Scientific and Social Research, 2025, Volume 7, Issue 1
https://ojs.bbwpublisher.com/index.php/SSR
Online ISSN: 2981-9946
Print ISSN: 2661-4332

Regarding the Evolution of BRM Simulator Training Concept in the Framework of MASS

Liang He[1]*, Guoyu Shao[2]

[1]Shanghai Maritime University, Shanghai 200000, China
[2]Bohai University, 20 Jinshan Street, Jinzhou 121007, Liaoning Province, China

Corresponding author: Liang He, heliang0002@stu.shmtu.edu.cn

Abstract: As artificial intelligence (AI) has advanced, there has been a lot of discussion and worry about academic theoretical research on MASS. The concept and facilities of BRM simulator training for MASS will be changed. BRM simulator training serves as a link between nautical theory and practice, which is crucial for the creation of MASS and the specification of MASS. This paper examines and discusses the transformation of BRM "resources" and the fresh requirement for instructor competency. The concept of BRM training for MASS is to change the focus from knowledge, skills, and attitudes to developing managerial competencies for judgment, analysis, and decision-making.

Keywords: MASS; BRM simulator; Conceptual change; Decision-making capability

Online publication: January 23, 2025

1. Introduction

Education, science and technology, and talent are the key and strategic pillars for the comprehensive construction of a modern socialist nation, according to the Chinese government, which has outlined its clear strategic thinking for accelerating the development of a powerful maritime and transportation power. Universities must actively support business and commercial demands as well as national initiatives. Universities must actively support the implementation of key national strategies like innovation-driven development, the Belt and Road Initiative, Made in China 2025, and Internet Plus, as well as industrial transformation and upgrading, to meet the challenges of a new round of scientific and technological revolution and industrial transformation. Training the nation's senior maritime talent to compete internationally is the responsibility of higher maritime education. Future unmanned ship usage and the ongoing advancement of ship intelligence provide new difficulties for maritime professional training. Actively advocating for the reform of maritime education and raising the standard of instruction for marine professionals is essential.

Research on the use and significance of BRM simulators in maritime education has been published, and

they are crucial in developing shipping talent. According to some academics, the BRM simulator ought to emphasize formal diversity and build a platform that allows the crew on the bridge to participate [1]. A ship crash instance has been utilized by some researchers to highlight the significance of BRM in the judicious use and distribution of resources, including information, material, and human resources [2]. A ship crash instance has been utilized by some researchers to highlight the significance of BRM in the judicious use and distribution of resources, including information, material, and human resources [3]. A research approach for maritime education has been put up by certain scholars and is based on the trinity of information, skills, and attitudes found in the BRM simulator [4]. Drawing from previous research, this paper combines the "Guidelines for the Construction of an Intelligent Ship Assembly Standard System 2020 Edition" and the "Intelligent Ship Specifications 2024" to propose that the primary focus of the BRM simulator training concept in the context of MASS should be the development of management capacity for analysis, judgment, and decision-making, as well as the capacity requirements for training facilities, equipment, and teaching staff.

2. BRM simulator training "resources" requirements, understanding, and transformation

To prevent marine mishaps brought on by careless or inappropriate use of resources during actual navigation, BRM simulator training aims to acquaint trainees with the bridge's operational environment and the effective use of bridge-related resources. Consequently, it is crucial to use BRM simulator training. To do this, the Chinese Ministry of Transport's Maritime Safety Administration has established hardware and instructor specifications for training facilities, and academic institutions have carried out critical studies on the concept and materials of BRM simulator training.

2.1. Hardware requirements for BRM simulator training "Resources"

The location, amenities, and equipment of the training facility are essential for BRM training. Only if the fundamental hardware prerequisites are met can the training needs and objectives be met. The Maritime Safety Administration of the People's Republic of China's Ministry of Transport has developed and issued the "Measures for the Implementation of the Regulations of the People's Republic of China on the Training of Seafarers" (henceforth referred to as the "Measures") in compliance with the STCW Convention to prevent inconsistencies or failure to attain the anticipated training quality. In terms of the appropriate locations, amenities, tools, and teaching personnel required for seafarer training, the "measures" outline the pertinent requirements for maritime training institutes to conduct seafarer training [5].

