



Research on the Construction of Education System for Maritime Technology in the Context of Intelligent Ships

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Abstract. With the rapid development of maritime technology, "intelligent ship" has become an inevitable trend in the development of shipping industry. The education of maritime talents has always been an important measure to ensure the vigorous development of shipping industry. It is imperative to study the education system of maritime talents in the context of "intelligent ship". Based on the demand for education maritime talents in the context of intelligent ship, this paper systematically studies the maritime talent system and system construction from three aspects: talent education mechanism, talent education system and talent education guarantee. On the basis of the study in this paper, we draw the conclusion that high-level maritime education should be carried out through the all-stage, all-round and whole process maritime education; We should actively carry out characteristic practice teaching and teaching under the enterprise-university-research institute cooperation, and explore a new way to train compound maritime talents suitable for intelligent ships in combination with the corresponding talent education mode.

Keywords: Intelligent ship, Maritime Technology, Education System, System construction

1 Introduction

In recent years, with the rapid development of new technologies such as Internet of Things, big data, cloud computing and communication technology, the scale of computing power has increased nearly ten times, which also drives the further development of artificial intelligence technology. The whole world is following this trend of technological development, and the working mode of the whole transportation industry has undergone revolutionary changes. The automobile industry is gradually and partly using the automatic driving system, intelligent distribution robots, instead of manual distribution, are gradually being used by the logistics distribution industry, and manual watch-keeping is being replaced by the intelligent dispatching system in the air transport industry. [1] Although the global transportation industry is dominated by the shipping industry, the intelligence level of ships is slightly inferior to other transportation industries. The main reason is the lack of ways

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and means to respond to the work changes brought about by the technological change. To solve this problem, we must rely on education reform and talent education. Therefore, it is imperative to train high-end talents needed in the era of artificial intelligence, which can bring new vitality to the shipping industry and promote the prosperity and development of the transportation industry. In this paper, the author states the countermeasures and suggestions on the construction of the education system of maritime talents in the context of intelligent ship from the perspectives of maritime talent education mechanism, education system and education guarantee, which has certain reference value for education maritime talents.

2 Current Situation of Maritime Talents Education in China

Maritime talents should have strong practical abilities, which is an attribute that cannot be ignored in talent education. Maritime talents should master professional abilities such as maritime technology, maritime engineering, meteorology, radio communication, etc., and they should be able to use intelligent technologies such as Internet of Things, network terminals, automatic control and big data analysis. In addition, they should also have professional qualities such as physical quality, psychological quality and flexibility. Maritime talents have to meet the high requirements for intelligent ships in many aspects, so we should train them from the source. For this purpose, many scholars have given their own suggestions and countermeasures. For example, Dalian Maritime University proposed to establish a practice platform and an intelligent maritime education system to meet the new requirements of intelligent ships for maritime talents; [2] Wuhan University of Technology put forward the spirit of building "new engineering course" and the talent education idea of "wide scope, solid foundation, strong ability and high quality" to face the coming new challenges; [3] Liang Mincang et al. put forward the countermeasures on high-quality crew education, such as combination of study and practice, teachers keeping pace with the times, and changing the talent education mode, so as to promote the simultaneous development of ship intelligence and crew transformation; [4] Ma Jianwen et al. analyzed the education trend and concept of applied maritime talents in the context of intelligent shipping, and put forward the education mode of applied maritime talents for intelligent shipping and the multidisciplinary integration knowledge system for intelligent shipping on this basis; [5] On the basis of expounding the development trend and characteristics of intelligent ships, Wei Lidui et al. explored the reform ways of higher maritime education and constructed the education mode of new maritime engineering talents; [6] Zhang Wei analyzed how to reform the teaching mode, set the development goal of maritime talents education, enriched the teaching mode to train new-type all-round talents, and strengthened the education of teachers; [7] According to the existing ways of maritime talents education and education in China, Chen Xiyu analyzed the traditional crew education and education mechanism, providing reference for the improvement and perfection of maritime talents education mechanism; [8] Li Jun et al.

analyzed the demand of intelligent ships for maritime talents, and concluded that the education mode of maritime talents should be innovated from the aspects of talent education system, reverse education, education strategy, curriculum planning and teacher teams; [9] Heike Deggin, director of the International Maritime Organization, and Rolf Skjong, director of the respectively gave constructive suggestions on the international legislation of intelligent ships; [10]SALLEH K M, a scholar of universities, put forward the new requirements for the education of maritime talents to cope with the changing trend of maritime management in the future; [11]Relevant U.S. colleges and universities train their own ship and maritime engineering talents according to the standards of education future industry leaders, so as to serve the exemplary leaders needed by their national defense; [12] The UK pays more emphasis on putting people first, and they have built “overpasses” of education between different academics and occupations, and established a lifelong education system. [13] Padova et al. have made a comparative study on the education modes of maritime talents in Britain, the United States, Japan and Australia, and found that there are great differences in the education modes of maritime talents in different countries, and analyzed the causes from different angles; [14] Libo put forward the demand for education by intelligent ships, including knowledge renewal and education renewal, university support and national support. At the same time, in combination with the long-term development plan of marine education, determined the development direction of maritime teaching in the era of intelligent ship teaching. [15]

