site practical guidance involves contacting numerous shipyards, which is relatively complex and troublesome. Moreover, teachers bear responsibility for students' production safety throughout the practical phase, making many reluctant to undertake practical teaching tasks. Additionally, the existing assessment systems in some universities tend to favor research, lacking a comprehensive evaluation system for practical teaching. This hinders the effective evaluation of practical teaching, and over time, it will affect teachers' commitment to practical teaching.

1.3 Enterprises lack initiative in participating in practical teaching

Currently, the enrollment scale of major universities is constantly expanding, which puts considerable pressure on companies to accept student interns. Against this backdrop, many companies are becoming reluctant to accept university students for internships, primarily due to concerns about safety and disruption to their normal production. Another reason is that companies typically prioritize economic benefits during the production phase, and student internships do not necessarily contribute to these benefits; in fact, they may even disrupt normal production and negatively impact the company's economic development. Therefore, many companies hold a negative attitude towards recruiting interns. Furthermore, there is a lack of multifaceted cooperation between universities and enterprises. In recent years, cooperation between schools and enterprises has largely remained at the level of student internships, with relatively limited content. Companies have not recognized the importance of university-enterprise cooperation in strengthening their technological capabilities, nor have they utilized student internships for self-promotion.

2. Reflections on the Integrated Practical Teaching System of "Production, Learning, Innovation, and Application" in Naval Architecture and Ocean Engineering

2.1 Innovative Practical Teaching System

Regarding the innovation of the practical teaching system for marine engineering, it is necessary to emphasize the cultivation of application-oriented talents, which can be achieved from the following four aspects:

One approach is industry-education integration. This integration encompasses the teaching system, teaching team, teaching resources, and talent development plan. A "sandwich" talent development model can be used to enhance students' abilities before they enter the workforce, by refining the course content and sequence. Given the specific nature of the shipbuilding profession, schools can negotiate with companies to develop tripartite agreements that clearly define students' rights during internships, giving them the autonomy to choose their future employment.

Secondly, there is the integration of learning and research. At this stage, students need to participate in naval architecture and ocean engineering research teams, allowing them to participate in faculty research projects. This greatly helps improve students' professional skills and overall quality. Furthermore, the university also needs to innovate scientific research based on the discipline to provide strong support for students' professional learning and development.

Thirdly, there is the integration of specialization and innovation. This integration mainly encompasses the cultivation of innovative concepts and engineering literacy. Regarding the cultivation of innovative concepts, it aims to enhance students' desire for innovation, innovative thinking, innovative methods, and innovative abilities. This can be achieved through a teaching method that integrates theory and practice, allowing students to learn fundamental principles alongside practical operations, thus improving their innovative awareness through continuous practical exploration. Regarding engineering literacy, it aims to cultivate students' engineering knowledge, engineering thinking, engineering practice, and engineering innovation qualities. This can be achieved through basic science experiments and computer simulation experiments. The former mainly includes physics and metalworking experiments, while the latter emphasizes the learning of shipbuilding technology, marine operational safety technology, and exploration technology. This requires students to have a comprehensive grasp of mechanics, which can be achieved through technical experiments.

Fourthly, it involves a three-tiered progression. This includes constructing a professional curriculum system, an innovative practice system, and a comprehensive training system, enabling the teaching of naval architecture and ocean engineering to be coordinated, jointly developed, and shared across multiple disciplines and majors.