The "measures" include 48 "resources" required for traditional navigation to guarantee the safe passage of ships, including multimedia classrooms, teaching nautical charts, teaching nautical books and materials in both Chinese and English, teaching "log books", chart tables, and chart work tools. It has also been established how much of the necessary "resources" are required. The following are prerequisites for instructors of practical training: Theoretical instructors must: 1) work for themselves; 2) be captains of the respective navigation areas; 3) have at least one instructor for each ship's ship handling simulator and one instructor for the console; 4) have other practical training instructors hired from outside, with a student-to-teacher ratio of 1:20.

The environment, tools, and supplies needed for navigation on a classic ship's bridge must be met by the site, facilities, and equipment criteria in the "measures." The aim is to accomplish the BRM training objectives while

simulating and restoring the bridge's actual condition as much as possible while the ship is sailing. It is possible to separate theory from practical training when it comes to the requirements for instructors of practical training. The practical training instructor must have at least one captain of the relevant navigation area level; however, the theory instructor does not need to have any prior maritime experience. Consequently, in the conventional ship BRM training that is now in place: To achieve the training's purpose and goal, 1) the theoretical and practical training instructors can train the trainees independently, and the theoretical instructor must be the training institution's instructor; 2) the practical training instructor places more emphasis on sailing experience, which can reflect the dual combination of training ability and experience; and 3) the teacher-student ratio is taken into consideration for other practical training instructors, who can be hired from outside.

2.2. Traditional BRM simulator training's understanding of "resources"

The term "bridge resource management" describes the methods, actions, or approaches used to manage the different accessible "resources" in a ship's bridge's working environment, as well as the organization and control of these resources [6]. In bridge resource management, the following resources are frequently utilized: 1) Human capital. The employees in charge of ship navigation are the primary target of management or utilization. The knowledge, abilities, experience, and personal skills of the staff, as well as their potential and capacity for teamwork, are the primary emphasis of people management. 2) Tangible assets that primarily refer to the instruments or navigational aids that guarantee navigation safety in conventional ship navigation. The ship navigation staff gathers the relevant ship navigation parameters and data from the navigation instruments and equipment, compiles and filters this information, and then takes the next navigation scenario into account. 3) Resources for information that mostly refer to the staff members in charge of ship navigation summarizing and analyzing nautical manuals and other directives or information. 4) Additional resources. Additional resources include the time, space, expertise, abilities, collaboration, and support of pertinent departments needed to guarantee the ship's regular operation and navigation.

The person in charge of a ship's navigation must use all available information, parameters, data, and so on to plan, organize, control, and coordinate the rational application of management, operate the necessary equipment correctly, direct operations rationally and accurately, and coordinate the relationships between all relevant parties to achieve effective control over the organization and implementation of operations on site and, ultimately, accomplish the goal of ensuring the ship's safe navigation.

2.3. The transformation of the BRM "resources"

The development of MASS will also be a future trend, and its research and trial operation has garnered a lot of attention in recent years. Examples like Yara Birkeland could be a clear indication that shipping needs to change [7]. China has, in the meantime, made great strides in the study of intelligent ships and has established relevant laws to support these studies and the creation of standards for them. For instance, according to the "Intelligent Ship Code 2024" (henceforth referred to as the "Code"), an intelligent ship uses technological tools like sensors, communications, the Internet of Things, and the Internet to automatically perceive and gather information and data about the ship itself, the maritime environment, logistics, ports, and so on. It also provides computer technology, automatic control technology, and big data processing and analysis technology to achieve intelligent operation of the ship in terms of navigation, management, maintenance, cargo transportation, and so on, making the ship safer, more economical, more ecologically friendly, and more efficient [8].

Consequently, the code's description of an intelligent ship will result in different BRM training concepts for intelligent and conventional ships. Ships with intelligence are capable of intelligent navigation. They can gather information about the ship's navigation status using sophisticated perception and sensor information fusion technologies, analyze and process it using computers and control technology, and then offer recommendations to help with navigation decisions. Additionally, they have features like visual enhancement, collision warnings, warnings of running aground, route design and optimization, and comprehensive information display. These features can be used gradually, ranging from autonomous navigation in open waters to autonomous navigation for the duration of the journey.