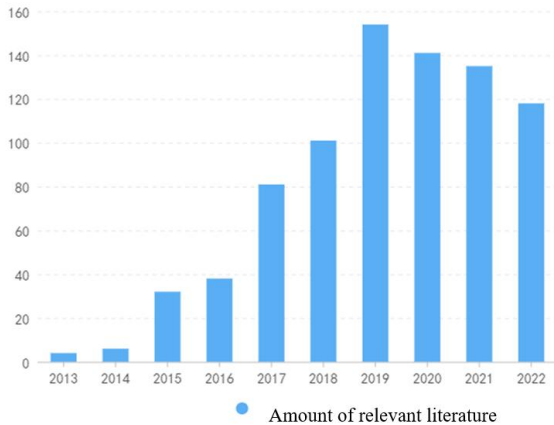


Fig. 1. Data changes of CNKI database from 2013 to 2022

(1) All-stage maritime education.

The education of maritime talents should extend beyond higher education and continue through their careers to adapt to the evolving demands of intelligent ships in the AI era. Enterprises should collaborate with educational institutions to ensure ongoing learning and technical updates for maritime professionals, aligning with the latest industry advancements in artificial intelligence. This comprehensive approach to education should span from academic education, through professional employment,

to post-retirement, ensuring talents remain proficient and relevant in the shipping industry.

(2) Whole-process maritime education.

Maritime education should be broad, encompassing pre-education, ongoing education, and post-education tracking, rather than narrowly focusing on academic achievements. It's crucial to evaluate prospective maritime talents on various aspects, including physical fitness and moral values, not just college entrance exam scores, to ensure they meet future industry standards.

(3) All-round maritime education.

Maritime education should develop students' foundational knowledge, skills, practical experience, and innovation. Maritime institutions need to create a thorough quality evaluation system focused on skill development and holistic student growth, using diverse assessment methods. Such a system ensures a more complete and scientific maritime education, enhancing talent education mechanisms.

2.1 Education System of Maritime Talents

The maritime talent education system aims to develop students' professional skills for intelligent ships through education, research, and practical education, ensuring quality. It's based on advanced maritime education, practical, characteristic teaching, and the collaboration between industry, academia, and research.

(1) High-level maritime education.

Advanced maritime education embraces interdisciplinary and multi-disciplinary approaches, essential in the era of intelligent ships. Traditional singular maritime disciplines fall short in nurturing versatile, high-quality, innovative talents needed today. The "Nautical studies+X" or "X+Nautical studies" model is ideal, combining core maritime education with other fields like electronic engineering, computer science, and logistics management, aligning with industry needs. This synergy cultivates multifaceted talents, with nautical studies providing a solid foundation for other disciplines.

(2) Practical teaching with maritime characteristics.

Maritime institutions should innovate their talent education to produce high-quality, multifaceted maritime professionals by moving beyond conventional academic-focused methods. Integrating practical, characteristic maritime teaching, aligned with shipping industry advancements, is crucial. Hands-on education through navigation simulators, site visits, and onboard experience deepens theoretical understanding, enhancing practical skills and problem-solving ability. This experiential learning is key to reinforcing knowledge and ensuring the success of maritime-specific practical teaching, continuously refining the talent education system through practice.

(3) Integration of "enterprises, universities and institutes".

The "enterprises, universities, and institutes" model is a practical approach for education maritime talents, involving industrial enterprises, education systems, and research institutes in long-term collaborative efforts to develop teaching content, plans, and requirements. Maritime colleges and enterprises should tailor teaching to

the shipping industry's needs, emphasizing practical teaching and modern technology. Enterprises and research institutes should focus on scientific innovation and provide financial support, while institutes and colleges should advance the practical application of technologies like intelligent ship automation and port digital modeling. This education model produces professional's adept at navigating the shipping industry's evolving challenges and innovations, thereby enhancing industry development. Thus, improving maritime talent education requires collaborative efforts from enterprises, universities, and institutes, as elaborated in Figure 2.

