



Research on Construction of Open Online Courses System for Marine Engineering Major

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Abstract. In order to explore the construction mode of open online courses suitable for marine engineering major and further improve the quality of education and teaching, this paper focuses on the construction of new engineering disciplines in the field of navigation. Based on the course characteristics of marine engineering major and the talent cultivation needs, a high-level, innovative, and challenging open online courses system is constructed. Organize and coordinate domestic sea-related universities to design the overall architecture of the open online courses system for marine engineering major, integrate advantageous resources, and form an inter-university collaborative innovation mechanism, and explore new ways to promote the construction of the open online courses system for marine engineering major.

Keywords: New engineering, marine engineering, Open online courses system, Collaborative innovation mechanism

1 Introduction

Since 2017, the Ministry of Education of the People's Republic of China has actively promoted the strategic action of "new engineering" construction [1,2]. China is a zonal maritime country, and the training of marine talents plays a major supporting role in the implementation of the strategy of "maritime power" and "shipping power"[3]. In the process of training marine talents and the development of the shipping industry, maritime education plays a basic, strategic and leading role [4,5]. Maritime engineering is a typical representative of traditional engineering, and scientific and technological progress has constantly changed the connotation and essence of maritime engineering [6]. Therefore, the development of new marine engineering requires active layout and comprehensive construction.

Under the background of informatization and intelligence, maritime education needs to carry out active reform in curriculum system and teaching methods to meet the needs of new engineering construction. As a new form of information technology and education integration, open online courses that conform to the knowledge and information acquisition methods of contemporary college students will become the first choice for the reform of higher maritime education [7,8]. Therefore, how to build open online courses and apply them to promote teaching reform is a hot issue that has attracted much attention in the field of higher maritime education.

This paper relies on the "Virtual Teaching and Research Department of Marine Engineering" applied by Dalian Maritime University, explores the establishment of an intercollegiate collaborative innovation mechanism for the open online course group for the major of marine engineering, led by Dalian Maritime University and bringing together domestic maritime related universities. The aim is to further improve the quality of maritime engineering education and teaching, and provide more and better online learning resources and powerful professional support for students in maritime related universities.

2 Construction of sea-related online open courses

Since 2012, a massive open online course, also known as "MOOC", has emerged [9]. Since 2013, China has gradually started the planning, construction, research and application of MOOC [10]. Compared with PPT, video open courses, SPOC and other teaching tools or methods, the construction and application of MOOC have effectively expanded the teaching time and space, which has a huge impact on the education community [11,12]. China's sea-related open online courses are basically the same as other professional open online courses in terms of course construction methods, but due to the particularity of the major, there is still a certain gap in the number and quality of the courses construction. According to the statistics of mainstream online course learning platforms such as MOOC of Chinese universities and Xuetang Online, the current construction of sea-related open online courses in China is shown in Table 1.

Table 1. Construction of sea-related online open courses in China

No.	Universities name	National open online courses related to the sea		Other levels of open online courses related to the sea
		Qty.	Courses name	Qty.
1	Dalian Maritime University	9	Maritime law.	22
			Marine automation.	
			Transportation of goods by sea.	
			Nautical English Listening and Conversation.	
			Marine simulation training.	
			Marine electrical equipment and system.	
			Engineering mechanics	
			Introduction.	
			Marine diesel engine.	

2	Huazhong University of Science and Technology	4	Engineering mechanics. Electrical circuit theory. Principles of ship design. Engineering heat transfer.	7
3	Harbin Engineering University	6	Mechanical drawing. Hydroacoustics. Military theory. Navigation and positioning system. Electric traction automatic control system. Maritime Law.	15
4	Wuhan University of Technology	0		9
5	Shanghai Maritime University	1	Smart port.	1
6	Jimei University	0		1
7	Ocean University of China	4	Oceanography. Physical oceanography. Port planning and layout. The past and present lives of the ocean.	2
8	Zhejiang Ocean University	1	Ship strength and structural design.	4

It can be seen from Table 1 that in the construction of sea-related open online courses, Dalian Maritime University has the largest number and highest quality of the courses, but there are also some objective problems as follows: 1) There are relatively few sea-related universities, compared with traditional teaching categories, the number of sea-related courses is obviously small, and effective coverage has not been formed. 2) The curriculum construction is mainly a single course, and no sea-related professional course group has been formed; 3) The construction of main courses has been gradually improved, but the resources of the professional system are insufficient.

For marine engineering major, compared with the traditional teaching mode, the multi-dimensional display of knowledge in open online courses meets the objective needs of marine engineering major for talent training, and can be combined with the "Internet +" further improves students' engineering cognition and engineering practice application ability. Therefore, the construction of the open online course system around marine engineering is of particular significance. However, in view of the objective situation that there are relatively few sea-related universities, relying on the strength of only one university to build open online courses, on the one hand, the construction period is too long, on the other hand, it is difficult to avoid problems such as imperfect course system structure, uneven courses, and relatively insufficient resources.

It can be seen that it is an important measure to build an open online course system for marine engineering major by concentrating the advantages of sea-related universities, integrating high-quality resources, fully tapping the teaching accumulation of collaborative universities, and forming an inter-university collaborative innovation mechanism for sea-related universities.

3 Construction of online open course system for marine engineering major

3.1 Architecture of open online courses system in marine engineering

At present, China's higher education has entered the stage of popularization, high-quality development has become the theme of the times, and students' demand for high-quality online education resources and high-quality online education services is becoming increasingly strong. This objectively requires higher education to pay more attention to teaching according to aptitude and deepen the reform of curriculum system construction under the background of technology.