The "resources" that correspond to traditional BRM have changed, as can be seen from the needs of the "norm," and this change is particularly evident in 1) The human resource transformation. The management of the expertise, experience, and understanding of conventional human crew members is no longer the main focus because intelligent ships possess intelligent navigation capabilities. 2) Material resources are transformed. The measures necessary for the ship's navigation are established once the information has been artificially integrated. Traditional navigation depends on the information gathered from various navigation aids. However, after thoroughly examining pertinent navigation data, intelligent navigation can offer recommendations regarding the travel scenario and actions to be followed. 3) Information resource transformation: Intelligent ships are capable of optimizing and designing their routes. They can create routes using weather forecasts and electronic route data, analyze navigation data while the ship is navigating, and optimize the route. This differs from the conventional BRM training, which entails summarizing and evaluating nautical literature and other data. 4) Transformation of other resources: Intelligent ships prioritize collaboration and support between shore-based and shipboard staff over collaboration between the engineering and deck departments of a traditional ship or technical assistance provided to shipboard staff by the company's engineering and marine departments.

3. MASS seaworthiness, BRM training hardware, and mindset change

In addition to MASS being a new product, MASS bridge navigation and resource management tools and objectives are also improved. To stay up with technological advancements and avoid maritime mishaps, new innovations, and technology will unavoidably result in new competency requirements. At the same time, new training concepts and methodologies are being developed to meet the new competency criteria.

3.1. Fitness requirements for MASS

To clarify the roles, qualifications, and training needs of personnel operating and using intelligent systems, as well as to mandate that pertinent personnel be knowledgeable about and proficient in operating and maintaining intelligent systems, the "Code" also lays out corresponding requirements for personnel, requiring shipowners or ship management companies to develop management measures, training plans, operating procedures, and others related to intelligent systems.

The shipowner or ship management company is identified as the responsible entity required by the "Code." For this reason, the shipowner and ship management business must set up and upgrade the operating system or management system for the firm's MASS. Simultaneously, training facilities will have to meet new standards for the education and credentials of shipboard staff, which will provide further difficulties. Therefore, training institutions should prioritize developing training concepts and hardware for MASS BRM before the widespread

usage of MASS. They should also make plans for the future to address the issues presented by MASS BRM training.

3.2. BRM training hardware and personnel transformation in the context of MASS

The "norm" outlines the primary organization in charge of managing and operating MASS, training them, and determining whether the appropriate staff is in place. It is now impossible to determine the precise needs for certain training locations, facilities, etc., because the requirements are only mentioned in broad strokes and no specific regulations have been established. However, from a different angle, the building of MASS necessitates meeting specific requirements and facility standards. For instance, China's 2020 Guidelines for the Construction of an Intelligent Ship Assembly Standard System (henceforth referred to as the "Guidelines") categorizes intelligent ship construction into three groups: B key technologies, such as BA interconnection and system integration, BB intelligent shipyards, BC intelligent services, and BD application of new-generation information technology; C shipyard applications, such as CA material yards, CB parts manufacturing workshops, CC small-group erection workshops, CD sectional manufacturing workshops, and other shipyard-related intelligent applications; and C basic commonality, such as AA general, AB testing, AC rating, and AD safety [9].

The "Guidelines" are a set of standards for building intelligent ships. The "Guidelines" outline the needs and development standards for upcoming intelligent ships. Requirements for the application of AR/VR standards are established in the guidelines' key technologies for next-generation information technology. These include general requirements for regulating the ship construction and assembly process, interconnection, system integration, human-computer interaction, performance testing, the use of virtual reality software and data processing, and safety requirements. Training institutions may therefore need to include virtual reality software systems and specialized safety training for MASS to overcome difficulties with the hardware facilities for networking, systems, interaction, and performance testing in the BRM training hardware for MASS. Teaching staff are also being subjected to increased competency standards at the same time. Captains with related navigation areas perform practical training after BRM theoretical teachers teach trainees just nautical theory. MASS must, however, also be knowledgeable about areas like system integration, networking, intelligence, and human-computer interaction. Consequently, to train MASS BRM trainees in the future, new theoretical projects will need to be introduced, and either new theoretical teaching staff will need to be prepared, or current theoretical staff will need to earn the necessary training credentials.