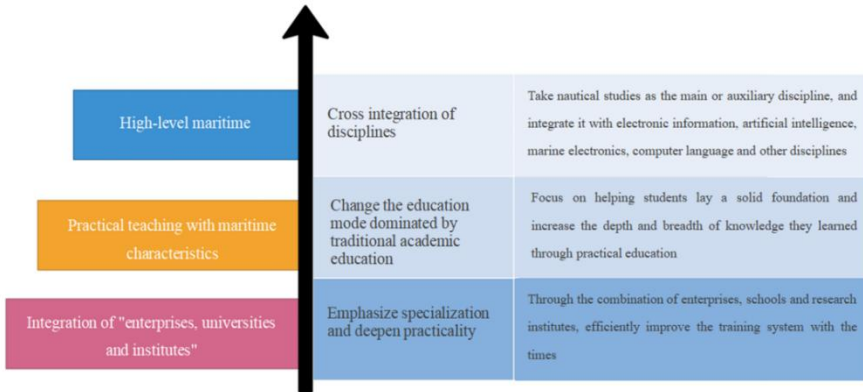


Fig. 2. Education system of maritime talents

2.2 Education Guarantee of Maritime Talents

The guarantee for the cultivation of maritime talents is the main driving force behind the construction of the maritime talent education system. In order to better respond to the future trend of smart navigation, we need to address the various obstacles we face, including the lack of competence of maritime talents, insufficient assistance of intelligent technology to maritime talents, and the existing problems within the shipping industry itself, such as concerns regarding the personal safety of seafarers, low social status of the seafaring profession, and unstable wages. Therefore, in order to achieve sustainable development in terms of the quality and quantity of maritime talents, the education guarantee for maritime talents should include four parts. Firstly, there is the guarantee of resource allocation. The cultivation of talents in maritime-related professions should have sufficient resource support, such as continuous optimization of educational resources including teaching staff, curriculum materials, and literature resources. Adequate resource allocation provides theoretical support for maritime disciplines, allowing students to enjoy higher quality educational resources, efficiently understand and grasp knowledge, and advance to higher levels. Secondly, there is the guarantee of technological support. Technology is the primary productive force, and every technological advancement in human history has improved labor tools and greatly increased labor productivity. Therefore, technology is an important support for the development of smart ships. Continuous research on key equipment, critical systems and device development, as well as the application of digitalization

and intelligent technology, provides strong technological support for maritime talents in operating intelligent ships. Furthermore, there is the guarantee of personal safety. As a special industry that involves long-term work at sea, the shipping industry often faces challenges such as offshore distances, difficult rescues, and potential disasters. Therefore, it is necessary to regularly provide basic safety education and emergency drills for maritime-related professionals, and relevant departments should establish measures to ensure the personal safety of maritime-related professionals. Safety measures can effectively enhance the safety awareness of maritime-related professionals and protect their basic rights and interests. Lastly, there is the guarantee of employment for talents. With the improvement of China's economic strength, the wage gap between seafarers on board and those onshore has narrowed. However, the social recognition of the seafaring profession in China is low, and there is no guaranteed income during off-seasons or adverse conditions, resulting in a low social status and limited professional attractiveness for seafarers. This affects the stability of the seafaring workforce and undermines the development foundation of the shipping industry. As maritime professionals in the context of artificial intelligence, they are also affected by these issues. Therefore, relevant departments need to formulate policies to ensure the employment of maritime-related professionals, provide more attractive salaries and benefits, provide development opportunities for maritime-related professionals, protect the resources of maritime-related professionals who can operate intelligent ships, thereby mobilizing the enthusiasm of maritime-related professionals and improving their social status.

3 Conclusion

Using the methods of literature research, comparison and data research, the author explores the problems and countermeasures faced by the education of maritime talents in the context of the development of intelligent ships through the research on the education system of maritime talents.

The research results of this paper are summarized as follows:

- (1) The development of intelligent ships has great influence and more needs on maritime talents, but it is difficult for maritime talents to meet their needs at present.
- (2) The education system of maritime talents in the context of intelligent ship should be based on education compound high-quality talents with intelligent technology, professional ability and occupational quality.
- (3) The construction of education system for maritime talents is a multi-faceted and multi-level education model, so to ensure the construction and development of the system, we should carry out study from three aspects: talent education mechanism, talent education system and talent education guarantee.
- (4) The education mechanism of maritime talents should cover all stage, whole process and all directions of maritime talent education, so as to ensure that it can lead the development direction of maritime talents.
- (5) The education system of maritime talents is an important form of maritime talent education, which pays attention to the professional and practical education of

maritime talents. Through integration and cross of disciplines, we should combine practical education with advanced technology of research institutes, meet or even surpass the quality needs of maritime talents required by intelligent ships.

(6) The education guarantee of maritime talents is the main driving force of the education system of maritime talents. By guaranteeing the resources needed in the education process and relevant systems after graduation, we can develop the quality and quantity of maritime talents sustainably.

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