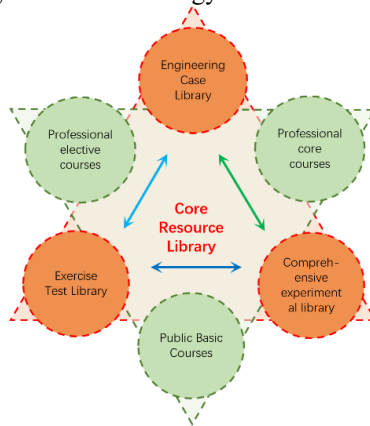


Fig. 1. Architecture of the open online courses system of marine engineering

The architecture of the open online course system for marine engineering major is crucial for the construction and application of open online courses. Its design first needs to be based on the systematic and rigorous characteristics of the traditional course system for marine engineering major. Secondly, it needs to maintain the advantages of interactive and information chemistry learning in open online courses, and internalize the teaching content, objectives, and activities that support the marine engineering professional system into online resources and system architecture. Meanwhile, considering the strong integration of theory and practice in the field of marine engineering, it is necessary to incorporate virtual simulation courses into the online open course system and build a core resource library, forming a network system with traditional professional courses, as shown in Fig. 1.

In terms of course content, the public basic courses of marine engineering major mainly include general courses and mathematics and natural science courses, among which general courses mainly include ideological and political courses, foreign language courses and career planning courses. These courses should consider more from the perspective of sea power and marine safety and security, to highlight the characteristics of maritime affairs^[13]. The mathematics and natural sciences courses required for the marine engineering major mainly include basic mathematical knowledge such as

advanced mathematics, linear algebra, analytical geometry, probability and mathematical statistics, as well as basic physics knowledge such as force, heat, light, and electricity. Under the development trend of intelligent and green ships, courses related to control, information, and computer should be appropriately strengthened. This requires that the professional foundation courses of the marine engineering major should include corresponding courses in the fields of mechanics, materials, thermodynamics, heat transfer, electronic information, computer science, control science, and other "mechanical, thermal, electrical, and control" fields. The core courses of marine engineering, such as main engine, auxiliary machinery, marine power system, marine automation, mechanical repair, and courses related to the design, maintenance, and management of ship electromechanical equipments, should also closely monitor the industry development trends and the direction of technology in the shipbuilding field, such that the open online courses constructed have both essential and forward-looking characteristics. At the same time, all practical courses in all courses should enhance their "high-level, innovative, and challenging" capabilities, enhance students' engineering design and practical skills, pay attention to the cultivation of digital and information literacy for the future, and cultivate high-quality marine engineering talents with both land and sea capabilities. In terms of course supporting resources, virtual simulation courses that directly reflect the strong practicality of marine engineering major can be included, while considering the latest scientific research achievements and engineering cases in the field of marine engineering, forming a core resource library that covers exercise libraries, experimental libraries, and case libraries.

In the era of informatization and intelligence, the courses have shown characteristics such as digitization, cross media, hybrid, and elasticity, and teaching methods have evolved towards personalization, autonomy, and collaboration. Therefore, the open online course system for marine engineering major needs to strengthen the construction of digital courses and the effective integration of hybrid teaching, achieve seamless connection between paper and digital, and reform traditional teaching methods, to truly achieve the goal of improving teaching effectiveness. Based on the above design, the open online course system for marine engineering major will provide comprehensive resources that transcend traditional course limitations and fixed teaching arrangements, with comprehensiveness and flexibility that single open online courses and traditional courses do not possess.

3.2 Inter-university collaborative innovation construction mechanism

In the process of China's higher education teaching reform, the construction of an open online courses system around the same major is a new thing ^[14]. Therefore, how to organically organize and give full play to the advantages of various sea-related universities and reflect the due advantages of the open online courses system is the key to determining the success or failure of the construction of the open online courses system for marine engineering.

This paper explores relying on the "Virtual Teaching and Research Department of Marine Engineering" applied by Dalian Maritime University, drawing on the Higher Education of Smart Education of China, Liaoning University Online Course Alliance

and Liaoning Learning Platform "MOOC Lecture Hall", organically organizing and fully leveraging the advantages of various maritime universities. Led by Dalian Maritime University, it brings together well-known universities in the field of marine engineering in China, such as Huazhong University of Science and Technology, Harbin Engineering University, Wuhan University of Technology, Shanghai Maritime University, Jimei University, Guangdong Ocean University, Dalian Ocean University, etc., to design the overall architecture and platform of the open online course system. With good teachers and resources, it integrates the overall design of the open online course system and platform for marine engineering major.

According to their own characteristics, each university builds corresponding open online courses according to the overall planning, and the resulting high-quality online resources are shared on Chinese university MOOC, Xuetang Online and other high-quality online course learning platforms, and can also be flexibly used in the form of small-class SPOCs as needed. Explore the inter-university collaborative innovation construction mechanism of the open online course group of marine engineering major.

4 Conclusion

This article analyzes the curriculum characteristics of the marine engineering major, revolves around the characteristics and talent cultivation needs of the marine engineering major. It constructs an open online course system with high order, innovation, and challenge, making the construction and application of the open online course system a structural support for marine engineering education and talent cultivation. Organizes and fully leverages the advantages of various maritime universities to design the overall architecture of the open online courses system for marine engineering major, achieves division of labor and collaboration among universities, and integrates system resources, forming an inter-university collaborative innovation construction mechanism for the open online courses system of marine engineering major, and exploring new ways to promote the construction of open online courses for marine engineering major.

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