3.3. BRM training concept change in the context of MASS

Human error can be decreased by BRM simulator training. When an operator in a given system completes a task, human error refers to mistakes in awareness, judgment, and behavior that result in either an operation that fails to accomplish the intended purpose or an inability to perform an operation that is appropriate for the environment and situation at the time. Human behavior that is insufficient to manage the current circumstance may result in system breakdowns. Thus, crew quality can be enhanced by BRM simulator training [10]. The concept of crew quality is not set in stone, though, and it could evolve in meaning and scope as social technology advances. A ship's crew is traditionally evaluated based on their work attitude, feeling of responsibility, navigational knowledge, emergency management skills, and capacity to adjust to pressure. The crew's jobs have gradually lessened due to MASS's technological intelligence, and electronic technology has gradually replaced them. For example, traditional paper books and materials have gradually given way to electronic charts and books and materials.

The trinity of knowledge, skills, and attitude forms the foundation of the marine teaching philosophy of the classic BRM simulator. However, sophisticated algorithms may now determine the appropriate steps or measures that the crew or shore-based workers need to take thanks to the development of intelligent navigation systems on MASS. The crew or shore-based staff have the option to turn off the intelligent navigation system and take manual intervention if they believe the planned actions to be dangerous. As a result, the MASS BRM Simulator's nautical education approach is primarily concerned with data analysis, determining the safety of activities based on data analysis, and making decisions. As a result, the Intelligent Ship BRM Simulator training idea might be expanded to include management capacity building for analysis, judgment, and decision-making.

4. Conclusion

To guarantee that students progress smoothly from theory to practice, BRM simulator training subjects serve as a link between theoretical navigation courses and real navigation on board. Thus, it is clear how important BRM simulator training is. From the standpoint of the "resources" needed for BRM simulator training on conventional ships, the comprehension of these "resources," and the prerequisites for instructors, this article examines the changes and distinctions between intelligent and conventional ships. The creation of sentient ships is now both possible and plausible due to advancements in artificial intelligence. China's "Guidelines for the Construction of an Intelligent Ship Standard System 2020" and "Intelligent Ship Specifications 2024" presently contain the blueprints and prototypes of future intelligent ships. To offer some inspiration for future BRM simulator training for intelligent ships, this can be used to analyze and assess the concepts and "resources" for such training.

Disclosure statement

The authors declare no conflict of interest.

References

[1] Zhou JP, Fang QG, 2007, Some Experiences from Training in Resource Management on the Bridge. Nautical Education Research, 2007(S1), 22–24.

[2] Chu SD, Zhang YJ, 2014, On the Use of BRM Training to Improve Students' Psychological Quality in Maritime Emergencies. Journal of Wuhan Vocational College, 2014(4): 90–93.

[3] Song HC, 2018, The Importance of Resource Management on the Bridge. Tianjin Navigation, 2018(2): 36–37.

[4] Yu SJ, Zhang Y, 2017, Research on the Application of Teaching Maritime Technology based on the BRM Simulator. Nautical Education Research, 34(3): 80–83.

[5] Ministry of Transport of the People's Republic of China, 2019, Implementation Measures for the Rules for the Administration of Training of Seafarers of the People's Republic of China. Accessed on November 23, 2024. https://www.msa.gov.cn/page/article.do?articleId=933CA326-99EA-4C3C-BB46-B2B364A8F9CE&channelId=25272961-CDA1-4403-BB56-9659C86F1BFD

[6] Yong W, 2012, Research on the BRM Curriculum System under the New Rules. Tianjin Navigation, 2012(3): 51–53.

[7] Skredderberget A, 2019, The First Ever Zero Emission Autonomous Ship. Accessed on November 23, 2024. https://www.yara.com/knowledge-grows/game-changer-for-the-environment/

[8] China Classification Society, 2023, Intelligent Ship Specification 2024. Accessed on November 23, 2024. https://

www.ccs.org.cn/ccswz//specialDetail?id=202312061041161178

[9] China Government, 2020, Guidelines for the Construction of an Intelligent Standard System for the Final Assembly of Ships (2020 Edition). Accessed on October 29, 2024. https://www.gov.cn/zhengce/zhengceku/2020-08/25/5537132/files/fde2eadad904407a8c425d6d468f2c2f.pdf%20,%20last%20accessed%202024/10/29

[10] Xuan SY, 2007, Human Error Control and BRM. Nautical Education Research, 2007(S1): 35–38.