2.2 Improve the practical training system and strengthen school-enterprise cooperation

In the talent cultivation stage, the education of Naval Architecture and Ocean Engineering should optimize the talent cultivation model. In addition to on-campus teaching, off-campus practical teaching is also necessary. In on-campus practical teaching, professional teachers should arrange practical teaching according to the actual development of the industry and the characteristics of the discipline, such as innovation practice, welding process practice, and shipbuilding and repair practice, ensuring that students can experience the key points and difficulties of actual work in on-campus internship factories. Then, experimental outlines should be formulated based on the on-campus practical platform, allowing students to carry out practical operations step by step, thereby strengthening their hands-on abilities over time. Furthermore, regarding the construction of the off-campus practical system, the university needs to set up various components such as cognitive internships, production internships, and graduation internships according to students' learning progress, and the entire process should be scientifically scheduled. Both of these practical teaching models require good cooperation between the university and enterprises to enable students to understand enterprise technology and production concepts, which greatly helps to enhance students' perceptual understanding of their professional studies. Simultaneously, students can immerse themselves in the company's operations, gaining a direct understanding of the entire workflow, such as design, steel processing, and segmented manufacturing. For specialized technologies like shipbuilding production management and inspection, students can also engage in hands-on practice. Furthermore, during the talent development phase, universities can collaborate with enterprises to assign industry mentors to teach students. This not only integrates theoretical teaching with practical experience but also allows students to ask mentors questions they encounter during their studies. This university-enterprise integration in naval architecture and ocean engineering comprehensively enhances students' skills, ultimately transforming them into application-oriented professionals.

2.3 Actively develop practical teaching bases to provide students with practical teaching conditions

Developing off-campus practical teaching bases is an important means of teaching naval architecture and ocean engineering in universities, and also a key path for talent cultivation. While this targeted talent cultivation model lacks flexibility, it's important to note that it can accelerate the achievement of professional development goals. Currently, many universities offer naval architecture and ocean engineering programs, and some are even dedicated to this major. These universities are generally located in economically developed coastal areas, thus leveraging their favorable geographical advantages and marine resources to establish practical teaching bases. This increases students' practical opportunities and provides them with a broader platform for development. After the establishment of these professional practical bases, universities need to develop talent cultivation plans based on industry development needs, students' abilities, and practical experience. Furthermore, practical demonstrations should be conducted during the specific practical phase. For example, in conducting practical teaching on ship safety performance testing, instructors should first conduct experiments, such as the ship's turning performance, heading stability, and inertia. After completion, instructors should guide students to collect experimental data and then analyze the ship's safety factor and the factors affecting its safety performance through data processing. This practical teaching model not only enables students to fully grasp the impact of ship safety performance on pharmaceuticals, but also allows them to understand the analytical methods of ship safety performance testing, thereby fully achieving the practical teaching objectives.

2.4 Cultivating a teaching team that integrates teaching, creation, and practice

In the teaching of naval architecture and ocean engineering in universities, a high-quality teaching staff is a key element in achieving the teaching objectives of practical courses. Regarding the establishment of an integrated teaching team encompassing “teaching, learning, creation, and doing,” teachers need strong professional and technical abilities. This requires not only mastery of basic professional knowledge but also strong language expression, systematic analysis, and problem-solving skills. Therefore, in this context, professional teachers should engage in practical exploration at marine teaching bases, and universities should regularly provide technical training for them, actively encouraging participation in national competitions to enhance their professional qualities and practical teaching abilities. Furthermore, a sound reward and punishment mechanism for professional teachers is needed. Teachers with relatively weak practical teaching abilities should be rehabilitated, perhaps by being sent to practical bases for on-site learning to strengthen their weaknesses. This approach will ensure the effective delivery of more capable teachers to the naval architecture and ocean engineering program and enhance the effectiveness of professional practical teaching.

3. Conclusion

In conclusion, under the new normal of the economy, Naval Architecture and Ocean Engineering is a key field for research on my country’s marine economic development and has a significant impact on the country’s socio-economic development. Therefore, this major needs to innovate its teaching system, utilizing an integrated “production, learning, innovation, and application” practical teaching approach to cultivate students’ comprehensive abilities. Given the characteristics of Naval Architecture and Ocean Engineering, purely theoretical teaching is insufficient to meet the needs of the discipline’s development. Emphasis should be placed on cultivating practical application-oriented talents. This can be achieved through university-industry cooperation, guiding students to participate in practice, strengthening their theoretical knowledge, and further promoting their practical skills. This is crucial for cultivating application-oriented professionals.

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